NATURAL HISTORY

THE JOURNAL OF THE AMERICAN MUSEUM

INDEX FOR VOLUME XIX

155446
13/4/20

Published from October to May, by
THE AMERICAN MUSEUM OF NATURAL HISTORY
NEW YORK CITY

1919

An illustrated magazine devoted to the advancement of Natural History, the recording of scientific research, exploration, and discovery, and the development of museum exhibition and museum influence in education. Contributors are men eminent in these fields, including the scientific staff, explorers, and members of the American Museum

NATURAL HISTORY IS SENT
TO ALL CLASSES OF MUSEUM
MEMBERS AS ONE OF THE
PRIVILEGES OF MEMBERSHIP

CONTENTS OF VOLUME XIX

ILLUSTRATIONS

INDEX OF VOLUME XIX

Names of contributors are set in small capitals

NATURAL HISTORY

THE JOURNAL OF THE AMERICAN MUSEUM

DEVOTED TO NATURAL HISTORY,
EXPLORATION, AND THE DEVELOPMENT OF PUBLIC EDUCATION
THROUGH THE MUSEUM

JANUARY, 1919

VOLUME XIX, NUMBER 1

NATURAL HISTORY

VOLUME XIX

CONTENTS FOR JANUARY

NUMBER 1

MARY CYNTHIA DICKERSON, *Editor*

Published monthly from October to May, by the American Museum of Natural History, New York, N. Y. Subscription price, $2.00 a year.

Subscriptions should be addressed to the Secretary of the American Museum, 77th St. and Central Park West, New York City.

NATURAL HISTORY *is sent to all members of the American Museum as one of the privileges of membership.*

Entered as second-class matter February 23, 1917, at the Post Office at New York, New York, under the Act of August 24, 1912.

Acceptance for mailing at special rate of postage provided for in Section 1103, Act of October 3, 1917, authorized on July 15, 1918.

THE AMERICAN MUSEUM OF NATURAL HISTORY

MEMBERSHIP

For the enrichment of its collections, for scientific research and exploration, and for publications, the American Museum of Natural History is dependent wholly upon membership fees and the generosity of friends. More than 4000 friends are now enrolled who are thus supporting the work of the Museum. The various classes of membership are:

Benefactor		$50,000
Associate Founder		25,000
Associate Benefactor		10,000
Patron		1,000
Fellow		500
Life Member		100
Sustaining Member	annually	25
Annual Member	annually	10
Associate Member (nonresident)	annually	3

Full information regarding membership may be obtained from the Secretary of the Museum, 77th Street and Central Park West.

NATURAL HISTORY: JOURNAL OF THE AMERICAN MUSEUM

NATURAL HISTORY, recording popularly the latest activities in natural science and exploration, is published monthly from October to May, inclusive, by the American Museum of Natural History. The subscription price is Two Dollars a year. NATURAL HISTORY is sent to all classes of members as one of the privileges of membership. Subscriptions should be addressed to the Secretary of the Museum.

POPULAR PUBLICATIONS

A large number of popular publications on natural history, based on the exploration and research of the Museum, are available in the form of handbooks, guide leaflets, and reprints. A detailed list of these publications will be found in the Appendix to NATURAL HISTORY. Price lists and full information may be obtained by addressing the Librarian of the Museum.

SCIENTIFIC PUBLICATIONS

The field and laboratory researches of the American Museum of Natural History and other technical scientific matters of considerable popular interest are represented by a series of scientific publications comprising the *Memoirs*, *Bulletin*, and *Anthropological Papers*. A condensed list of these publications will be found on the inside back cover of NATURAL HISTORY. Price lists and complete data may be obtained from the Librarian.

Courtesy of Underwood and Underwood

HIS FORCE SEEMED TO INCARNATE THE SOUL OF AMERICA

The energy and latent action, the rational thought, the controlled will, the moral force—that was Theodore Roosevelt (1858–1919)

He denied himself all things that weaken. He gave his life to work and to whatever circumstances brought in the way of private and public duty and private and public fellowship. "Work, duty, and fellowship"—he preached them and lived them with the zeal of a prophet, and they pretty much make the message he leaves us: "work" and "duty," the basis of moral force in man or nation, the iron qualities on which the United States were founded; "fellowship," a key to an understanding of our neighbor and a melting pot for class differences. He believed in the "joy" of life also, but not merely the old primeval heritage, and never pleasure sought as such, but, instead, that achievement which comes as a by-product of work faithfully done, lack of self-seeking, trust in the good in one's fellow men, and knowledge of nature

NATURAL HISTORY

VOLUME XIX JANUARY, 1919 NUMBER I

Theodore Roosevelt[1]

HIS AMERICANISM REACHED IN TO THE MARROW OF HIS BONES

By JOHN BURROUGHS

NEVER before in my life has it been so hard for me to accept the death of any man as it has been for me to accept the death of Theodore Roosevelt. I think I must have unconsciously felt that his power to live was unconquerable. Such unbounded energy and vitality impressed one like the perennial forces of nature. I cannot associate the thought of death with him. He always seemed to have an unlimited reserve of health and power. Apparently he cared no more for the bullet which that would-be assassin shot into his breast a few years ago than for a fleabite.

From his ranch days in Montana to the past year or two I saw and was with him many times in many places. In the Yellowstone Park in the spring of 1903, in his retreat in the woods of Virginia during the last term of his presidency, at Oyster Bay at various times, in Washington at the White House, and at my place on the Hudson, I have felt the arousing and stimulating impact of his wonderful personality. When he came into the room it was as if a strong wind had blown the door open. You felt his radiant energy before he got halfway up the stairs.

When we went birding together it was ostensibly as teacher and pupil, but it often turned out that the teacher got as many lessons as he gave.

Early in May, during the last term of his presidency, he asked me to go with him to his retreat in the woods of Virginia, called "Pine Knot," and help him name his birds. Together we identified more than seventy-five species of birds and wild fowl. He knew them all but two, and I knew them all but two. He taught me Bewick's wren and one of the rarer warblers, and I taught him the swamp sparrow and the pine warbler. A few days before he had seen Lincoln's sparrow in an old weedy field. On Sunday after church, he took me there and we loitered around for an hour, but the sparrow did not appear. Had he found this bird again, he would have been one ahead of me. The one subject I do know, and ought to know, is the birds. It has been one of the main studies of a long life. He knew the subject as well as I did, while he knew with the same thoroughness scores of other subjects of which I am entirely ignorant.

He was a naturalist on the broadest grounds, uniting much technical knowledge with knowledge of the daily lives and habits of all forms of wild life. He probably knew tenfold more natural history than all the presidents who had preceded him, and, I think one is safe in saying, more human history also.

In the Yellowstone Park when I was with him, he carried no gun, but one

[1] This article, in part, was read before the Roosevelt Memorial Meeting at the Century Club, New York City, February 9, by Major George Haven Putnam

day as we were riding along, he saw a live mouse on the ground beside the road. He instantly jumped out of the sleigh and caught the mouse in his hands; and that afternoon he skinned it and prepared it in the approved taxidermist's way, and sent it to the United States National Museum in Washington. It proved to be a species new to the Park.

In looking over the many letters I have had from him, first and last, I find that the greater number of them are taken up with the discussion of natural history problems, such as Darwin's theory of natural selection, "sports," protective coloration. He would not allow himself, nor would he permit others to dogmatize about nature. He knew how infinitely various are her moods and ways, and not infrequently did he take me to task for being too sweeping in my statements.

When, in the early part of the last decade, while he was President, there was a serious outbreak of nature-faking in books and in various weekly and monthly periodicals, Roosevelt joined me and others in a crusade against the fakers and wielded the "big stick" with deadly effect. He detected a sham naturalist as quickly as he did a trading politician.

Roosevelt was much amused by the change that had come over the spirit of that terrible beast, the grizzly bear in Yellowstone Park. In a letter to me he comments as follows:

White House, Washington
August 12, 1904

Dear Oom John,

I think that nothing is more amusing and interesting than the development of the changes made in wild beast character by the wholly unprecedented course of things in the Yellowstone Park. I have just had a letter from Buffalo Jones, describing his experiences in trying to get tin cans off the feet of the bears in the Yellowstone Park. There are lots of tin cans in the garbage heaps which the bears muss over, and it has now become fairly common for a bear to get his paw so caught in a tin can that he cannot get it off and of course great pain and injury follow. Buffalo Jones was sent with another scout to capture, tie up and cure these bears. He roped two and got the can off of one, but the other tore himself loose, can and all, and escaped. . . .

Think of the grizzly bear of the early Rocky Mountain hunters and explorers, and then think of the fact that part of the recognized duties of the scouts in the Yellowstone Park at this moment is to catch this same grizzly bear and remove tin cans from the bear's paws in the bear's interest!

The grounds of the White House are lovely now, and the most decorative birds in them are some red-headed woodpeckers.

Give my regards to Mrs. Burroughs. How I wish I could see you at Slabsides! But of course this summer there is no chance of that.

Always yours,

[Signed] Theodore Roosevelt.

Roosevelt was a many-sided man and every side was like an electric battery. Such versatility, such vitality, such thoroughness, such copiousness, have rarely been united in one man. He was not only a full man, he was also a ready man and an exact man. He could bring all his vast resources of power and knowledge to bear upon a given subject instantly.

Courageous, confident, self-assertive, he was yet singularly tender and sympathetic. He was an autocratic democrat. "Hail fellow well met" with teamsters, mechanics, and cowboys, he could meet kings and emperors on their own ground. A lover of big-game hunting, he was a naturalist before he was a sportsman.

His Americanism reached in to the marrow of his bones. I could never get him interested in that other great American,—one more strictly of the people than he was—Walt Whitman. Whitman's democracy was too rank and unrelieved to attract him. The Rooseveltian strenuousness and austerity and high social ideals stood in the way.

Roosevelt combined and harmonized opposite qualities. Never have I known such good-fellowship joined to such austerity, such moral courage to such physical courage, such prodigious powers of memory united with such powers of original thought. He could face a charging lion, or a grizzly bear, as coolly as he could an angry politician.

There was always something imminent about him, like an avalanche that the sound of your voice might loosen. The word demanded by the occasion was instantly on his lips, whether it were to give pleasure or pain. In his presence one felt that the day of judgment might come at any moment. No easy tolerance with him, but you could always count on the just word, the square deal, and tolerance of your opinion if it were well founded.

The charge that he was an impulsive man has no foundation; it was a wrong interpretation of his power of quick decision. His singleness of purpose and the vitality and alertness of each of his many sides enabled him to decide quickly where others hesitate and stumble. The emphasis and the sharpness of his yea and nay, were those of a man who always knew his own mind and knew it instantly. What seemed rashness in him was only the action of a mind of extraordinary quickness and precision. His uncompromising character made him many enemies, but without it he would not have been the Roosevelt who stamped himself so deeply upon the hearts and the history of his countrymen.

When I think of his death amid these great days when such tremendous world events are fast becoming history, and recall what a part he could have played in them, and would gladly have played, had his health permitted, I realize with new poignancy what a loss the world has suffered in his passing! A pall seems to settle upon the very sky. The world is bleaker and colder for his absence from it. We shall not look upon his like again.

Farewell! great Soul, farewell!

The warm human fellowship about the camp fire, where our thoughts turned to great adventures, and our tongues uttered intimate words of home and friends and the great adventure which is life

Courtesy of Charles Scribner's Sons

Roosevelt in South America on the expedition which explored and mapped the "River of Doubt," now the Rio Téodoro.—Roosevelt's books covering his explorations and his observations on animal life were written in the field, which in large measure accounts for their accuracy and vividness. (He is here shown protected from fever-carrying insects by gloves and a mosquito net helmet)

Courtesy of Charles Scribner's Sons

The canoes of Roosevelt and Colonel Rondon on the "River of Doubt" at the junction of a large tributary, the Bandeira

Theodore Roosevelt, Naturalist

PERSONAL AFFILIATION WITH THE AMERICAN MUSEUM—SERIOUS AND SINCERE PURPOSE AS EXPLORER AND NATURALIST

By HENRY FAIRFIELD OSBORN

ROOSEVELT spent the first years of his life and the last years as a naturalist, and it chanced that he was in close touch with the American Museum at both ends of his wonderful career. In the range of his life as a naturalist, as an observer, traveler, explorer, writer, and last but not least, a biological philosopher, as in the range of his work over the vast fields of history, of government, and of international relations, his service was stupendous: and now that we are able to look at his life as a whole, we realize that he was not *one* man, but many great men, many personalities, combined and harmonized into one,—all impelled by indomitable will and determination, all inspired by idealism, all warmed and humanized by the most loving and sympathetic temperament.

This manifold ability and multiple nature came out in the course of his plans for a great expedition to South America, projected in the spring of 1913 and executed between October, 1913, and June, 1914. He had selected an unknown and particularly dangerous region, where the native tribes had never been thoroughly subdued by the Brazilian Government. He marked out this region as his first choice for a South American expedition, but I sent word to him through Dr. Frank M. Chapman, who was representing us in these plans, that I would never consent to his going to this particular region under the American Museum flag; that I would not even assume part of the responsibility for what might happen in case he did not return alive. With a smile he sent back a characteristic word: "I have already lived and enjoyed as much of life as any nine other men I know; I have had my full share, and if it is necessary for me to leave my remains in South America, I am quite ready to do so." Although more prudent plans prevailed, and we finally determined upon a route which resulted in the discovery of the Rio Roosevelt, yet the exposure, the excessively moist climate, and the dearth of food, clothing, and supplies, very nearly cost Theodore Roosevelt his life.

It was Roosevelt's warm sentiment for his native city and the survival of the memories of his boyhood education as an ornithologist, so delightfully described by himself in the pages of the JOURNAL,[1] which brought him back into relation with the American Museum, after he had, by means of his two years in Africa, completed his magnificent service to our National Museum at Washington immediately on leaving the presidency.

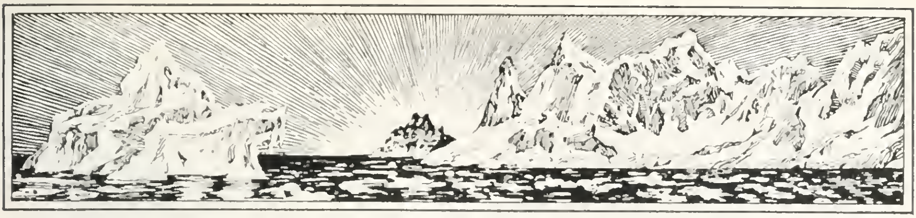
In planning the South American journey, as in planning that to Africa, he prepared with the utmost intelligence and thoroughness for what he knew would be a hazardous trip, even after all precautions had been taken. With the trained assistance of his son Kermit Roosevelt, with the South American experience and stalwart courage of Mr. George K. Cherrie, and with the devoted and most intelligent companionship of Colonel Candido Mariano da Silva Rondon and Mr. Leo E. Miller, this expedition developed into the most important that has ever gone from North into South America. As a result of this expedition through Para-

[1] "My Life as a Naturalist," AMERICAN MUSEUM JOURNAL, May, 1918

guay and the wilderness of Brazil, more than 450 mammal and 1375 bird specimens were added to the American Museum's collections, in addition to the geographic results which aroused such a chorus of discussion and diversity of opinion. Roosevelt was so impressed with the importance of continuing this exploration, that on his return he personally contributed $2000 from his literary earnings, to send his companion naturalists back to the field. The Museum accordingly sent Messrs. Leo E. Miller and Howarth Boyle to Colombia and Bolivia, and Mr. Cherrie to the marshes of Paraguay, to continue the work of the first Roosevelt Expedition.

An American statesman, who should have known better, has recently characterized Roosevelt as "one who knew a little about more things than anyone else in this country." This gives an entirely false impression of Roosevelt's mind. His mind was quite of a contrary order; for what Roosevelt did know, he knew thoroughly; he went to the very bottom of things, if possible; and no one was more conscientious or modest than he where his knowledge was limited or merely that of the intelligent layman. His thorough research in preparing for the African and South American expeditions was not that of the amateur or of the sportsman, but of the trained naturalist who desires to learn as much as possible from previous students and explorers. During his preparation for the African expedition, I sent him from the rich stores of the American Museum and Osborn libraries all the books relating to the mammal life of Africa. These books went in installments, five or six a week; as each installment was returned, another lot was sent. Thus in the course of a few weeks he had read all that had been written about the great mammals of Africa from Sclater to Selous. He knew not only the genera and species, but the localities where particular species and subspecies were to be found. I remember at a conference with African great game hunters at Oyster Bay, where were assembled at luncheon all the Americans that he could muster who had actually explored in Africa, a question arose regarding the locality of a particular subspecies, Grévy's zebra (*Equus grevyi foai*). Roosevelt went to the map, pointed out directly the particular and only spot where this subspecies could be found, and said that he did not think the expedition could possibly get down in that direction. This was but one instance among hundreds not only of his marvelous memory but also of his thoroughness of preparation.

We shall have a memorial of Theodore Roosevelt, the Naturalist, in the American Museum of Natural History. He honored the institution by his presence: he loved it and gave his inspiring touch to many branches of its activity during the closing years of his life. In the intervals of politics, of pressing duties of every kind, he would repair here for keen and concentrated discussions on animal coloration, or geographic distribution, or the history of human races, or the evolution of some group of animals, or, perchance, the furtherance of some expedition. What the Roosevelt memorial shall be it is premature to say, except that it will certainly be a memorial to the beautiful and courageous aspect of his manifold character and life as a naturalist. This memorial will be such as to remind the boys and girls of all future generations of Americans of the spirit of love, of zeal, and of intelligence with which they should approach nature in any of its wonderful aspects.



Roosevelt—The Friend of Man

By ROBERT E. PEARY

Rear Admiral, United States Navy, Retired; President, Aërial League of America; Chairman, National Aërial Coast Patrol Commission

A SORROWING nation pays meet tribute to the passing of the greatest American of his time—Theodore Roosevelt.

The one outstanding feature of the complex character of Roosevelt, the man of many parts, was his friendship for man in the abstract—and when this friendship took concrete form for the individual, it became, for its recipient, a tower of strength as fortifying and as impregnable as Gibraltar.

The friendship of Theodore Roosevelt was indeed a most precious possession. Whenever and wherever extended, it had the effect of a superlative super-incentive to greater deeds—a step by step advancement, onward and upward, never permitting a retrogression.

I make the following statement without fear of successful contradiction, that no other single personality in this great world of ours today has gathered from such a multitude, from all quarters, kinds, and conditions of life, the utmost in spontaneous affection that has been accorded him during his years of contact with a world's people.

Thousands upon thousands, in all parts of the world, became his friend through the magnetic personality of his written words, which have reached to the uttermost extremes of enlightened civilization all over the globe.

Inestimable tribute should be paid to Colonel Roosevelt's memory for the advice and support, given when President of the United States, to the Peary Arctic Club Expedition to the North Polar Regions which resulted in reaching the Pole April 6, 1909.

In 1912, at the annual dinner of the Explorers' Club, I ventured the prophecy that in a few years the polar regions would be reconnoitered and explored through the air. That prophecy is about to be consummated.

The great war has forced the development of the science of aëronautics and aircraft to that point where no portion of the globe exists today that cannot be visited and explored by either plane or dirigible. It is indeed a fitting tribute to Colonel Roosevelt's earnest support of aëronautics at all times, that the Bartlett Arctic Expedition, promulgated and organized through the efforts of the Aëro Club of America, should be known as "The Roosevelt Memorial Expedition."

Colonel Roosevelt was a veteran supporter of aëronautics. In 1897, when he was Assistant Secretary of the Navy, he used his influence to secure the necessary appropriation needed by Professor Langley to continue his plans for aviation. Colonel Roosevelt was also responsible for giving the United States Army an aëroplane before any other nation had one. In 1907 he approved the ordering of a biplane and a dirigible.

Scientific results of inestimable value to the United States and to the whole world are directly traceable to Roosevelt's friendship for man.

Theodore Roosevelt and Africa

THE MAN WHO FELT THE ATTRACTION OF LIFE IN THE SILENT PLACES AND THE WIDE WASTE SPACES OF THE EARTH

By CARL E. AKELEY

FROM field naturalists who knew Roosevelt he always received profound and unstinted admiration; they knew that his greatest pleasure lay in seeing and learning; that he found infinite joy in studying wild animal life in its native haunts; that he had the observing eye and keen mind of the ideal naturalist.

His expedition to Africa had been definitely planned in his mind several years before it actually came about. I had returned from an expedition to Africa late in 1907, and recall the emphasis of his words at the White House one day as he said to me, "When I am through with this job, I am going to Africa."

I met him in Africa in 1912 on the Uasin Gishu Plateau. It was morning and our American Museum Expedition was marching toward the N'Zoia River, when one of the boys called my attention to a *safari* two miles or so to the south. With the thought that it might possibly be the Roosevelt Expedition, I sent a runner to make inquiry, while we proceeded to the banks of the river and made camp. The runner soon returned, stating that he had met a runner halfway, that it was the Roosevelt party, and that they were going into camp on the edge of the marsh not far from where we had seen them.

When our camp was made, we started out on our horses in the direction of the marsh, but when about halfway met the Colonel with Kermit, and two others of his party. We all returned to our camp and a good part of the afternoon was spent making arrangements for an elephant hunt for the next day.

Within an hour or two after leaving camp in the morning, we picked up the trail of a small herd of elephants, and as they were easily tracked through the grass, we moved very rapidly. At about eleven o'clock, while we were following the trail quite casually, someone in advance heard a sound which resulted in our coming to a standstill. We made a short detour to the left, and a few minutes later were looking at a small band of cows and calves enjoying their midday siesta under a clump of bush. We advanced under cover of a large ant hill to within about fifty yards, from which point we looked them over carefully and decided which were valuable for our scientific purpose.

I indicated the particular cow that I wanted the Colonel to shoot for the American Museum group. Of course at this distance from the elephants we could speak only in lowest whispers and every move was guarded. I waited for the Colonel to take a shot, expecting him to do this from behind the ant hill where we were afforded a splendid protection against a charge, but he started forward toward the elephants and I, with Kermit, was obliged to follow closely. My impulse was to tell him that I wanted him to shoot the cow and not "take her alive!" He continued to go steadily forward, however, intending to get so close that there could be no doubt of the effectiveness of his shot; but the elephants suddenly began moving in our direction, at which he promptly fired. This did not stop their advance, but rather accelerated it instead, so that quick action was necessary. When we got through we had four dead elephants.

All of the party, except the Colonel

and myself, returned to camp to send out tools, equipment, and men, preparatory to taking care of the great skins and skeletons of the four elephants. He and I sat down under a tree with our luncheon, and for two or three hours we conversed of intimate things. For a number of months the Colonel had seen no one from home except the members of his own party. We were fresh from the United States and there was much to talk of. He spoke much of his family, of Mrs. Roosevelt, and his sons and daughters. It was then that I learned to love Roosevelt.

It is not an easy thing to give expression to the thoughts that come to my mind of this man who has so recently passed beyond our range of vision. What I feel most is that whereas Roosevelt is gone, his influence seems greater than ever. Many of us will feel, with respect to the things that Roosevelt wanted us to do and which we never seemed to have time to do, that now we have time for nothing else.

As to Africa, perhaps no man in modern times has gotten so much out of the "Dark Continent" as did Roosevelt. In the "Foreword" of his *African Game Trails* he describes Africa in two pages with a vividness others have failed to give in volumes. And no single sentence of it consists of word and phrase merely; every bit of it stands for the man's own personal experience and his own intense thinking and feeling. I wish that the African hall of the American Museum might be done as a memorial to Theodore Roosevelt. I would have this Foreword on a bronze tablet at the entrance:

Africa[1]*—In the Words of Roosevelt*

"I speak of Africa and golden joys"; the joy of wandering through lonely lands; the joy of hunting the mighty and terrible lords of the wilderness, the cunning, the wary, and the grim.

In these greatest of the world's great hunting-grounds there are mountain peaks whose snows are dazzling under the equatorial sun; swamps where the slime oozes and bubbles and festers in the steaming heat; lakes like seas; skies that burn above deserts where the iron desolation is shrouded from view by the wavering mockery of the mirage; vast grassy plains where palms and thorn-trees fringe the dwindling streams; mighty rivers rushing out of the heart of the continent through the sadness of endless marshes; forests of gorgeous beauty, where death broods in the dark and silent depths.

There are regions as healthful as the northland, and other regions, radiant with bright-hued flowers, birds and butterflies, odorous with sweet and heavy scents, but treacherous in their beauty, and sinister to human life. On the land and in the water there are dread brutes that feed on the flesh of man; and among the lower things that crawl, and fly, and sting, and bite, he finds swarming foes far more evil and deadly than any beast or reptile; foes that kill his crops and his cattle, foes before which he himself perishes in his hundreds of thousands.

The dark-skinned races that live in the land vary widely. Some are warlike, cattle-owning nomads; some till the soil and live in thatched huts shaped like beehives; some are fisherfolk; some are ape-like naked savages, who dwell in the woods and prey on creatures not much wilder or lower than themselves.

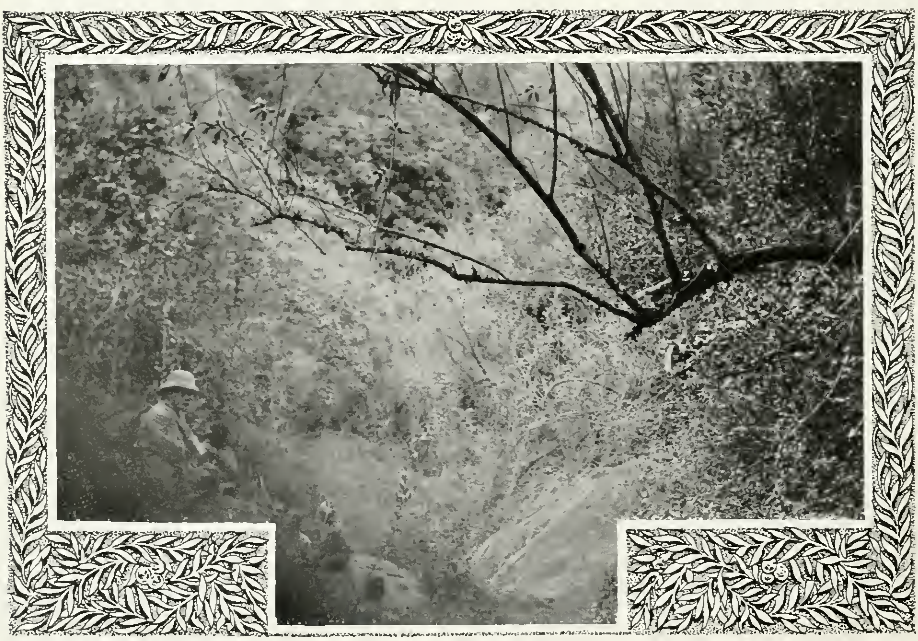
The land teems with beasts of the chase, infinite in number and incredible in variety. It holds the fiercest beasts of ravin, and the fleetest and most timid of those beings that live in undying fear of talon and fang. It holds the largest and the smallest of hoofed animals. It holds the mightiest creatures that tread the earth or swim in its rivers; it also

[1] Quoted from the Foreword of *African Game Trails*, through the courtesy of Charles Scribner's Sons.

holds distant kinsfolk of these same creatures, no bigger than woodchucks, which dwell in crannies of the rocks, and in the tree tops. There are antelope smaller than hares, and antelope larger than oxen. There are creatures which are the embodiments of grace; and others whose huge ungainliness is like that of a shape in a nightmare. The plains are alive with droves of strange and beautiful animals whose like is not known elsewhere; and with others even stranger that show both in form and temper something of the fantastic and the grotesque. It is a never-ending pleasure to gaze at the great herds of buck as they move to and fro in their myriads; as they stand for their noontide rest in the quivering heat haze; as the long files come down to drink at the watering-places; as they feed and fight and rest and make love.

The hunter who wanders through these lands sees sights which ever afterward remain fixed in his mind. He sees the monstrous river-horse snorting and plunging beside the boat; the giraffe looking over the tree tops at the nearing horseman; the ostrich fleeing at a speed that none may rival; the snarling leopard and coiled python, with their lethal beauty; the zebras, barking in the moonlight, as the laden caravan passes on its night march through a thirsty land. In after years there shall come to him memories of the lion's charge; of the gray bulk of the elephant, close at hand in the sombre woodland; of the buffalo, his sullen eyes lowering from under his helmet of horn; of the rhinoceros, truculent and stupid, standing in the bright sunlight on the empty plain.

These things can be told. But there are no words that can tell the hidden spirit of the wilderness, that can reveal its mystery, its melancholy, and its charm. There is delight in the hardy life of the open, in long rides rifle in hand, in the thrill of the fight with dangerous game. Apart from this, yet mingled with it, is the strong attraction of the silent places, of the large tropic moons, and the splendor of the new stars; where the wanderer sees the awful glory of sunrise and sunset in the wide waste spaces of the earth, unworn of man, and changed only by the slow change of the ages through time everlasting.



Personal Glimpses of Theodore Roosevelt

By DAVID STARR JORDAN

ROOSEVELT entered Harvard College in 1876 at the age of eighteen, hoping to become a naturalist, having already made a considerable collection of birds, besides many observations as to their habits. His eyesight being defective, however, and not connecting well with magnifying glasses, his early ambition was discouraged by his teachers to whom the chief range of study lay within the field of the microscope. They overlooked the fact that besides primordial slime and determinant chromosomes, there were also in the world grizzly bears, tigers, elephants and trout, as well as song birds and rattlesnakes,—all of which yield profound interest and are alike worthy of study.

So, being discouraged as to work along his chosen line, and in his love of outdoor science, the young naturalist turned to political philosophy, his secondary interests lying in history and politics. He then closed up his private cabinet, giving his stuffed bird skins (through Professor Baird of the Smithsonian) to me. These I transferred to the University of Indiana where they are now in a befitting glass case in Owen Hall, each skin nicely prepared and correctly labeled in the crude boyish handwriting which the distinguished collector never outgrew.

Long after all this, I once took occasion to remind Mr. Roosevelt that "they spoiled a good naturalist" in making him a statesman. But the naturalist was never submerged in the exigencies of statesmanship. During an automobile drive in 1912 across the Santa Clara Valley, Roosevelt displayed a keen interest in the sparrows and warblers of the thickets along the road. These he could call by their first names and mostly by their second. Once in the Yosemite with John Muir, he noted elements in bird and squirrel life which had escaped even his keen-eyed and sympathetic companion.

In our exploration of Hawaii in 1901, my colleague, Dr. Barton W. Evermann, and I came across a very beautiful fish, the *Kalikali*, golden yellow with broad crossbands of deep crimson. This then bore the name of *Serranus brighami* given it by its discoverer, Alvin Seale. But the species was no *Serranus;* and it was moreover plainly the type of a new genus. This we called *Rooseveltia*, in honor of "Theodore Roosevelt, Naturalist" and in recognition of his services in the promotion of zoölogical research. With this compliment he was "delighted." "Who would not be?" he said.

In the various natural history explorations undertaken by me—and by others during his administration as President of the United States—we could always count on intelligent and effective sympathy. In so far as scientific appointments rested with him he gave them careful and conscientious consideration. Indeed, during his administration, governmental science reached its high-water mark. In 1905 I was preparing for an exploration of the deep seas around Japan by means of the Fish Commission steamer "Albatross." While I was talking this matter over with Roosevelt he said, pounding the table with his fist: "It was to help along things like this, Dr. Jordan, that I took this job!"

The story of Roosevelt's relation to Tutuila in Samoa has never been told, and though scientific only in part, it may be related here.[1]

The three islands of Samoa were held for a period of years under the joint protectorate of Great Britain, Germany, and the United States. The general result was unsatisfactory, a condition due mainly to the petty intrigues of German agents. In Stevenson's words, "There was a fresh conspiracy every day," and a good account of this situa-

[1] This incident is republished by courtesy of *The New Republic*.—THE EDITOR.

tion was given by "R. L. S." in *A Footnote to History*.

England at last exchanged her rights here for certain advantages elsewhere, and the islands themselves were divided, Upolu, the center of population, and Savaii, the largest of the group, going to Germany, while Tutuila, with its magnificent harbor at Pago Pago, and little Manua went to the United States. The native Tutuilans took the matter seriously and were much pleased with the new arrangement. The two chieftains, Mauga and Paa Vei, then caused to be drawn up an elaborate document formally deeding the sovereignty of their island to the United States. Now, in the etiquette of the South Seas, to receive a present without acknowledgment is a flagrant insult, but the people saw the United States occupy the island and erect docks, storehouses, and residences without a word of thanks.

When I went to Samoa in 1902, I found the inhabitants of Tutuila much worked up over the matter. Tuamanua, chief of the tiny outlying island, was in a state which, on a larger scale, would be called rebellion. I went before the little congress at Pago Pago and explained to the people that the United States did not wish to take away any of their rights. It had paid the owners for the land occupied as well as for all service required. It had, moreover, through the governor, Captain (later Rear Admiral) Uriel Sebree, taken great pains to safeguard the interests of the people in their relations to traders in copra, the dried meat of the cocoanut which is the principal export of that region. I also called attention to the fact that in the interest of the people the President had sent Professor Vernon Kellogg (of Stanford University) and me to study the fisheries of the islands to find out all the kinds and what they were good for. I had myself furnished them with a series of paintings of poisonous fishes, some species having in their tissues a substance analogous to strychnine, which would produce the dangerous and often fatal disease known as *ciguatera*. In addition, Professor Kellogg had rendered a material service in teaching them how to get rid of the mosquito and thus to abate their two most dreaded scourges, "dengue" and "elephantiasis," both diseases being produced by minute animal organisms carried from person to person by the mosquito.

I also called to their minds the sad fact that just about the time their deed of gift was received at Washington, the President of the United States had been assassinated by an insane ruffian. It was probable that in the confusion which followed, the document had been misplaced and the incoming President, always thoughtful about such matters, had possibly never seen it. I would bring the affair to his attention, sure that he would make a courteous response. This kept the people quiet for the time, and expectant as to the future.

I then sent a statement of facts to the President, and soon after left the island; but I read in the press in the fall of 1902 that President Roosevelt had sent a gold watch each to Mauga and Paa Vei, also a flag to the little native police corps or *Fitafitas*, and that in Pago Pago they had had a "red-letter day of rejoicing."

On returning to Washington I found that the deed of gift had been filed under the head of "Docks." Pago Pago, from the official point of view, being merely the water front of a naval station. Fear of precedent had prevented acknowledgment.

McKinley's advisers emphasized this point but Roosevelt characteristically did not care a straw for precedent. He did what a natural man should do. *He made it right with the people.* He said afterward to me in regard to it, "It always pays for a nation to be a gentleman."

Roosevelt, the Man of Abundant Life[1]

By GIFFORD PINCHOT

WE who loved Roosevelt have not lost him. The qualities we treasured in him, his loyalty, his genial kindness, his unwearied thoughtfulness for others, the generosity which made him prefer his friends in honor to himself, his tenderness with children, his quick delight in living, and the firm soundness of his life's foundations, are potent with us yet. The broad human sympathy which bound to him the millions who never saw his face, his clean courage and self-forgetful devotion to his country, the tremendous sanity of his grasp on the problems of the nation and the world, and the superb simplicity and directness of his life and thought still live as the inspiration and the basis for the new and better world which is to come.

The people loved Roosevelt because he was like them. In him the common qualities were lifted to a higher tension and a greater power, but they were still the same. What he did plain men understood and would have liked to do. The people loved him because his thoughts, though loftier, were yet within their reach, and his motives were always clear in their sight. They knew his purposes were always right. To millions he was the image of their better selves.

Roosevelt was the greatest preacher of righteousness in modern times. Deeply religious beneath the surface, he made right living seem the natural thing, and there was no man beyond the reach of his preaching and example. In the sight of all men, he lived the things he taught, and millions followed him because he was the clear exemplar of his teaching.

Unless we may except his Conservation Policies[2] Roosevelt's greatest service during his presidency was the inspiration he gave young men. To them he was the leader in all they hoped to be and do for the common good. The generation which was entering manhood while he was President will carry with it to the grave the impress of his leadership and personality.

To the boys of America he was all they hoped to be—a hunter, a rider, a sportsman, eager for the tang of danger, keen and confident, and utterly unafraid. There was no part of his example but was good for boys to follow. Roosevelt, half boy till his life's end, yet the manliest of men, of a fineness his best friends best understood, was their ideal, and will not cease to be because he has passed on.

To him the unforgivable sin, and there was but one, was betrayal of the interests of his country. The man who

[1] Address at Roosevelt Memorial Meeting, Metropolitan Opera House, Philadelphia, afternoon of Sunday, February 9.

[2] The name of Gifford Pinchot is closely connected with the work in conservation accomplished by Roosevelt, who states the high value he placed on Mr. Pinchot's services in the chapter on "The Natural Resources of the Nation" in his *Autobiography* (p. 429):

"Gifford Pinchot is the man to whom the nation owes most for what has been accomplished as regards the preservation of the natural resources of our country. He led, and indeed, during its most vital period embodied, the fight for the preservation through use of our forests. He played one of the leading parts in the effort to make the national Government the chief instrument in developing the irrigation of the arid West. . . ."

The story of the forestry work of the Roosevelt administration is one of great historical interest. It includes the training of foresters at a newly opened forest school at Yale, the development of our present Forest Service with trained foresters in control of the public lands, the great increase by Executive Order of the area of the national forests, and their opening to settlers under regulation, the calling of the first meeting of governors in this country (May, 1908), and the appointment of a National Conservation Commission with the purpose of making an inventory of all the resources of the nation. Gifford Pinchot was chairman of this commission. All of this work from 1901 to 1909 formed the basis of the country's present practical enlightenment on conservation.—THE EDITOR.

sinned that sin he neither forgave nor forgot. For opposition to himself he cared but little; enemies he had in plenty, but they cast no shadow on his soul. He was a gallant and a cheerful fighter, willing, as he often said, to be beaten for any cause that was worth fighting for, and whether in defeat or victory, never unbalanced and never dismayed.

Roosevelt lived intensely in his family life. The doer of great things himself, and the occasion of great accomplishment in others, what he did was not done alone. It is but right that we should recognize the part played by the strong and gentle, wise and loving woman, whose hand was so rarely seen yet still more rarely absent in all that was best in her great husband's finest living and most memorable achievements.

The greatest of executives, he transformed the machinery of government with the flame of his own spirit. He was his own hardest taskmaster, and always unwilling to ask of his men the thing he was not ready to do himself. He was our leader because he was the better man. He worked more hours, at higher speed, with wider vision. He trusted us, and gave each man his head. Always eager to recognize good work and give due credit for it, always ready with an excuse for the man who honestly tried and failed, he had nothing but scorn and contempt for the man who never tried at all.

Filled with the joy and the spice of living, afraid neither of life nor of death, thankful for sunshine or rain, never sorry for himself, never asking odds of any man or any situation, he used the powers he had as only his great soul could use them—powers seldom if ever before assembled in one individual, but nearly all of them duplicated, one here, one there, within the knowledge of us all. It was the use his soul made of his body and his mind that was the essence of his greatness.

The greatest of his victories was his last, his victory over the indifference of a people long misled. He was the first to see the need for it. To gain it he seemed to throw away his future. In the event he won results and earned a name which will live while the knowledge of America's part in the Great War still endures.

He was the leader of the people because his courage and his soundness made him so. More than any man of his time, he was loved by those who ought to love him, and hated by those who ought to hate him. His ideals, his purposes, his points of view, his hostilities, and his enthusiasms were such as every man could entertain and understand. It was only in the application of them that he rose to heights beyond the reach of all the rest of us.

What explains his power? Life is the answer. Life at its warmest and fullest and freest, at its utmost in vigor, at its sanest in purpose and restraint, at its cleanest and clearest,—life tremendous in volume, unbounded in scope, yet controlled and guided with a disciplined power which made him, as few men have ever been, the captain of his soul. Alert, glad, without meanness and without fear, free from arrogance and affectation, with few hesitations and few regrets, slow to promise but ardent to perform, delighting in difficulties, welcoming danger, sensitive to the touch of every phase of human existence, yet dominated by standards more severely set for himself than for any others, sustained by a breadth of knowledge and of sympathy and by an endurance, both physical and mental, which belonged to him alone, Roosevelt lived with a completeness that lesser men can never know.

In Roosevelt above all the men of his time, the promise of the Master was fulfilled—"I came that ye might have life, and that ye might have it more abundantly."

Photograph by Kermit Roosevelt

Roosevelt and Carl E. Akeley elephant hunting on the Uasin Gishu Plateau, British East Africa

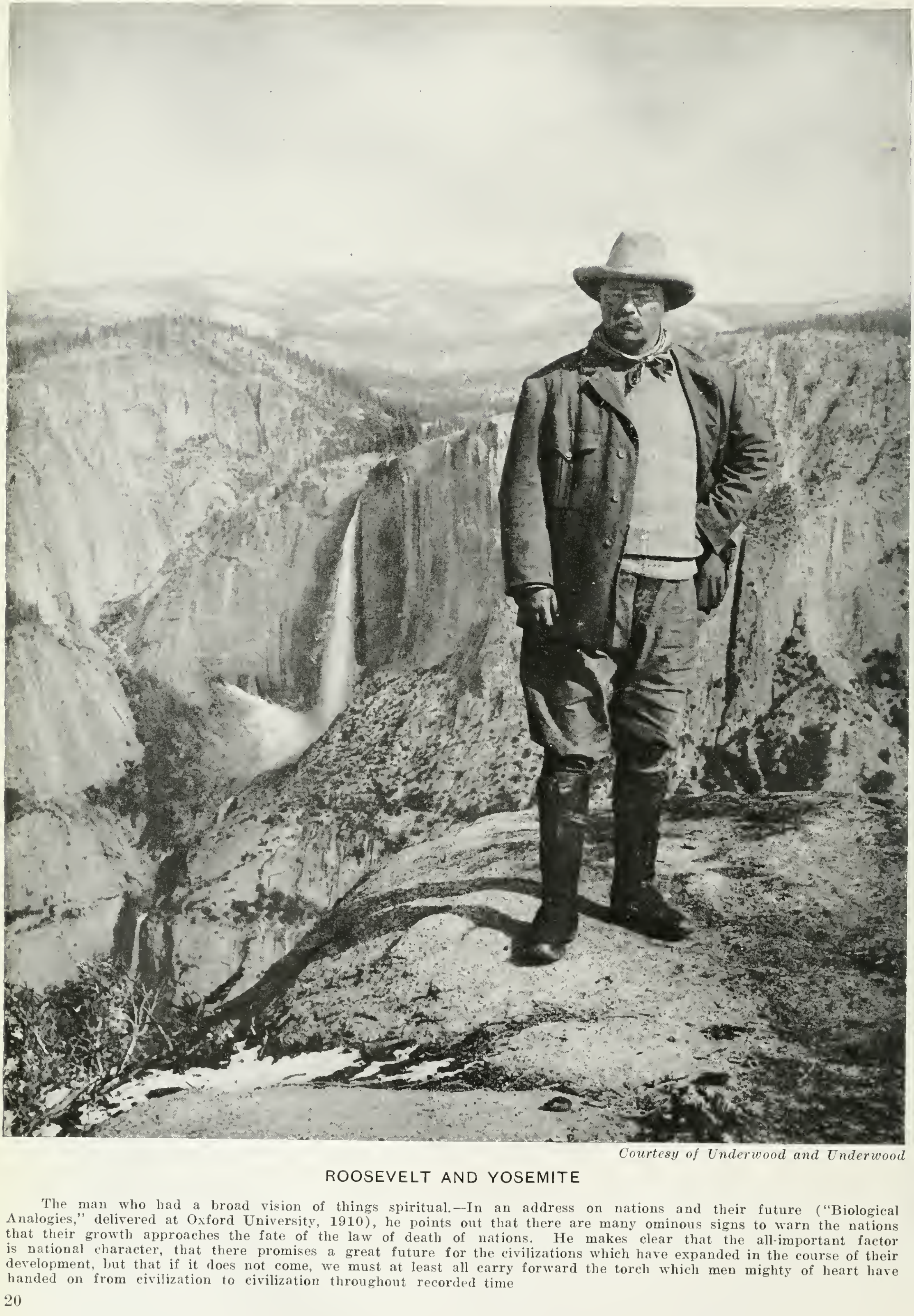
The elephant shown here, lying where it fell from Roosevelt's shot, is one in the group now in preparation in the American Museum's elephant studio. Roosevelt, while on his African Expedition, hunted and shot elephants for permanent exhibition in the United States National Museum and the University of California

SERIES OF PHOTOGRAPHS

SUGGESTIVE OF

THE VARIED ACHIEVEMENTS AND INTERESTS OF THEODORE ROOSEVELT

EXPLORER, NATURALIST, SOLDIER, STATESMAN, WRITER, AND FRIEND OF MAN



Courtesy of Underwood and Underwood

ROOSEVELT AND YOSEMITE

The man who had a broad vision of things spiritual.—In an address on nations and their future ("Biological Analogies," delivered at Oxford University, 1910), he points out that there are many ominous signs to warn the nations that their growth approaches the fate of the law of death of nations. He makes clear that the all-important factor is national character, that there promises a great future for the civilizations which have expanded in the course of their development, but that if it does not come, we must at least all carry forward the torch which men mighty of heart have handed on from civilization to civilization throughout recorded time

Courtesy of Underwood and Underwood

ON A HUNTING TRIP IN COLORADO, 1905

"It is an incalculable added pleasure to anyone's sense of happiness if he or she grows to know, even slightly or imperfectly, how to read and enjoy the wonder-book of nature. All hunters should be nature-lovers. It is to be hoped that . . . from now on the hunter will stand foremost in working for the preservation and perpetuation of the wild life, whether big or little."—From *Pastimes of an American Hunter.*

The invitation to get out into the western country on hunting trips for a few weeks each year came to Roosevelt neither from the delights of natural history and sportsmanship alone, nor alone from interest in conservation problems; he especially gloried in remembering the heroic part played by the pioneers, and by the nation in handling early problems of statehood:

". . . In all the history of mankind there is nothing that quite parallels the way in which our people have filled a vacant continent with self-governing commonwealths, knit into one nation. . . . It is a record of men who greatly dared and greatly did; a record of endless feats of arms, of victory after victory and ceaseless strife waged against wild man and wild nature. . . . The old iron days have gone. . . . Let us see to it that, while we take advantage of every gentler and more humanizing tendency of the age, we yet preserve the iron quality. . . . We need the positive virtues of resolution, of courage, of indomitable will, of power to do without shrinking the rough work that must always be done, and to persevere. . . ."—From address at the Quarter-Centennial Celebration of Statehood in Colorado

With John Burroughs in Yellowstone Park, 1903.—They are on their way to the big geyser region, Roosevelt, in accordance with his habit from a boy on such occasions, sitting with the driver of the sleigh. Roosevelt was especially interested in the big game and would go entirely alone on long twenty-mile tramps for the pleasure of creeping up unawares on a band of elk or mountain sheep and eating his luncheon while he studied them. Burroughs says, in telling their experiences and laughter when racing on skis down some of the hills: "The spirit of the boy was in the air about the Cañon of the Yellowstone, and the biggest boy of us all was President Roosevelt." It was on this trip that Mr. Burroughs first came to know of Roosevelt's great natural history knowledge and of his trained powers of observation:

"Born observers are about as rare as born poets. Plenty of men can see straight and report straight what they see; but the men who see what others miss, who see quickly and surely, who have the detective eye, like Sherlock Holmes, who 'get the drop,' so to speak, on every object, who see minutely and who see whole, are rare indeed. President Roosevelt comes as near fulfilling this ideal as any man I have known."—From *Camping and Tramping with Roosevelt*, by John Burroughs

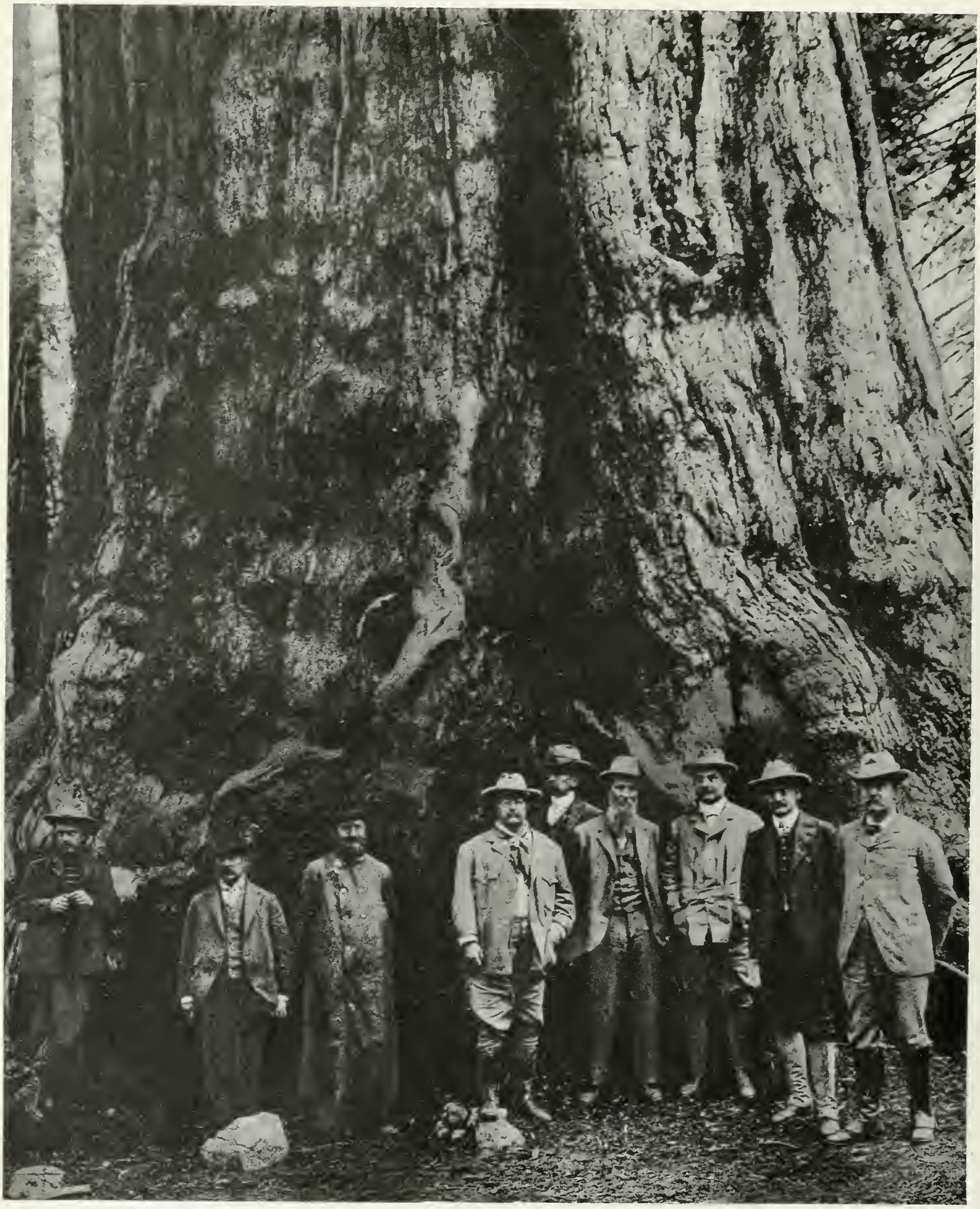
Portraits of two bird lovers in the Yellowstone.—He lived thus in the wilderness, he followed the elk and the antelope, he listened to bird songs as though there were nothing else in the world. But he emerged after a few days into a world of people, politics, and speeches again, and waged anew and strenuously the fight for a high type of national service

Courtesy of Brown Bros.

Roosevelt with a group of East Side children.—Roosevelt believed in the doctrine of will for a man, and he had a conscience, and he helped New York grow a legislative conscience, beginning even before the day when he knew Jacob Riis and *How the Other Half Lives*. The following is one of the truest things Mr. Riis says of him in *Roosevelt, the Citizen*: "The fact is he is a perfectly logical product of a certain course of conduct deliberately entered upon and faithfully adhered to all through life, as all of us are who have any character worth mentioning." New York's East Side gave genuine reverence to this character of Roosevelt which fearlessly righted wrongs in tenements and playgrounds, in liquor and police laws. He believed in the good in his fellow men, and his trust was never more fully justified than in his work on New York's East Side

Courtesy of Brown Bros.

An inspiration back of Peary's work.—It is easy to understand that with his admiration for courage and hardihood no man in America was more ready than Roosevelt to do homage to the great explorer. Also with his love of wandering alone in the wilderness, and in his experience in standing in positions of great personal responsibility, none would so well appreciate the wearing loneliness and responsibility of the life of the explorer. He compares the explorer and the soldier as to these qualities in his Introduction to Peary's *Nearest the Pole*



Courtesy of Brown Bros.

BESIDE "GRIZZLY GIANT," ONE OF THE SEQUOIAS HE PROTECTED

Theodore Roosevelt in California at the time of his administration (at the left stands Governor Pardee, at the right in order, John Muir; Dr. Butler, of Columbia; Secretary Loeb; and President Wheeler, of Berkeley).—We can realize the delight that it was for John Muir to show his beloved Yosemite and Sequoia cañons and forests to a man of Roosevelt's appreciation and power of observation. They spent three days at this time tramping and camping together, sleeping in the open, between trunks of giant Sequoias—as Roosevelt said later "in a great solemn cathedral, far vaster and more beautiful than any built by the hand of man."

Roosevelt's initial work in conservation of natural resources, especially of forests, will go down in history as the greatest constructive legislation ever established by an executive in the United States.

On the sixteenth of January, 1919, ten days after the death of Theodore Roosevelt, a bill designating the California giant redwood district as "Roosevelt National Park," passed the Senate of the United States unanimously. He said, in 1903, the Sequoias should be preserved because they are "the only things of their kind in the world," "monuments of themselves"—they now stand majestic monuments for him

Courtesy of Underwood and Underwood

AT WASHINGTON IN 1905

"I do solemnly swear that I will faithfully execute the office of President of the United States, and will to the best of my ability preserve, protect, and defend the Constitution of the United States. And thus I swear."

When Roosevelt became President in 1901 he was the youngest man who had ever taken the oath. His interest in natural history immediately recalled the administration of Thomas Jefferson; but he so far outstripped his predecessor that his seven and one half years in Washington marked a golden age for zoölogy, for exploration, and conservation, a time when scientific expeditions and publications were instigated and encouraged, and naturalists and explorers from all over the world were welcome guests at the White House.

As to statesmanship, a man of great constructive imagination was at the helm. He studied the problems of the nation and the psychology of men. He made himself accessible to every man from every section of the country. He learned their points of view, their interests. He worked with an insatiable desire to understand the thought and feeling of all ranks. Then, like the great synthetic scientist, the true leader, he marshalled all his data before him, formulated conclusions, and led the people where it was best for the good of the country and themselves that they should go.

But the greatest thing that Roosevelt did as President was to bring back to the mind of each man in the country a realization that the government is in truth "for the people, of the people, and by the people"

Courtesy of Underwood and Underwood

ROOSEVELT, THE THINKER AND WRITER.—HE PREACHES READABLENESS IN SCIENTIFIC WRITINGS

Theodore Roosevelt wrote plain prose, but which had the first characteristic of the highest type of writing, clearness. There was never anything uncertain or obscure about the meaning of what he wrote, any more than there was in his own mind about what he thought. And the meaning is always there, ideas jump out at us from the heat of his human experience to inflame our imagination and incite our action. Whether he wrote of the commonplace or the dramatic, it was with equal power —and sometimes also with great literary charm.

He has expressed definitely his own opinion on the form writing should take: "If he [the writer] . . . possesses the highest imagination and literary quality, he will be able to interest us in the gray tints of the general landscape no less than in the flame hues of the jutting peaks . . . Otherwise no profit will come from study of the ordinary; for writings are useless unless they are read, and they cannot be read unless they are readable." From this as a theme he eulogizes "the lofty imagination" necessary for the great historical or scientific writer, and drives away the bugaboos of "inaccuracy" and "shallowness" with which the technical writer often stigmatizes the "readable" book: "Very few great scientists have written interestingly, and these few have usually felt apologetic about it. Yet sooner or later the time will come when the mighty sweep of modern scientific discovery will be placed, by scientific men with the gift of expression, at the service of intelligent and cultivated laymen . . . Indeed, I believe that already science has owed more than it suspects to the unconscious literary power of some of its representatives [for instance, in regard to evolution] . . . where their predecessors had created hardly a ripple, Darwin and Huxley succeeded in effecting a complete revolution in the thought of the age . . . I believe that the chief explanation of the difference was the very simple one that what Darwin and Huxley wrote was interesting to read . . ."

Photographs by Herbert K. Job

SIMPLE DELIGHTS OF NATURAL HISTORY IN THE FIELD

In the picture above—Roosevelt and a young heron encounter each other face to face in a Louisiana Bird Preserve. Mr. Herbert K. Job also was a member of the party and snapped the photograph

At the request of the National Association of Audubon Societies Roosevelt created the Louisiana Bird Preserves by Executive Order in 1904 and 1905. It was in 1915 that he made this tour of the islands with Mr. Job. Between March 14, 1903, and March 4, 1909, of his administration, he established by Executive Order fifty-one National Bird Reservations, distributed in seventeen states and territories from Porto Rico to Hawaii and Alaska.

The photograph below—One does not need to be a boy in years to enjoy a tour of discovery over the beaches of our Gulf Coast where great sea turtles have roamed when all was still and deposited their eggs under the sand

AFTER A LION SPEARING BY NANDI WARRIORS, AFRICA

Photograph by Kermit Roosevelt

This warlike tribe now lives in peace, under British rule, and the young warriors have little opportunity to win glory except in spearing the lions which sometimes kill their cattle. Roosevelt describes the spearing and the victory dance, in one of the most tense bits of description in *African Game Trails* (pp. 405–410).

Roosevelt accorded proportionately to the Negro tribes of Africa and the native helpers on his expedition the interest and appreciation he gave everyone. At home in America he was always the most democratic of men, yet moved in an aristocracy of his own choosing, an aristocracy of worth. Nationality did not matter, class, education, position, money, never counted. For him all depended on the individual strength of character of the man.

In the chapter on "Wild Hunting Companions" of *a Book Lover's Holidays*, he has written delightfully of the wild black boys of Africa who were his and Kermit's daily companions for many months under the equator. He expresses the strong attachment he felt for them, and his interest in them as representatives of an age far remote from that of white men of twentieth century civilization

Courtesy of Brown Bros.

SPEAKING TO THE STUDENT BODY AT HARVARD UNIVERSITY

Roosevelt has once and for all proved false the belief that an honest man and a gentleman cannot be in politics. He has inspired the young college man of high ideals to find success in public life.

"I suppose for one thing ordinary, plain, every-day duty sent me there [into politics] to begin with. . . . When I said I wanted to go to the Republican Association they told me that I would meet the groom and the saloon-keeper there; that politics were low, and that no gentleman bothered with them. 'Then,' said I, 'if that is so, the groom and the saloon-keeper are the governing class and you confess weakness. You have all the chances, the education, the position, and you let them rule you. They must be better men;' and I went."

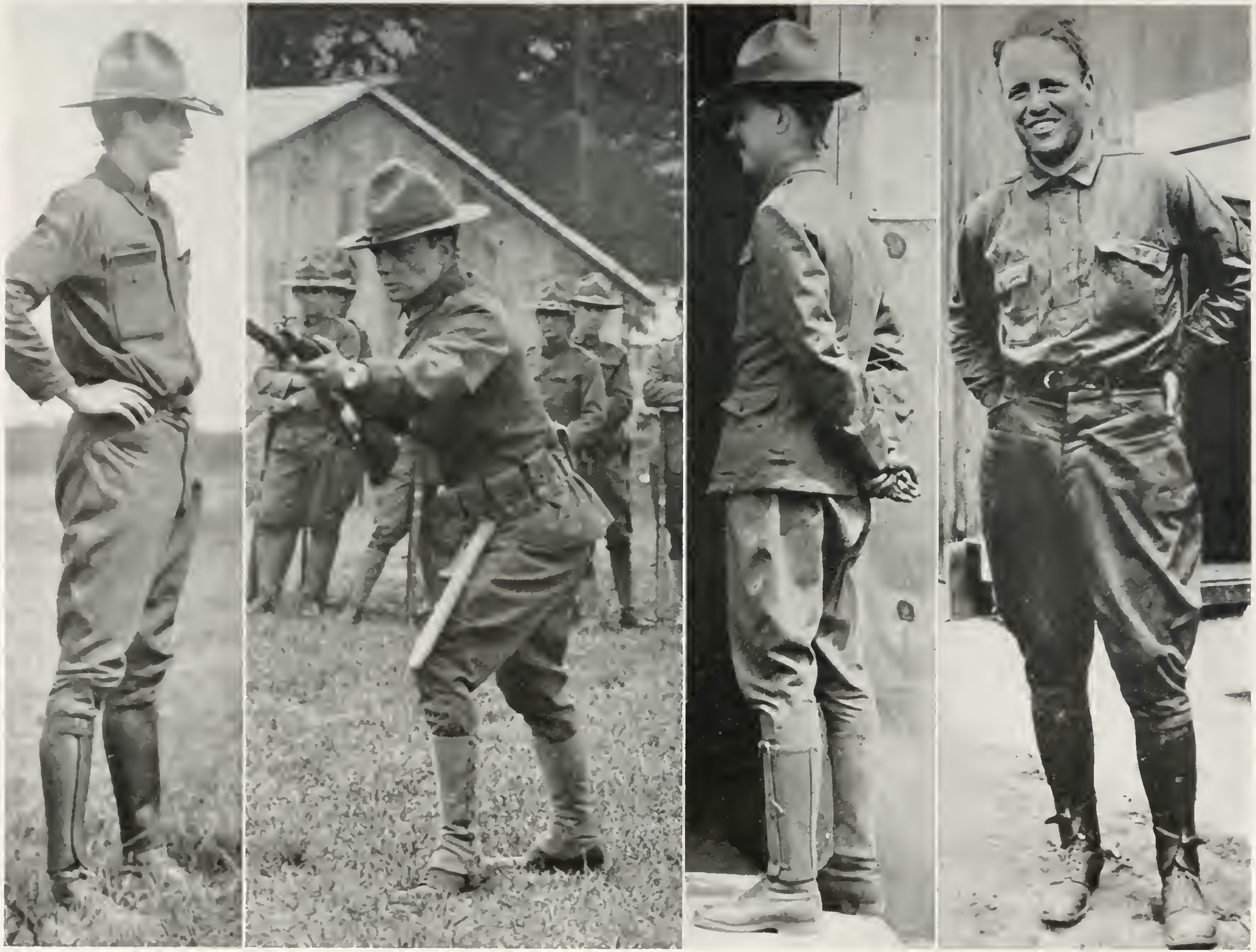
"A heavy moral obligation rests upon the men of means and upon the men of education to do their full duty by their country. On no class does this obligation rest more heavily than upon the men with a collegiate education, the men who are graduates of our universities. Their education gives them no right to feel the least superiority over any of their fellow citizens; but it certainly ought to make them feel that they should stand foremost in the honorable effort to serve the whole public by doing their duty as Americans in the body politic."—From "Colleges and Public Life"

Courtesy of Underwood and Underwood

IN LONDON

A "Teddy Bear" joins the procession for an honorary degree at Cambridge University

Roosevelt saw ahead the natural spiritual bond the English language is likely to prove in the immediate future. During the years of the great war especially, he emphasized the need that all foreign-born men in America, now and hereafter, learn to speak English in order to possess the heritage of American ideals. Meanwhile, the war has been uniting English speaking peoples and shaping conditions to make the English language the language of the world. Roosevelt designated himself "like the Americans of tomorrow, rather than like the Americans of today; for I have in my veins the blood of men who came from many different European races." He foresaw that these "Americans of tomorrow" will have no feeling of the alien with any or all English speaking peoples of that future day, because a common language unites in things of the spirit, and "Common heirship in things of the spirit makes a closer bond than common heirship in the things of the body"



Courtesy of Brown Bros.

SONS OF THEODORE ROOSEVELT

(From left to right in the photograph)

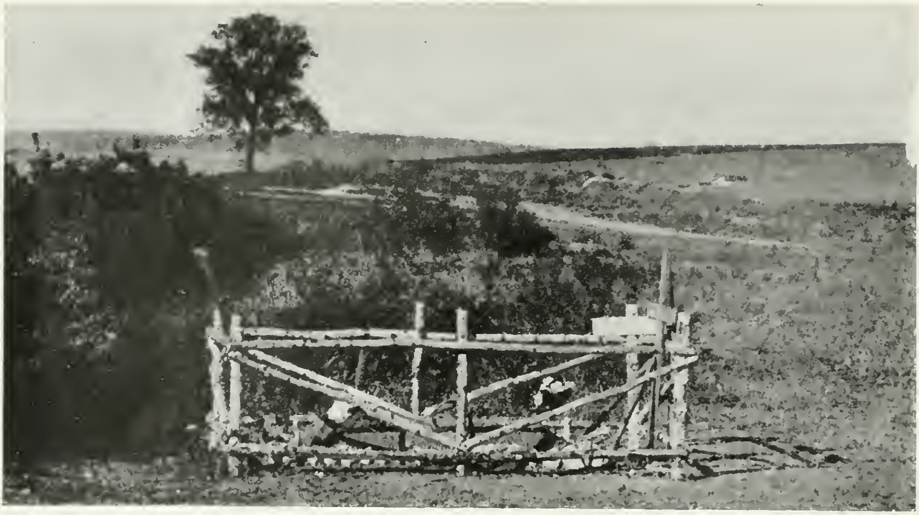
Archibald Roosevelt won a commission as volunteer in the first officers' training camp and was promoted to a captaincy in the 26th Infantry by General Pershing after reaching France. He was wounded in March, and is now in General Hospital No. 1, New York City. He was decorated with the French War Cross for gallantry in action.

Theodore Roosevelt, Jr., Lieutenant Colonel 26th Infantry, 1st Division, Army of Occupation, Germany. He commanded one of the first American battalions to go under fire. He was gassed in June and wounded in July. He won the French War Cross with three palms.

Kermit Roosevelt, Captain, 7th Field Artillery, 1st Division, Army of Occupation, Germany. He was formerly with the British Expeditionary Force in Mesopotamia, Light Armored Motor Battery. British D. S. C.

Quentin Roosevelt, Lieutenant 95th Aero Squadron, killed in action July 14, in preparation of the Soissons counter offensive. He had won the French War Cross.

Quentin Roosevelt, the youngest son, was but nineteen, a sophomore at Harvard. He volunteered at the first moment, as did the older sons, but was rejected because of defective vision. He was so eager to go, however, that he applied for entrance in the Canadian Flying Corps, but was finally taken instead into the United States Aviation Section (in April). He reached France just a few weeks after the other sons



Courtesy of Underwood and Underwood

QUENTIN ROOSEVELT SLEEPS ON FRENCH SOIL

Quentin Roosevelt was shot down while fighting at odds with enemy aëroplanes over the German lines in the Château-Thierry region. He was buried with military honors by German airmen near the spot where his machine fell. Much was expected of him, but he gave more. His sacrifice is to America as a symbol of the soul of democracy, of the country's young manhood offered to the cause of liberty.

Quentin visited France in 1909. A letter written to an old teacher at that time shows his boyish interest in flying (he was eleven years old): "We were at Rheims and saw all the aëroplanes flying, and saw Curtiss who won the Gordon Bennett cup for swiftest flight. You don't know how pretty it was to see all the aëroplanes sailing at a time. At one time there were four aëroplanes in the air. It was the prettiest thing I ever saw. The best one was a monoplane called the 'Antoinette,' which looks like a great big bird in the air. It does not wiggle at all, and goes very fast. It is awfully pretty turning." And at the close of the letter, "Tell S—— that I am sending him a model of an aëroplane that winds up with a rubber band. They work quite well. I have one which can fly a hundred yards, and goes higher than my head."

When he was in training at Mineola, he often chose the air above his home at Sagamore Hill to practice his most startling maneuvers, his father never being sure until afterward that the army plane which had so thrilled them was Quentin's.

When the news of the boy's probable death came from France, Roosevelt, who had been sorrowing that he could not personally be on the western battlefront, dauntlessly gave answer: "Quentin's mother and I are very glad that he got to the Front and had a chance to render some service to his country, and to show the stuff there was in him before his fate befell him"

Courtesy of Underwood and Underwood

THE HOME AT OYSTER BAY AND AËROPLANES WHICH DROPPED WREATHS OF MOURNING

The story of Roosevelt's life is told, and we realize that his spoken and written words have often stood concrete results of his own vivid experience as boy and man. Those who know the facts will recognize the following as autobiographical: "I would order them [young men] to work . . . I would teach the young man that he who has not wealth owes his first duty to his family, but he who has means owes his to his State . . . I would preach the doctrine of work to all, and to the man of wealth the doctrine of unremunerative work."

"Of course, what we have a right to expect of the American boy is that he shall turn out to be a good American man. Now, the chances are strong that he won't be much of a man unless he is a good deal of a boy. He must not be a coward or a weakling, a bully, a shirk, or a prig. He must work hard and play hard. He must be clean-minded and clean-lived, and able to hold his own under all circumstances and against all comers."

"In life as in a football game, the principle to follow is: Hit the line hard; don't foul and don't shirk, but hit the line hard."—From "The American Boy," 1900.

In such plainly spoken words as these the spirit of Roosevelt will live for innumerable future generations of Americans.

Among all his messages perhaps none is more important in the light of the present speed at which civilization is having to settle difficult issues, than the following so often quoted from *The Strenuous Life*:

"In speaking to you, men who preëminently and distinctly embody all that is most American in the American character, I wish to preach, not the doctrine of ignoble ease, but the doctrine of the strenuous life, the life of toil and effort, of labor and strife; to preach the highest form of success which comes . . . to the man who does not shrink from danger, from hardship, or from bitter toil, and who out of these wins the splendid ultimate triumph. . . . As it is with the individual, so it is with the nation . . . If we are to be a really great people, we must strive in good faith to play a great part in the world. We cannot avoid meeting great issues. All that we can determine for ourselves is whether we shall meet them well or ill. The twentieth century looms before us big with the fate of many nations. . . . If we shrink from the hard contests where men must win at hazard of their lives and at the risk of all they hold dear, then the bolder and stronger peoples will pass us by, and will win for themselves the domination of the world. . . . Let us shrink from no strife, moral or physical, within or without the nation, provided we are certain that the strife is justified, for it is only through hard and dangerous endeavor, that we shall ultimately win the goal of true national greatness."

Courtesy of Brown Bros.

ROOSEVELT OVERLOOKING OLD ROME

"The man who works, the man who does great deeds, in the end dies as surely as the veriest idler who cumbers the earth's surface; but he leaves behind him the great fact that he has done his work well. The Roman passed away exactly as all the nations of antiquity which did not expand . . . ; but their very memory has vanished, while he himself is still a living force throughout the wide world in our entire civilization of today. . . ."—From Roosevelt's address on "National Duties."

There is good evidence that no human beings of recent times have surpassed in intellectual powers various personages of the old Greek and Roman civilizations; it may be that even the distant future will hold no greater geniuses than the world already has known. On the other hand, the future promises to bring rapid evolution in human society and organization of state; there is distinct prophecy in Roosevelt's example and urging toward loyalty, morality and coöperation, in social and political relations, both national and international. Roosevelt stood strongly for the "League of Nations"

Has Progressive Evolution Come to an End?

LIMITS OF PHYSICAL AND INTELLECTUAL EVOLUTION OF MAN—THE FUTURE MAY HOLD NO RACE OF SUPER-MEN, BUT IT IS LIKELY TO PRESENT A SUPER-STATE AND A SUPER-CIVILIZATION

By EDWIN GRANT CONKLIN

Professor of Biology, Princeton University

THE term "evolution" is used in several senses. When considered in its larger aspects, as for example with respect to the increasing complexity of organization in the succession of life forms upon the earth, we are dealing with what may be called progressive organization or organic progress. When considered from the standpoint of increasing diversification, as shown in the appearance of varieties and species which are no more complex in organization than the forms from which they sprung and which may be even less complex, we have a type of evolution which is not progressive and which may be called speciation or diversification. A third aspect of evolution is that which deals with increasing adaptation to conditions of life and which may be called progressive adaptation; this may or may not be associated with progressive organization or with speciation.

Organization, of whatever kind, means differentiation and integration, specialization and coöperation, diversity and harmony. Progressive evolution invariably and inevitably means increasing differentiation and integration. In the long history of life upon the earth, organisms have varied in every possible way, they may be said to have made millions and millions of experiments in finding the path of progressive evolution, and in every instance this path has been in the direction of greater specialization and coöperation.

Millions of years ago unicellular organisms reached the utmost limits of the differentiations which were possible within a single cell. Thereafter a new path had to be found if further advance in organization was to occur. This new path was found in the direction of multicellularity. Multicellular forms did not arise by the coming together of separate cells, as is sometimes assumed, but rather by the failure of cells to divide completely; when the original cell divided, the products no longer moved apart as separate and complete individuals but remained attached to one another, and instead of restoring all missing parts as each cell did when it became a separate and complete individual, the initial differences between cell products were preserved and increased at successive divisions. In this way entire cells became new units of differentiation and at the same time all the cells remained bound together into a unit of a higher order.

A wholly similar process of differentiation by cell formation takes place in the development of the egg; if cell formation is stopped in this case, differentiations never go beyond a stage comparable with those of the unicellular organism, and if the different cells fail to stick together they generally lose many of their differentiations and revert to the simpler organization of the egg. Whenever a complex protozoan divides, it goes back in organization to a more primitive condition, and after division it starts to differentiate over again; and so successive generations of protozoans make little or no advance in organization. But when the cells of a multicellular animal or plant divide they do not go back to the stage of differentiation of the egg but preserve the differentiations which they have already attained and continue to augment them during the process of development. In multicellular organisms this increasing differentiation of the cells is made possible by the close union and interdependence of the cells, whereas in the unicellular forms the very independence of the cells prevents increasing differentiation.

In a manner wholly similar to the case of the one-celled forms multicellular organisms reach a stage of differentiation beyond which they cannot go within the limits of a single body. The very nature of differentiation signifies limitations in certain directions in order to secure further development in other directions. If a creature have wings it cannot also have hands (except in the case of the angels); if it have limbs for running it cannot also have limbs for swimming; if it have enormous strength it cannot also have great delicacy of movement. Thus while certain animals are differentiated in one direction and others in another, no one animal can be differentiated in all directions. In man differentiation has gone farthest in the structures and functions of the brain. In many other respects man is relatively undifferentiated; his limbs, hands and feet, his teeth and alimentary tract are far less highly differentiated than are these organs in many other animals, but his brain is much more highly differentiated. This very fact of a highly specialized nervous system and a generalized condition of many other organs has led to the wonderful intellectual and social evolution of man and has made possible not only the rational control of his own evolution but also the control of his environment.

Path of Social Evolution

Just as the multicellular condition permits a higher degree of organization than is possible in the unicellular, so the union of multicellular organisms into a unit of a higher order opens up a new path of evolution and progress. But here also, as in the former instance, the principles of progressive evolution are increasing differentiation and integration. In this way biological colonies or societies are formed, and in various animal societies one can trace the stages of social evolution from a condition in which all the individuals are much alike and the bond of union between them is a very loose one, to such societies as those of ants, bees, and termites in which the differentiations and integrations of individuals have gone much further even than in human society. We do not know whether progressive evolution of such animal societies has already reached its limits in colonies of ants and termites, but we do know that further evolution, if it occurs, must involve a still greater degree of differentiation and integration of individuals or of colonies.

Path of Intellectual Evolution

Meanwhile man has entered upon a new path of evolution, namely, the intellectual and ethical, and just as there was a great forward movement when the path of multicellularity was taken, and again when social organizations took the place of solitary individuals, so human advances in the path of intelligence and morality are perhaps the most significant in the whole range of organic evolution. Here, as in the cases of physical and social evolution, the factors or elements out of which the new organization is builded are present in the lowest and simplest forms of life, but it is only by the progressive differentiation and integration of these factors that progress is achieved.

The elements out of which the psychic faculties of man have been developed are present in all organisms, even in germ cells, in the form of sensitivity, tropisms, reflexes, organic memory, and a few other factors; in more complex animals these take the form of special senses, instincts, emotions and associative memory; and in the highest animals, and especially in man, they blossom forth as intelligence, reason, will, and consciousness. All stages of this development may be seen in various animals below man and also in the development of the human personality from the germ cells.

No one knows whether human beings have already reached the limits of development of their intellectual, rational, and volitional powers. It is customary to assume that there is no limit to the possibilities of development in this direction, and certainly in the knowledge of and control over natural phenomena the most striking progress is now being made, chiefly, however, by coöperative effort. But this is not the question involved when we ask whether man has already reached the highest possible development of his intellectual and rational powers. There is good evidence that no recent human beings have surpassed in such powers many men of the ancient Greek race or many other individuals who have appeared in the past. Perhaps the intellectual evolution of man has already reached its climax in these greatest personages of history, so that even in the distant future there may never appear greater geniuses than Socrates, Plato and Aristotle, than Shakespeare, Newton and Darwin.

Path of Rational Coöperation

Finally, a new path of evolution has been found by man in rational coöperation, that is in the further development of human society on a basis of intelligence rather than of instinct. Certainly in this direction the limits of human evolution have not been reached; indeed, it may be said that the rational evolution of society has barely begun. It is a notable fact that the social evolution of man is going forward at a very much more rapid rate than his physical or intellectual evolution.

In bodily structure and in intellectual capacity man has changed but little since the beginnings of recorded history, but in social organization the most enormous advances have been made, and changes are still going on at a rate which is amazing if not alarming. The chief causes for this difference in the rate of physical and social evolution are to be found in the fact that individual experiences are more quickly and permanently impressed upon the intellect than upon the body or the instincts, and especially in the fact that through intelligent society past experiences are transmitted to future generations, each generation, as it were, standing upon the shoulders of the preceding one, whereas the physical man begins his development anew in each generation from the germ cells, and if he inherits any bodily features due to the experiences of his ancestors, a thing which seems most doubtful, they are very few and rare.

Progress Has Ceased in Many Lines

There is no probability that future evolution will develop more complex animal or plant cells than those which now exist or have existed in the past;[1] there is little likelihood that more complex multicellular forms than those which have lived or are now living will ever be evolved, for apparently the limits of complexity within a single cell or body have already been reached. Doubtless, both cells and bodies will continue to undergo changes which on the whole will lead to better adaptations to existing conditions, but such changes probably will be relatively slight as compared with the great evolutionary

[1] Among animals no new phyla have appeared since the vertebrates in the Silurian, or perhaps even earlier; no new classes since the mammals in the Triassic and the birds in the Jurassic. In the evolution of animals only about fourteen times in the whole history of life have new phyletic paths been found and several of these were blind alleys which led nowhere. The climax of the progressive evolution of fishes was probably reached in the Devonian, of amphibians in the Permian, of reptiles in the Mesozoic. In all these classes the formation of new species has been going on more or less continuously, but progressive evolution in the sense of increasing complexity of organization has reached or passed its climax.

advances of the past; protozoa will still remain protozoa and man will still be man.

There is no evidence and little probability that a higher animal than man will ever appear on this planet. To a larger extent than in the case of any other creature man controls his destiny, and even if the human race should become extinct, from what other existing group of organisms is it conceivable that a higher type could arise? There are other animals which in certain respects are more highly developed physically, there are social insects which in some regards are more highly developed socially, but no other animal approaches man in intellect and probably none will ever surpass him in the combination of physical, intellectual, and social capacity.

Furthermore, there is no present reason for supposing that in the future man will be more highly organized physically or will be endowed with greater intellectual capacity than have been many individual men of the past or present, though in both body and mind he will probably become better adjusted to conditions of life. It is conceivable that further evolution of the brain of man may occur, just as it is possible to conceive of a further evolution of the neck of the giraffe or of the trunk of the elephant, but there is a limit to increasing specialization beyond which it is not practicable to go. It is doubtful whether the brain of man could undergo much further differentiation without introducing disharmonies within the organism or with the environment, and the facts that since the beginnings of human records there does not appear to have been any appreciable growth of the brain in size or complexity, and that since the ancient Greeks there has been no appreciable increase in the intellectual capacity of man, plainly indicate that the possible limits of evolution in this direction have been reached. The most that can be hoped for by the scientist is that the standards of races as a whole may more nearly approach the best individual standards which now exist, and under a wise system of eugenics and education this improvement can be effected.

Paths of Future Progress

On the other hand, there is good evidence that in social organization and in coöperative efforts the limits of human evolution have not been reached. The future may produce no super-men but it is likely to produce a super-state and a super-civilization.

Progressive evolution, then, has proceeded along several lines and not along a single one; it may be represented, not by a ladder, but by a branching tree in which growth has ceased in certain branches but is still going on in others. In man there have been three main lines or branches of evolution,—physical, intellectual, and social,—but in all lines progress has meant increasing differentiation and integration. Furthermore, the directing and regulating principles may be the same in all of these lines; it may be, for example, the survival of the fittest, but there are many kinds of fitness. Physically, the fittest is the most viable; intellectually, it is the most rational; socially, it is the most ethical. These three lines are not necessarily antagonistic, as Huxley supposed, but all three may and do coöperate in such a way that each strengthens the other. Least of all is there any justification for the views of Bernhardi and other biological militarists that the most powerful, combative, and dominating are the fittest socially. Darwin himself long ago protested against this mistaken conception of natural selection and showed that in social evolution the most ethical is the most fit.

But while these different lines of evolution are not necessarily antagonistic, it is important to remember that all life processes, including evolution, are balanced as it were between contending forces. Life itself as well as evolution, is a continual adjustment of internal conditions to external conditions, a balance between constructive and destructive processes, a combination of differentiation and integration, of variation and inheritance, of the needs of the individual and of those of the species. And in addition to these conflicting relations we find in man the opposition of instinct and intelligence, of emotion and reason, of selfishness and altruism, of individual freedom and social coöperation.

The past evolution of man has occurred almost entirely without conscious human guidance; but with the appearance of intellect and the capacity of profiting by experience, a new and great opportunity and responsibility have been given man of directing rationally and ethically his own evolution. More than anything else, that which distinguishes human society from that of other animals is just this ability to control instincts and emotions by intelligence and reason. Those who maintain that racial, national, and class antagonisms are inevitable because they are instinctive, and that wars can never cease because man is a fighting animal, really deny that mankind can ever learn by experience; they look backward to the instinctive origins and not forward to the rational organization of society. We shall never cease to have instincts, but unless these are balanced and controlled by reason, human society will revert to the level of the pack, or herd, or hive. The foundations of human society are laid in gregarious instincts, but upon these foundations human intelligence has erected that enormous structure which we call civilization.

Can there be any doubt that, if the evolution of human society continues in the future, it will bring into one organization larger and ever larger numbers of men until perhaps it may finally include the whole human species, and that it will at the same time lead to greater specialization and more intimate coöperation of all its members? As the union of many cells into one body, the union of many persons into one colony, the union of many colonies into one nation have marked great advances in evolution, so, let us hope, the union of many nations into one league may mark the next great step in human progress.

Finally, with the development of intelligence and of rational society we reach in human evolution the highest stage of organization which has ever been attained and, so far as we can now see, the highest attainable, for we have here not merely the differentiations of the human body and the countless differentiations of human society but much more we have the control over environment and the forces of nature which makes man the most powerful and speedy of all living things whether on land, in water, or in the air; which gives him a keenness and range of sensation that are unparalleled elsewhere, and which practically extends his nerve connections to all parts of the earth. Man has indeed by means of intelligence added to his own personal powers the powers of nature. His evolution is no longer limited to his body but takes in the whole of his environment.

This new path of progressive evolution is in all respects the most important which has ever yet been discovered by organisms. The course of progress has led from smaller and simpler units to larger and more complex ones until now, by means of rational coöperation, we have governmental units which include as much as one fourth of the entire human species, we are on the eve of bringing together into some form of league or federation all the nations of the world, and we are in process of annexing to our own personal powers the illimitable forces of the universe.

Photograph by Alfred M. Bailey

THEIR INTERESTS ARE SAFEGUARDED BY UNCLE SAM

Now and then a cry is heard that birds are injurious to man's interests and should be killed. For example, this last summer great pressure was brought to bear on the United States Food Administration to destroy all the pelicans in the Gulf Coast region, especially those on the coasts of Florida and Texas, because of the claim that they "existed by millions" and were daily eating "hundreds of thousands of dollars' worth of food fish." The Food Administration asked the writer to investigate this. With the kind cooperation of State Fish Commissioner Woods, of Texas, Conservation Commissioner Alexander, of Louisiana, and Shellfish Commissioner Williams, of Florida, I was able to cruise the coasts of these states and visit all the breeding colonies of pelicans. We counted and estimated their numbers, and gathered quantities of the food which the adult and young alike disgorged in the writer's presence. At the conclusion of the investigation it was found that only about 65,000 adult pelicans were inhabiting the Gulf Coast of the United States in the summer of 1918, and that more than 95 per cent of their food during the month of June consisted of menhaden—fish never used for human consumption

Photograph by Alfred M. Bailey

Brown pelican flying above its home colony on the United States Bird Reservation locally known as "Mud Lumps," at the mouth of the Mississippi River

Wild Life Conservation Along the Gulf Coast

FLORIDA, ALABAMA, MISSISSIPPI, LOUISIANA, AND TEXAS IN BIRD PROTECTION, THE FIRST WITH MISSISSIPPI A NATIONAL SHAME, LOUISIANA A NATIONAL PRIDE

By T. GILBERT PEARSON

Secretary of the National Association of Audubon Societies

NO area of like extent in the United States is so memorable from the standpoint of wild life conservation as that region which we may designate as the Gulf Coast.

Beginning with the mouth of the Rio Grande, this area sweeps northward, eastward, and then southward for fourteen hundred miles until we reach the far-famed bird islands of the Dry Tortugas off the south end of Florida. This region, with its shallow seas, islands, sand beaches, and extensive marshes, has for ages been the abode of innumerable water birds that have long attracted the avarice of mankind.

Thirty years ago, when bird killing for the feather trade was at its height, one could have found a dozen vessels at once cruising the Florida coast in quest of the vast assemblages of gulls, terns, egrets, and shore birds which at that time inhabited the mangrove islands and coral reefs. Similar killing went on elsewhere along the Gulf Coast at that time. The egging business also flourished in those and even later days.

In 1904, Mr. Frank M. Miller, of New Orleans, reported that five thousand eggs had just been broken on one of the Louisiana islands inhabited by sea birds, in order that all the eggs gathered the next morning might be fresh ones. For years cargoes of eggs taken in this manner were supplied to the markets of New Orleans. He stated further that at least fifty thousand eggs were that year taken and used in the manufacture of glue.

Along the Louisiana coast from the Mississippi River westward to Texas, there extend vast salt marshes varying in width from five to thirty miles. This extensive domain, which the land has as yet only partly reclaimed from the sea, is the winter home of myriads of ducks and geese. To this region were attracted thousands of hunters, who, until recent years, shot unrestricted the wild fowl that gathered here in winter to feed and rest. The markets of the Louisiana cities were open to the sale of the bodies of these birds, and enormous numbers were shipped to northern markets.

The first serious attempts to protect the wild life of the Gulf Coast were made by the National Association of Audubon Societies. As far back as 1902 these societies were conducting campaigns of education and seeking to arouse among the people of that region an interest in conserving their wild bird life. These efforts have continued through the years, but have produced little effect in much of the territory, and pronounced hostility has been encountered in many regions. Thus on July 14, 1905, Guy Bradley, the Association's warden near Cape Sable, Florida, was shot by plume hunters and the birds in the colony he guarded were destroyed. Later, up in Charlotte Harbor, Florida, on November 30, 1908, Columbus G. McLeod, another Audubon warden, was killed and the boat in which his body fell was sunk with sandbags.

The Association has worked systematically for the establishment of state game warden systems in the various states bordering on the Gulf, but with only moderate success. In 1913 the legislature of Florida finally enacted a law providing for a state game warden and deputies. Two years later the law was repealed. Florida stands today as the Rip Van Winkle state in the matter of wild life conservation. The state's efforts to protect its wild life have been practically nil.

To the westward lies Alabama with a short coastline, and inhabited by comparatively few shore birds. The subject of bird and game protection was taken up by the Honorable John H. Wallace, in February, 1907, and since that date this active officer has done much to conserve the bird life for his state.

Passing on to Mississippi, we find the only state in the Union, aside from Florida, that makes no declared effort through state officers to enforce its laws for the protection of wild life. Two years ago the legislature passed a bill to establish a game commission, but the courts declared it unconstitutional, and Mississippi hunters kept merrily on as heretofore, killing very much when and where they pleased.

In regard to Louisiana the story is a long one, if one should undertake to tell it all. Mr. Frank Miller, backed by the National Association of Audubon Societies, secured the establishment of a number of Federal bird reservations off the coast, and in July, 1908, induced the legislature to create a "Board of Commissioners for the Protection of Birds, Game and Fish." He was appointed chairman of the board, and undertook the great work of conserving the wild life of his state. In due time his political life came to an end. Under the leadership of the present game commissioner, the Honorable L. M. Alexander, Louisiana has made notable strides in the protection of its wild life, and considering the conditions which he found when entering office, about six years ago, no state in the Union can equal his record.

During the winter Louisiana contains more wild waterfowl than any other two states in the Union, and here also there are surely as many gunners to the square foot as can be found anywhere on this continent. Yet Mr. Alexander has secured the enactment of reasonable and necessary conservation laws and he enforces them with a tact and wisdom that are most stimulating.

Aside from the Government bird reservations, the Audubon Societies' islands, and the work of the Louisiana Game Commission, mention should be made of the three large tracts of marshland set aside as bird refuges. One of these, Marsh Island, 77,000 acres in extent, was purchased by Mrs. Russell Sage, and set aside as a bird sanctuary. This was in 1912. Two years later the Rockefeller Foundation purchased a tract of 86,000 acres a few miles to the west of it, and declared it to be a bird sanctuary for all time. Mr. Edward A. McIlhenny, who was responsible for both of these purchases, together with Charles Willis Ward, bought and set aside another reservation of 57,000 acres of marshland. These three tracts, carefully guarded at all times, constitute the most important refuges for wild life in the southern states.

Thus Louisiana, at one time a slaughter pen for wild life second only to the state of Florida, is today occupying an enviable position among the states that are intelligently conserving their wild life.

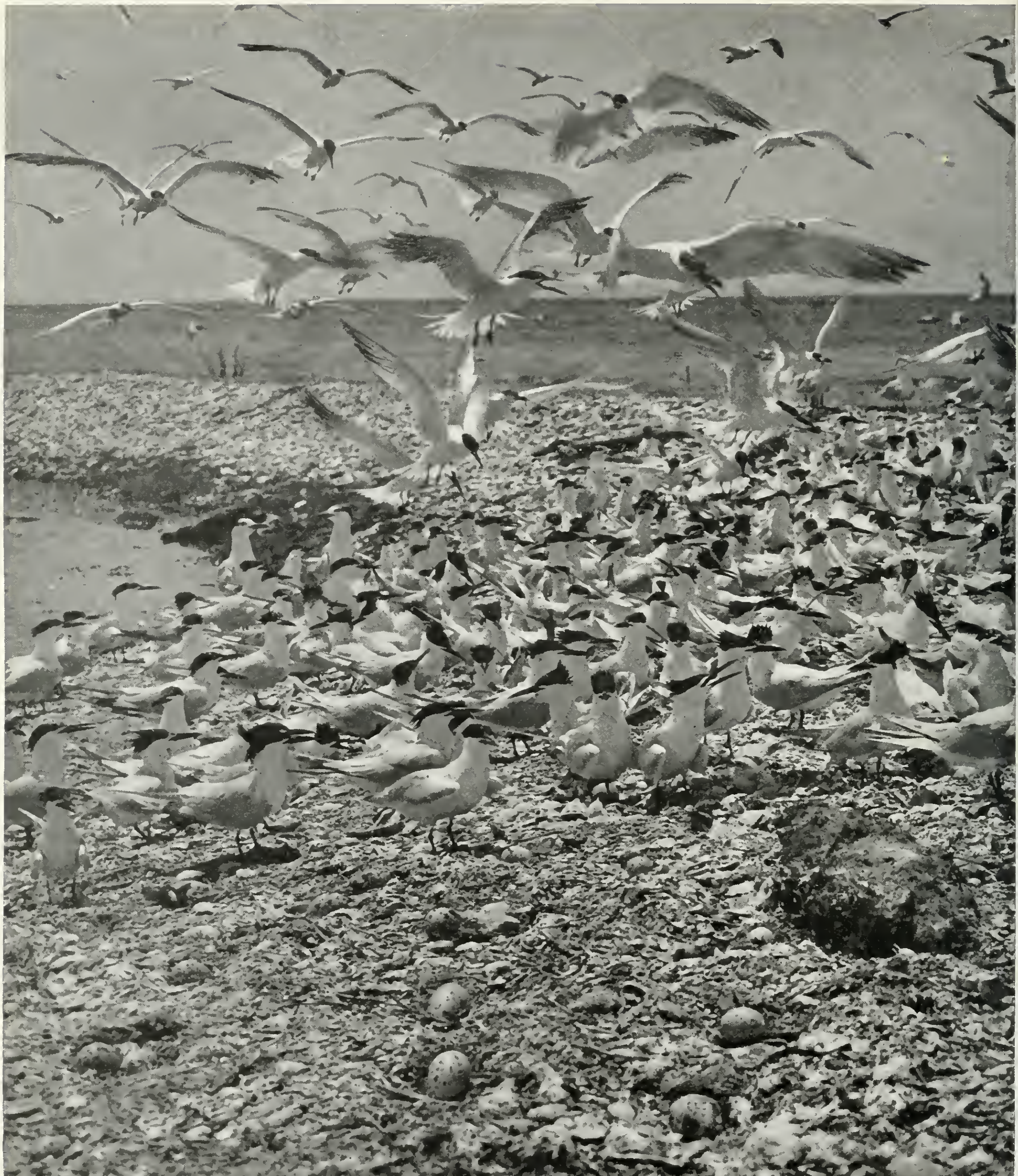
There remains but one state along the Gulf Coast to mention, that is Texas. From the standpoint of the sea-bird life, which consists of gulls, terns, herons, and pelicans, this region is today not an important one, for the bird life that was once abundant has been reduced to extremely small proportions, and the state has done little to stay the hand of the gunners.

Few birds along the Gulf Coast are now killed for the feather trade, with the exception of the egrets. Thanks to the wardens of the Audubon Societies and the Louisiana conservation guards, egging as a business is a thing of the past, and as we have already seen, the killing of ducks in their winter haven, Louisiana, is now carefully regulated.

It was shown that one more silly prejudice against our wild life was without foundation when, this summer, the food of the brown pelican was investigated at the request of the United States Food Administration (for details see page 40). As I sailed along parts of the Gulf Coast where twenty years ago water birds were found by tens of thousands and saw how scarce, in many regions, they are today, I was impressed anew with the possibility of destruction which man may work with the helpless wild life of a country, and I felt again how tremendously important it is that the present generation should do all within its power to save the remnant of the wild life along our beautiful southern coast.

Photograph by Alfred M. Bailey

Mr. T. Gilbert Pearson, secretary of the National Association of Audubon Societies, making a practical investigation of the food of the brown pelican (compare with photograph, page 61). For details regarding the recent demand of fishermen for the extermination of the brown pelicans, and the results of the investigation by Mr. Pearson, see page 40



Photograph by Alfred M. Bailey

SUMMER "SNOW FIELDS" OF TERNS

The Cabot terns (*Sterna sandvicensis acuflavida*) are smaller than the royal terns, more slender and graceful, and of a more affectionate disposition with one another. They are beautiful birds with silver-pearl wings, eyes of piercing blackness, crests of jet, and dark bills tipped with yellow—truly little "doves" of the sea.

These terns have been especially persecuted in the past by the feather hunters and had become almost extinct when Louisiana, in conjunction with the Federal Government, the National Association of Audubon Societies, and various private individuals interested in bird protection, undertook to conserve the state's bird life on an extensive scale. Bird refuges have now been established throughout Louisiana and on the outlying islands, and a state board of commissioners[1] has been inaugurated to promote the protection of wild life. During the winter Louisiana is a haven for more water birds than any other two states of the Union, and in recent years she has occupied the enviable position of being one of the most conscientious protectors of her feathered guests

[1] See note at bottom of following page.

Observations on the Water Birds of Louisiana[1]

By ALFRED M. BAILEY

Of the Louisiana State Museum, New Orleans

LOUISIANA is so situated geographically and has conditions so favorable for bird life that she stands foremost among the bird states of the Union. The great hordes of wild fowl from the frozen North, using the Mississippi Valley as a migration route, find a place of refuge and a source of food supply that have no equal in any other state, and each spring when these winter guests again return to their nesting grounds at the North, veritable "snow fields" of white-winged terns and other beautiful sea birds arrive from farther south to take their places as her summer residents.

In years gone by, this state was the slaughter ground of the plume and wing hunters, but today Louisiana has under her protection more than three hundred thousand acres of land and salt marsh given over entirely as places of refuge for wild life. Wardens patrol these areas continually, so that the large numbers of waterfowl shall be unmolested.

Among early attempts at conservation in Louisiana was that of Mr. E. A.

[1] Illustrations from a series of remarkable bird photographs by E. A. McIlhenny, Stanley C. Arthur, and Alfred M. Bailey.

NOTE.—This state board is at present under the leadership of Mr. M. L. Alexander, and is doing a good work. Game laws are not sufficient. Public sentiment has a great deal to do with enforcing laws, and the State Department of Conservation and the Louisiana State Museum have been conducting an educational campaign by means of motion pictures and exhibits of wild life showing economic and æsthetic values. In a state so cut up with waterways and impassable swamps, it would be very difficult to protect all places desired without this aid from the people as a whole. To carry on the work the department has eighteen patrol boats and a force of more than one hundred men. The men chosen for the work are those who chance to have their homes in the area to be protected. They are therefore familiar with the conditions of the region and are able to be on hand at all times.

McIlhenny, the well-known sportsman and conservationist, when he started his famous Avery Island heronry. This wonderful bird paradise is on a little pond of scarcely two acres, which was made by damming a small creek. Nesting places were provided by planting scrub willow and buttonbush. In the swamps near by, Mr. McIlhenny captured eight snowy herons, or egrets, a species which was at that time nearly extinct in this state because of the ravages of the plume hunters. During the summer and fall months he kept these egrets in captivity along the edge of his little pond. He visited them daily and they soon grew tame. When the other birds started their return south Mr. McIlhenny gave his pets their liberty. They stayed around the pond for several days and then joined the others on their southern journey. In the spring, however, five birds returned and two pairs built their nests in the scrubby trees and reared their young in safety. That fall eleven of them migrated to their southern home; nine returned in the spring, and several young were raised.

To increase the number of egrets Mr. McIlhenny resorted to many experiments. As the little blue herons lay eggs similar to those of the egrets and as their young are also white, he transferred egrets' eggs to the herons' nests. When the egrets missed their eggs, they again laid, so that two broods were obtained in place of one.

From that time on these snowy herons increased rapidly. Other species joined them until today the little pond has a wealth of bird life that can be equaled by few other places of similar size.

I had heard of this little haven for birds many times and expected to find a wild, inaccessible swamp, but contrary to my expectations, I found the heronry snuggling at the foot of the rolling hills of Avery, a most unnatural place for birds,—for there is a factory within one hundred yards, with busy factory folk hurrying to and fro, and a railroad runs along the edge of the pond, the birds nesting within thirty feet of it. Indeed, the birds do not even rise as the trains go by. And these are the same birds that go out daily to feed in the swamps and there will not allow man to approach closer than several hundred yards. Such is the response of birds to protection!

On the great wild fowl refuges of Louisiana a development of natural colonies is going on under the protection afforded. These areas are carefully guarded and thousands of black mallards and other summer birds breed here each year. The last stand of the roseate spoonbill in Louisiana is in the western part of the state at Cameron Parish, truly a wonderful sight in June when we visited it—and yet pitiful. We traveled along the Intercoastal Canal to Black Bayou, a weird, beautiful stream with its gnarled, moss-hung cypresses, and paddled down the little side stream in pirogues. We counted 287 spoonbills clustered in the tops of the cypress trees, their pink colors showing against the green with all the freshness of peach blossoms in springtime. These few birds are all that are left of the large colonies which once gave color to the southern swamps.

The year 1917 was very dry, and the spoonbills did not nest along the bayou, but they were building during our visit, and it is reported they had a very successful season. Their warden was formerly a market shooter and alligator hunter—yet he efficiently protected the birds, and although he could neither read nor write, he could obey orders. One day some men came down from a town near by to "shoot out" the birds as they had been accustomed to do. As they were approaching, the warden paddled up in his pirogue, shoved his gun in the ribs of the nearest man, and then asked their business. They "allowed" they were going to kill

Photograph by Alfred M. Bailey

THE DOWNY YOUNG OF THE CABOT AND ROYAL TERNS

The royal terns (*Sterna maxima*) nest so close together that it would seem no space can be found for another bird, yet the birds seem to have not the least doubt as to which eggs are their own. They lay one egg only, either in a shallow pit or on the bare sand, and both parents take turns incubating. The eggs are variously mottled and the young birds are just as varied in their markings This speckled coloration renders them inconspicuous on the shell-strewn gravel banks. When very small the young terns crouch close to the shell to avoid detection; fifteen newly hatched royals can be counted in the space in the foreground of this photograph

Photograph by Stanley C. Arthur

The skimmer (*Rynchops nigra*) is perhaps the most interesting species breeding on the shell keys of Louisiana. Great bands of these solemnly dressed birds stalk gravely along the shell and then rise and wing away with a peculiar erratic flight, swinging here and there, and calling out monotonously. They are very conspicuous against the ground and show up plainly on the nest, but sometimes in flight the whole flock will disappear from view, for their wings are margined with white and may blend with the colors of the sky

Photograph by Alfred M. Bailey

The young skimmer when crouching in the sands looks not unlike a young tern. It has the upper and lower mandibles of about the same length (compare with adult skimmer above). These birds nest in large colonies on all the "outside" islands of the Gulf Coast, choosing the exposed beaches as the proper place to deposit their three or four protectively mottled eggs in a mere scoop in the sand a few birds, but Buck thought otherwise and proceeded to read the law to them. He said that he had been commissioned to "run-hell-out-of" anyone coming in there, and he was going to do it. Under the circumstances, the men decided to leave the birds unmolested.

In the last few years I have observed a great increase in numbers of the wild fowl which swarm along the Gulf Coast, and all the men living in that region say the same. In fact, the geese and ducks were in such hordes in 1917 that they inflicted serious loss on the rice farms of Cameron Parish. The ground was white with thousands of snow geese, and clouds of ducks poured into the fields. It is a sight that makes a bird lover happy—even though the rice farmer does not appreciate the beauty of it. The great "pastures" of the gulf, wide-stretching prairies, are the feeding grounds of a multitude of blue geese, Canadas, and white-fronted geese. I witnessed a flight of blue geese that I shall never forget—and yet the old-timers of Louisiana say there are relatively only a few of the blue geese left today.

I rode on horseback late one afternoon to some fresh-water ponds near one of the Cheniers (an oak-grown ridge), and awaited the coming of the birds to their evening resting place. Before my arrival, one flock of geese had already settled, and I could hear their calls a long time before the birds came into view. When within one hundred yards of this great decoy flock, I dismounted and crawled along the edge of the little pool where I could watch them. Their white heads loomed up conspicuously against the dark background, the sprinkling of snow geese marking the size of the flock, so that I could tell how far it extended, even where I could no longer see the darker birds. They "talked" continually, and moved about from one grassplot to another.

Soon from afar I heard the echoing call of another flock of blue geese, a call from apparently all directions, clear and resonant, carrying far across the waste lands. In the gray distance, vague, wavy forms appeared, great V-shaped masses, wedging their way surely and confidently with little V's trailing from the ends of the first great band, and weaving shadowy, intricate lines across the dim lit sky.

The answering calls of the birds on the ground made a perfect bedlam, as flock after flock of calling birds circled out of the sky and joined the resting throng. There seemed to be from a dozen to fifteen flocks in a company, and as one company settled with military precision, another company would swirl in out of the grayness, while still another great horde could be heard off in the distance. I watched this continual arrival of geese for more than an hour, until it grew too dark to see, and then I still lingered for the sheer joy of hearing all those wild voices.

In the morning I saw the birds as they were leaving for the day, and again they seemed to fly in great companies, their long V-shaped flocks trailing across the sky as far as the eye could see.

These great flocks of blue geese assemble each winter on the wide-stretching prairies and the burned salt marshes along the Gulf Coast to feed on the tender shoots of the new grass. There are always a few white-headed patriarchs in the vast band which stand sentinel-like, and watch for possible disturbers. When alarmed the geese rise up in a cloud, like so many gigantic mosquitoes, and circle off a few hundred yards.

They feed during the day and at night prefer to rest in the numerous lagoons that dot the marshland. Each day great hordes arise from the feeding grounds, circle around, and then head for the shell banks to "gravel." "Hell Hole" is their favorite resort, and this

Photograph by E. A. McIlhenny

The blue geese (*Chen cærulescens*) are conspicuous among the waterfowl for their pure white heads. These geese breed in the Hudson Bay country and migrate to the southern United States during the winter months. Great flocks assemble each year along the Gulf Coast to feed on the tender shoots of the new grass and to "gravel" on the shell banks. The mouth of the Mississippi and the region around South West Pass of Vermilion Bay are the greatest blue goose sections of Louisiana

Photograph by E. A. McIlhenny

Occasionally the stock raisers of the western part of Louisiana complain that the geese injure their pasture lands, for these birds settle down in great flocks to guzzle in the mud, digging thousands of small lagoons across the fields. They are great "talkers" when flying in bands or when collected together at night, but a few white-headed patriarchs always stand as sentinels to give an alarm at the approach of any intruder. The blue geese associate freely with ducks and other species of geese (especially the snow geese), from which they differ little in habits

Photographs by Alfred M. Bailey

MISSISSIPPI "MUD LUMPS" AND THEIR SUMMER RESIDENTS

Brown pelicans (*Pelecanus occidentalis*) nest on the different islands along the Louisiana Gulf Coast, and the largest colony in the country is found on the "Mud Lumps" of the Mississippi Delta. Through the faint blue haze of the gulf one sees what appears to be wooded hills with an outspread city at their foot. On nearer approach this resolves itself into a fifteen-foot mound of mud and a row of pelicans. The soft mud underneath the tenacious river bottom of the Mississippi Delta forces up bumps in the latter and then bursts through as a mud "volcano," forming small mud islands. The "lumps" most thickly inhabited by pelicans are found off the mouth of Pass á l'Outre, where at least 50,000 birds come each year to raise their young. The outermost islands are occupied first; then, as larger numbers of birds arrive, the islands toward the shore are gradually filled up, until finally all the islands are covered with families of awkward parents and downy white youngsters. Three chalk-white eggs are laid in a rather neatly made grass nest, although on some of the mud lumps which are devoid of vegetation the nests are merely a pile of sticks clumsily thrown together. The pelican nests are at times subject to raids by raccoons; in one instance nearly one thousand nests on Grand Cochere Island were destroyed by these animals in six weeks

Photograph by E. A. McIlhenny

YOUNG ANHINGAS, OR "SNAKE BIRDS," AT HOME

The anhingas (*Anhinga anhinga*) hide their nests in secluded spots directly over the water, frequently selecting the cypresses which abound in the swamps and ponds of Louisiana. The adult birds are wonderful divers and swimmers and when frightened tumble precipitously into the water. In fishing, the anhingas do not drop on to their prey, as do the gulls, for instance, but pursue their victim under the water as it tries to hasten out of harm's way. They swim under water for long distances with only the head and lithe neck above the surface, looking not unlike some strange water serpent—in fact, they are commonly known as "snake birds."

The young are covered for the first few weeks with a buff-colored down. They have the peculiar habit (as can be seen in the photograph) of drawing themselves up from the nest by placing their bills over a convenient branch or the edge of the nest. If the young are approached, they merely cling tenaciously to the nest, and when thrown into the water are quite helpless.

For the most part anhingas eat small fish, but they will take any of the small creatures of the ponds, even young alligators and small terrapins. The adults feed the young by regurgitation

Photograph by E. A. McIlhenny

The roseate spoonbills (*Ajaia ajaja*) nest among the dense moss-hung cypresses by the lagoons and bayous near the Gulf Coast. The birds dwell near together on flat nests built with sticks of considerable size, and lay their three or four eggs about the first of June. Previous to nesting, the old birds pass through their spring molt, after which they are arrayed in a plumage of beautiful carmine and white, in marked contrast with the dark green of the cypress

Photograph by E. A. McIlhenny

The beautiful little snowy egrets (*Egretta candidissima candidissima*) were once common throughout the Gulf region, but they have fallen before the hunters of "aigrettes" for the millinery trade until now the species is on the verge of extinction. The snowy egrets start nesting late in March, building their nests in remote marshes or on the margins of lakes and ponds. Mr. McIlhenny started "Avery Heronry" with eight of these egrets on a little pond artificially prepared for them. The birds have become much attached to their nesting place, and return to the heronry year after year to enjoy its protection

Photograph by E. A. McIlhenny

The Louisiana heron (*Hydranassa tricolor ruficollis*) is the most common wader in the South. This long-necked and long-legged bird, with its beautiful colors—and its harsh squawks—nests in various heronries throughout the state and on many of the mangrove islands bordering the gulf. Being very pugnacious, it is almost a pest in some of the heronries, for it tends to drive out the more gentle snowy egret

used to be their great slaughter ground, from which fact it derived its name; for the old-timers would say, "If you want to give the geese hell, go to the gravel hole!" Now the birds may gravel in safety. For "Hell Hole" is included among the protected areas.

But if the geese are numerous, there is no word to describe the numbers of ducks that sometimes crowd these sanctuaries. Yet even with such numbers during migration, spread them over the country, as at other times of the year, and we have only too few.

Off the Louisiana coast are the famous breeding islands of the birds. A few years ago the boatmen plundered the colonies as they pleased, taking the eggs and killing the beautiful terns for their wings. Some species became so scarce as to be almost extinct in this region, but now the birds are swarming once again on these shell keys, the thousands of flashing wings lending their beauty and breaking the monotony of the wide stretches of salt marsh and shimmering gulf.

It would be hard to estimate the number of breeding birds on the islands for their habits are so varied. Close in among the salt grasses are the fork-tailed Forster's terns. These active little fellows build their nests on the dead grass piled high by the tide; and the black-headed laughing gulls and least terns find comradeship with them. Too numerous to count are the Cabot, royal, and Caspian terns nesting on the outer shell keys.

The Cabot tern is my favorite, for he is more fearless, more unconcerned, and seems to take better care of his youngsters than the other species. When we approached the Cabots, they stretched their necks to full length, with crest erect, and protested at the tops of their voices. If we came too near, they rose and drifted gracefully away, and then circled in from behind and fluttered down to protect their babies from the hot sun. One tern I watched did her best to coax her little one over the rim of the beach toward the water's edge. She would go ahead a few steps, teasing and scolding, and then go back again as though out of patience with the wayward offspring.

Terns are ideal birds to study and photograph from a blind. They sail back to their eggs within a few feet of the photographer almost before he has had time to conceal himself. At first they are very suspicious and stand at "attention," but they soon lose their caution and devote themselves to their domestic duties.

Skimmers, too, nest on these islands by the thousands. These grotesque birds stalk solemnly along the shell keys, whole flocks of them together, their black colors gleaming in striking contrast with the sea and the sky, and their white underparts blending harmoniously with the light shell of the ground, so that their elongated form and bill seem all the more out of proportion.

The skimmers receive their name from their habit of skimming the water for food. Whole strings of them may be seen darting along, their lower mandibles cleaving the surface. They are particularly active at dusk and I believe they are more or less nocturnal for I have seen them about at all hours of the night.

Photograph by E. A. McIlhenny

The adults of the little blue herons (*Florida cærulea*) are dark blue, but their young are white and easily mistaken for the young of the snowy egrets. All stages of plumage are found between the adult and young, the birds of mixed colors being known locally as "crazy herons" or "calico birds" (see page 67). The herons are timorous and seclusive and their rookeries are always in the wildest and most inaccessible places. The species is still very abundant in different parts of Louisiana

The young are fuzzy little fellows and have a habit of "taking to their heels" immediately they see anyone, but they crouch down when cornered and depend upon their gray coloration to protect them. They can make a little pit in the sand in no time by using their feet and breast, and when so crouching they will allow one even to step on them.

Then there are the clumsy-looking pelicans which have so aroused the wrath of the fishermen recently along the Gulf Coast. The largest colony of brown pelicans in the country is at the mouth of the Mississippi River on the United States Bird Reservation locally called "Mud Lumps." These lumps themselves are of geologic interest because of their peculiar formation, being squeezed up from under the river bottom by pressure beneath. Here fifty thousand pelicans nest with their thousands of downy young and make the "lumps" one of the most interesting places in the world.

The young when first hatched resemble little black India-rubber balls, and are extremely sensitive to the sun and therefore constantly sheltered by their parents. In a few days the white down appears and the rookery is then white as a cotton field. As soon as the youngsters are able to paddle about, they keep their parents busy fishing in order to satisfy their enormous appetites. Then there is a continuous arrival of old birds from afar; a long string of birds flying with methodically timed strokes,—a few strong beats and then a coast, each bird following the wing strokes of the leader and all scaling so close to the water that it seems they must strike the surface at every beat. And what excitement there is among the young when the old birds arrive! The white fellows follow after with anxious begging cries; the parent bird opens wide her bill and disgorges the fish, while the youngster anticipates its arrival by thrusting his head down the old bird's throat. It is amusing to see a heavy young one, weighing more than the adult, feeding this way, and the more they receive the more they beg. They flop their wobbly wings and jerk their heads back and forth, blinking their eyes, and staggering about. They often receive so many fish that the tail of the last remains in sight, and when an extra large fish is taken, its course can be followed down the skinny neck. Often they become so gorged that they sprawl over on their breasts, or flop over on their backs with feet extended in the air. At first when I walked around the rookery, I thought these stuffed fellows were dying, but when they were straightened out, they immediately disgorged and started paddling away. Those birds large enough to travel take to the water immediately on the approach of danger, and they gather in large flocks as they drift idly on the quiet water and wait until their rookery is undisturbed again.

Besides the birds which make up the vast colonies, there are many other interesting species nesting in this state. The ibis, the awkward wood stork, and the beautiful roseate spoonbill are found in different parts. The anhingas choose the cypress, hiding their nests among the dense curtains of moss, and darting away at the first approach of danger. What wonderful divers they are, and how interesting their young! (See page 52.)

Louisiana is not a state of greatly diversified scenery, but she offers a beautiful contrast when compared with other states of the Union. The placid lagoons are bordered with huge cypresses and wide-stretching live oaks, all clothed with a drapery of Spanish moss. The swamps are often a jungle of tropical luxuriance, impassable because of the clinging vines. The lowlands have their fascination with their beaches and wind-blown trees, their wave-beaten palmettos, and inviting waters.

As a natural bird paradise, the state of Louisiana is admirably adapted to become a haven of refuge, which will be able gradually to send its feathered folk throughout the country to gladden the hearts of the thousands who wander out of doors.

A SERIES OF DUOTONE REPRODUCTIONS SHOWING THE PROTECTED BIRD LIFE OF OUR LOUISIANA COAST

BY ALFRED M. BAILEY

Photograph by Alfred M. Bailey

GRACEFUL FOLLOWERS OF BOATS AT SEA

The laughing gulls (*Larus atricilla*) fish far out at sea, where their cries may be heard early and late as they follow the boats for the trails of refuse. The prolonged call of the flock is the most peculiar of gull cries and not unlike harsh, derisive laughter. Fast fliers, light of wing, and keen of vision, they sail with marvelously controlled movements in graceful, clear-cut figures which make them a delight to the eye. They circle the boat round and round, without apparent wing movement; they suddenly stop in their flight to hover above the surface or to dive downward upon some scrap which they snatch as they sail past

Photograph by Alfred M. Bailey

IN THE SUNSHINE ABOVE THEIR BREEDING ISLAND

The laughing gulls are the only gulls breeding in the southern United States. In the breeding colony several hundred may nest on the same little island, choosing the mangrove and marsh-grown areas for their nests. When disturbed they rise out of the grass and hover overhead, their black and white colors in marked contrast with the blue of the water and the green of the vegetation. The long-legged young are adepts at taking care of themselves, skulking in the grass if unobserved or sprinting with great speed if in any danger

Photograph by Stanley C. Arthur

A TERN TRAGEDY

Terns' eggs are a great delicacy and very tempting to a laughing gull. The gull is more or less predaceous, and if terns' nests are left unguarded, is likely to seize the opportunity to eat the eggs or even the young. It is said that the gull may alight on the good-natured pelican's head and snatch the little fishes which escape from the huge bill as the bird drains off the gallon or more of water scooped up with the catch

Photograph by Alfred M. Bailey

GROTESQUE FISHERMEN WHO TRAVEL "BY AËROPLANE" BETWEEN THEIR VILLAGE AND THE SEA

We induced the old pelicans to come close to our photographic blind after we had crawled inside, by having one of the boatmen chase the young birds near to us. The old pelicans kept eying the blind suspiciously, however, and if we made too much noise, they were off in a hurry, but after a few circles they would drop heavily among the young birds again. Pelicans are solicitous of the welfare of the nestlings and insist that they keep sheltered from the sun. If a young fellow decides to come out and enjoy the scenery, it is given a few good pecks, after which it makes all haste to take advantage of the haven offered. The birds are more or less intolerant of one another's young, and when a stranger offspring waddles in the way, it is given several good cuffs. In spite of considerable parental solicitude, however, it is not unusual to see one of the foolish old birds standing on its offspring without seeming to notice the protesting squawks

Photograph by Alfred M. Bailey

A STRANGE PERFORMANCE

The parent pelican feeds its young by disgorging partly digested food. In the evening from far out in the gulf, long lines of adult birds come winging their way with methodically timed strokes, so heavily burdened with the bony sardines they carry that they can scarcely fly. The youngster who posed for this picture was anxiously trying to go down its elder's throat after the sardines. The action is a matter of habit and racial instinct although having the appearance of intolerable impertinence on the part of the young bird. The young often receive so many fish that the tail of the last remains in sight; in fact they often become so gorged that they flop over on their backs with feet extended in the air.

The pelicans are good natured and make fine pets. We picked up a wing-tipped bird and kept it for several days. At first it refused to eat, but finally, when it decided to accept our proffered gifts, it took fourteen catfish at one feeding. The young birds were not greatly disturbed by our intrusion and seemed to delight in running between our legs as they wobbled around clumsily with an audible pat pat of their large webbed feet

Photograph by Alfred M. Bailey

PART OF A COLONY OF SKIMMERS IN ITS SUMMER HOME

The black skimmers rest during the day on sandy beaches along the coast and outside islands to which they give a very somber appearance as they huddle together, their jet black coats standing out against the sand like a heavy pall spread over the ground. These birds are difficult to approach for study, but they may easily be watched by using a photographic blind. They flutter down in front of the blind, eying it uncertainly, and at the first suspicious movement dart away, only to circle around a few times and return again and again

Photograph by Alfred M. Bailey

SMALL BANDS OF SKIMMERS FISH TOGETHER AT DUSK

At dusk the skimmers leave the beaches and dart along over the water, the long lower mandible just cutting the surface. The colony breaks up into small groups of a dozen or so, which cruise the waters carefully, wheeling and skimming close to the surface of the shimmering gulf as they search here and there for fish and shrimps. They are extremely noisy birds and have a rasping call that is repeatedly hurled at the intruder

Photograph by Alfred M. Bailey

BLACK BAYOU, THE LAST STAND OF THE ROSEATE SPOONBILLS IN LOUISIANA

The sluggish bayous of southern Louisiana, bordered by cypresses and live oaks gracefully festooned with trailing Spanish moss, offer havens of refuge to the numerous water birds. Deep and clear with scarcely perceptible flow, the streams maintain their undisturbed peace, protected by the surrounding jungles. Here on Black Bayou the roseate spoonbills make their last Louisiana stand, the anhingas nest among the dense curtains of moss; also here the all but extinct ivory-billed woodpeckers work at their noisy carpentry

Photograph by E. A. McIlhenny

A SPECIES ALMOST EXTERMINATED BY PLUME HUNTERS

The little snowy heron, or egret, is now carefully protected by the United States Government. Its home life has been studied in detail by Mr. McIlhenny at Avery Island Heronry. The male gathers the materials for the nest and the female builds them into the frail platform, but both birds take their turn incubating the four greenish eggs. After about eighteen days the young birds hatch from the eggs, skinny little fellows with lines of white down. They are very unattractive looking for three weeks, but then begin to grow rapidly and are soon climbing about the limbs of the tree, using their wings, beak, and feet to aid them. As the young grow, their appetites increase until each old bird must make six or eight trips a day to the fishpond of the heronry

Photograph by E. A. McIlhenny

SNOWY HERONS DISPLAYING THE NUPTIAL PLUMES, OR "AIGRETTES"

One bird watches continually at the nest and when its mate returns with crop full of fish for the young birds, the two caress and coo with a great show of affection, throwing out their plumes like puffs of powder and erecting their crests and neck feathers. The snowy egrets are birds of grace, their white plumage, gold-lustered eyes, and glossy black legs making a brilliant contrast with the gray monotony of the swamps in which they usually make their home. The long, delicate "aigrette" plumes were once much in demand for millinery ornaments and the bird paid the inevitable price of beauty in wild things, being hunted nearly to extinction

Photograph by E. A. McIlhenny

"CALICO BIRDS," LITTLE BLUE HERONS IN IMMATURE PLUMAGE

The little blue herons breed in the immature, or "calico bird," plumage (see adult plumage on page 55). The bird on the left with spread wings displays to good advantage the clouded primaries and a set of blue feathers portentous of the coming coloration. These herons build their nests among the water willows, and lay four or five eggs very similar to those of the snowy egret. Mr. McIlhenny, taking advantage of this similarity in the eggs, increased the number of snowy egrets in his Avery Island Heronry by replacing the blue herons' eggs with the egrets'

Photograph by Alfred M. Bailey

LOUISIANA PROTECTS HER THOUSANDS OF ROYAL TERNS

The royal terns nest by the thousands on all the outlying islands. They stand astraddle the single egg or young, with uplifted crest and wings half drooping, calling with evident pride as loudly and as harshly as they can. Then they gently lower their bodies toward the ground, the breast feathers parting to allow the egg or young bird to be snuggled against the skin. Although the terns are rather quarrelsome and have their family disputes, the home life is carried on in immense colonies and many thousands of young are raised each year

Photograph by Alfred M. Bailey

A SIGHT THAT DELIGHTS THE HEART OF THE BIRD LOVER

Young royal terns, when disturbed by an intruding visitor, take to the water, and it is no uncommon thing to see whole "rafts" of these little birds swimming along parallel to their home island, or even far out at sea. The old birds guide their young back to shore after they feel that all danger from intrusion is past. They hover overhead and seem to be scolding, then fly back toward the land, but immediately circle round again as though to push the youngsters along

Photograph by Alfred M. Bailey

THE FEARLESS ROYAL TERNS

The royal terns are well named, for they have a truly royal bearing with large, strong wings, dark, keen eyes and heavy, capable bill. They nest farther from the edge of the gulf than do the Cabots, but their eggs and young are so similar to those of the latter that they are nearly indistinguishable. Both royals and Cabots nest so close together that there is barely space for the birds to cover their eggs, and yet no bird seems to have the least doubt as to which egg is its own. The terns are quite tame, now that feather hunting is no more, so that a bird lover may spend hours within a few feet of their haunts without their seeming to resent his intrusion in the least

Photograph by Alfred M. Bailey

A LOUISIANA BIRD HAUNT

In spring the subtropical forests of Louisiana's alluvial plains, the low coast marshes, and the wide prairies with their surmounting pine hills offer a natural paradise in which all the water birds may build their nests and raise their broods. All the feathered folk which use the Mississippi Valley as a migration route, revel in the natural luxuriance of the state and enjoy the enviable protection which is there afforded

Photograph by Alfred M. Bailey

THE BLUE GOOSE FROM ARCTIC TUNDRAS

In winter the ducks and geese arrive from northern lakes and distant Arctic tundras to feed on the wind-swept savannahs and sport along the marshy beaches. The blue geese are peculiarly colored, dark above and below with pure white heads, although occasionally individuals have immaculate underparts, or may show various intergradations between dark and light. The residents of Louisiana say that the geese used to come in such numbers that they covered the coast for miles, a great mass of floating birds, but lack of protection for many years has depleted the numbers

"Four Years in the White North"—A Review

By HERBERT L. BRIDGMAN*

DETERMINATION of the scientific value of the work of the Crocker Land Expedition is for the future, but the *Four Years in the White North*[1] of its leader, Mr. Donald B. MacMillan, may be appraised at once as a human document, one of the most instructive and entertaining contributions to the literature of the North. It should not, however, be inferred that Mr. MacMillan evades or avoids the scientific inquest, which must later be held by specialists and experts on his work. On the contrary, he distinctly invites it by a detailed, itemized list of the expedition's records and achievements in which more than a score of distinct and comparatively independent pieces of work are set forth as if to aid in distributing the credit in a final and authoritative valuation of the whole. It may fairly be doubted whether any expedition which ever sought and wrought in the Arctic zone was more persistently dogged by ill luck than that whose adventures of chance or mischance are recounted in MacMillan's four years' absence; a term it may be well worth while to remark, never exceeded by any expedition in the eastern Arctic and equaled only by Admiral Peary's in 1898–1902, during which he accomplished his great journey around the northern end of Greenland and definitely eliminated that route to the North Pole from the possibilities.

Born in refraction and imagination, shadowed and delayed by George Borup's tragic and untimely death, almost wrecked the second night out of port, navigation entrusted to a hesitant and inexperienced master, a company which made up in enthusiasm what it lacked in training, its principal objective upon which rested name and existence, the very reason for its being, dissolved like the baseless fabric of a dream, with no sight or news of relief ships the first summer and none the second, incompetence of men and perversity of nature both conspiring to prevent the ships from breaking through the pack and reaching destination and effecting a rescue, the party gradually dwindling one by one, each taking chances and making the best of his way homeward, a disclosure of what must have been the low ebb of spirits and mental vitality, until at Christmas, 1916, only two of the original party remained: all these incidents, and others like them which are obvious, and still others which must inevitably have existed, demonstrate a condition of things which, protracted through four long years, must have meant a strain on nerves, temper, and mental and physical force which only the best equipped and most wisely conserved could withstand. That MacMillan endured the test and begged to be allowed to stay another year when Captain Robert A. Bartlett and the "Neptune" finally arrived at Etah and insisted that he return, shows that he is of the stuff of which explorers are made.

It is not perhaps worth while to attempt to re-state the narrative and experiences of the expedition. That has

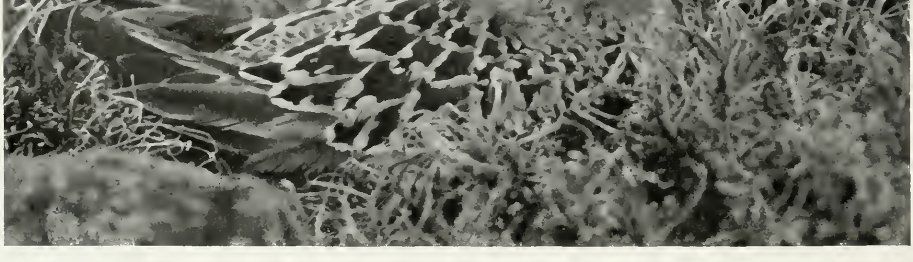
[1] *Four Years in the White North*, by Donald B. MacMillan. Harper & Brothers, New York, 1918.

* Mr. Bridgman is secretary of the Peary Arctic Club, president of the department of geography of the Brooklyn Institute of Arts and Sciences, vice-president of the American Scenic and Historic Preservation Society, and a member of the board of regents of the University of the State of New York. He was delegate of the United States, of the National Geographic Society, Peary Arctic Club, and New York Explorers' Club to the International Congress for Study of Polar Regions which met at Brussels in 1906, and United States delegate to the International Polar Commission which met at Brussels in 1908 and at Rome in 1913. He is actively engaged as manager and editor of the Brooklyn *Standard Union*, and in his interests as a journalist is chairman of the Publishers' Association of New York City

The eggs of the knot (*Tringa canutus*) are very rare in collections, for this sandpiper has not often been found by explorers because it makes its home well back in the hills of Greenland. Greely was the first to describe the egg of this species. The eggs of all wild fowl which nest along the shore are a regular source of food supply to the Eskimos and are preserved for winter use by freezing

already been done by Mr. MacMillan in magazine and other articles, although the *Four Years* does sensible and valuable service in bringing the whole story together from beginning to end. Here anyone by a little study can determine exactly the order, personnel, and time of the several field parties, and just where any member was and what he was doing on a certain date. It is no depreciation, either, of the work to say that the manner rather than the matter of the story will most surely arrest and hold the attention of the readers, a style and quality absolutely unique among books of its class. A certain sort of optimism, not to say exuberance, soon impresses itself on the consciousness of the reader and, as he goes on, he is inclined to wonder whether MacMillan may be, not the original Mark Tapley, in which case he would be rather venerable, but his intensified and more highly developed reincarnation.

When Crocker Land "busted," to quote the street's expressive irreverent word, MacMillan took the whole experience philosophically. When he had retraced his steps to Peary's Cape



The knot on its nest.—In summer the feathers of the back are black, margined with reddish yellow. The rump is white, tinged with red, and the lower parts are deep bay. This coloration renders the sandpiper difficult to discern when on the nest

Thomas Hubbard outlook, and saw what Peary had seen two years before, he sturdily confirmed Peary's opinion and declared that, except for his experience and physical and ocular demonstration, he should say unhesitatingly that he saw distant land. When, two years later, he was at King Christian Island after an arduous and obstinate march, and was obliged to turn back with his reconnaissance incompleted because his dogs were "all in" and his food nearly "all out," he accepted the inevitable with the same good temper and quenchless optimism.

Once a familiar visitor to our Atlantic coast, the knot has gone the way of many edible waterfowl and is now relatively rare. It is a species of very wide distribution, breeding in the Arctic countries from Iceland to Siberia and wintering on all the continents of the world. In olden days the English netted and fattened these birds for the table, and several early writings on their care and culinary uses are still to be found

Apart from the narrative and its running accounts of the expedition, two chords dominate *Four Years* and give it a distinctive place among all books of its class. To these might be added a third, that of literary style, although it so fuses and intermingles itself with the more prominent and essential features that its presence is less readily recognized and appreciated.

First, in his understanding and sympathy with the natives, his faithful comrades and helpers, MacMillan is unique and remarkable. A considerable understanding of the language and a comprehension of customs and of that indefinable something, racial spirit, of the Eskimo, seem to have brought about a condition of confidence and coöperation, which until Peary's time was utterly unknown, and which in MacMillan's case was doubtless the consequence and fruitage of his years of association with that great leader.

MacMillan applied and enlarged the Peary method and the principles of his master, and demonstrated again that the support and loyalty of the Eskimos are indispensable to any explorer working in the eastern Arctic hemisphere. MacMillan, however, seems to have gained the good graces of the whole tribe, old and young, women and children, as well as of the men, the hunters and the sledge drivers of his field parties. It is no slight testimonial to his poise and control that he was able to hold them all loyal and attached throughout the expedition's long stay in the Arctic. Into all the Eskimos' domestic, even love affairs, the current of daily life and gossip, MacMillan entered with lively sympathy and keen appreciation. This is reflected on almost every page of his book and expressed in numberless instances of service and hospitality.

The other characteristic of *Four Years* rests in the fact that no lover of the tropics and their languor and luxury ever lost himself in "wonder, admiration and praise" more genuinely and unreservedly than MacMillan loses himself in his affection for and loyalty to the Arctic, its phenomena and environment. Torngak, the demon, had no terror for him. While of course it is admitted that there have been times and places more agreeable than the weather side of a pressure ridge in the blinding snow at 40° below, or on a toboggan in darkness rushing down a glacier to whatever may be at the bottom, or plunging along the ice foot on a ledge from which the dogs are occasionally pulled up to the trail again by main strength, or snowbound in an igloo, oil gone and food almost exhausted, nevertheless, all these are forgotten when summer and the million birds come, the waters are unloosed, the picturesque falls flow again, and the poppies carpet the scanty fields with their "cloths of gold." The transposition is complete and Mr. MacMillan has succeeded in transferring its spell to the pages of his book.

Less severe and nervous in style than Peary, less stately and scientific than Scott, less verbose and subjective, fortunately, than Nansen, MacMillan writes with a freedom, almost abandon, of appreciation, which strikes a distinctly new note in the annals of the Arctic and which will carry his *Four Years* to many readers for its own intrinsic charm and sympathetic exposition.

Two omissions, one more, the other less, important, may be noted. That no map should have been provided for a work which is so much almost all outdoors is inexplicable, possibly inexcusable. This is the more remarkable, as maps on which all the geographical outlines and the track charts have been located are readily available, and it would seem that the first duty of the publishers should have been to supply an edition which would contain a simple outline map by which the different parties and their relations to one another might be followed and understood. The caricature of a map used, which is notable mainly for misspelled names, in no degree answers the purpose and is not worthy author or publisher.

MacMillan wisely ignored the Cook controversy, or what the malicious and misguided tried to make a controversy, of ten years ago; but his faithful and loyal E-took-a-shoo remembers it all, identified the landmarks, the courses, distances, and locations. If MacMillan had chosen to have the testimony of an eyewitness, he could have given the finishing and conclusive blows to a foul thing, which, however, is rapidly receding from deserved contempt into merited oblivion. Sometime, possibly in the interest of the truth and for the help of future historians, MacMillan may give to the world from E-took-a-shoo's lips the true and literal story of that extraordinary episode.

The seven appendixes to *Four Years* are all valuable and contain much supplemental and collateral information by the other members of the expedition. Ekblaw's nearly one hundred pages give the tale of his great traverse of Grant and Ellesmere lands in 1915, with other sledge excursions, and a study of the vegetation about Borup Lodge, the headquarters, while MacMillan contributes a detailed memorandum of the thirty-five species of Arctic birds with which he made personal acquaintance.

Copyright, 1918, Harper & Brothers,
"Four Years in the White North"

SUMMERTIME

When the long summer day begins and the sun comes up from the south, the sea ice breaks and the snows melt. Then on all sides can be heard the sound of running water and the call of the birds. The hills burst into blossom, the Eskimo tribes gather together for a great hunt and holiday, and Nannook, the polar bear, goes fishing for seals.

AN ICEBERG TRAVELING SOUTHWARD IN MELVILLE BAY

These great outguards of the Arctic sea are born in the century-old snows of the Greenland ice cap. They crumble from the projecting ends of the numerous glaciers, squeezed out to the sea by the tremendous weight of this eight-thousand-foot ice mass, and float southward in the ocean currents to pile on the Labrador coast or meet their death in the warm waters of the mid-Atlantic.

In Melville Bay the explorer and whaler first begin their battle against sea ice, snow, and wind. If the season is propitious, they may sail to the north of Greenland, but if the elements turn against them here, they will go back defeated or else be crushed in the ice mill of the Labrador current

MACMILLAN'S DOG TEAM WAITING TO BE FED

Eskimo dogs are supposed to be descendants of the northern gray wolf and greatly resemble their ancestor except for their curled tails. Fleet of foot, good natured, and hard working, they are absolutely essential companions of Arctic travel and hunt. With their backs humped from hunger and their tails drooping from fatigue, they will pull away on starvation rations or on no rations at all until they literally drop from exhaustion. Should they scent game *en route*, the driver's only choice lies between slipping the traces or receiving a wild ride in pursuit. Walrus is their best food and polar bear hunting their greatest sport

A FINE DAY, GOOD GOING, AND A WELL-FED TEAM

On a smooth hard surface a well-fed team gives an exhilarating exhibition of speed. In the eastern Arctic a team usually consists of from eight to twelve dogs harnessed separately by sixteen-foot rawhide traces. This arrangement makes it possible for a driver, seated on the sledge with his twenty-five foot whip, to keep each dog at his task, but it also has the obvious disadvantage of giving the outside dogs only an indirect pull. Also the traces gradually get braided into a huge rope which requires much patience to disentangle at below-zero temperatures. On a smooth surface ten dogs will pull two thousand pounds, but when rough ice or snowdrifts are encountered, the weight of the load depends as much upon the driver's strength as upon the team's pulling power

THE MIDNIGHT SUN OVER CAPE SABINE

Cape Sabine and Etah on either side of Smith Sound are the "Pillars of Hercules" of the North American route to the Pole. Many ships have driven their prows into the ice which binds these two points, only to turn back discouraged. A few have passed on, some to return successfully and some to have the ice lock behind them. This cape has witnessed the ships of three nations vainly endeavoring to reach the Polar Sea. Captain Inglefield, R.N., first sighted the cape in 1852 and "beheld the open sea stretching through seven points of the compass," but so rapidly did this sea close up on him that he was compelled to drive a hasty retreat to the south. Dr. Kane, the first American explorer, was icebound shortly after passing, and it was just off this cape that the "Proteus," searching for Greely, went down in the ice jam. In 1905 Peary's ship "Roosevelt" sailed past on her first voyage, only to creep back the next year into Etah Harbor a battered hulk. But she returned here again in 1908 on her last and successful attempt to reach the Pole. MacMillan, on the Crocker Land Expedition, made his base at Etah and sledged across the Sound to Cape Sabine on Ellesmere Land, from which he made a rapid journey on to the open sea in the direction in which Peary thought he discerned land

Copyright, 1918, Harper & Brothers, "Four Years in the White North"

Apparently Nannook visited Borup Lodge expressly to be photographed, and very accommodatingly climbed a berg near by for his pose. Cold and ice and freezing salt water have no terrors for the "King of the North," but dogs and Winchesters are easily his masters. It is no great sport hunting the polar bear, but he supplies good meat for winter days and warm fur for winter trousers. Peary introduced the wearing of furs as does the Eskimo in place of woolen clothes, and this innovation has been a life-saver for polar explorers

Copyright, 1918, Harper & Brothers, "Four Years in the White North"

Traveling on the ice foot, the great natural highway of the North.—This pathway, lying between high and low tide, is formed by the continual accretion of ice left by each receding tide. This fringe extends along the shore line, even where the sea cliffs are vertical, and after the sea ice breaks up it forms the only smooth, although at times precarious, thoroughfare for the Arctic traveler and his dog sledge

Copyright, 1918, Harper & Brothers, "Four Years in the White North"

The ring of rocks which held down Greely's tent in "Starvation Camp" on Cape Sabine, where the surviving seven of his party of twenty-five were finally rescued by Schley as they were at the verge of death.—Greely had established on Lady Franklin Bay one of the international circumpolar scientific stations planned by the United States Government. MacMillan, working from Cape Sabine, explored considerable stretches of hitherto unvisited shore line and interior on the large islands off the Greenland coast

Copyright, 1918, Harper & Brothers, "Four Years in the White North"

Peary's old hut at Cape Sabine, built during the unsuccessful North Pole Expedition of 1900–1902, just across Smith Sound from Etah, where Peary and, later, MacMillan wintered. From Etah Peary sledged to Cape Sabine and established headquarters from which he could move north in the spring to Fort Conger, Greely's old headquarters, and then on to the polar ice. This is the so-called "American Route" by which attempts to reach the Pole have been made

IN THE NEW YORK STATE FOREST PRESERVE

The New York State Forest Preserve in the Adirondacks and the Catskills is a glorious garden of nearly 2,000,000 acres in which every resident of New York State is part owner. The state seeks to conserve this great area of field and forest, mountain, lake, and stream to safeguard New York's water supply, present and future, as a permanent protection to the sources of the state's greatest rivers. While doing this it leaves the entire tract open to the people for sport, recreation, study, or camp life—a playground for 10,000,000 people, and room for them all! The state asks only their appreciation of what conservation of the forests means, and that it can be done only through the coöperation of all the people. It has taken nature many lifetimes to grow the forests and set the watercourses, and only the same slow process can restore them if they are destroyed

Forest Conservation in New York

THE FOREST PRESERVE IS OWNED COLLECTIVELY BY ALL THE PEOPLE OF THE STATE

By GEORGE D. PRATT

New York State Conservation Commissioner

NEW York State's Forest Preserve was created in 1885.[1] Since that date the state-owned land in the Adirondack and Catskill mountains has been increased, until the preserve now includes a total of 1,838,322 acres, an area greater than the small states of Rhode Island and Delaware combined. Its administration is in the hands of the Conservation Commission—a big task when we consider that the state-owned land is bounded by more than 9000 miles of property lines. It involves many intricate questions of litigation, sociology, recreation, fire protection, and reforestation.

Much of the land comprising the Forest Preserve unfortunately consists of comparatively small parcels, intermixed with privately owned land; in fact only about 50 per cent of the vital forest land is owned by the state and the remaining 50 per cent is subject to the most uncontrolled exploitation. In order to consolidate the state holdings, the voters of New York State, in 1916, approved by a large majority a bond issue of $7,500,000 for the purchase by the state of lands in the Adirondack and Catskill regions to be added to that already owned by the state, and, according to the state constitution, "to be forever kept as wild forest lands."[2]

One of the greatest problems, therefore, now before the New York Conservation Commission is the wisest and most effective expenditure of the money authorized by this bond issue for additions to the Forest Preserve. Lands must be purchased for the state which will be most useful for Forest Preserve purposes and which will round out the state's holdings in its mountainous and natural forest regions.

The problem is not so simple a one of buying and selling as might at first

[1] As long ago as 1822, De Witt Clinton, then governor of New York, told the legislature that "Our forests are falling rapidly before the progress of settlement, and a scarcity of wood for fuel, ship and house building, and other useful purposes, is already felt in the increasing prices for that indispensable article. No system for plantation for the production of trees, and no system of economy for their preservation, has been adopted, and probably none will be until severe privations are experienced." We have no record that any definite action followed this good advice, doubtless because the severe privations foreseen by De Witt Clinton were slow in arriving. It was not until 1885 that his wise suggestions regarding forest conservation began to be followed.

[2] The value of the Forest Preserve as a safeguard for New York's present and future water supply, and as a protection to the sources of New York's greatest rivers, is practically self-evident. But there are further economic advantages of great forested areas which are not generally appreciated. They are not only conservers of water supply, but they are actual regulators of climate and inducers of rain. Regions of extensive tree growth are cooler in summer and warmer in winter, with smaller sudden fluctuations in temperature, than barren sections of similar location. Moisture-laden winds from the ocean or from large inland bodies of water sweep onward over the land until they strike the cooler currents of wooded areas. This moisture is then precipitated as rain, which falls over wide areas of forest and farm land. In this respect New York is most fortunately situated, drawing rain from both the Atlantic Ocean and the Great Lakes.

In conserving the rain that has fallen, the forests render a still further service. The ground under the trees is covered with the accumulated débris of years or even of centuries. This is the duff, the carpet of the forest floor. It serves two purposes, namely, preventing rapid evaporation of ground water when dry winds sweep over the land, and acting as a sponge to hold the rainfall and control the run-off. In the arid regions of the west the rain runs down the creek beds like water from a shingled roof, and soon after the rain has ceased the ground is as dry as before. The forests thus equalize the flow of the streams and regulate the power they generate for industrial purposes, by reducing floods in the spring or after heavy rains, and providing a steadier flow in the summer. The deep snow of winter melts more slowly under the trees, and the run off is more gradual.


DOMINION OF CANADA
OF VERMONT
ST. LAWRENCE RIVER
MASSENA
WADDINGTON
LOUISVILLE
NORFOLK
MADRID
LISBON
POTSDAM
Part of the Ten Townships
STOCKHOLM
BRASHER
LAWRENCE
16
FORT COVINGTON
BOMBAY
WESTVILLE
CONSTABLE
BURKE
CHATEAUGAY
CLINTON
CHAMPLAIN
CHAZY
MOIRA
BANGOR
DICKINSON
BRANDON
BELLMONT
ELLENBURG
DANNEMORA
BEEKMANTOWN
SCHUYLER FALLS
GRAND ISLE
SOUTH HERO
NORTH HERO
ISLE LA MOTTE
ALBURG
Macomb's Purchase Great Tract
Macomb's Purchase Great Tract No 2
HOPKINTON
COLTON
PIERREPONT
BLACK BROOK
WILLSBORO
KEENE
WILMINGTON
Macomb's Purchase
EDWARDS
PITCAIRN
MORIAH
NORTH

ADIRONDACK FOREST AND ADJOINING TERRITORY

Compiled in 1917 from maps and field notes on file in the State Department at Albany, New York, and from the topographic sheets of the United States Geological Survey. The New York State Forest Preserve now includes a total of 1,838,322 acres, an area greater than the small states of Rhode Island and Delaware combined. Much of the land comprising the Forest Preserve unfortunately consists of comparatively small parcels, intermixed with privately owned land; in fact only about 50 per cent of the vital forest land in the Adirondacks, as shown by the dark areas on the map, is state owned and the other 50 per cent is still subject to possible uncontrolled commercial exploitation be imagined. In the preservation of stream flow, the forests upon the steep mountainsides are of first importance. If these slopes have been denuded by the ax, and afterward, perhaps, also swept by fire, erosion from rainfall will carry away the soil, and it will be forever impossible to renew a forest growth. The Commission must accordingly determine the sections that are of this character, upon which no further lumbering of any sort should be done, and which should be immediately purchased by the state.

Sections of other lower lands not subject to erosion may have some of the timber removed without detriment to the forest cover. Where this can be allowed, the land can be acquired by the state at a far lower sum than the thickly timbered mountain slopes. These are but two of the considerations that we must have in mind in purchasing additional state land. There are many others, but they are all corollaries of the one great problem of completing the state's Forest Preserve before it is forever too late.

A "corduroy" road built by a lumber company for hauling logs from the mountain slopes. Many of the high slopes have been denuded by the ax and eroded by rainfall so that forest growth can never be renewed on them

Protection of the forests from fires, which, in a large number of cases, start in the "slash" left by lumbermen on privately owned land, is one of the most important tasks of the Conservation Commission. The detailed care of the forests is in the hands of the forest rangers, numbering sixty-five. They report to the five district rangers, who in turn are in immediate touch with the main office in Albany. In addition there are fifty-two fire observers on duty during the dry season.

In the fighting of forest fires, New York has many advantages over some of the other states, because of the mountainous nature of the country which permits the maintenance of mountain observation stations for the quick detection of conflagrations. In New York there are now fifty-two such mountain stations, all of which are connected by telephone with the nearest ranger. On

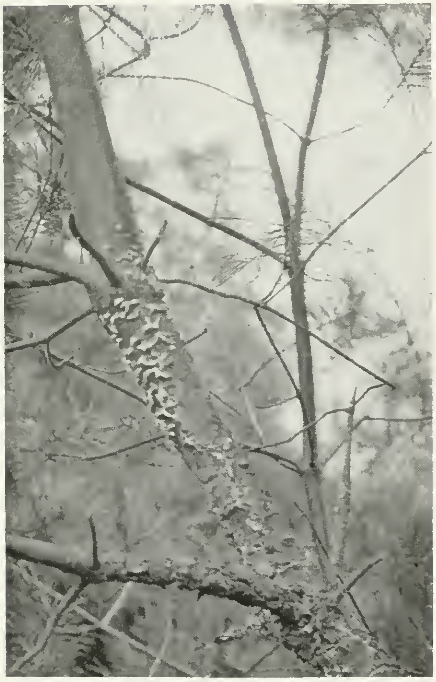
Semi-permanent camps are welcomed on state land.—Each year more people take advantage of the State Forest Preserve to enjoy the phase of outdoor life they like best. The woods have a full and hearty answer for every appeal, and offer unstinted hospitality for sport or the simple pleasure of life in the open. The upper picture shows one of the most popular camps, a tent with raised floor of wood, set in a dense growth of conifers and deciduous trees. In the lower picture is an open cabin of logs with ample fireplace of rocks. It is set in the sunshine of a clearing

New York State nursery at Salamanca, one of six nurseries owned by the state, where approximately 10,000,000 seedling trees are propagated annually to replant denuded areas. Slat screens protect the tender young trees from direct sun in summer, and are removed in early fall to harden the growth for winter. After permanent snow comes, a single layer of burlap protects the young trees from the danger of alternate freezing and thawing

Ten-year-old transplanted trees in state plantation near Ray Brook.—With young trees from the state nurseries about 4000 acres are planted each year by the state, and as many more by private enterprise. The trees are planted close together to encourage "natural pruning" through lack of direct sunlight on the side branches, thus stimulating the formation of long straight saw logs free from knots

EXAMPLE OF REFORESTATION BY PRIVATE ENTERPRISE

Twenty-eight years ago this land (near Chestertown), denuded and practically worthless, was planted with white pine which today is very valuable and constantly becoming more so. White pine attains its maximum commercial value in about fifty years



Branch of young white pine, dying from white pine blister rust, a parasitic fungus which came from the forest nurseries of Germany in 1909, and has wrought great damage ever since. The whole tree is doomed

many of the mountains wooden towers were at first erected to lift the observers above near obstructions, but during the last two or three years most of these have been replaced with steel towers of permanent construction. The steel towers have a room at the top about seven feet square, with glass windows. The windows protect the observer from the sweep of the wind and make possible his presence on the tower every day and all day long, throughout the critical periods. In these steel towers telephones are installed in the rooms at the top. Cabins for the residence of the observers are provided near the towers.

In working out the system, we have kept in mind the fact that eternal vigilance and quick action, with coordination of all fire-fighting forces, is the key to the safety of our forests. While we have been particularly fortunate in the last few years in weather conditions, we have, nevertheless, had numerous outbreaks of fire, and have been able to prove that they can be promptly detected and the fire-fighting forces quickly put into action.

As a further step toward more complete efficiency, the Conservation Commission has recently prepared, after careful examination of all of the forest land by the ranger force, a fire map upon which is indicated the character of every acre of land in the forest sections—green timber, land lumbered for soft wood, or for both hard and soft wood, with the year when lumbered, burned-over land, barren land, or agricultural land. The map also indicates roads passable for automobiles, or for wagons only, and also foot trails. Upon

The yellow spring spores of the white pine blister rust are ready to start on the wind to their next nursery on the under side of currant and gooseberry leaves, where they will develop until they again go forth on the wind to continue their infection of the pines. Drastic measures are being taken to save the pines. Fortunately the State Conservation Commission can accomplish what would be impossible for private enterprise

On guard over part of the state's great forest preserve which stretches out far and wide beneath him.—This Conservation fire observer on Black Mountain is one of the keen-sighted, cool-headed, alert men trained to distinguish the almost imperceptible difference between wisps of cloud and wisps of smoke floating over the tree tops—a momentous distinction, as failure to report a fire promptly often allows it to get beyond control, and a mistake sends men and equipment many long miles for nothing

it is also indicated every telephone line—and even the telephone instruments. Camps are shown, with the number of men available at each, as well as points where supplies and tools are located. In brief, the fire map is a veritable "war map," and serves as a basis for discussions at meetings of the rangers, private landowners, and officers of the Commission, where all concerned become familiar with the fire problems of the forest districts before the fires have developed. This system of analysis and preparedness is the system that is followed in every well-organized city fire department, and it is the system that we believe necessary if our forests are to be protected in the most critical times.

Three years ago the district rangers were equipped with Ford automobiles for getting easily about their territory and for taking men quickly to fires. Last year we added trailers loaded with camp outfits and tools, so that no time need be lost in getting these necessary articles to the nearest points on a highway.

I have referred to the denudation which follows from unrestricted lumbering and forest fires. In the Forest Preserve alone we have today approximately 125,000 acres of such denuded land which must be replanted with forest trees if a suitable forest growth is to be brought back upon it. Besides this there are vast stretches of privately owned land in the same condition and demanding the same sort of treatment, if we are to pass on to our descendants the forest resources that we ourselves found when we first came into this region. There are also great quantities of idle, non-agricultural land scattered throughout the state that should be brought under forest growth by reforestation.

It may be surprising to many to learn that of the entire extent of the Empire State approximately 35 per cent is suitable for forest growth but not for agriculture. One of the great problems of the Conservation

Fire observation tower on Black Mountain.—Mountain climbing is becoming a favorite sport in America. More than 50,000 persons climbed peaks in the Adirondacks last summer for the view to be obtained from the top

Commission is to bring about the planting of forests not only upon the state's own denuded land, and upon privately owned denuded land in the forest regions, but also upon the hundreds of thousands of acres of idle land in agricultural parts of the state that are fit for nothing but to grow trees. A great beginning has been made in this work by the establishment of six state nurseries which produce each year approximately 10,000,000 young trees. This is only a beginning, however, and tremendous strides must yet be taken before we can feel that we have even begun to approach our goal.

How important this matter of reforestation may become is better understood when we consider that in the warring countries of Europe whole forests have been cut down to supply timber for the uses of war, and that virtually all of these forests had been artificially created by planting. Without these forests the armies of Europe would have been in desperate plight indeed. If this is true in war, how much more true is it in peace, which has so many and varied uses for adequate supplies of timber and wood.

Still another forest conservation problem of tremendous urgency is now before the Commission. There has been an invasion from Germany in the guise of the white pine blister rust. This is a fungus disease which attacks white pine trees and accomplishes their complete destruction. It was imported from some of the forest nurseries of Germany and has already gained a most alarming foothold in many of the eastern states and even in some of those in the Middle West. It is found everywhere throughout New England to an extent that threatens the absolute extermination of white pine trees in those states. Already it has spread across the border into New York and our utmost efforts must be put forth if it is to be checked.

This parasitic fungus has a life history described by the expression "alternating generations." The spores are ripe in May and June and are carried by the wind from the pine trees to the leaves of currant and gooseberry bushes, where they undergo a change and are again carried by the wind either to other currant or gooseberry bushes or back to the white pine. The method of eradication is accordingly to destroy all currant and gooseberry bushes in the immediate neighborhood of infected areas, as well as to destroy the infected trees themselves. The cure must be rigorously applied. It will cost a large amount of money and must be carried out with the utmost degree of thoroughness—otherwise within a compara-

Where man has made both science and nature helpless.—A hillside first denuded by wasteful lumbering and then swept by fire in the slash. This was ten years ago. Rain completed the ruin by washing away the unprotected soil, leaving only bare rocks. The place must now be forever barren, but could have been saved by modern forestry and fire protection

Seconds count in reaching a forest fire.—Three years ago light speedy motors were provided for the district rangers to replace their horses in patrolling the districts and responding to emergency calls. Trailers are attached, carrying additional men and equipment. There are five district rangers who keep in touch with the main office in Albany and direct the detail and routine work of sixty-five forest rangers and fifty-two special fire observers

The New York Conservation Commission's new steel fire observation tower on Mount Adams, replacing an old wooden structure. The construction is strong but open, offering little resistance to the wind and quickly shedding the snow. There is a room on top about seven feet square with glass windows to keep out rain and wind, which is very high at this altitude, and a telephone for prompt reporting of fires. The observer has a comfortable cabin close by, but during the danger season he spends all the daylight hours in the tower room

tively short time we shall have no white pine forests in the state of New York.

The Conservation Commission's campaign against the blister rust, and against carelessness with fire in the woods, has been greatly aided by a system of educational work with the public, by means of posters of various sorts and lectures illustrated with lantern slides and motion pictures.

Finally, one of the greatest benefits of forest conservation in New York State and one of the chief interests of the Conservation Commission is the value of the forests for recreation and for æsthetic purposes. It must not be forgotten that *the Forest Preserve is owned collectively by approximately 10,000,000 people,* and that increasing thousands of them are actually making annual use of it for vacation purposes. The sportsman seeks the forests for the fish and game which alone can be found there. But the people who travel to the mountains today for purposes other than fishing and hunting far exceed in number those who rank as sportsmen. It is estimated that fully 50,000 persons climbed the mountains in the Adirondacks last summer, for the views to be obtained from the tops. More than 1300 climbed one mountain alone, and that not one of the most popular ones. Tramping, camping, and canoeing are becoming increasingly favorite forms of recreation, and are annually bringing to the woods more and more vacationists. Many of these people who come to enjoy the Forest Preserve find their shelter in hotels and boarding houses outside its limits. For others the Conservation Commission has formulated the most liberal plan possible under the constitution of the state of New York for the erection of tents and lean-tos for temporary occupancy on state land. It is upon the continued interest and coöperation of this large body of vacationists and the public generally, that the success of New York's broad forest policy depends.

A STREAM THAT COMES FROM FOREST-COVERED HILLS

Such country as this is not valuable for agriculture but it is very valuable for timber growing. Thirty-five per cent of New York State is not suitable for agriculture, but modern methods of forestry can make it profitable for forest growth

A DEVASTATED EUROPEAN FOREST IN THE WAR ZONE

An American forest swept by fire presents the same scene of desolation as the shell-wrecked forests of Europe. A century will hardly suffice to restore the ruined forests of Europe; and a century will hardly suffice to restore fire-swept forests in America. This is something for every American to think of so that he may use his influence against carelessness with fire on every occasion

BACK ROAD THROUGH THE NEW YORK FOREST PRESERVE

Young deciduous trees have a peculiar charm; delicate as lace work, the soft green layers of their branches stretch against the shadows behind them and gradually fade back into the fascinating mystery of the woods. It is good to feel that such beauty is in the world.

The great enemy of the forest is fire, sometimes smoldering unsuspected so deep under the surface of the humus that when a chance puff of wind breaks it into flame it is only extinguished after great labor by trenching, sometimes roaring through the tree tops with incredible velocity; in any case the factor of importance is promptitude. In the operations of the Conservation fire fighters, the old back roads through the woods prove most useful, making distant points quickly accessible. A fire map is issued, showing every road, trail, station, camp, cache for emergency tools and equipment, the condition, area, and date of burned regions, and character and position of all woods and water courses

FOREST CLAD HEIGHTS OF THE ADIRONDACKS FROM INDIAN PASS

The dense growth that covers these mountains is composed of both conifers and deciduous trees. Permanent preservation of the forests upon the upper elevations is essential for the protection of steep slopes and to prevent great fire risks. The Conservation Commission is now engaged in acquiring such lands for the state, in order to insure a continuous forest growth upon them. New York is fortunate in the position of her forests, for winds may blow east from the ocean or west from the Great Lakes, and their moisture is precipitated in rain by the cool air rising from the forest, and falls over a wide expanse of farm land

THE FORESTS ABOUT TYRELL LAKE IN THE ADIRONDACKS

On the green of the crowded tree tops sunshine alternates with cloud shadow. The spirit of primeval life adds a subtle charm to the beauty of the little lake set in hills that sweep away in almost appalling vastness until they fade away into the horizon.

In the forest shade countless streams have set their courses to feed natural reservoirs and provide water power, navigable rivers, and a supply of water for man and his agricultural lands. Wasteful lumbering, and especially an unguarded fire, would turn all this wealth and beauty into a profitless waste. The forests are the people's birthright, and the state seeks to conserve this birthright for them

BLUE MOUNTAIN LAKE, ONE OF THE MOST BEAUTIFUL IN THE ADIRONDACKS

An island-dotted gem of clearest water, set in a hollow of forested hills. In such a spot the spirit of many a city-crushed toiler is revived and invigorated for months to come. The massive peak of Blue Mountain, from the side of which this photograph was taken, commands the lake

MT. McINTYRE'S SNOW-CLAD PEAK ABOVE SPRUCE FORESTS

High Adirondack slopes are often covered with valuable areas of spruce which the state seeks to preserve. On the ground, the snow protects sleeping mosses, ferns, and flowering plants from rapid changes of temperature, and its moisture slowly disintegrates the fallen dead leaves so that the chemical substances which they contain are absorbed back again into the earth, there nourishing new plant life in the endless cycle of growth

Wild Horses of the Plains

By JAMES H. COOK[1]

INTRODUCTORY NOTE.—Mr. James H. Cook was famous in his youth as an Indian scout and is now recording some of his early experiences on the frontier, of which this article is an excerpt. The American Museum and in fact American science are indebted to him and to his son Harold for the discovery of the Agate Spring Quarry, near the Cook Ranch, on the Niobrara River of western Nebraska, which has proved to be the most wonderful deposit of fossil mammals in the world, with the single exception of the Rancho-la-Brea. At Agate Spring Quarry were found the *Moropus* skeletons described in the February number of the JOURNAL (1918).

The following pen picture of the mustangs is the most perfect I have seen. The superb qualities of these animals were derived from their barb and from their much more remote Arab ancestors. The real mustang is now very rare. Mr. Cook has secured a very typical example for the American Museum's collection of horses.—HENRY FAIRFIELD OSBORN

SO far as we have any knowledge, no evidence has as yet been obtained which would prove that horses were living on the North American continent at the time of its discovery by Europeans. That vast numbers of horses, however, in several stages of evolutionary development, existed here for millions of years prior to that discovery is proved by abundant evidence.

We may well ask in what manner the countless numbers of horses which once roamed our great plains could have been exterminated. Their passing is as mysterious as the sudden disappearance of the millions of "passenger pigeons," which inhabited some of our eastern states up to within the last half century and are now considered extinct.

Recently, while on a visit to the Grand Cañon, I met an old resident who told me that during the last few years he had seen several small flocks of passenger pigeons in the timber of the mesa lands along the Colorado River. He said he had seen and killed many "back East" when he was a boy, and that he knew well the difference between the "banded tailed" or "wood pigeon" of the West, and the passenger pigeon.

Each year as time goes on we obtain new evidence relative to the days of the "long ago." Possibly we may find, a little later on, some evidence showing that scattered herds of horses were still in existence upon this continent at the time of its discovery. Only two years ago (1916) the fossil remains of a horse which connects the prehistoric horse with the horse of today, were discovered in the state of Nebraska.

Our greatest scholars have thought that the true mustangs of the Plains originated from the stock of "Moorish barb" horses which Cortez and other Spanish explorers brought to Mexico in the sixteenth century. During the numerous exploring expeditions of the early Spaniards, one of which extended as far north as the region now occupied by Kansas and Nebraska, no doubt some of the horses used by the explorers escaped from time to time. Stampedes might be caused by storms, or at sight of the herds of bison likely to come thundering by. Probably at times, tired, thirsty horses strayed away from their owners and became lost in their efforts to find water or grass. In this way horses doubtless were scattered over the Plains between three and four hundred years ago—and they multiplied.

At the time of which I write, 1870 to 1880, there were thousands of these inbred beautiful little horses living on the ranges of the West, in the vast country that lies between the valley of the Mississippi River and the Rocky Mountain region. They were true mustangs, named by the inhabitants of Mexico. Their average weight was about eight hundred pounds, I think. The colors that predominated among them were cream, buckskin, or mouse-color. A few black stripes about the legs above the knees, or hocks, and a black stripe along the middle of the back, extending from the mane to the tail, were common markings. The stallions, although they usually had rather heavy manes, did not have a shaggy appearance. They were clean-limbed and their hoofs were black and perfect, as a rule. Never having known the taste of grain, and deriving their food entirely from the native grasses and forage plants, they certainly were hardy.

[1] Of Agate, Nebraska

They could stand more hard riding with no other food than that which they could "rustle" when turned loose, than any breed of horses with which I have ever had experience, either on the Plains or in the mountains. As blacksmiths or "hoofshapers" never had tinkered with their feet or forced them to wear iron shoes, their hoofs were strong and would stand wear over the roughest kind of mountain trails.

I have seen many bands of mustangs on the Plains as far north as the head of the Loup River, Nebraska. North of that point I have never seen any, neither have I heard from any of the old white trappers or the Indians, who lived in that country, that they ever saw any. When the wagon roads were made across the Plains to California, and to the various army posts that were established in the West, horses and mules escaped from the wagon trains occasionally and joined the bands of mustangs. Strange as it may seem, the well-broken, gentle horses and mules which joined the bands of mustangs and lived with them for a few months or years, became, if such a thing could be, more wild and watchful than the mustangs. I am quite sure that a few old, long-headed army mules I have noted ranging with bands of mustangs were about the most wisely wild creatures it has ever been my good fortune to see. Back in Missouri, or some other state, or under the gentle care of some expert government "mule skinner," they had acquired a knowledge of men and their ways. Their extremely delicate sense of smell enabled them to scent a man at long range, especially one who carried about with him a large halo from an old pipe or "chawing plug."

After one of these mules had lived in the open with the mustangs for a few months, the slightest scent of a man at any minute, night or day, would cause it to snort in such a wildly terrifying manner that the entire band of mustangs would stampede, running perhaps forty miles at topmost speed, before they could get control enough of their courage to look back to see what had caused the excitement. I have observed that both mustangs and range horses have a keen sense of smell and are able to scent the trail made by horses with which they have been associated, following it rapidly, over ground where a man could see no sign that horses had passed.

One thing for which the mustangs had to be on the lookout at all times was the big wolf, or "lobo." This cowardly pest was ever hungry for a taste of horse flesh. Animals weakened or crippled from any cause, or very young colts, were easy prey if the wolf could but sneak up and cut their ham strings with his sharp teeth before the defenders in the band saw him. For the strong, active mare or stallion a wolf might show some respect: a thoroughly enraged horse, fighting with its teeth, striking lightning-like blows with its forefeet, and playing a "double tattoo" with its heels, is no plaything for even a pack of wolves to tackle.

Stallions and mares which escaped from emigrant and freighting wagon trains on their way across the Plains, and intermingled with the mustangs, caused the heretofore purebred mustangs to become gradually more and more scarce. By 1880 almost all had disappeared from the Plains; and the few mustangs remaining today are to be found only among the herds of Indian ponies on some reservation where the breeding-up process to get larger horses with which to haul freight or till the soil, has not been rigidly enforced. Now and then a pony having the conformation, coloring, and marking of the mustang may yet be obtained from the older Indians, who have long known the good qualities of the mustangs. In a few places so-called "wild horses" may be found, but they are not the original breed of mustangs. They are bands of range-bred horses gone wild or spoiled, usually by someone's bad management—or luck—when trying to corral them. A sudden scare at the entrance to the corral will make horses turn and try to run back on to the range. Should they succeed in one attempt, they will be hard to corral afterward, and if they break back from the corral two or three times, they become a pretty badly spoiled lot of horses—but must not be confused with mustangs.

In the early seventies, while I was working with wild Spanish cattle down in the southwestern part of Texas, getting my early education as a cowboy, I had my first opportunity to learn something regarding mustangs. There were many living on the comparatively small prairies scattered about in the brush country of that region, and a number of men were making a business of catching bands of mustangs to sell in the states to the east and north.

The method employed in the capture was

A DESCENDANT OF THE MUSTANG, AGATE, NEBRASKA

In former years great herds of beautiful wild mustangs roamed the Western Plains of the United States. They were small, averaging about eight hundred pounds in weight, but clean-limbed and very hardy. Cream, buckskin, or mouse colors prevailed, with a few black stripes about the legs above the knees and a similar stripe along the middle of the back from mane to tail. By the year 1880 almost all had disappeared from the Plains, and only an occasional descendant may now be found among the herds of Indian ponies as follows: In some thicket a little back from the edge of a prairie large circular corrals were built, high and strong, of heavy posts set in the ground and bound together with green rawhide thongs. The entrance led into a chute or passageway, wide at the outer end and narrowing toward the inner end, where not more than three horses abreast could pass through. This type of entrance prevented the horses from escaping in a rush for the gateway when they found themselves trapped, before the heavy bar poles could be put up and securely lashed. From the outside of the entrance to the corral on either side were built wings extending in the shape of a large V. For a short distance out from the corral these wings, which often extended a quarter of a mile or more, were made very strong, and so high that a horse could not jump over. Then wings and entrance were concealed by green brush.

When the corral and its wings were in readiness, a lot of riders, quite widely separated and moving in a half circle, rode out of the timber and chaparral on the side of the prairie where the wild horses ranged, and the horses, of course, fled before them. The riders at the ends of the half circle then made straight for the ends of the wings of the corral, while the rest of the riders kept the mustangs running toward the corral and prevented any from turning back. The riders drew nearer and nearer together as they approached the corral. As soon as the mustangs were well within the wings, their pursuers closed in on them, yelling, and firing their pistols, whereupon the leaders among the mustangs, on the lookout for any little opening in the green thicket through which they might escape, rushed through the narrow opening at the inner end of the chute, only to find themselves hopelessly trapped. The fright of these horses can be imagined. They rush frantically around and around the corral. Sometimes they all make for one side of the corral, piling up to such an extent that those farthest back when the rush

This shows well the shoulder stripe which characterizes the full-blooded mustang. The following quotation from a letter from Mr. Harold J. Cook, son of the author, will explain that it is to him NATURAL HISTORY is indebted for the illustrations.

"I have not been able to find anywhere photographs of the real 'old time mustang,' so I have done the next best thing I could think of. I caught up a descendant of some of these old horses that we recently bought from the Indians, and took some snap shots of him. I have tried to get these for ten days, but it has snowed, rained, and blown wildcats. The pony has the characteristic back and shoulder stripes. I tried to get a view showing these. In size, build, and make-up he conforms quite well with the type. He has very little if any of the hot blood of the white man's horses in his veins" started, can climb up over those trampled down in front. When a hundred or more are knocked down and piled up close to the corral fence, some escape by jumping from the pile of struggling horses over the top of the corral. By this method of capture many hundreds of horses are maimed and many killed.

When the horses are securely corralled, the riders generally go to camp and let the terror-stricken animals settle down for a few hours. Then they return to the corral and the real scare for the horses takes place, for the terrible looking creatures who have driven them into that awful pen now climb down from the top of the circle of posts into the corral with them. As the mustangs are somewhat exhausted by their previous attempts to escape, they soon become a panting, foaming, almost breathless mass of horses. Sometimes the old stallions show fight, in which case they are promptly shot. Lassos are then brought into play. The horses are lassoed by the feet, thrown down, and either strong rawhide hobbles or clogs are placed on their front legs.

Hobbles for horses are in common use at this date in many parts of the West, but I never have heard of clogs for horses being used in any part of the West other than the brush country of southwestern Texas. These clogs are made by taking strong, forked sticks about an inch and a half or two inches in diameter and about two feet in length, and lashing them with rawhide thongs on to the front leg of a horse. With these the animal can make little headway when he tries to run. Like a hobbled horse he soon becomes very tired of trying to go at speed.

When all the horses which are neither killed nor injured have been hobbled or clogged, they are usually left in the corral until they are pretty hungry and thirsty. Then the bar poles are taken down and the horses allowed to work their way out of the corral through the narrow chute and into the wings. These wings usually take in some little water hole, or the bend of a creek, where the horses can drink. Riders frighten them back if they try to work beyond the mouth of the wings of the corral for the first day or two. Gradually they are allowed to work their way out on to the prairie to graze during the daytime. At night they are driven back into the corral. After a few days of this treatment, the hobbles and clogs are removed from those horses which are most subdued. At the end of a few weeks the entire herd is freed from hobbles and clogs, having become accustomed to control by riders to the extent of being driven in any direction desired.

I never took any part in "mustang hunts" of this type, but I have watched the performance a few times. It was certainly a pretty cruel business. During the days when I hunted big game in Colorado and Wyoming Territory, a hunting partner of mine, best known as Wild Horse Charlie, was, I think, the first man to make a business of catching mustangs on a larger scale, on the open plains. He called his method "walking them down." In the spring of 1876 he captured several bands of mustangs on the plains of eastern Colorado, driving them into Nebraska and Iowa, where they were sold as saddle or driving ponies. In his method he took three or four good riders and made a camp on the range of the mustangs, at a time when advantage could be taken of moonlight for the work. From some good observation point, a rider would then locate a band of horses with his field glasses, by moonlight. Bright and early in the morning the work of capturing the horses would begin. Mustangs have a habit of settling on a range. When possible, they confine their feeding and their flights from danger to certain boundary lines. This fact is well known to plainsmen.

Upon discovering a band of mustangs, a rider approaches them from a direction opposite to that in which he desires the horses to run. As the mustangs have wonderful sight and are always on the lookout for danger, they take to their heels as soon as the rider comes into view. This rider does not race after them, but follows fast enough to keep them in sight. The other riders, stationed at as good observation points as possible, note the direction in which the mustangs start to circle, in order that each rider in turn may be relieved every few hours during the long chase. At the end of a few hours, the first man to start after the horses is relieved by another rider. He can then go to camp, change his tired saddle horse for a fresh one, and get a little rest. This relay system, continued night and day, never allowing the mustangs to stop for either food or drink, will, at the end of a few days, exhaust them so that the riders can approach and begin to control the turning of the mustangs in any direction desired. Naturally the riders keep them as close to their camp as possible.

The mustangs cover many miles of ground during the first two or three days of the chase—a distance of one hundred miles for each twenty-four hours is not an exaggerated estimate. On about the seventh or eighth day of the chase, or sooner on some occasions, the aged or weaker mustangs, completely exhausted, play out and stop, or some of the aged stallions turn on their pursuers for a fight. Such stallions are shot by the riders, and the exhausted animals lassoed, hobbled, or "sidelined." Sidelining means tying together the front and hind foot on one side of an animal with a pair of hobbles to prevent it from traveling at speed. At the end of the tenth day after the chase begins the wild horses are under such control that they can be driven to some strong cattle corral in the country.

A third method of capture is by "creasing." This is used to capture individual mustangs considered especially valuable because of their beauty, color, conformative marking, or because they show unusual speed. This method has been more talked about than successfully carried out.

To crease a horse, a person must first get within close shooting distance of this most animated target. He must then place a rifle bullet in the top of its neck, grazing the cords of the neck just enough to stun the animal and knock it down so that it can be tied down before recovering from the shock. Not only must one be a mighty good shot, but extremely lucky, to make a success of this method; it is very easy either to break the neck of the animal, simply give it a bad scare and a slight wound, or score a clean miss.

I tried it once but I never attempted to crease a second mustang. While engaged in the work of gathering wild cattle down in Frio County, Texas, I caught sight, on numerous occasions, of a small band of mustangs led by one of the handsomest stallions I have ever seen. He was cream-colored, with white mane and tail. His mane was parted and hung equally heavy on both sides of his neck. He had a black stripe down the middle of his back, and also one around his legs. I discovered that this band of horses was in the habit of drinking from a little pool so located in a washout of an old creek bed that it could be approached from only one side, three sides of the washout having high, perpendicular banks. These creek banks leading to the water hole made wings that were probably about one hundred and fifty feet long. I conceived the idea that if I could hide in the vicinity of this watering place until all the horses, coming to drink, should be in the narrow runway leading to the water, I could dash up to the mouth of the runway and, as the horses rushed past me in making their escape, I could crease the desired stallion with my six-shooter. At that time I considered myself hard to beat, either mounted or on foot, in the use of the six-shooter.

After weeks of waiting, an opportunity to try out my scheme at last arrived. While out hunting for some saddle horses which had strayed from our camp, I saw this band trailing toward the water hole. Keeping out of their sight, I beat them to the place. I concealed myself and my horse in a dense chaparral thicket about one hundred yards from the mouth of the runway through which the horses would go to get a drink. The horses must have felt that there was no danger, for they rushed in a bunch down the runway and into the water, where they made such a noise splashing and pawing about that they did not hear me approach. They certainly got up some action in getting past me when I rode into the runway. As the stallion came rushing madly by, passing within ten feet of me, I made an attempt to crease him. The result was that I broke his neck. At first I thought I had been successful, but when I saw what I had done, I could have cried. Perhaps I did, for I certainly felt very sorry to have taken the life of that beautiful creature. I realized then that, had I thought to use my lasso instead of my six-shooter, he either would have escaped or been mine. Seldom would one find a band of mustangs in such a natural trap with an opportunity to use either lasso or pistol at such short range. I never made another attempt to crease a mustang.

Some writers have told us of certain tribes of Mexican Indians who were possessed of such speed that, starting out on foot, they could run down and capture the mustang. I have been told about both white men and Indians who, on foot, had run down, killing or capturing, many wild animals, including antelope, deer, and mustangs. I have never seen a performance of this kind. I can understand how a man trained to the work of trailing or tracking game could follow an animal for an indefinite length of time, provided the course followed by the animal led over such ground as to make tracking possible. Unless a man did depend largely upon his tracking qualifications, he would have to lope along at a lively clip for the first forty-eight hours of his chase after a mustang, or lose sight of his game, if the mustang acted in the manner of those pursued by horsemen.

Doubtless, away back in a time when the wild life of our country knew nothing of pursuit by men on horseback, mustangs may have felt safe when out of range of arrows shot from bows, even when the archer was in full view. All wild life seemed to know, or felt it knew, that there was a distance at which it could feel safe, even from its most feared enemy—man. If instinct did protect the wild life at one time, I think it hardly can be depended upon in these days, at least without being very much readjusted. Air craft and automobiles are now aiding the mighty Nimrods in ridding the world of its wild waterfowl and the last of its fleet-footed, pronghorn antelope. Such things as pump guns and rapid-fire, high-power rifles proved too slow.

To me there is a certain grace and beauty about wild creatures that is lost as soon as they become domesticated. They certainly lose their alertness, and my respect and admiration decline in corresponding ratio.

Primitive Ideas on Numbers and Systems of Measurement

By ROBERT H. LOWIE

IT IS sometimes rashly asserted that primitive tribes are incapable of conceiving numbers greater than three or five. Even if such peoples exist—and this seems highly problematical—the lack of terms for any but the lowest numbers would not prove their inability to develop adequate arithmetical notions. This is, indeed, exactly what has taken place among many of our North American Indians, whose conceptions and vocabulary of numbers have been materially enlarged through contact with modern civilization. Under the old conditions of life there simply was no need for such conceptions and accordingly they had not sprung into existence.

Nevertheless, there are probably few, if any, stocks of humanity that are not able to count up to twenty. The reason is obvious: man has twenty fingers and toes. It is interesting and almost startling to find how many of the numeral systems on record have a digital basis,—quinary, decimal, or vigesimal. Thus, Mr. Waldemar Jochelson, of American Museum Jesup Expedition fame, has analyzed the terms of the Yukaghir of northern Siberia. One really means "one finger"; five is derived from the stem for "wrist" or "hand"; ten signifies at bottom "the fingers all together." One hundred formerly marked the limits of Yukaghir numeration and was expressed by doubling the word for "ten."

The Kai, a Papuan tribe occupying the mountainous and wooded hinterland of Finschhafen, New Guinea, regularly use their fingers in counting; they begin with the little finger of the left hand and after finishing both hands proceed to the feet, beginning with the big toe in each case. This practice is strikingly illustrated in their vocabulary. Seven is "two on the other hand"; eleven "one on the foot"; sixteen "one on the other foot." When introduced to the white man's week the Kai logically enough allotted to each finger a day, and he will say, "I shall be back on the thumb," when he wishes to indicate that he will return on Friday.

Remarkably similar is the method pursued by the Tamanac of the Orinoco River. Five means "the whole hand," six is "one of the other hand," eleven "one to the foot," sixteen "one to the other foot." That the same type of numeral system should be found in Siberia, in New Guinea, and in South America is assuredly a noteworthy phenomenon. We may recognize here some evidence for the lately challenged doctrine of the psychic unity of mankind, for in this case at least the theory of borrowing seems excluded.

Very different from these primitive gropings is the highly developed numerical system of the Maya Indians of Yucatan, which enabled them to designate numbers transcending a million. In fact, two systems were in vogue among them—the one peculiar to the inscriptions on stone monuments, the other distinctive of the fiber-paper books (codices). Confining our attention to the latter, we find a method of numeration by position, in which "the numerical value of the symbols depended solely on position, just as in our own decimal system, in which the value of a figure depends on its distance from the decimal point."[1] Instead of proceeding from right to left, however, in the expression of numbers, the Maya started from the bottom and worked their way upward to the higher positions; and, what is more significant than this purely external arrangement, the basis of the system was not decimal but *essentially* vigesimal. Perhaps the most astonishing feature of the scheme is the development of a zero symbol, for as Tylor[2] puts it: "This invention of a sign for nothing was practically one of the greatest moves ever made in science." The zero was unknown to the ancient Greeks and Romans, and European civilization learned its use from Hindu culture through the intermediation of the Arabs.

To express 20 the Maya did in principle what we do to write 10; that is, they wrote the zero symbol in the first position and the 1 symbol in the second. The numbers from 1 to 19 were all put into the first position and expressed by a combination of dots and bars. One dot represented 1, two dots 2, one bar stood for 5, one bar and four dots for 9, three bars and four dots for 19. The only inconsistency in the system occurs in the third position, which instead of representing the value of 400, that is, 20 by 20, only stands for 360,—undoubtedly because of the number of days in a year since the system had a purely calendric use. Otherwise, however, the vigesimal basis is preserved. A unit in the fourth position equals $20\times360=7200$; and the fifth position represents $7200\times20=144{,}000$. This method of numeration must always rank as a capital achievement of the human intellect.

Primitive ideas on numbers are by no means wholly of a rational cast, however. Precisely as 13 is considered an unlucky number with us, so among most of the ruder cultures numbers are invested with altogether peculiar characters and potencies. In aboriginal North America four generally plays an exceptional part as a mystic or sacred number. Some tribes have conceived the idea that everything in the universe must be arranged in quartets. Thus, in a ceremonial procession there will be four halting places; at each stop the chanters will sing four songs; and in folk tales the heroic exploit is accomplished at the fourth attempt after three trials have miscarried. In other regions the mystic number may be five as among the Paviotso of Nevada, or nine as in parts of Siberia, or ten as among the Pythagorean philosophers of ancient Greece. Sometimes different peoples entertain the most contradictory notions as to the same number. Thus, while seven is highly revered in parts of Asia, the Kikuyu of British East Africa consider it the most unlucky of numbers when their shamans forecast the future by pouring out counters from a gourd container after the manner of a dice game.

Let us turn from primitive notions of numbers to their practical application. Savages are indeed superb observers and are able to record their impressions in graphic fashion, but they rarely require precision of statement. Primitive man is incomparably better acquainted with the fauna and flora of his habitat than is the average college student with his own environment, but the data he has accumulated are raw material for science rather than science itself. His standards of measurement accordingly cannot be expected to attain a higher plane than those current, say, among the illiterate peasantry of Europe.

A concrete illustration will make the matter clearer: The Baganda of East Africa, whose intricate political organization and well-developed trade relations suggest an unusual degree of intellectual sophistication, measured building poles by the "foot": one foot was placed immediately before the

[1] Morley, S. G., Smithsonian Institution, *Bureau of American Ethnology*, Bulletin 57, p. 129.

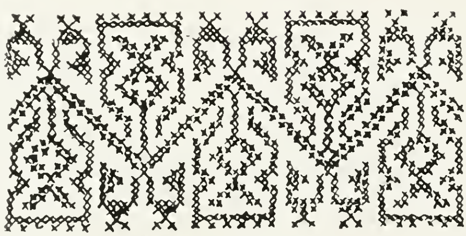
[2] Tylor, E. B., *Anthropology*, D. Appleton & Co., 1904, p. 315

other along a felled tree and the length determined by counting. But there was apparently no attempt either to standardize the foot or to bring other modes of linear measurement into any consonance with the foot. On some occasions the outstretched arms formed the standard, in measuring fences and roads the cubit was used, while the span from the tip of the thumb to the top of the second finger served to determine minor distances. What holds for linear measure applies in equal degree to dry measure. Salt was tied up in small packets approximating a tablespoonful; in larger quantities it was sold by the basket holding about ten pounds. Sweet potatoes, however, were bundled up into thirty-pound lots, firewood was tied into bundles of about forty pounds. Beer was measured by the gourd or for brewing purposes by the tub,—a vessel six feet long by two feet six inches wide and eighteen inches deep.

Judged by the Baganda standards, the measurements of at least the greater number of American tribes are on a lower plane, although it is inconceivable that the masons and artisans of Yucatan or Peru were without adequate means of determining lengths. Oddly enough the foot, which plays so important a rôle in the Old World, was apparently never used among the North American Indians. It also seems strange that there is no evidence for the use of scales and weights nor of liquid or dry measure. The kind of linear standards employed may be illustrated by the case of the Pima of Arizona. Here a yardlike measure is employed, that is, the distance from the center of the breast to the finger tips. After the coming of the Caucasian a definite series of values was established on this basis. Ten of these "sticks" were made equivalent to one "cut" of calico, equaling one load of wheat, or about 150 pounds and ten cuts or loads were reckoned equal in value with one horse. Land is measured by steps of about five feet, while long distances are estimated in terms of a day's journey.

To turn to still another region of the globe. In the Banks Islands, Melanesia, the fathom is the favorite unit and appears prominently in the measurement of money, a measuring rod serving as an auxiliary device. In monetary transactions two pegs are stuck into the ground a fathom apart, and strings of shell money are looped round them until the specified number of fathoms has been told off. Another standard is represented by the distance from one shoulder to the tips of the extended fingers of the other hand; more rarely the Banks Islanders employ the distance from the elbow to the finger tips of the same hand. A short measure is based on the length from the wrist to the finger tips.

The study of primitive methods of measurements has been much neglected and it is thus impossible to make a broad comparative statement. There are indications, however, that anthropologists are becoming interested in ascertaining details about the concrete knowledge possessed by the peoples they visit, and in this connection measurements will inevitably be investigated and will assuredly prove a fascinating chapter in some future history of science.



An Indian Peace Medal[1]

With quotations from the original diaries of the Lewis and Clark Expedition, 1804–1806

By CLARK WISSLER

A SILVER peace medal of the Jefferson medallion type, found in an Indian grave on the banks of the Clearwater River, Idaho, recalls one of the most interesting events in the exploration of this continent—the Lewis and Clark Expedition. The medal was discovered in 1899 by Mr. Lester S. Handsaker, an engineer engaged on the construction of the Northern Pacific Railroad. Inasmuch as the railroad follows almost the exact route of these early explorers, and the records show that they distributed many such medals among the Indian tribes that they encountered, it seems unmistakable that the one thus brought to light was carried on that famous expedition.

When Lewis and Clark made their memorable journey from the mouth of the Missouri to where the Columbia empties its waters into the Pacific Ocean, no more virgin country than that traversed could be imagined. Indians and wild animals were the sole occupants of the great territory afterward known as the Louisiana Purchase, but which, at the time the undertaking was conceived, was still the property of France. At the suggestion of Jefferson, Congress, in January, 1803, made an appropriation of $2500 to defray the expenses of an expedition, to be under the leadership of Captain Meriwether Lewis and his friend Captain William Clark, for the purpose of exploring the Missouri and Columbia rivers and their principal branches. With this small sum were purchased mathematical instruments, arms, camp equipage, medicines, provisions, and presents for Indians. The last item included articles of clothing, beads, paints, flags, knives, tomahawks, and medals.

An account of a council meeting with the chiefs at Fort Mandan, on the Missouri River six or eight miles below the mouth of the Knife River, where the expedition passed the winter of 1804–05, states: "We proceeded to distribute presents with great ceremony. One chief of each town was acknowledged by a gift of a flag, a medal with the likeness of the President of the United States, a uniform coat, hat and feather. To the second chiefs we gave a medal representing some domestic animals and a loom for weaving; to the third chiefs, medals with the impression of a farmer sowing grain."

Peace medals for promoting friendly relations with the Indians were manufactured in America as early as the year 1757 by a

[1] This medal was presented to the American Museum of Natural History in 1901 by Mr. Edward D. Adams, of New York City.

Philadelphia association composed chiefly of members of the Society of Friends. One of the first issued had on the obverse the raised head of King George II and on the reverse the sun, an Indian sitting at a camp fire, and a white man offering him a pipe of peace. After the Revolution such medals always bore the head of the President in office at the time of its manufacture. One struck in 1792, bearing the profile of George Washington, was presented to Red Jacket, Chief of the Iroquois and last of the Senecas, who never afterward was known to be without it.

The Jefferson medal, which differed in design from that issued by Washington, was made of bronze in three sizes. The smallest was also struck in silver and was furnished with a stem and ring for suspension. All sizes bore the same design: on the obverse a medallion bust, with the legend, "Thomas Jefferson, President of the U. S., A.D. 1801," and on the reverse clasped hands, pipe and battle ax crossed, and the legend, "Peace and Friendship." It was a silver medal of this type which was found by Mr. Handsaker in the Indian grave beside the Clearwater River in Idaho; it now forms a part of the collections of the American Museum of Natural History as a gift from Mr. Edward D. Adams of New York City. When discovered it was wrapped in many thicknesses of buffalo hide.

Both Captain Lewis and Captain Clark kept full diaries of the events of each day while on the expedition. These original diaries have been published precisely as written with the quaint spelling and capitalization used by these explorers.[1] On consulting them we find that in September, 1805, on their way to the Pacific, they met with Nez Percé Indians on the Clearwater near the spot where the medal was found. We cannot, of course, be sure that the medal in the Museum was given out here, but we do see by these diaries that the explorers gave out medals.

Under date of September 21, 1805, Clark wrote:

"... passed down the river 2 miles on a steep hill side at 11 oClock P.M. arrived at a camp of 5 squars a boy & 2 children those people were glad to see us & gave us dried sammon one had formerly been taken by the Minitarries of the north & seen white men, our guide called the chief who was fishing on the other side of the river, whome I found a cherfull man of about 65. I gave him a Medal."

Again on September 23, 1805, the diary states that another medal was given out.

Upon the return journey on May 10, 1806, Captain Lewis made the following entry in his diary. After having stated that he met near the Clearwater some of the Nez Percé Indians who received them so kindly and treated them with such hospitality Lewis records the event in his diary as the most happy so far experienced. He says:

". . . This is a much greater act of hospitality than we have witnessed from any nation or tribe since we have passed the Rocky mountains. in short be it spoken to their immortal honor it is the only act which deserves the appellation of hospitallity which we have witnessed in this quarter. we informed these people that we were hungry and fatiegued at this moment, that when we had eaten and refreshed ourselves we would inform them who we were, from whence we had come and the objects of our resurches. a principal Cheif by name Ho-hâst-ill-pilp arrived with a party of fifty men mounted on eligant horses. he had come on a visit to us from his village which is situated about six miles distant near the river. we invited this man into our circle and smoked with him, his retinue continued on horseback at a little distance. after we had eaten a few roots we spoke to them as we had promised, and gave Tinnachemootoolt and Hohâstillpilp each a medal; the former one of the small size with the likeness of Mr. Jefferson and the latter one of the sewing [sowing] medals struck in the presidency of Washington. we explained to them the designn and the importance of medals in the estimation of the whites as well as the red men who had been taught their value."[2]

It is interesting to note in this last entry the specific mention of a Jefferson medal as having been presented to one of these chiefs. As this region has always been the home of the Nez Percé, it is a fair assumption that the medal found was from the grave of one of this tribe. It is of course even possible that it was the grave of this particular individual, though we must not forget that many similar medals were distributed, as the preceding extracts from the diaries suggest.

[1] *Original Journals of the Lewis and Clark Expedition*, 1804–1806, Vol. 3, pp. 81, 85 (New York, 1905).

[2] *Original Journals*, Vol. 5, pp. 15–16.

"Billy the Boy Naturalist"[1]

An attractive little volume with a title that will appeal to children has just appeared from the pen of Dr. William A. Murrill, assistant director of the New York Botanical Garden. When one delves into it, he finds that it is autobiographical, that Billy is Dr. Murrill himself when a boy, that it is "the true story of a naturalist's boyhood." But the story is not told in the usual biographical way,—instead the book consists of many short stories of boyhood experiences, arranged in four chronological groups, or chapters, as the author calls them. For the most part, the stories are unrelated to one another, that is, each one is complete in itself, being simply a record of an incident that had permanently impressed itself upon a normal boy's memory. To write these down and put them together in book form was a happy idea. It is so pleasing that one cannot help wondering why some one has not thought of doing this kind of thing before.

To think of an eminent botanist, a leading authority on fungi, turning aside to write this volume, reminds one of Charles Lutwidge Dodgson ("Lewis Carroll"), author of works on higher mathematics, when he wrote *Alice's Adventures in Wonderland*, or of Robert W. Wood, professor of physics in Johns Hopkins University and author of works on optics, when he produced *How to Tell the Birds from the Flowers*. But the work under consideration differs from the above juvenile books in that it is really true.

Grown-ups, who were born and reared in the country, will read it because it will recall, as pleasant memories, identical or similar experiences which probably have not been thought of for years, such as "spelling bees" and playing prisoner's base at school, and "husking-bees" and sorghum-molasses making at home. Young people will enjoy these and the other incidents, such as catching a fish with a pin hook, exploits with a home-made bow and arrow, collecting butterflies, fighting fire on the mountain, and catching young rabbits at wheat-cutting time when they ran out as the field of standing grain got smaller and smaller.

These stories will make capital supplementary reading for use in the elementary grades in the public schools and also for use in the home. They combine good human nature with good natural history.—G. C. F.

[1] Murrill, William Alphonso, *Billy the Boy Naturalist*, the true story of a naturalist's boyhood in Virginia just after the Civil War. Pp. i–xii, 1–252. Forty-three half-tone illustrations from photographs. Published by W. A. Murrill, Bronxwood Park, New York City, 1918.

"Adventures in Beaver Stream Camp"[1]

Captain Dugmore is well known as nature writer, photographer of African big game, and, more recently, for his services in the British Army. He has chosen the present tale, primarily one for boys, as a vehicle to present information about the Newfoundland caribou; and among a number of full-page illustrations are four of his photographs of these animals from life.

The narrative relates the experiences of two boys, castaways on the wild coast of Newfoundland, with only the simplest tools and, to begin with, a rudimentary knowledge of woodcraft. It tells how, when the necessity arises, they succeed in spending the winter in comparative comfort and safety, depending entirely on their own resources, and with the caribou forming their principal meat supply. The story is full of wholesome adventure.

Civilized man, separated fortuitously from his environment, has often been known to perish from pure abstract mental helplessness, and a story of this nature has real educational value.

Stefánsson tells us how, by following the customs of the natives, he has been able to live in comfort in the Arctic under conditions where polar expeditions have perished. There is sound philosophy in the traditional reply of the Indian, when asked if he were lost: "Indian right here. Tepee lost"; or, in the closing words of Captain Dugmore's story: "'You see, Mother,' Charlie added, 'we were not lost, only mislaid.'"—J. T. N.

[1] *Adventures in Beaver Stream Camp; Lost in the Northern Wilds,*" by Captain A. Radclyffe Dugmore. Doubleday, Page & Co., 1918.

Sight Conservation Classes in New York Schools

By FRANCES E. MOSCRIP

Inspector of Classes for the Blind

THE Board of Education of New York City is conducting classes for partly sighted pupils, known as "sight conservation" classes. This work was inaugurated in the winter of 1917 and has grown until the classes at present number nineteen in three of the boroughs of Greater New York. The centers are located in various elementary schools with registers ranging from ten to eighteen pupils each. The classrooms are selected with a view to even distribution and proper diffusion of light. Provision for ample blackboard space is made on account of the nature of the instruction given to the partly sighted pupils. To avoid undue fatigue and to facilitate the handling of large books, maps, and other objects, the desks and seats are placed on movable bases, and large tables and chairs are provided for the use of the pupils. The teachers assigned to these classes are those who have had experience in the regular grades and whose temperaments and special aptitudes are such as to enable them to develop handicapped children.

The need for sight conservation classes sprang from observation of pupils with some sight in the classes for the blind, who rebelled against finger reading and persistently used their impaired vision to read the embossed print, and from the existence of numbers of children in regular grades who were unable, because of short-sightedness and other eye defects, to keep up with their classes. Our classes are operated much the same way as are the classes for myopes in London, which have been conducted for a number of years.

The purpose of these classes is twofold, the hygienic care of the child and his educational development. A clinic under the supervision of the Board of Health, authorized by the Board of Education, is conducted for the refraction and treatment of the eyes of the pupils and candidates of the special classes, and for the control of abnormal physical conditions arising from eye trouble or its cause.

The character of the instruction given to these pupils does not impose eyestrain. Their oral lessons are received in the regular grades with the normally sighted children, and such of the written work as is feasible is done in the regular grades. Most of the written work is done in large type in the special classroom, and for short periods of time. The blackboards are utilized for this purpose. Masses of figures are not given either for reading or writing. The reading lessons are conducted by special teachers by means of charts and clear type readers. The notes in the various subjects are prepared by the special teacher in print or script more than double the size of the ordinary print of textbooks. Manual work involving little or no use of the eyes, such as knitting, chair caning, basketry, cooking, and the larger forms of carpentry, is given to pupils of sight conservation classes. Typewriting by the touch system is also taught.

The sight conservation classes are making possible lives of usefulness and enjoyment for those who, handicapped by poor sight, are unable to receive their education in the regular way. The classes are also placing emphasis upon the improvement of general educational methods and the necessity of properly lighted schoolrooms. The special attention given to the care of the eyes, and to the development of thought, initiative, and pleasing personality, will fit the pupils of these special classes for responsible positions in salesmanship, insurance, social service, and various lines of farming. Occupations like these present no risk to eyesight. The investment in work of this nature is more than justified in the saving to the state on its work in connection with its care of dependents.

Notes

ATTENTION is called to the change in title of this magazine from AMERICAN MUSEUM JOURNAL to the old, honorable, and historical name NATURAL HISTORY. A change has been contemplated for two years or more, partly to avoid confusion with other publications known as "Museum Journals" and partly because the magazine for these years has not restricted itself to a consideration of the American Museum's work and interests. As expressed many times by the Editor in letters to contributors, the magazine would like to feel that it stands as a medium of expression between authoritative science in America and the people, a place for publication of readable articles on the results of the scientific research and thought of the nation for people who are not technically trained. These people have neither time nor desire to pore over technical, unreadable articles, but nevertheless are intelligently, practically, and often profoundly interested. NATURAL HISTORY would like to stand for the highest type of authoritative natural history, expressed by the investigators themselves, by explorers, by the accurate observers in laboratory or field. In addition it desires to interpret the technical publications of our scientific thinkers, if not by popular articles by the same authors, then through reviews by other well-known scientific thinkers, these "reviews" being, as suggested, readable discussions of the given subject apropos of the technical work. It would also of course report phases of the educational work being accomplished by the scientific departments of the United States Government and by the various scientific institutions of the country, especially those of the museum type.

There has been so much shallow, inaccurate, "popular" science, nature study, and natural history, written by persons untrained in science and with distorted imaginations, that a prejudice still remains in the minds of some scientists against putting their observations and conclusions, even when of great value for the layman, into readable form. But the time of such suspicion and condemnation against the mere form of expression of an idea is well-nigh past, and the greatest scientific men of the country are daily proving their willingness and desire to write in a way to be understood not only by the trained, technical man, but also by the man with no knowledge of the shorthand of the scientific vocabulary.

We need especially to have a knowledge of nature and science today. The day of necessity has come for conservation of the world's natural resources and preservation of animals fast becoming extinct; there is seen approaching the time of conscious control of evolution; and just ordinary culture demands in the present decade knowledge of science in addition to what it has always demanded in literature, music, and art. And these reasons do not take account of the added joy in life that comes from a knowledge of nature. We people of today need to know the book of the earth, to study it as a Bible, feeling the divinity in it. NATURAL HISTORY hopes to meet this need in part.

WE welcome the good news that the Royal Museum of Natural History in Brussels escaped unscathed the ravages of the Germans. There has been sent to *Nature* an extract from a letter recently written by Louis Dollo, professor of palæontology in the University and Conservateur of the Royal Museum, reporting "that everything is well here, that *our Museum is intact*, that absolutely nothing is lost, and that we are safe!"

THE seventy-first meeting of the American Association for the Advancement of Science was held at Baltimore in December. Of the four hundred or more addresses, many were concerned with problems connected with the war, but the program as a whole showed a quick adaptation to the broader problems of reconstruction now confronting the country. That the experiences of the last two years have left a marked effect on American scientists was particularly brought out in the paper by Dr. George E. Hale on "The National Research Council," in which he discussed the past results and the future possibilities of the Council as a permanent body.

FOLLOWING the inauguration of national scientific organizations such as our National Research Council, there has been under way the organization of an international body for the promotion of scientific research. Representatives of the scientific academies of the Allied Countries and the United States held a meeting last October in London. A Committee of Inquiry was appointed which met later in Paris and constituted itself as a temporary International Research Council with the object of becoming a Federation of National Councils. A permanent executive committee of five was named which is to have its seat in London. There are great possibilities for international coöperation in scientific research, the internationalization of great laboratories, the exchange of publications, and the preparation of bibliographies. Above all, the manifest spirit of coöperation will certainly prove a stimulus to scientific workers.

Scientists have recently called attention to the need of replacing German in certain classes of scientific literature with English. The prevalence of German as a scientific medium is exemplified by the fact that of the 286 journals listed in the *International Catalogue of Scientific Literature* under general biology, 169 are in German and only 49 in English. There has been a similar German conquest in the case of the yearly reviews and great compendiums of scientific advance. It is suggested that the collection and publication of scientific information might well fall among the activities of the National Academy of Sciences which has recently been requested by President Wilson in an Executive Order to take over and perpetuate the work of the National Research Council in the stimulation and formulation of "comprehensive projects of research," in the promotion of coöperation, and in the gathering and collating of "scientific and technical information at home and abroad, in coöperation with government and other agencies," and the rendering of "such information available to duly accredited persons."

A fitting memorial to the memory of Theodore Roosevelt is the greatest of our national parks which is now being established in the Sierra Nevada as an extension of the old Sequoia Park. Along its eastern boundary runs the main ridge of the Sierra, crested at the south by Mount Whitney, the highest peak in the United States. Three rivers rise among the mountains of the new park, the Kaweah, the Kern, and King's. It is said that Tehipite Valley, through which flows the middle fork of King's, excels Yosemite Cañon in grandeur. The former Sequoia Park with its giant *Sequoias*, the "big trees" of California, is drained by the Kaweah River. The Roosevelt National Park is to be preserved for the true lover of the out-of-doors who may still lose himself on the long trails and snowy peaks in this heart of the American wilderness.

During the war and the excessive demand for coal, attention has been turned toward the Arctic, especially to the island of Spitzbergen where effort alone is required to create one of the chief coal-producing regions of the world. It is said that in 1918 the shipment to Scandinavian ports reached 100,000 tons. It has been known for some time that vast quantities (estimated as at least 4,000,000,000 tons) of good steam-coal are present in this Arctic land and a cargo was shipped to Europe as early as 1899. In later years American, British, and Swedish companies have mined more or less unsystematically and in 1912 it is said that one company alone shipped out about 40,000 tons. Iron ore in unknown quantity, as well as other mineral products, is also present, but exploitation is hampered, especially by the lack of definite political control in the island.

President Wilson, while on his visit to Europe, has been signally honored by the learned societies and universities of the Old World. The University of Paris took this occasion to confer their doctorate, *honoris causa*, before a distinguished gathering in the Sorbonne. In acknowledging the honor conferred upon him the President delivered a brief address contrasting especially the two systems of culture between which the war has been waged. "I agree," he said, "with the intimation which has been conveyed today, that the terrible war through which we have just passed has not been only a war between nations, but that it has been also a war between systems of culture; the one system the aggressive system, using science without conscience, stripping learning of its moral restraints, and using every faculty of the human mind to do wrong to the whole race; the other system reminiscent of the high traditions of men, reminiscent of all those struggles, some of them obscure, but others clearly revealed to the historian, of men of indomitable spirit everywhere struggling toward the right, and seeking, above all things else, to be free. . . ."

The ancient universities of Italy also honored him on his brief trip to Rome and he was elected a member of the Accademia dei Lincei, the oldest existing scientific society in the world. The universities of Bologna, Rome, Padua, and Florence all sent deputations to bear their greetings and confer various degrees. In England the President was unable to stop at Oxford or Cambridge, but he had opportunity to meet many of the leading representatives of art, literature, and science at the state banquet tendered him at Buckingham Palace.

THE construction of a connecting pathway across Central Park between the Metropolitan Museum of Art and the American Museum of Natural History, proposed by Professor Henry Fairfield Osborn, gives occasion to Mr. Lewis Mumford, in the *Scientific Monthly*, to discuss recent tendencies in these two museums. They have changed from mausoleums of ancient art and animal remains to educational institutions which respectively illustrate to their visitors the past history of man's handicraft and display the facts of natural science in such a way that the student will be instructed by their order and surroundings. The arts have grown up in response to natural social demands, therefore, artistic productions, to be rightly understood, must be taken, so far as possible, in their natural context and not viewed as unrelated fetishes for some manner of beauty worship.

The Metropolitan Museum, notably in the Swiss, the Georgian, and the Queen Anne rooms, is giving expression to this organic view of art with scenes that impress by their unity rather than confuse by their diversity and multiplicity. Similarly, the Natural History Museum is taking advantage of the artist's vision in the reconstruction of primitive life, in the arrangement of animal habitat groups, and in the general organization of its collections so as to tell a connected story of the natural history of the earth and its inhabitants. The landscape artist and the animal sculptor have been called upon to assist in laying out this panorama. The two museums are accordingly becoming complementary in their methods, the one borrowing from natural science an organic and social conception of art, while the other is recognizing the aid which the fine arts can lend to the study of nature and man.

AMONG foreign honors bestowed upon Americans during 1918 may be noted the election of Colonel Henry S. Graves, of the United States Forest Service, to the Royal Scottish Arboricultural Society of Edinburgh, and the promotion of Dr. Alexis Carrel, of the Rockefeller Institute, to the rank of Commander of the Legion of Honor. Dr. Simon Flexner also received the title of Officer of the Legion of Honor and was elected a corresponding member of the Société des Hôpitaux.

DR. ALEŠ HRDLIČKA, curator of the Division of Physical Anthropology at the United States National Museum, was recently elected an honorary fellow of the Royal Anthropological Institute of Great Britain and Ireland.

UNDER the heading "Notes from a Traveler in the Tropics," Major Frank M. Chapman writes in *Bird Lore* of casual observations on bird life along the route of his journey to South America for the Red Cross. The fall and winter seasons are not propitious for finding birds in our southern states or in Cuba, as the southern migrants have disappeared and the winter residents have not yet arrived from the north, but on the Isle of Pines, off the coast of Cuba, Major Chapman was entertained by many feathered hosts, including the *Anis*, a common species of Cuba, whose whining whistle is one of the very few really unpleasant bird notes. Dr. Chapman sailed from Havana to Colon to visit the Panama Red Cross and the extremely active Canal Zone Chapter. In passing the Gatun Lake he noted that the dead trees, killed by flooding this great area, were disappearing and that this partly artificial body of water gives promise of becoming one of the most beautiful lakes of the tropics. Its charms are as yet undiscovered by the birds—except for a few brown pelicans, cormorants, and ducks—but its forested shores and rocky islands are certain to afford a future home for the tropical migrants.

The Aëronautical Society of America, at its meeting January 9, elected Mr. Carl E. Akeley, of the American Museum, to life membership in recognition of his important invention of a camera especially designed for use in aëroplane work.

We quote the following from *El Palacio*, the journal of the Museum of New Mexico: "Indian Commissioner Sells is giving emphatic praise to the part taken by the Indians in the war. Out of 33,000 eligibles for military duty, more than 6500 served under the flag in the Army, 1000 were in the Navy, and 500 were regularly engaged in other war work. More than 6000 of the enlistments were voluntary. Indians bought Liberty Bonds until now an equivalent of a $50 bond is held for every man, woman, and child of the Race."

At the annual meeting of the American Anthropological Association, held in December in Baltimore, Dr. Clark Wissler was elected president of the Association and Dr. Pliny E. Goddard was reëlected editor. A plan for a future permanent research body in connection with the National Research Council was considered and referred to Professors Franz Boas, Alfred M. Tozzer, and Dr. Aleš Hrdlička for definite formulation.

Dr. H. J. Spinden, of the anthropology department of the American Museum, has just returned from an archæological and ethnological expedition to Central America and Colombia, where he acquired extensive collections of textiles, pottery, mesh bags, and other articles of aboriginal handicraft. In eastern Nicaragua he studied the social organization, arts, and ceremonies of the Sumu and Misskito Indians. He found these Indians still wearing the style of sleeveless cotton jacket, with designs of interwoven egrets' down, that Columbus described in the account of his fourth voyage. Archæological explorations were conducted in Honduras and Nicaragua. In the latter country he discovered heavily forested regions virtually devoid of population, although the archæological remains indicated that they were once inhabited by a relatively highly civilized people. Apparently more savage tribes have come in recent times from South America and forced out the indigenous population. In the republic of Colombia Dr. Spinden examined the public and private collections of native artifacts, including golden vases and figurines from the Cauca River Valley which are the most beautiful of their kind to be found in the New World.

A bronze tablet, commemorating the one hundredth anniversary of the birth of Lewis Henry Morgan, is now on exhibition in Memorial Hall of the American Museum. Lewis Henry Morgan was in many ways the "father of American anthropology." After publishing the *League of the Ho-dé-no-sau-nee or Iroquois*, he became aware of the similarity between the Iroquois system of reckoning relationship and that found among the Ojibway. As a result of this comparison he made an extensive study embodied in *Systems of Consanguinity and Affinity of the Human Race*, which is the pioneer work on primitive social organization. The general ornamentation of the tablet is representative of Indian wampum belts, one of which is a record of the famous Iroquois League. Morgan was adopted by the Seneca Tribe of the Iroquois in 1842. The commemorative tablet is to be sent to Wells College in Aurora, New York, Morgan's birthplace.

The inauguration of *The International Journal of American Linguistics* under the editorship of Professor Franz Boas, of Columbia University, and Dr. Pliny E. Goddard, of the American Museum, with the coöperation of Professor Uhlenbeck, of Leiden, and Dr. W. Thalbitzer, of Copenhagen, fills a previously unoccupied field in anthropology. Two numbers of the new journal have already appeared, the first containing a general introduction by Professor Boas in which he sets forth the most pressing needs and problems of American linguistics.

Mr. Clarence B. Moore has added another monograph[1] to his many publications on American archæology, giving the results of recent explorations in Florida and Alabama. The aborigines of this region originally practised the custom of "killing" or breaking a hole into the pottery which they buried with their dead in order that its soul might accompany its previous owner. So expensive a custom, however, was later re-

[1] *The Northwestern Florida Coast Revisited* (Journal of the Academy of Natural Sciences of Philadelphia, 2d Series, Vol. XVI, part 4, 1918).

fined into the use of cheap pottery manufactured especially for funeral purposes, with a hole already made in the bottom or even with genuine ornamental openwork. Inasmuch as the Indians of this neighborhood made their deposits of earthenware to the east of their burial mounds, Mr. Moore and his party were able to obtain large amounts of material, local searchers having contented themselves usually with digging a hole in the center of the mound.

THE Museo Nacional de Chile occupies a beautiful and spacious building constructed for the International Exposition in 1875, in the *Jardin des Plantes* or Quinta Normal, of the old Spanish city of Santiago. This city, with a population of 400,000, is one of the most beautiful of the world, and besides being the capital of Chile, is also the center of that country's culture and learning. In the Museum the departments of archæology, geology, botany, and zoölogy are represented by extensive native and exotic collections; and for printing the scientific contributions to Chilian natural history the Museum publishes a *Boletin del Museo Nacional de Chile* and a series of *Anales*. The institution had its inception in the work of the French naturalist, Claude Gay (author of the *Historia fisica y politica de Chile,* 24 volumes, Paris, 1843–51), who visited the country (1828–42) to study the natural history. It now fills a prominent place in Chile's educational and scientific progress. Dr. Eduardo Moore has been the director since 1910.

SECRETARY LANE, of the Department of the Interior, has announced the renaming of the national monument on Mount Desert Island, Maine, as Lafayette National Park. This reservation, formerly known as the Sieur de Monts National Monument, has been singled out to commemorate our ancient alliance with France. It was discovered and named by Champlain in 1604.

DR. SIMON FLEXNER, the renowned pathologist and director of the laboratories of the Rockefeller Institute for Medical Research, was elected president of the American Association for the Advancement of Science, at their recent meeting in Baltimore. Dr. Flexner has been serving during the war as a Lieutenant Colonel in the Medical Corps.

Courtesy of the Bulletin of the Pan-American Union

The Museo Nacional de Chile, in the old Spanish city of Santiago. It carries on important work in exploration and research and coöperates with the schools by means of exhibits and lectures

Natural History owes an apology to its readers that the index for 1918 is included with the January instead of the December number and that there has been delay in the issuance of these two numbers. Fortunately the February number is in press as the January number appears. Attention is called to what will prove the unusual interest of the March number, including articles descriptive of the total eclipse of the sun in June, 1918, by Professor S. A. Mitchell, director of the Leander McCormick Observatory of the University of Virginia, painting the solar corona, by the artist, Howard Russell Butler, with reproductions in color, the wild flowers of Greenland, by W. Elmer Ekblaw, of the Crocker Land Expedition and the University of Illinois, and the unknown jungle of Panama, by Lieutenant Colonel Whelen, of the United States Army.

Canada is to be congratulated on possessing the second largest telescope in the world, recently installed in the Dominion Astrophysical Observatory near Victoria, British Columbia. Dr. J. S. Plaskett, director of the observatory, narrates the history of the construction of this gigantic seventy-two inch reflector in the *Journal of the Royal Astronomical Society of Canada*. The glass disk, cast and annealed by the St. Gobain Glass Co., Charleroi, Belgium, narrowly escaped a possible tragic ending, being shipped from Antwerp but one week before war was declared, in July, 1914. The cast was 73½ inches in diameter and 13 inches thick, with a central hole about 6 inches in diameter. The rough mass weighed about 5000 pounds, but when finished it was reduced to 4340 pounds. The great and difficult task of giving the final polish to the mirror required nearly two years, but the result is a credit to Brashear Co., of Pittsburgh, in whose hands the work was, as the maximum deviation of the curve of the glass from theoretical perfection is but one eighth of a wave-length. The mounting of the telescope was constructed by the Warner and Swasey Company, of Cleveland. No difficulty was experienced in setting up the parts and the instrument was in use a week after the delivery of the mirror to Victoria.

The National Association of Audubon Societies has issued a call to the nature lovers of America to erect a Roosevelt Memorial Fountain. Their announcement is in the form of an appreciation of Roosevelt, bearing on the cover the legend: "He taught and practiced clean, straight sportsmanship, with a power that has caused thousands of men afield to walk in straighter paths."

The work of the wardens engaged by the National Association of Audubon Societies to guard the Federal Bird Reservations, the egret colonies, and the breeding islands along the Atlantic Coast, has been affected in no way by the war. These wardens report that the egrets have fared better than the sea birds, which have had but an average year, many natural accidents destroying the eggs by thousands.

A new and crafty method of egret destruction has been reported. The hunter erects a canvas screen near the egret rookery. He then flashes a strong light into the rookery, which startles and bewilders the birds. As the stream of light is changed from the rookery to the white screen the victims follow and dash to their destruction against the canvas. It is said that this trick was suggested by the accidental killing of some birds in a similar way on the Florida coast, when a steamer's searchlight was turned alternately on an egret rookery and on the white canvas of a passing sailboat.

The Brooklyn Museum has recently constructed and opened to exhibition a Desert Life Group which is one of the largest habitat exhibits ever conceived. It represents what might be termed the "optimum life conditions of the North American Desert" as seen in spring in southwestern United States or northern Mexico. The dominant plants are, of course, giant cacti, around which are grouped models of the various smaller species of cactus and other desert plants collected near Tucson, Arizona. The animal representatives of the desert fauna were taken by Mr. Robert Cushman Murphy on a hunting trip to northern Lower California. Five specimens of pronghorn antelope are prominent in the right half of the group. The antelope might at one time have been taken in Arizona, but the species is now so far extinct that it can be found only in out of the way and inaccessible haunts. To the artists and modelers of the group there were presented unusual problems, particularly in the reproduction of the cacti, and the results are a brilliant tribute to their craftsmanship.

Courtesy of the Brooklyn Museum Quarterly

"The wilderness and the dry land shall be glad; and the desert shall rejoice, and blossom like a rose" (Isaiah xxxv, 1). Two views of the forty-foot wide Desert Life Group (left half of the group, above, and the right half, below) recently installed in the Brooklyn Museum. Like the Arizona Bird Habitat Group in the American Museum, only on a larger scale, it reveals the desert in the full flower of springtime. The upper photograph shows some of the cacti of the group, the giant saguaro, the smaller bushlike choya (at the left), the bisnaga or barrel cactus (beneath the saguaro), and the low prickly pear (left foreground). The lower photograph shows the five specimens of pronghorn antelope in the group, the sole representatives of a distinctly North American family of ungulates, and recognized as fleeter of foot than any other American mammal

At this time when public attention is turned toward the solution of international problems by agreement between nations we can well look at the international bearings of bird protection. Dr. Joseph Grinnell, of the University of California, has recently devoted an article in the *Scientific Monthly* to this question, pointing out the necessity for some joint action to protect the migratory birds. Our American golden plover breeds in northern Canada and summers as far south as Argentina, passing through about seven political jurisdictions. The common swallow of England migrates to South Africa, and the knot is a visitor on all the seven seas. A single country, however good its intentions, can do little to protect such travelers; it may only spare the birds for the guns of its less conscientious neighbors. A beginning was made in the direction of international protection by the treaty between the United States and Canada with reference to insectivorous and game birds. It is hoped that the countries which have shown the most consideration for the birds may bring a moral influence to bear in extending an appreciation of the value and necessity of conserving the world's wild life.

THE *Victoria Naturalist* reports that 1,500,000 penguins are annually killed for the sake of their oil, but that in spite of this enormous slaughter the penguin colonies have not decreased. A representative of the Australian Ornithologists' Union has been delegated to investigate the traffic at once; it seems scarcely believable that the penguins can escape extinction under such treatment.

A METHOD of drying lumber, reported to the *Quarterly Journal of Forestry* (London) would seem to be the direct antithesis of our familiar "kiln-drying" by hot air. The temperature of the drying shed is reduced by means of a refrigerating apparatus in one end of the shed to such an extent that the moisture of the air is condensed as hoarfrost and the air kept continually dry. In this way all moisture given off by the lumber is immediately disposed of and the lumber dries without the danger of the cracking and checking which accompanies hot-air drying.

THE more than ordinary fertility of ground which has been plowed and harrowed by shell fire has suggested the possibility of using explosives in the operation of tree planting, especially where large areas must be covered quickly as in the rehabilitation of the devastated sectors of France. In a report of experiments to the Académie des Sciences, M. André Piédallu recommends this method for the reason that it loosens up the soil to great depths, supplies nitrates, saves labor, and is much more rapid than digging the holes for the trees.

A COMMISSION appointed by the Biological Board of Canada has submitted a report on the relation of the sea lion to the fishing industry. At the instigation of the fishermen a bounty of \$2 a head had been placed on these animals on the ground that they were inimical to the salmon fisheries. It was not entirely ascertained by the commission just what constitutes the main food of the sea lion, but it was satisfactorily shown that the destructiveness was too slight to warrant a general slaughter. The sea lion may be legitimately exploited, as is its cousin the fur seal, for guano, and for leather and oil by taking the young only, and its protection may therefore be urged for commercial reasons. Quite sufficient protection can be given to the fishermen's nets by frightening away these very timid animals.

THE number of fur seals on the Pribilof Islands, according to a census for 1918, is 496,600. The pups born for the season and the breeding cows each numbered 143,005. These figures are exclusive of the 33,881 seals taken during the calendar year, 7000 on St. George Island and 26,881 on St. Paul Island. The catch did not reach the total of 35,000 skins authorized by the Government, but a few seals were likely to be killed from time to time during the remainder of the year as a source of meat supply for the natives. In addition, 386 fur seals were speared from canoes by the Indians on the coast of Washington, as reported by the superintendent and physician of the United States Indian Service at Neah Bay. The Canadian and Japanese governments each are entitled to 15 per cent of the year's take of skins, in compliance with the terms of the North Pacific Sealing Convention of July 7, 1911, the market value of this amount being credited to the respective governments to offset certain advance payments made to them by the United States. Work on the new by-products plant for St. Paul Island, designed for the manufacture of oil and fertilizer from seal carcasses, was pushed rapidly in order that the carcasses of seals killed on the island in 1918 might be utilized in the preliminary operations.

"ANTICLINES in the Southern Part of the Big Horn Basin, Wyoming," is the subject of a report dealing with the oil fields of Wyoming, lately issued as *Bulletin* 656 of the United States Geological Survey. Anticlines, those folds of the earth's crust which cause the strata to dip in opposite directions, lie in a broad belt around the border of the Big Horn Basin and are almost certain indications of the presence of oil. According to the authors of the report, those anticlines lying nearest the central trough of the basin offer the greatest prospect for successful drilling, while those separated from the central trough by other anticlines show scarcely a trace of oil. Oil was discovered in the basin as early as 1888, but no great attempt was made to produce it until 1906, and it was not until 1914 that the largest wells were opened. Since that time, however, the output has increased from 3,560,375 to 6,234,137 barrels, obtained largely from the Grass Creek, Elk Basin, Greybull, and Torchlight fields. As nine anticlines adjacent to the central trough remain untested, other productive oil fields may yet be discovered.

VOLUME VI of *Fossil Vertebrates in The American Museum of Natural History* has just appeared from the department of vertebrate palæontology of this institution. It includes contributions 168–192, which appeared during the years 1915–17 inclusive, from the studies of Messrs. Osborn, Matthew, Brown, Granger, Gregory, Mook, Anthony, Watson, and von Huene. These articles are collected from the *Museum Bulletin* volumes of the corresponding years. The edition is limited to sixty and is distributed to the principal research centers in this country and abroad.

DR. E. W. GUDGER, of the State Normal College at Greensboro, North Carolina, spent several months in 1918 at the American Museum working on the bibliography of fishes, which is in preparation by the department of ichthyology. Methods of fishing practiced in the South Seas, including the use of vegetable poisons and other primitive devices, were among the points of chief interest in his research.

DR. WILLIAM K. GREGORY, associate in palæontology in the American Museum, was recently elected a corresponding member of the Zoölogical Society of London.

AT the meeting of the Entomological Society of America held in Baltimore in December Dr. Frank E. Lutz, associate curator of invertebrate zoölogy in the American Museum, was elected a member of the executive committee.

SINCE the last issue of the JOURNAL the following persons have been elected members of the American Museum:

Life Members, MESSRS. SIDNEY A. KIRKMAN, R. E. SEAMANS, and PAUL WATKINS.

Sustaining Members, MRS. JAMES MCLEAN and MR. A. MCEWEN.

Annual Members, MESDAMES MAURICE W. KOZMINSKI, CHARLES J. LIEBMANN, ANNIE TRUMBULL SLOSSON, HARRIET WEIL, MISSES KATHARINE N. RHOADES, DOROTHEA B. SMITH, HENRIETTE STRAUSS, MARION WILKINSON, MAJOR GARRARD COMLY, THE REV. DR. ARTHUR H. JUDGE, DOCTORS ABRAHAM HEYMAN, PHILIP HOROWITZ, LEO KESSEL, JOKICHI TAKAMINE, MESSRS. WILLIAM EDWIN ALLAUN, D. ELLIS HAMBURGER, A. C. JENKINS, HENRY W. KENNEDY, JOHN E. LEIKAUF, WILLIAM MENKE, HENRY MIELKE, LAURENT OPPENHEIM, F. A. PARK, WALTER PFORZHEIMER, LIVINGSTON RUTHERFORD, and HENRY STEMME.

Associate Members, MESDAMES EVERARD APPLETON, HUMPHREY BIRGE, MISSES ELEANOR J. CHADEAYNE, HELEN A. ILER, THE REV. GEORGE A. THAYER, DOCTORS MAX C. BREUER, ROBERT H. ELLIS, CURTISS GINN, GEORGE M. HORTON, J. C. OLIVER, JOHN F. STEPHAN, MESSRS. CHAS. E. ADAMS, JOSEPH A. ARCHIBALD, CHARLES K. ARTER, LELAND G. BANNING, FRANK W. COMMONS, EDWARD COOKINGHAM, WILLIAM G. CROCKER, HARRY TREVOR DRAKE, W. M. DUNCAN, J. MCF. EATON, LOUIS MCLANE FISHER, WILLIAM HUNTINGTON FOBES, EDWARD I. GARRETT, LOUIS W. HILL, EVAN HOLLISTER, JR., H. E. HOLMES, CHARLES R. HUNTLEY, RICHARD N. JACKSON, JOHN G. JENNINGS, CLARENCE H. JOHNSTON, WILLIAM B. KIRKHAM, HUGO A. KOEHLER, F. W. LEADBETTER, A. L. LOWRIE, JAMES R. MACCOLL, ELBERT B. MANN, DONALD MCBRIDE, AMOS B. MCNAIRY, CHARLES NAGEL, O. E. OVERBECK, EDWARD S. PAGE, WM. P. PALMER, H. E. PARTRIDGE, CHARLES L. SOMMERS, FRANKLIN D. L. STOWE, CARLETON B. SWIFT, and MASTER BENJAMIN PATTERSON BOLE, JR.

The American Museum of Natural History

Its Work, Membership, and Publications

The American Museum of Natural History was founded and incorporated in 1869 for the purpose of establishing a Museum and Library of Natural History; of encouraging and developing the study of Natural Science; of advancing the general knowledge of kindred subjects, and to that end, of furnishing popular instruction.

The Museum building is erected and largely maintained by New York City, funds derived from issues of corporate stock providing for the construction of sections from time to time and also for cases, while an annual appropriation is made for heating, lighting, the repair of the building and its general care and supervision.

The Museum is open free to the public every day in the year; on week days from 9 A.M. to 5 P.M., on Sundays from 1 to 5 P.M.

The Museum not only maintains exhibits in anthropology and natural history, including the famous habitat groups, designed especially to interest and instruct the public, but also its library of 70,000 volumes on natural history, ethnology and travel is used by the public as a reference library.

The educational work of the Museum is carried on also by numerous lectures to children, special series of lectures to the blind, provided for by the Thorne Memorial Fund, and the issue to public schools of collections and lantern slides illustrating various branches of nature study. There are in addition special series of evening lectures for Members in the fall and spring of each year, and on Saturday mornings lectures for the children of Members. Among those who have appeared in these lecture courses are Admiral Peary, Dean Worcester, Sir John Murray, Vilhjálmur Stefánsson, the Prince of Monaco, and Theodore Roosevelt. The following are the statistics for the year 1918:

Attendance in Exhibition Halls	627,302
Attendance at Lectures	64,036
Lantern Slides Sent out for Use in Schools	72,287
School Children Reached by Nature Study Collections . . .	817,610

Membership

For the purchase or collection of specimens and their preparation, for research, publication, and additions to the library, the Museum is dependent on its endowment fund and its friends. The latter contribute either by direct subscriptions or through the fund derived from the dues of Members, and this Membership Fund is of particular importance from the fact that it may be devoted to such purposes as the Trustees may deem most important, including the publication of NATURAL HISTORY. There are now more than four thousand Members of the Museum who are contributing to this work. If you believe that the Museum is doing a useful service to science and to education, the Trustees invite you to lend your support by becoming a Member.

NATURAL HISTORY

THE JOURNAL OF THE AMERICAN MUSEUM

DEVOTED TO NATURAL HISTORY, EXPLORATION, AND THE DEVELOPMENT OF PUBLIC EDUCATION THROUGH THE MUSEUM

FEBRUARY, 1919

VOLUME XIX, NUMBER 2

NATURAL HISTORY

VOLUME XIX

CONTENTS FOR FEBRUARY

NUMBER 2

MARY CYNTHIA DICKERSON, *Editor*

Published monthly from October to May, by the American Museum of Natural History, New York, N. Y. Subscription price, $2.00 a year.

Subscriptions should be addressed to the Secretary of the American Museum, 77th St. and Central Park West, New York City.

NATURAL HISTORY *is sent to all members of the American Museum as one of the privileges of membership.*

Entered as second-class matter February 23, 1917, at the Post Office at New York, New York, under the Act of August 24, 1912.

Acceptance for mailing at special rate of postage provided for in Section 1103, Act of October 3, 1917, authorized on July 15, 1918.

THE AMERICAN MUSEUM OF NATURAL HISTORY

MEMBERSHIP

For the enrichment of its collections, for scientific research and exploration, and for publications, the American Museum of Natural History is dependent wholly upon membership fees and the generosity of friends. More than 4000 friends are now enrolled who are thus supporting the work of the Museum. The various classes of membership are:

Benefactor		$50,000
Associate Founder		25,000
Associate Benefactor		10,000
Patron		1,000
Fellow		500
Life Member		100
Sustaining Member	annually	25
Annual Member	annually	10
Associate Member (nonresident)	annually	3

Full information regarding membership may be obtained from the Secretary of the Museum, 77th Street and Central Park West.

NATURAL HISTORY: JOURNAL OF THE AMERICAN MUSEUM

NATURAL HISTORY, recording popularly the latest activities in natural science and exploration, is published monthly from October to May, inclusive, by the American Museum of Natural History. The subscription price is Two Dollars a year. NATURAL HISTORY is sent to all classes of members as one of the privileges of membership. Subscriptions should be addressed to the Secretary of the Museum.

POPULAR PUBLICATIONS

A large number of popular publications on natural history, based on the exploration and research of the Museum, are available in the form of handbooks, guide leaflets, and reprints. A detailed list of these publications will be found in the Appendix to NATURAL HISTORY. Price lists and full information may be obtained by addressing the Librarian of the Museum.

SCIENTIFIC PUBLICATIONS

The field and laboratory researches of the American Museum of Natural History and other technical scientific matters of considerable popular interest are represented by a series of scientific publications comprising the *Memoirs*, *Bulletin*, and *Anthropological Papers*. A condensed list of these publications will be found on the inside back cover of NATURAL HISTORY. Price lists and complete data may be obtained from the Librarian.

Photograph by Champlain Studios

FREDERIC AUGUSTUS LUCAS

Director of the American Museum of Natural History

Before coming to the American Museum as director, in 1911, Dr. Lucas had many years of museum service as curator-in-chief of the Museum of the Brooklyn Institute of Arts and Sciences and as curator of the Division of Comparative Anatomy of the United States National Museum. He has given his labors not alone to the technical branches of zoölogy, but he has also furthered by his writings and his museum policies the broader fields of popular scientific education

--See "The Remaking of a Museum Collection," page 222

NATURAL HISTORY

VOLUME XIX FEBRUARY, 1919 NUMBER 2

Human Culture

ITS PROBABLE PLACE OF ORIGIN ON THE EARTH AND ITS MODE OF DISTRIBUTION

The time is ripe for organized interpretative work in world archæology, and such interpretation is of interest and importance, not only to students of anthropology, but also to the students of everything else that is human

By N. C. NELSON

With illustrations from original diagrams by the Author

THE origin of human culture is a question which has challenged the thought and imagination of man since long before the days of writing. Nearly every people, whether of high or low attainments, possess myths and legends to account for the principal inventions and technical processes of which they make use. Prehistoric man evidently recognized that such ordinary things as hammerstones and houses and domestic hearth-fires had not always been; that, in short, somebody invented them or brought them from elsewhere, and the person who accomplished such a feat for the general enhancement of human life was usually immortalized as a culture-hero. Our best known and classic example is doubtless the Greek story of Prometheus, who, with the aid of Minerva, the goddess of wisdom, went up to heaven to light his torch at the chariot of the sun and thus brought down fire as a gift to man. The implication is that Prometheus literally stole the sacred flame and for this crime he was duly punished. But the gods had been outwitted; and though they raged, they were doomed, for with the help of fire, man proceeded to make himself master of the earth.

To the iconoclastic scientist of the last few decades such explanations have too often been only mere nonsense. We are still trying to explain the many gifts which our rude predecessors have left us to enjoy; and our explanations, partial and imperfect as yet, are at best written in terse technical language which only the specialist is supposed to understand. But some day when the matter-of-fact investigator has finished the skeletal structure of his thought on the subject of human culture a gifted imagination will arise to clothe it and make it live. Of such poetic nature is undoubtedly much of the lore, like the Prometheus story, which has come down to us from the ancient East. Originally based at least in part on sound observation, it was adapted so that all who saw and heard might understand, each according to his capacity. We of the West with our cut-and-dried views on every subject have all too commonly insisted on literal interpretation where only suggestion to encourage original thought was intended.

And what now of our modern explanation of human culture? We of the present generation think that we have done much in building the aëroplane;

but in the process which we call culture history, the making of a simple pointed stick for digging edible roots out of the ground, was hardly less important. If now we should attempt to name all the discoveries and inventions which lie between these two extremes we should be astonished at how much was really accomplished before our own day.

We need not, however, go to such lengths here but we may properly ask *when* and *where* the more important inventions were made. When did man actually first make use of fire? Where were our numerous domesticated plants and animals first brought under control? What people made the first loom, the first potter's wheel, the first flint knife? The answer to these and similar questions is not yet recorded in books, nor is it handed down in reliable form as oral tradition. The material for the answer is scattered all over the world, even in places where we should not have expected men to congregate. For the most part the data lie buried in ruins located on the desert and on the plain as well as in the forest and among mountain fastnesses; they occur in mounds and in cemeteries, in caves and in rock-shelters and even in peat bogs and the muddy depths of lake bottoms. The fact of these occurrences of the record of early human life and activity has become known largely through accident and it is only of late that we have begun honestly to admit their significance and to go deliberately in search of them.

Where this search will ultimately lead we do not precisely know. But with respect to the *time* and *place* of origin of many of the fundamental elements which go to make up what we term human culture a definite opinion is slowly gaining ground. Briefly stated this opinion is, first, that the most widely distributed inventions like fire-making and flint-chipping are the oldest; and, second, that because these inventions are so nearly identical in widely separated parts of the world, they had probably a common center of origin. This center of origin is not yet definitely located but we know at any rate that it lies much nearer the center of the earth's land formation than it does to any one of the various continental extremities. In other words, it lies nearer to the meeting place of Europe, Asia, and Africa (a great traditional center of origin, it is well to recall) than it does to the Cape of Good Hope, or to the far away island of Tasmania, or to the still more distant Cape Horn.

The whole question is one of profound interest and importance, not only to students of anthropology, but also to the students of everything else that is human. The subject is here approached from the point of view of several years' archæological work done under the auspices of the American Museum in the Pueblo region of the Southwest. Certain conclusions developed from this investigation are of such a nature that they seem to throw light not only on the archæological problem presented by the whole American continent but on the problem presented by the entire world.

Discovery in the American Southwest of the Apparent Law of Distribution of Human Cultures

In 1912 the writer began archæological investigation in a hitherto unexplored section of the Pueblo area known as the Galisteo basin, directly south of and adjacent to the city of Santa Fé, New Mexico. The region, which was abandoned by native settlers finally toward the end of the eighteenth century, comprises about twelve hundred square miles and contains upward of one hundred ruins, about sixty of which are small, even insignificant, while the remaining forty attain, some of them, the size of respectable towns. After having spent a whole season sampling seven of the larger settlements, it became apparent that in addition to being the repositories of important materials for Museum exhibition purposes, the settlements, as a group, presented a very definite chronological problem.

The ruins themselves showed some evidence of difference in age, and the broken pottery which lay strewn over their surfaces was particularly eloquent, there being a variety of styles, some of which were obviously not contemporary. In certain of the most recently vacated settlements one such style was soon eliminated as of early historic date, being always found in association with bones of the horse and other domestic animals of European origin. At the end of the second field season in 1914, through the discovery of occasional superposed ruins and also through finding a stratified refuse heap of considerable height, the time order of all the more distinctively local pottery styles—five or six in all—was determined, and it became possible at once to indicate with certainty the relative ages of the different ruins.

This principle of ceramic stratification seemed capable of extension to the remainder of the Pueblo area and, after the contemplated excavations were finished in the Galisteo region, the better part of two field seasons was devoted specifically to that type of work. Decisive results were not immediately forthcoming, partly because refuse heaps turned out to be absent in some localities; but with the assistance of Professor Kroeber and Mr. Spier, also of the American Museum staff, other methods of determining the time sequence of pottery styles were worked out, and at the present moment the general chronologic order of the most important prehistoric centers of Pueblo settlement is tolerably clear.

In connection with this stratigraphic work the writer had occasion, in 1917, to travel from Santa Fé for about 350 miles southeastwardly to the town of Pecos in Texas with a view to learning how far the Pueblo culture had formerly extended in that direction. A variety of observations was made; but we are here concerned with one only and one which was not at first recognized as of any special importance.

Santa Fé is situated on the extreme edge of the present Pueblo habitat and so, in wandering about the outskirts, one finds fragments of pottery representing all the six successive styles or types characteristic of the various ruins of the vicinity, including the modern style (No. 6, Figure on page 134) which came into general vogue about 1680. This modern ware ceases, roughly speaking, about twenty miles south of the city. About twenty or twenty-five miles farther on, beyond the southern limits of the Galisteo basin, the next preceding style (No. 5, in vogue between 1540 and 1680) disappears. Fifty miles farther out the next preceding style (No. 4) drops off. Eighty miles onward the next preceding style (No. 3) runs out, and somewhat more than one hundred miles beyond that, pottery and other indications of former Pueblo life cease altogether. Such archæological evidence as remains beyond this limit is clearly assignable to nomadic peoples.

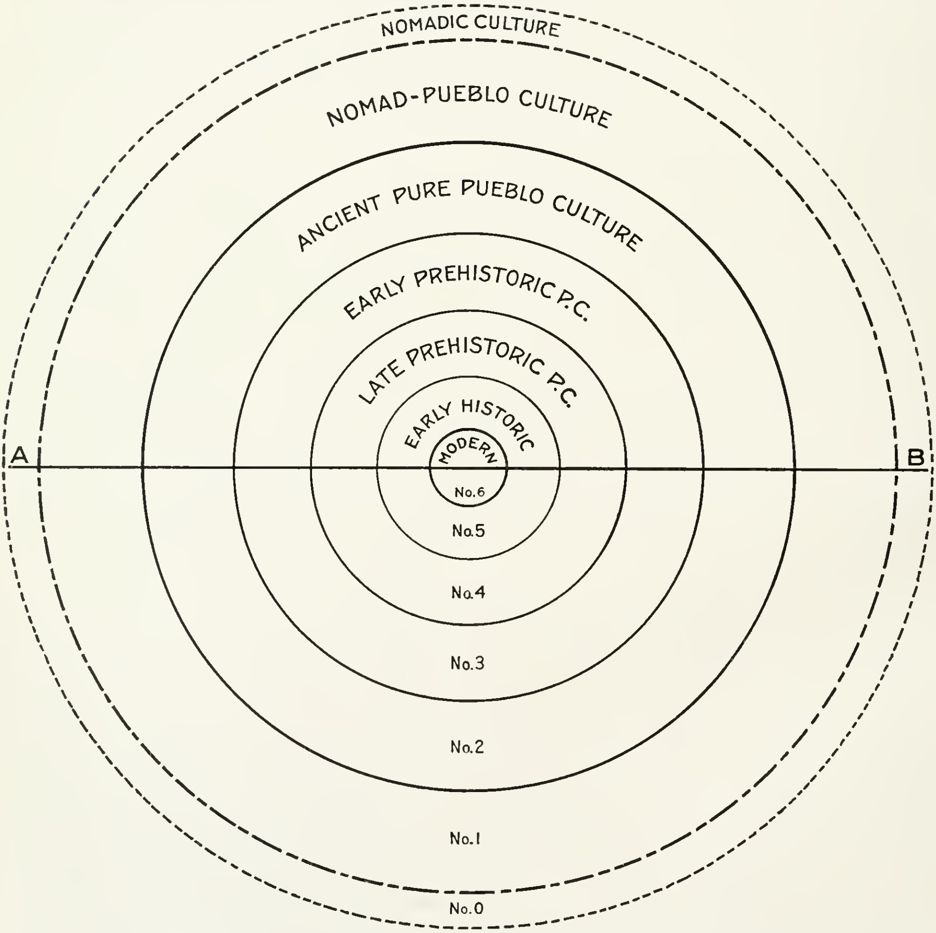
The type of pottery found in the outer Pueblo zone is not, as might have been expected, comparable with style No. 2 of the central area near Santa Fé, but is in part a mixture of the styles numbered 1 and 2. And, what is most interesting, there are associated with this pottery and certain other distinct Pueblo features several nomadic traits such as small temporary dwellings, mortars for grinding foodstuffs in place of the genuine metate, and so on. In other words, this zone clearly marks an ancient transition belt connecting the hunting tribes and the agricultural tribes.

At first this zonal arrangement caused little wonder. It was regarded simply as the accidental result of successive advances into the Pueblo territory on the part of the nomadic tribes

(Apache and Comanche) localized on the southeastern border—an invasion which was brought to a standstill close to Santa Fé in modern times. A somewhat similar dropping off of the various stratigraphically determined ceramic levels was recognized as taking place also in a northwesterly direction, the outer border being located on the shores of the Great Salt Lake in Utah. But on this line, too, there had been steady encroachment of nomadic tribes such as the Ute and Navaho.

Gradually, however, it was recognized that a very similar cultural ladder could be descended in a southwesterly direction where several tribes still live a hybrid Pueblo-Nomad kind of life. On the northeast, no very marked zoning has taken place because here a high mountain range has served to ward off invasion and the Pueblo tribes have been left nestling against its near base from the earliest times to the present.

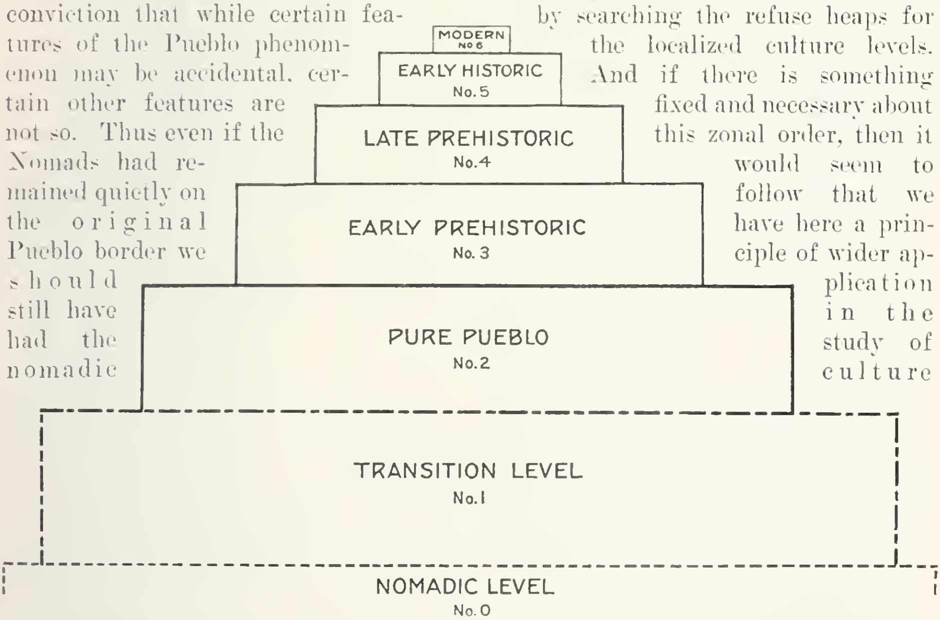
The outstanding facts of this geographical distribution of Pueblo pottery may be represented diagrammatically as in the Figure below. And if we



Diagrammatic presentation of the geographic distribution of six successive styles of Pueblo pottery. The distance from the center to the outer zone represents several hundred miles. Within the inner circle are to be found every one of the six styles, including the one still in process of manufacture. In the next circle every style except the modern occurs, and so on out to the next to the last zone in which only the most ancient ware is to be found. The last zone is the illimitable foreign area into which no Pueblo pottery has penetrated make a sectional representation of the same phenomenon, to show the time order, we obtain a pyramidal structure as shown in the Figure below. Obviously the vertical and horizontal arrangements of the pottery series are identical. That is, in digging down through our refuse heaps in the surviving high center of development in order to discover the historical sequence of pottery styles, we encounter these styles in the same order in which they lie zoned out geographically. Our diagram of course does a certain amount of violence to the facts, but of that we may give account later. The aim at present is merely to clarify the general situation.

The first conclusion regarding this strange parallelism was, as has been stated, that it was a mere coincidence, an accident due to nomadic invasion. But some contemplation has led to the conviction that while certain features of the Pueblo phenomenon may be accidental, certain other features are not so. Thus even if the Nomads had remained quietly on the original Pueblo border we should still have had the nomadic region (No. 0), the transitional zone (No. 1), and the present high center of pure Pueblo development (No. 6), which in that case might today have extended over the zones numbered 2 to 5. The relative positions of phases 0, 1, and 6 would have remained the same in our two diagrams. Briefly, wherever we are able to distinguish a culture center we are bound to have, first, an inner area of pure development, second, a surrounding zone more or less affected by traits "borrowed" from neighboring centers, and third, beyond that, the distinctively foreign area which may itself break up into any number of separate culture centers.

In dealing with this Pueblo problem we might have obtained our key to the historic order of the ruins in the Galisteo basin by determining the zonal order of pottery distribution instead of by searching the refuse heaps for the localized culture levels. And if there is something fixed and necessary about this zonal order, then it would seem to follow that we have here a principle of wider application in the study of culture



Sectional view (along the A-B line) of the preceding diagram to show the relation between the geographic distribution and the historic order of development of the six recognized styles of Pueblo pottery. By digging down through the stratified débris levels, within the limits of the modern Pueblo habitat, the various successive pottery styles were encountered in the same order in which they were found in traveling radially from this place out to the extreme limit of former Pueblo influence. Roughly speaking, the older the pottery the deeper it is buried and the farther it has spread. This diagram and the preceding illustrate cultural distribution within a single limited area; but the order observed appears to hold true in a measure for all culture areas and for culture as a whole in its distribution throughout the world. This wider application is illustrated by the diagrams on pages 138 and 139 history. By means of this principle we may be able without turning a spadeful of earth to throw considerable light on a number of historical problems, great and small, which have not yet been illuminated by the application of thorough-going archæological methods. Space limitations forbid elaboration in this place but one or two applications may be at least suggestive.

Application of Apparent Law of Distribution to the American Continent

First, let us shift our point of observation from the Southwest to Middle America, that is, southern Mexico, Central America, and northern South America. Here we find ourselves, as it were, on the summit of aboriginal New World achievement. From this summit, if we look northward over what is today tolerably well known terrain, we see a series of more or less distinctly marked culture zones occupying successively lower and lower levels; and if we then look southward we perceive a nearly corresponding series of zones in that direction.

Thus matching the Pueblo culture on the north we have the so-called Calchaqui culture on the south, in northwestern Argentina. On comparing these two widely separated centers we find not only a general similarity in fundamentals but actual identity in the case of several specific traits. Beyond this zone we observe a transition belt inhabited by tribes who have adopted the rudiments of agriculture but who still retain many features of the hunting type of life. This belt in the north would include all of the eastern two thirds of the United States. Still farther out comes a broad belt inhabited by non-agricultural tribes, that is, nomads who have developed a comparatively high type of hunting culture and who, whether roaming or stationary, are in possession of the northwestern United States together with most of Canada to the north and most of the vast interior portion to the south, in particular the Pampean regions of Argentina. Finally, on the extreme margin of the continent, along the Arctic shore on the north and in Tierra del Fuego on the south, we have remnants of two somewhat unevenly specialized centers which, however, from the point of view of Middle America, we may properly group together and classify as a low type of hunting culture.

Complete justification of all the preceding assertions would require lengthy discussion. Still, the only point here insisted upon is the general pyramidal character of our continental phenomenon, and that no one can deny. In the former case of the Southwest, we were obliged to admit the Pueblo pyramid to have been produced perhaps in part by the accident of nomadic encroachment. In the present case of America as a whole, our pyramid is the result of exactly the opposite tendency: archæological investigations clearly show the higher continental cultures to have been steadily encroaching on the lower. Nevertheless, in both cases the pyramidal condition remains and for that reason the writer is convinced that it is not an accident but is instead an almost axiomatic fact.

In attempting now to offer an explanation of the visibly corresponding culture zones of North and South America, we are not required to deny the influence either of environment and psychic unity on the one hand or of recent trait transmission by borrowing on the other. We may insist, however, that none of these explanations is entirely adequate; and that instead—on the basis of analogy with our demonstrated Pueblo phenomenon — these zones correspond for the much simpler reason of being actually surviving parts of one and the same culture center which formerly extended over all the intervening area. Each pair of segments in turn, beginning with the Eskimo-

Fuegian, has been separated and the connection obscured by the superimposed development of a higher culture.

The archæological test of this hypothesis is easily applied. All that is necessary is a careful determination of the various culture strata to be found beneath the topmost layer of our great pyramid. If the zonal arrangement pointed out for the continent at large has any real historical significance, then we should find in Middle America a corresponding stratigraphic arrangement. And, already, sufficient has been accomplished in this direction to assure us that the final result will come out virtually as indicated.

This should mean, briefly, that the earliest culture wave to sweep into the New World was of the hunting type and approximately on a level with that of the Fuegian tribes of today. In the course of time this culture came to characterize the entire continent, but was displaced by higher developments in the narrow confines of Middle America at a comparatively early date, possibly long before the original primitive phase had reached its present marginal positions in Tierra del Fuego and Greenland. On some such basis it seems possible also to reconcile a good deal of conflicting anthropological opinion regarding early man in the New World. For while all agree as to the generally primitive character of Eskimo-Fuegian culture, some maintain that it is not at all ancient. If now we can show this type of culture to lie at the bottom of Middle American developments we shall probably at the same time establish for it a very respectable geologic antiquity.

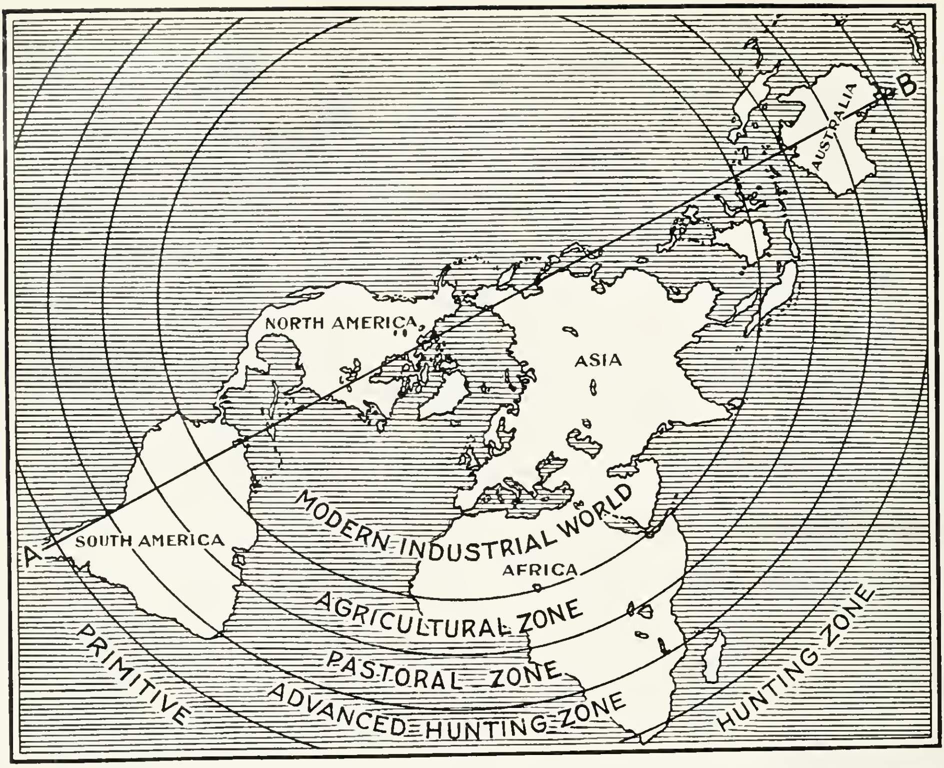
Application to the World as a Whole

The pyramidal idea, proved for the Southwest and indicated as probable for the American continent, seems true also in a general way for the world at large. Unfortunately, the earth's land formations and their climatic provinces are not so disposed that we can give an adequate demonstration of the geographical aspect of culture distribution by simply laying down a series of concentric circles. Still, the idea to be conveyed may perhaps be made more directly intelligible by such procedure, even at the risk of doing absolute violence to some of the facts we are considering. The best that can be done is to present a map of the inhabited world on a Bering Strait projection and with that point as a center describe our circles in a partly arbitrary fashion. (See illustration, page 138.)

The zones thus indicated might be variously named. Perhaps our ethnological terminology will serve best and we may begin on the extreme border and repeat inward toward the Bering Strait center, in succession: lower hunters, higher hunters, pastoral nomads, sedentary agriculturists, and industrialists. It is not, of course, contended that this simple distribution scheme is literally true in all of its details, but merely that it is more true than false or, in other words, that it is fundamentally true. The most primitive cultures do fall within the outer zone, as the most complex fall within the inner circle, and whether we approach this inner circle from Tasmania or South Africa or Tierra del Fuego, we do encounter the advanced cultures in approximately the order indicated.[1]

We have, lastly, to look at this horizontal phenomenon in its vertical aspect. Each of our most primitive cultures, surviving here and there on the margins of the Old as well as of the New World, shows such striking similarity to one phase or another of the ancient Palæolithic culture of western Europe that few students have failed to note the fact. And the notion of possi-

[1] It will perhaps be pointed out that a corresponding series of zones should be plotted within our inner circle of high development, grading down in reverse order toward the Arctic Ocean. But the circumpolar phenomenon has been left out purposely in the present broad treatment, first, for the sake of clearness, and second, because it is, after all, a feature due largely to environmental conditions.



Diagrammatic presentation of the general geographic distribution throughout the world of the commonly recognized culture stages at the time of the discovery of America. The indicated position of the given zones on any one of the three continental land masses crossed by them is not to be taken literally throughout, nor is even the order of names to be considered hard and fast. In South America, for example, the "pastoral zone" is all but nonexistent. Accurately drawn, the zones should not be indicated by true circles but by something like isothermal lines which would actually eliminate most of North America and a good part of northern Asia from the central area as now constituted. The idea to be conveyed by the above rigid diagram is simply this, that the world's most advanced cultures are at home within the central area and that, as we travel out from this center toward any one of the three land mass extremities, we find ourselves descending a cultural pyramid; and, finally, that the farther out we go the cruder and more nearly alike the cultures for the distantly separated land masses become. In other words, the cultural attainments of the native tribes of Tasmania, South Africa, and Tierra del Fuego, although very far apart in space, are almost the same; whereas by contrast the cultures characterizing the central area are highly differentiated.

ble historic connection thus engendered is greatly strengthened by a consideration of the archæological data for the world at large.

In the case of America, for example, we discover at once that the resemblance in question was formerly closer than it is today. Briefly stated, our Eskimo and Fuegian cultures, especially the former, show strong Magdalenian[1] affinities. For the continent at large, however, the Solutrean flint technique is typical and has been typical, it seems, throughout nearly the whole known history of American developments. Only here and there, for instance along the Argentine coast, on the isle of Cuba, and in the Ozark and Mammoth Cave regions, have we obtained more or less distinct traces of chipped stone artifacts which in type and technique resemble the Aurignacian and Mousterian products. Whether we shall ever be able to isolate definitely something corresponding to the Acheulian and Chellean phases remains to be seen; but when we stop to consider the relatively enormous time interval covered by the

[1] Various European culture levels of Palæolithic time, determined by the character of the stone and other implements used by early man, and thought to range backward from a few thousand to 400,000 and more years, are in their order counting backward from modern and Neolithic as follows: Magdalenian, Solutrean, Aurignacian, Mousterian, Acheulian, Chellean, Strepyan, etc.

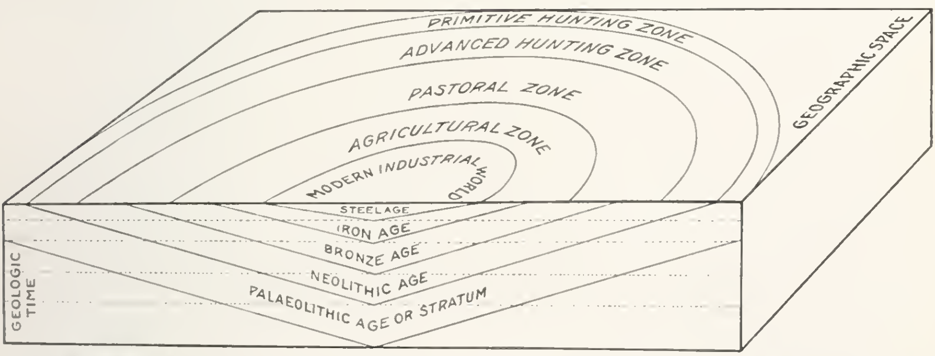
coup-de-poing type[1] of implement and when we bear in mind also its nearly complete distribution over the Old World, it becomes obviously hazardous to exclude its occurrence from the New World.

Most likely we shall some day reverse the balance of American opinion against the genuine antiquity of the scattered finds already made in the drift of the Delaware and Ohio basins. But even if this should come to pass, it is probable that the various phases of Palæolithic culture as we know them at their best in western Europe can never be brought out into sharp relief in America. That is to say, we shall never be able to obtain clear and detailed stratifications, because the best part of the New World was so far away from the center of origin that the earliest culture waves had spent themselves before they arrived here.

No attempt can here be made to fix this center of origin or even to suggest that it ever can be identified with any particular locality. All that can be stated at present is that seemingly the oldest archæological data known have hitherto been found within the limits of our inner circle, which also marks our present center of high development. Our oldest cultural remains have thus far been found in the vicinity of the Mediterranean, but for various reasons, theoretic and practical, it seems probable that still older remains might be found farther to the east, roughly speaking in central or southern Asia. But, wherever the first real inventions were made, it would be preposterous to suppose that all other inventions, even the most primitive and fundamental, were made in that same place.

Throughout nearly all of culture history, conditions were probably much as they are today: there were a number of culminating centers and the dominant one may at times have been difficult to recognize; but at any rate no particular center retained permanent sway. As within historic times, every particular culture phenomenon probably refined itself to the point of stagnation and ultimately fell an easy prey to any vigorous barbarian group. In principle there is no difference be-

[1] The *coup-de-poing* type of implement resembles a large crudely made spear point and is the oldest implement recognized as intentionally made by early man.



A possible explanation of how the zonal similarities for the separate continents came about is illustrated by a sectional view along the generalized A-B diameter of the preceding diagram. The view is taken along this A-B diameter but it should actually follow a line running through western and southern Europe as well as southern and eastern Asia. The diagram is largely self-explanatory and is a repetition of the first two illustrations, with simply a change of text. The only real modification occurs in the sectional portion where the pyramid has been inverted in order to indicate the passage of time while the normally associated groups of inventions and practices traveled from the center of origin out toward the margin of the inhabited world. Only the relatively crude cultures have arrived on this outer margin, where it is said they are not very ancient; but in the center of high development these same crude cultures lie stratigraphically very deep or, in other words, are decidedly ancient. For that reason it is assumed as likely that most of the world's great culture stages first arose in the central area and spread from there as successive waves in all directions tween the decline of the Pueblo culture and the fall of Rome.

With all these limitations and precautions in mind we may conclude our semi-speculative survey of human culture with a diagrammatic presentation of what seems to be the essential historic and geographic factors involved. The elements of this diagram have already been set forth in connection with the Pueblo phenomenon. The zonal schematization we may leave unmodified, but the sectional presentation, reared in the form of a steplike pyramid, although apparently correct, is actually faulty, as was stated. The constructional error in question was not so obvious, however, in the case of the minor Pueblo pyramid as it will be in the case of our great world pyramid. Briefly stated, the difficulty hinges on the fact that no single invention and much less any whole cultural complex, wherever it originated, could spread all over the inhabited world in the twinkling of an eye. If we grant, for the sake of argument, that density of population and consequent specialization along various lines of activity first came to a head somewhere near the meeting place of Europe, Asia, and Africa, it is obvious that it would take a considerable period of time for even the most adaptable sort of invention to reach, let us say, Tasmania and Tierra del Fuego.

As is plainly evident, very few of the advanced ideas concretely realized in the central area of high development ever reached the outermost zones; and, regarding those which did arrive there, we are constantly being told that they occur only superficially, whereas, in the inner area, the corresponding primitive forms lie stratigraphically deep. This signifies undoubtedly that millenniums of time passed while the various successive adaptations in culture spread over the world. To represent the fact diagrammatically we have simply to break the horizontal division lines of our terraced pyramid in the middle and then raise up both of the outer ends. This in effect inverts our old pyramid and enables us at the same time to combine the time and space diagrams into one. The result is indicated in the Figure on page 139.

This paper is an attempt to present the large and complex subject of human culture in its simplest possible terms. The explanation is not finished. Actual inspection of details would immediately bring out numerous difficulties and weaknesses. It is not, of course, argued, for instance, that the surviving cultures as we view them today, from the central to the extreme zone, will give us an exact picture of human cultural development. All the while since differentiation set in, these zones have reacted on one another. That is, a few traits have flowed perhaps both in and out on horizontal lines in addition to the many traits which welled up as it were from below. But in a general and at the same time in the most profound way, the outer zone has unquestionably preserved for us the really ancient culture.

We may properly conclude with something in the nature of a prophecy. The signs of the times are auspicious. Events of the last few years have brought it about that men, in planning the future, have to think in world terms or fail. There is a sense in which the same is true also in connection with reconstruction of the world's past. If, after a century of exploratory work in archæology, we still continue over local minutiæ to the exclusion of everything else, we shall ultimately become so burdened with endlessly duplicated detail facts that no man can master them and the wasteful procedure will break down of its own weight. If, on the other hand, we simply dare to see our problem whole, then surely many of our present minor difficulties will fade away of themselves. The time is ripe for organized interpretative work.

Nature Reflected in the Art of the Ancient Chiriquians

By GEORGE GRANT MacCURDY
Assistant Professor of Prehistoric Archæology and Curator of the Anthropological Collection, Yale University

THE age of the cave artist was the age preëminent of fundamentals in art. It was then that the arts of sculpture in the round and in relief, of engraving, and painting were born and first flourished. This troglodyte art was remarkable for its realism, especially throughout its earlier phases. It dealt with life forms, for the most part those of animals useful to man. Its beginnings and its realistic character were due in a measure at least to the necessity of controlling the food supply.

With the final retreat of the continental glaciers and the disappearance of the reindeer and the mammoth from western Europe, cave art suffered an eclipse. The Palæolithic period was followed by a more practical if less artistic age, the Neolithic. While the men of the New Stone age contributed in their turn to art progress, it was in other directions, notably through the far-reaching discovery of the ceramic art.

In any discussion therefore of Neolithic art, ceramic art plays an important rôle. This is true not only of prehistoric Europe but also of prehistoric America. Since many of the ornamental designs that have had such a vogue in historic time had already taken shape before the dawn of history, their origin is to be sought for in prehistoric records. Since the problem in Europe is more complex than that in America, I have chosen some prehistoric American examples, which seem to illustrate the principles that control the origin and evolution of ornament in art. These prove that Neolithic art, like cave art, reflected almost exclusively man's zoölogic environment; they also indicate that man's attitude toward this environment had changed somewhat, the change being measured by the extent to which realism was replaced by conventionalism, and the ex-voto by the totem.

During the earlier as well as the later Stone age, man must have taken a certain delight in the beauty of animal forms independent of their real or supposed influence upon his fortunes; his ability to reproduce the chief features of the animal forms which interested him most no doubt gave him added satisfaction.

The examples chosen all come from a single restricted culture area, namely the province of Chiriqui on the Pacific coast of Panama, and have been selected principally from the unrivaled collection of Chiriquian antiquities in Peabody Museum of Yale University. The specimens belong to the late Stone age, or, to be more exact, the transition from the Neolithic to the age of metals. They are almost wholly from the field of ceramic art and date from a time when the use of the potter's wheel was still unknown in America.

The pottery of ancient Chiriqui is divisible into a number of rather distinct groups depending on the nature of the paste and slip, the form and finish, the presence or absence of paint, and above all the character of the ornament; whether in the round, in relief, incised, or in color; and if in color, the method of producing the design.

An outstanding feature of ancient Chiriquian pottery is the association of a given animal with a given kind of ceramic product. The next and chief phenomenon is the proliferation of a whole series of decorative motives grouped about a single animal form and presumably derived from it. If this be true, then Chiriqui affords some striking proofs of the way ornamental designs have arisen and of the preponderating influence of conventionalism in their evolution.

A knowledge of the folklore of the ancient Chiriquians might throw light on why the artist made so much of certain animals while ignoring others. This choice might well have been influenced by various considerations such as totemism, tradition, comeliness, or even the mere coincidence of similarity between some artificial product and some well-known animal form. The favorite models were the animals common to the region in question, those whose peculiarities of form and of habit were not beyond the reach of common knowledge. While the artist often produced figures with mixed attributes, their component parts are always referable to living local forms rather than to fabulous creatures.

The largest group of ware is characterized by a distinct kind of paste and slip, the absence of paint, a remarkable purity of form and finish, and ornamentation in the round or in relief. The ornamentation dominant is taken from the armadillo. A favorite adaptation is the use of a more or less realistic figure of the armadillo as tripod supports; another is the perching of the figure on the shoulders of vases. More remarkable still is the isolation of a single feature or part of the armadillo and its use as a decorative motive independent of and at the same time representative of the whole: the eye, the foot, the tail, a band of the carapace. A pleasing pattern for the neck of a vase is a series of carapace motives or tail motives, in zigzag, with a foot or an eye symbol filling each angular space. Each carapace band, or each tail, as the case may be, is executed skillfully as well as realistically. Only when it comes to the arrangement, the disposition of the series, is there a departure from nature.

In dealing with the armadillo figure as a whole the artist allowed himself considerable latitude. At times he was satisfied with nothing less than a faithful copy. At other times reduction and simplification of parts were carried so far as to render identification difficult. Again, the artist indulged in the reduplication, exaggeration, elimination, or fusion of parts, at all times, however, leaving an unmistakable though indefinable stamp upon his work, a touch that entitled him to rank as a student of nature and, by virtue of this, as a true artist; for the two go hand in hand, are inseparable.

The reasons why the Chiriquian artist gave special prominence to the armadillo are somewhat obscure, beyond its local occurrence, peculiar habits, and its utility as an article of food. Its mythological background is trifling in comparison with that of some other animals; but this could be accounted for in part at least by its limited range. On the other hand the bird and the serpent have a very wide geographic distribution; and curiously enough these are, above all others, the mythological world favorites. It is therefore not at all surprising to find the trail of the serpent in ancient Chiriquian symbolism. In fact it is the chief decorative feature in one small group of ware and has left an impress on two other groups. Like the armadillo ware, the serpent ware belongs in a class by itself because of its distinctive (black) paste and slip and the fact that the designs are incised instead of being in the round or in relief. Moreover, the effect of the incised pattern is heightened through the filling in of the incisions with a white substance.

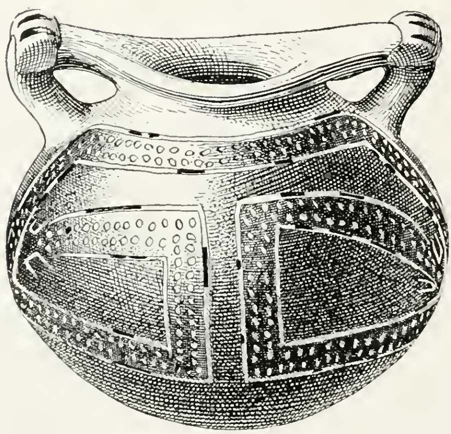
The favorite theme is a long serpentine body with a head and protruding forked tongue at each end. The whole forms a balanced and somewhat stylistic figure, which is repeated on the opposite side of the vase. With the elimination of the heads, the breaking up of the body into geometric patterns, and the shifting of the body markings from their original position, the symbolism sometimes reaches a stage of almost complete disguise. As long, however, as the artist confined himself to the distinctive serpent ware his meaning is comparatively clear. When, and if, he attempted to carry this conventionalized serpent symbolism over into other groups of ware calling for a change of medium and technique, and where other motives dominated, the results became confused with designs that started from wholly different originals.

Like the bird and the snake, the fish has an all but universal range, but it does not seem to have left such an indelible impress on the mind of primitive man as have the former two. Chiriquian waters abound in fish, which must have been one of the chief sources of food supply among the ancient inhabitants. Nothing could be more natural than that the potter should endeavor to reproduce a form of such utilitarian as well as artistic adaptability. In fashioning the long tripod supports for urn-shaped vases he would inadvertently arrive at a form suggesting the outlines of a fish; the fortuitous resemblance could be heightened *ad libitum* by emphasis upon such details as the nose, eyes, and fins. In some examples the piscatorial attributes are suggested by the merest touch, such as the slight flattening at the end to indicate the tail fin or the application of a single node on the back to represent the dorsal fin. In others the details are worked out with such care that one is able to identify the exact species.

Few animals have left a more potent symbolic impress upon the culture of various peoples of the earth than has the alligator or crocodile (Spanish *el lagarto*). The extent of this influence is revealed in art. The prototype of the Chinese dragon is no doubt the alligator, with which the Yangtze River teemed in prehistoric time and which must have filled with terror the heart of the riparian rice-grower of that period (as pointed out by Dr. Berthold Laufer). It was probably the Egyptian crocodile that inspired the author of the book of Job to write: "Canst thou draw out leviathan with a hook?" As was the case in China and Egypt, so it was in Chiriqui, where the record is none the less complete because of its being pictorial instead of written.

Representations of the alligator not only are confined almost wholly to two related groups of Chiriquian pottery but also are dominant in these groups. Since both groups depend on color for their ornamentation, the alligator occurs consistently in painted forms only, never as a figure in the round, in relief, or incised.

The larger of the two groups is known as alligator ware and is characterized by a paste of excellent quality, a cream-colored slip, and by red and black delineating colors, both being of an enduring nature. The more realistic figures of the alligator are in profile and decorate the bodies of globular vases, one being painted on each side. The artist emphasized certain features of the animal by preference: jaws of exaggerated length and recurved, especially the upper one, undue prominence of the frontal region, a synclinal sweep of the body line, and a scrupulous care that the scales and spines be not omitted. A favorite method of bringing the scales into view was to group them in triangular or semicircular fields that rose above the dorsal line. Profile figures of the alligator are encountered ranging all the way from elaborate realistic representations to a simple abbreviated horizontal body curve with a single dot in the hollow of the curve to indicate the dorsal body markings.



SERPENT WARE

Representations of the serpent on Chiriquian pottery are almost wholly confined to one small ceramic group, the so-called *black incised* ware. On this the serpent motive is so all-pervading as to justify the name *serpent ware*. The deep incisions in this ware were made before the paste hardened and were filled with a white substance that stands out in bold contrast with the black ground. The geometric decorations of the uppermost vessel here shown are a survival of the serpent symbol. In the second figure the body of the serpent with head at both ends passes around the body of the vase three times.

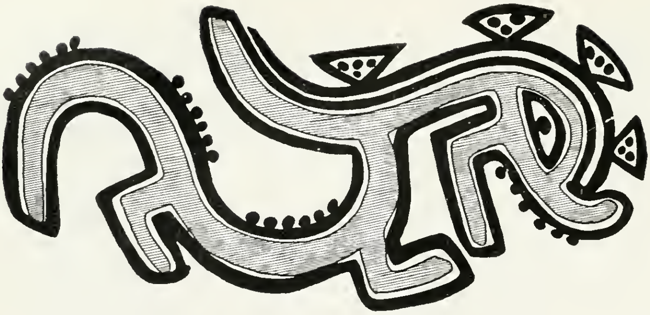
Opposite sides of the third vase are decorated with a pattern evidently intended to represent a similar serpent with head and forked tongue at each end. The body of the serpent is folded on itself in such a manner as to produce geometric outlines and thoroughly cover the field to be decorated. The handles of this vessel, where they merge into the lip, are crossed by an incised fillet resembling the carapace symbol so common in the armadillo ware. A breaking up of the elements that enter into the realistic representation of the serpent is sometimes seen, a series of triangles being formed by the body motive with the markings appearing only in the enclosed spaces. This results not only in economy of labor but also in more thoroughly covering the area to be decorated; hence conventionalism has ever been as much the child of economy as of ritual

ALLIGATOR WARE

The skill of the ancient Chiriquian artist is nowhere better displayed than in his treatment of the alligator, representations of which characterize two related ceramic groups (the so-called alligator ware and the polychrome ware) which, unlike the armadillo ware, depend on color for ornamentation. In this profile figure are combined the chief features of the alligator, including scales and spines

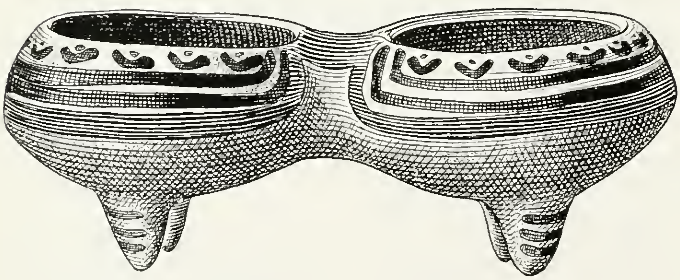
It is by no means certain that the ancient Chiriquians may not have had in mind the crocodile rather than the alligator, since both are found in Chiriquian waters. The length of jaw depicted at times by the artist seems to indicate the former instead of the shorter muzzled alligator. The stylistic figure here shown has a head at both ends of the body. Dots representing eyes and teeth are placed where space invites rather than where they belong

What at first glance looks like a meaningless bundle of waving arms portrayed on this vase is a conventional treatment of the alligator with the head turning backward The much exaggerated jaws extend over the back and tail, balanced by a long appendage on the neck, while the space below is amply filled by a relatively small trunk, tail, and legs



A favorite representation shows the alligator in absolute profile. Note the open mouth with teeth, the upturned snout, the dorsal markings on the head and tail, and the long crest attached to the neck

Vessels of the alligator group mounted as tripods are comparatively rare. The supports are usually short, solid, pointed cones marked by horizontal black bands. In this vase from El Banco the neck is quite short and the shoulder decoration consists of three panels each bearing a series of scale-group symbols.



The profile view of the alligator is here reduced to its simpiest elements: the curve of the body line and a dot in the hollow of the curve to represent the scales on the back of the animal

A representation of the alligator similar to the figure at the top of the page is here shown, the body markings being represented by only one type of scale-group motive, repeated three times on the head and five times on the tail

Not content with his success in executing the profile view of the alligator, the artist also took special pains to picture the dorsal aspect of the animal, a difficult problem happily solved through the aid of conventionalism. By means of a series of parallel lines the rows of spines on the alligator's back were indicated: while to the lateral margins of the series were attached spines or dotted triangles to represent the scales. To these triangles I have given the name scale-group motive, while the figure as a whole I have called the dorsal-view motive. The latter is a favorite decoration for arched panels on the shoulders of vases.

The other group of ware in which alligator motives prevail is small but of special importance. It is known as polychrome ware, and is at once recognizable through the addition of purple as a delineating color, special skill in the elaboration of designs, and versatility in the shaping process. It is in this group alone that we find the highly ornamental branching scroll pattern evolved from the multiple body line of the alligator combined with a series of alligator profile motives.

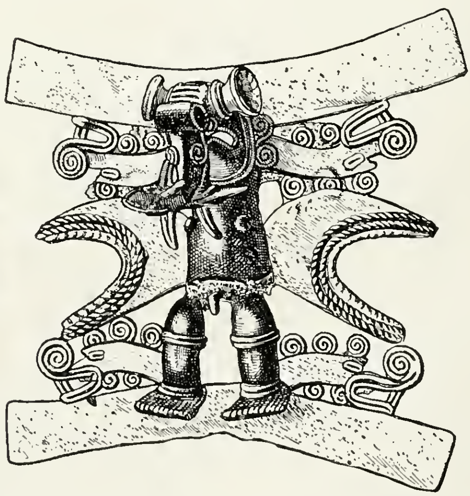
In this rare ceramic group we find a painted figure with alligator and human attributes combined—alligator head on a human body to which are attached human arms and legs and an alligator tail—a figure which I have called the alligator god. The alligator god was a particular favorite with the Chiriquian metal worker. Over and over again we find him among the gold figurines. His human feet are usually planted on the body of an alligator, to each end of which is attached an alligator head and undifferentiated forelegs: while on his alligator head rests a similar double-headed alligator inverted.

The octopus frequents the waters on both sides of the Isthmus. Like the alligator it might be expected to cast a powerful spell over the mind of primitive man. The reasons for this would be clear enough if one could see it through the eyes of the *Travailleurs de la Mer,* as Victor Hugo attempted to do. The prehistoric as well as the historic art of the Mediterranean region bears abundant evidence of this. Figures of the octopus, both realistic and conventionalized, occur in the art of ancient Greece and elsewhere. Passing to the New World, one readily encounters two centers of the octopus cult, Peru and Chiriqui.

In Chiriqui we find the association of the octopus with a single kind of ceramic product, which for the sake of convenience we may call octopus ware. This ware differs from the alligator group and both differ from the armadillo ware. In point of numbers the octopus group ranks next to the armadillo group. It consists for the most part of slender-necked globular vases of medium size. The prevailing color of the slip is red. On this the designs were laid down in wax. The part to be decorated was then treated with a uniform coat of black. Later the vessel was passed through a hot bath; this melted the wax which carried with it portions of the overlying black, leaving the desired pattern in the color of the ground. The technique and the nature of the colors employed are thus wholly different from those in the ceramic groups already described. The only point in common is that here again the prevailing decorative motives center about a single zoömorphic original—the octopus—and are presumably derived from it.

There is something peculiarly fitting in the association of the octopus with small-necked round-bodied vases that depend for their ornamentation upon a system of negative painting. By adding eight appendages the body and mouth of the vase at once become the body and mouth of an octopus. This is equally the case whether the arms depend from the neck or rise from the

Polychrome ware is remarkable for its rarity as well as for its refinement and beauty of ornamentation. It is more closely akin to the alligator ware than to any other, the delineating colors, black and red, being the same, while the addition of purple in many cases gives a distinguishing character. The elaborate branching scroll decorating this vase is derived from the multiple body curve of the alligator, to which seven alligator profile motives are attached (compare with third figure, page 146)



The alligator god (at the left).—This extraordinary design on the inside of a cup or chalice of polychrome ware represents the human body and extremities surmounted by the alligator's head with all its characteristic traits. The artistic red and purple spines are attached to the crests instead of to the head proper. It has been observed that there is great resemblance in this decoration to that of the earliest known period of Chinese art

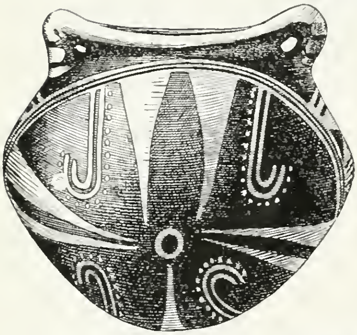
The parrot god (at the right).—The human body is sometimes combined with avian attributes, as seen in this figure cast in gold. Even here alligator symbolism is present in the foot rest, which is repeated in inverted position to form the headdress of the god

Octopus ware, showing realistic figure of an octopus.—One of the best examples of the association of a given animal with a certain ceramic product is exemplified in this so-called octopus ware, which like the alligator ware depends on color for its ornamentation. The method of producing the design and the nature of the colors used are, however, very different in the two.

In this example of octopus ware the octopus appendage alone is used. It appears in a curved frondlike representation and also in the guise of a short-based triangle with a series of dots representing the suckers, these motives alternating in a series below the neck of the vessel

FURTHER EXAMPLES OF OCTOPUS WARE

Outlined in black on a light ground, eight octopus arms (of the curved frond type) depend from the neck of this vase, the neck and mouth of the vase being in the position of body and mouth of the octopus.



Triangular and curved frond octopus appendages converging toward the center of a circular panel. On the vessel at the right there are four sets of appendages, namely, one descending from the neck, one rising from the base, and two converging toward the centers of opposite circular panels

Here the triangular and frond type (the fronds are straightened) of octopus appendage alternate, filling an arched panel. The straightened fronds bear two rows of suckers each

A pale yellow and black vase has a zonal decoration. The two broad black bands are broken up by a succession of diamond-shaped figures each representing an octopus body. (Compare with figure at top of page 149.) Appendages have been eliminated and dots indicating the suckers have been placed within the body areas vessel's maximum horizontal circumference.

Again the globular shape of the body makes it possible to describe a circular panel on each side. This is sometimes filled by a realistic figure of the octopus. Again in the center of this panel a small circle may be traced; and toward this make-believe mouth as a center, octopus appendages converge from the periphery of the panel. Thus can a single vase be made to represent two complete octopus figures. In some examples the reduplication is repeated about the neck and bottom of the vase respectively, resulting in a quadruple representation of the complete octopus figure.

The one outstanding feature of the octopus is the set of eight suckered appendages; to these the Chiriquian artist gave special attention. The more realistic appendage representations are frondlike and accompanied by a row of sucker dots along the convex margin. The less realistic appendage motive takes the form of a short-based triangle, with a row of suckers paralleling one or both of the long sides. From both the frondlike and the triangular appendage the suckers are often omitted, or they may appear by transposition on the body of the octopus.

In addition to the armadillo, serpent, fish, alligator, and octopus,[1] each of which is dominant in a distinct ceramic group, there are several other animals which appealed more or less to the fancy of the artist. Among these are the frog occurring by preference in the armadillo group, the monkey, raccoon, squirrel, iguana, tapir, deer, peccary, crab, owl, parrot, and jaguar. The two last named are met with not only in the alligator ware especially as whistles but also among the metal figurines. Both are sometimes combined with human attributes to form what I have called the jaguar god and the parrot god.

The development of decorative and symbolic art is not to be demonstrated by means of mathematical formulas; that its manifestations are however subject to the laws of growth and of decay, there can be little doubt. In the evolution of ornament in art, the haphazard plays an insignificant rôle. The reasons for each step may not always be obvious, but they exist nevertheless. The work of a given artist reflects alike his spiritual make-up and his environment, cultural as well as natural. The marks of kinship running through the group of alligator or octopus motives, for example, rest on a more solid basis than mere fortuitous convergence toward a common type. Each artist either had in mind the common source of inspiration, or else copied from someone who was drawing on that original source. The source is always and everywhere nature; and that art is best which remains true to its source.

[1] Mr. B. W. Merwin of the University Museum, Philadelphia, has recently called attention to a snake (*Crotalus durissus*) from Chiriqui, the scale pattern of which is not unlike some of the designs to be found both in the alligator and octopus ceramic groups. In other words, with such an exuberant proliferation of decorative motives derived from a single zoömorphic original there is ever present the possibility of the overlapping of motives that started from wholly different originals. For example dots were employed not only to represent the scales of the alligator but also for the suckers of the octopus; they might also be made to stand for spots on a snake's back. The dotted triangle served as a convenient symbol for groups of alligator scales. On the other hand a short-based triangle accompanied by dots along one or both of its longer sides was without the shadow of a doubt derived from the octopus appendage. A realistic representation of the body pattern of a Chiriquian rattlesnake is satisfactorily expressed by means of rhombs, and perhaps even by triangles. The confusion arising from possible convergences of this kind is, however, reduced to a minimum by the fact that the three animals in question are each dominant in its own distinctive ceramic group. In the alligator ware, the influence of other animal forms is negligible; the same is true of the octopus and the serpent wares. The probabilities are therefore that a dotted triangle is not a serpent motive when occurring on alligator or octopus ware; neither is it a scale-group symbol or appendage-sucker motive if occurring within the ceramic group known as serpent ware. This much can be said without denying the possibility of the reverse being true in exceptional cases.

Peace Conditions

Parallelism between the development of the high animal organism and that of the super-nation, both in accordance with broad general principles of organization: especially mutual dependence and coöperation

By JAMES G. NEEDHAM
Professor of Entomology and Limnology, Cornell University

PEACE-KEEPING is not so much a matter of treaties signed at the close of hostilities, as it is a state of public mind. "Peace terms," so called, may be named arbitrarily by the authorized representatives of warring states; but peace conditions are fixed in the psychic organization of our species. The "terms" must conform to the conditions; else there will be no lasting peace.

What are the conditions? How shall concord and organic health be assured in the political organization of the world?

Much light is shed upon the problems of organization by the study of nature's supreme model, the body composed of cells. These are the units of a lower order, that correspond to the persons composing the body politic. In our own bodies they are so highly integrated and their operations are so unified that we can scarcely think of them as distinct parts which have been able to get on together by reason of improvements in corporate organization. Yet our life is at bottom cell life, and all our activities of body and mind are the result of the coördinated functioning of the component cells. Moreover, these cells begin their existence in comparative independence, and differentiate, specialize, and merge their interest and find their several places and functions as the body grows.

The grades of organization among cells and the resultant forms of animal life are not more diverse than are the forms of political organization which have accompanied the social efforts of mankind; and the parallelism between the two is so close and so detailed one can scarcely doubt that broad general principles of organization are involved. With increasing size both have developed media of exchange, channels of transportation, lines of communication, supporting structures, organs of outlook and centers of control. Tasks have been differentiated and division of labor has made each part to bear responsibility for the welfare of all.

Parallelisms have always indicated conditions set by nature; conditions to which all organisms, whether physical or social, must conform in order to live.

In every organization, whatever its components, *mutual dependence is the strong bond of union.* This is the first condition of peaceful and permanent association. Unfortunately, it is wholly at variance with what have heretofore been national ideals of self-sufficiency. If each nation had to continue to raise, to mine, to manufacture all that its own people require for sustenance, and had to maintain defenses adequate to meet all comers, then permanent world peace would be forever impossible.

The road to world peace runs in the opposite direction. Let the peoples of the earth make common cause of their needs of defense, as the parts of the body have done; let them remove all artificial barriers to the fullest and freest use of the world's diversified products. Let them *organize an agency of control* to determine local conflicts of interest in accordance with the greater good: then peace will be possible.

In union, strength is found. By coöperation, the common tasks of life are more easily performed. But increase in the mass makes for better living only as the parts of the mass come to function together harmoniously, and each bears its share in meeting the common needs. *Mutual responsiveness* is the true measure of organic efficiency.

Peace is organic health.

If any organization is to attain to a high degree of efficiency its parts must be mutually dependent, having need of one another; mutually responsive, serving one another; and there must be also some organ of control, capable of determining for the sake of the larger interests of the body that local and private quarrels shall cease.

The human race at large is unorganized, inchoate. Its elements are combined in heterogeneous units of varied size and composition that are not consistently either racial or geographic. It resembles a slime mold rather than a vertebrate, since the mass may be divided and its parts may be recombined arbitrarily.

And yet, out of the mass there have emerged groups highly organized and highly efficient. The primal group is the family, firmly founded upon the one differentiation that Mother Nature has imposed upon us—the differentiation between the sexes. Combinations of families into clans and tribes grow out of the discovery of the advantages of coöperation in large tasks. Boundaries are at first determined largely by kinship, or by advantages of trade. With progress in agriculture and handicraft further compounding becomes possible and nations are organized. Always the size of the group is directly related to conditions of living: complexity of organization follows upon increase in size. But, large or small, every group that has attained to communal efficiency has followed the lines laid down by nature for all the living.

From the dawn of history even to this present hour the most marked psychological characteristic of all groupings of mankind has been the behavior of group-members toward one another as contrasted with their attitude toward outsiders; brotherhood within, enmity without. Federation, whether of families, tribes, or nations, has made for peace and coöperation inside the group, and for war and conquest outside. The closer the neighboring groups and the stronger their internal organization, the more intense has been their strife.

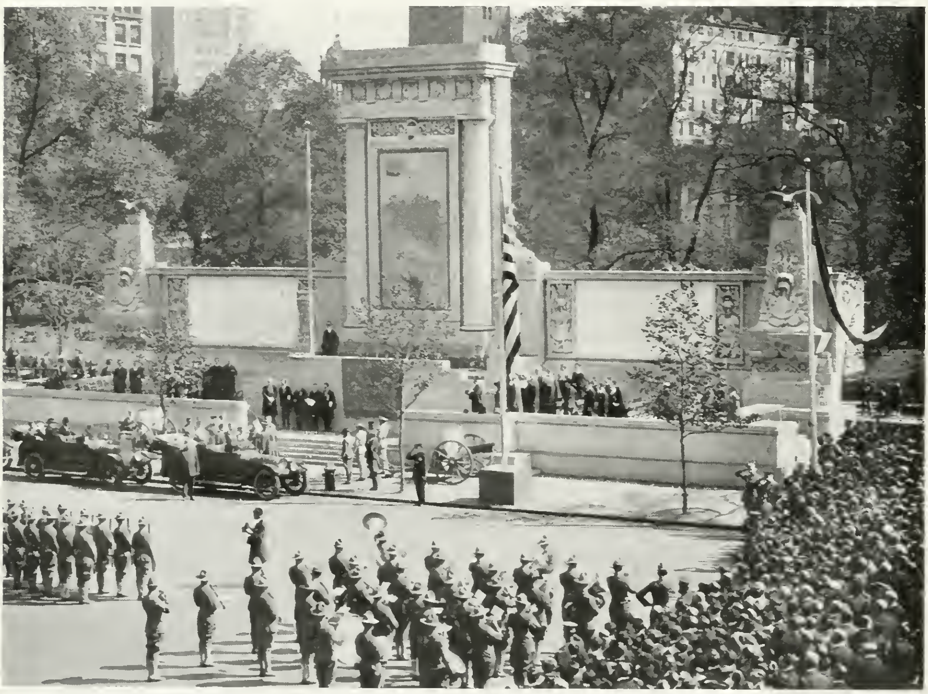
Every group has exalted its own heroes, traditions, folk ways, and looked down upon those of other groups as inferior. Whoever we were, we were the chosen people. Others were benighted in proportion as their ways diverged from our own. We have thought it our mission to extend our own kind of culture throughout the earth. This has been the spirit of nationalism; and it differs not a whit from the spirit of warring tribes in savagery.

Yet every organized group is a peace unit, within which comradeship, law, and order naturally develop. And with the progress of knowledge especially in agriculture and the arts, groups have grown larger and more inclusive. Living has been made easier. Substantial benefits to vast populations have come through federation; and wars, if more severe, have become less frequent. And now that science has brought the ends of the earth near together by means of rapid travel and instant communication, the conditions are ripe for a world-wide federation, and a new peace pact that shall include all mankind.

Such a pact will succeed if nature's laws are observed in the making and in the administering. In my judgment, it is of far less importance where national boundaries are drawn than how they are afterward maintained: it will not be a serious matter if "subject peoples" be included within those boundaries if only these be given freedom, security, and responsibility under their own government.

If human society is ever to become efficiently organized, it must *develop an* *organ of control.* Before the Great War started we had the beginnings of a process of efficient organization of the world: we had international postal regulations, international copyright, and many international organizations, mostly without authority although not without influence. These had arisen as naturally as did the scattered ganglia of the lower animals, and like the ganglia they exercised separate and local control. Now that the war is over, these need only to be connected more intimately by means of a higher control center. Let the nations of the world make common cause of all their common interests.

The changes necessary are not greater than, nor different from, those that have taken place in the organization of tribes into a nation. The larger union that shall include all mankind needs only what the successful tribe or the successful nation has had in the past—needs only what the successful animal body has had—an organization of its units for mutual labor and mutual benefit. Mutual dependence, mutual responsiveness, government for the sake of the governed; these are the conditions set by nature for the making of an effective organic union: they are as inescapable as the law of gravitation.



THE ALTAR OF LIBERTY

Dedicated not to honor, not to vainglory, nor to personal pride; dedicated to the one great thing that marks the great man or the great nation, to the ideal of sacrifice. The Altar of Liberty in Madison Square was the great rallying point for New York City's mammoth celebration at the opening of the Fourth Liberty Loan on September 28, 1918. Vice President Marshall dedicated the Altar, which upon subsequent days was visited and decorated by the representatives of all the Allied Nations, including Ambassador Ishii, of Japan, and Sir Henry Babington Smith, British High Commissioner, who brought the message of "sacrifice" for a common cause

The Method and the Knowledge of Science

KNOWLEDGE GAINED BY THE METHOD OF INTUITION IS UNSATISFACTORY; THE METHOD OF SCIENCE IS THE ONLY SOURCE OF TRUE KNOWLEDGE IN THE WORLD

By WINTERTON C. CURTIS

Professor of Zoölogy, University of Missouri

FOREWORD.—When the scientist discusses the philosophy of science he often makes himself ridiculous to the philosopher. Still philosophers as often seem ridiculous to scientists, and the danger is not in being laughed at, but in the continual neglect of discussion that takes us beyond our immediate fields of thought and investigation. The biological scientist is keenly alive to the problems of philosophy, because thought appears to him a product of evolution; and because, in his studies in embryology, he has long realized that one of his ultimate problems is the relation of mind and matter. Without apologies to the philosophers, we shall, therefore, set forth a creed to which we believe many biologists subscribe. If this meets with criticism in place of agreement, we shall be satisfied; for we desire rather discussion than enforcement of particular views. These are problems of human interest and are in the back of every scientist's mind whether or not he subscribes to the interpretations here presented.—THE AUTHOR.

The Method of Science

ANY man is a scientist when he puts two and two together and draws conclusions which are justified by the observed facts, for science uses only refinements of the inductions and deductions practiced in everyday life. The method of science is what Huxley described as "trained and organised common sense."[1] The man of the street or farm has a deal in common with the scientist, although the latter may seem to him both fool and dreamer. Let us consider this proposition that the method of science is but an extension of the method of common sense.

As there may be some question regarding the meaning of the term, we may agree at the outset that a man has common sense when he deals rationally with the facts of his experience. The phrase is sometimes used in derision, to contrast the sense of the everyday man with that of the theorist to the disadvantage of the latter. Again, it suggests something held in common by a large number of persons, or the sense of the common people. When analyzed, does the phrase not mean, that the man of common sense sees the whole situation or, as the scientist might put it, considers all the data and draws his conclusion therefrom? We think a man's judgment sound because he does what another would do, if confronted with the same situation and possessed of like ability to think straight. The theorist fails if he does not consider the workaday elements of the case, and the practical man if he judges solely by rule of thumb without the light of theoretical considerations. A man with the gift of common sense should know enough to consider both sides. Now science has gone forward in the past, not by any wizardry, but by the application of trained and organized sense in the solution of its problems; and the methods of thought which advance science do not differ in kind from those of the most hard-headed man of affairs, who creates from insignificant beginnings a business of international proportions.

For illustration, the owner of a quarry uncovers a layer of rock different in appearance from any before offered for

[1] Huxley, Thomas H., "On the Educational Value of the Natural History Sciences," pp. 38–65, *Science and Education.*

sale in his locality. Lacking expert advice, he begins experiments and observations, with a view to determining its utility for building purposes. After subjecting the stone to different tests, he concludes it can be put to certain uses. It is good for crushing and rough masonry, but not for sills and lintels; good for road foundations, but not for surfacing; and the like. In reaching these conclusions, he first establishes certain facts, then compares these with facts previously known; then classifies the stone as good or bad for a given purpose; and finally arrives at the proposition that a stone of this nature may be put to such and such a use. He is now in a position to convince would-be purchasers of the excellence of his material. Even an Indian, selecting the flint for his arrow points in the same locality years before, might have gone through similar mental processes.

If we compare the sense of science with the foregoing, the case is as follows: A geologist examines the same rock layer, because of peculiarities which have attracted his attention. He first makes a survey of the entire bed, collecting the fossils and observing structural features, comparing as he does so the present bed with others he has seen. Ripple marks and mud cracks may tell of shallow water, the fossils may indicate a marine origin, the distorted bedding planes may give evidence of lateral pressure. At last, he classifies it as belonging in a particular horizon and arrives at the proposition that stone of this nature belongs to a certain period of the earth's history. In such a case, the geologist believes he has reached conclusions obvious to others and is ready to take his colleagues over the ground, exhibiting facts and explaining inferences.

The quarryman goes through similar mental processes, did he but know it, although he is likely to go astray because his knowledge of rocks is after all rather limited, and because hope of gain is his sole incentive. The only advantage the geologist has is his broader knowledge and his desire to establish the facts rather than to line his pocket. The point for us is the parallelism between the mental processes of the two men, which are in essence the inductive method of science. The method of Sherlock Holmes would be a case in point, easy enough when you see the steps to the conclusions, and valid in so far as the original facts are unshakable and the inferences therefrom logical necessities. Every one who reads of Holmes's exploits sees that his mental processes are but an extension of everyday observation and inference, and so it is with science. Indeed, some teachers advise students to read classic detective stories, as good examples of the process of scientific induction.

The distinctive feature of the scientific method may be characterized by the adjective "common," if we use the word as meaning "shared equally or similarly by two or more individuals." For the common sense of science is that kind of sense which may be "shared" by normal members of the human species. It is not the whim of one individual, but the opinion held by all normal individuals when confronted by the same or a similar set of facts.

Before developing this, we should recognize three possible objections to the statement that the conclusions of science may be shared by all in common. First, the fact that many people hold a belief is no evidence of its validity. We no longer think what is "believed always, everywhere and by all" to be necessarily true, as did the early Fathers; for "all" may labor under similar delusions and hold the same unwarranted belief. If common belief were scientific evidence, then prenatal impression and telegony are facts overwhelmingly established in man and the familiar mammals. Second, some one may ask, who are the "normal" individuals? To which we can best reply with the old Quaker's remark to his wife, "All folks are queer but thee and me, and I sometimes think thee's a little queer." A third objection must be answered at greater length. It may be asked, in view of the frequent differences of opinion among scientific men, whether any such thing as a common interpretation of phenomena exists. To which we answer, there is this common interpretation with respect to certain phenomena.

To illustrate specifically, it is a familiar fact that all living bodies are composed of units known as cells. The exceptions to this cellular organization of protoplasm, such as multinucleated cells, plasmodia, syncytia, etc., can all be brought into alignment with the general theory of nuclear and cytoplasmic materials. There was a time in the history of biology when nothing of the sort was known, and later, a time when a hypothesis of the universal cellular organization of protoplasm was proposed on a basis of limited observation. This working hypothesis was for a time debatable. But the increasing number of cases in which cells were observed soon led to its acceptance as an established generalization, now to be designated as the cell *fact*, since it is hypothetical only when we assume, as we do in the erection of our cell theory, that all living things are constructed after this fashion whether we have examined them or not. We have studied hundreds of thousands of living things and found them all composed of cells, and we assume that we shall always find cells as new animals and plants are examined. The phrase "cell theory" is like the phrase "theory of gravitation," theoretical only when we assume it will hold good elsewhere or when we push our analysis further and theorize about underlying causes. No one disputes the existence of cells, nor the assumption that we shall find them as long as we use microscopes, any more than he disputes the universality of gravitation, because of which we assume that stones thrown from the ground always come down whether in California or Japan or on the planet Mars. There is then common agreement regarding the existence of cells and the agreement extends to many details of their structure and activities, as for example that all cells contain chromatin or that all cells take in oxygen.

What we mean when we say the cell theory meets with common acceptance is that every one who has taken the time and pains to examine living tissues with the microscope, has observed the cells; that we ourselves have seen them; and that our contemporaries tell us their experience is like our own. There is, therefore, among the competent, a consensus of opinion represented by the cell theory, in other words, a "common" sense in which this phrase is understood. The only way this sense differs from that of persons without biological experience is that it rests upon wider observation and is, therefore, the more reliable. It happens that these conclusions regarding cells may be drawn only by persons trained to the use of microscopes; and only after special preparation of the materials examined, which is an illustration of what Huxley meant by "trained and organised" sense. It is not that the observations and conclusions of science are fundamentally different from those of everyday life, but that they are refinements of these, made possible by the training of the scientist and the organization of his material. There is no necromancy in science, for the methods by which science has advanced are the methods which normal individuals regularly use. Science has often made initial strides through the work of investigators who perceived the unifying features in large series of phenomena, and whose daring hypotheses were like the flight of the poetic imagination or the vision of some genius of the commercial world. But what finally counts is the confirmation of each such hypothesis step by step, until it becomes a commonplace, verifiable by anyone who reviews the facts at first hand.

This refinement of the technique is the essential difference between the scientific and the popular method of drawing conclusions. In fixing the ice cream freezer or the furnace, one may be exercising a very common kind of sense. But it is a sense which differs from that exhibited by the scientific investigator, only in so far as the facts examined by the investigator are the more complicated and can be approached only after extended preparation. The man who builds a concrete sidewalk in his yard learns by experience and experiment, and by thinking things out as he goes. The man in an engineering experiment station, who is trying to advance our knowledge regarding the chemistry of cement, does essentially the same thing. Only he begins far ahead of the untrained man and, having a broader knowledge, recognizes possibilities of error the other does not comprehend.

By these and similar illustrations, it is seen that there is nothing unique in science or in the methods of science. Scientists are not wizards, but men who apply to natural phenomena the methods of analysis used by logical minds in the affairs of daily life. The facts of science are shared by all who possess the training necessary for their apprehension. We believe, moreover, that any normal person who trains himself to examine the facts will subscribe to our common agreement. If there is debatable ground and difference of opinion, it is because science no sooner gets a fact tolerably well established than it goes after other facts. While we agree upon the interpretation of certain data, conflicting data may be adduced at any time; or we may undertake entirely new lines of investigation, which at first yield uncertain results. Having satisfied ourselves as to the general epigenetic course of development and having a common agreement regarding this, we press on to something new, like the problem of fertilization or of differentiation. And here we are on ground where the facts are so poorly established we do not find a common sense in which to formulate a theory. There are divergent views in science, only because the essence of science is progress, and because we are interested in the things to be done rather than in those already accomplished. Apparently divergent opinion may eventually result in agreement once the facts are adequately known.

The differences between the main branches of science further illustrate our point. Physico-chemical science deals with comparatively simple phenomena, and has, therefore, reached an advanced position. The biological sciences, having all of chemistry and physics, and in addition the complexities of living matter, have developed slowly and today present relatively less common ground than physical science; while in the social sciences the complexities are further increased by the most unpredictable element of all—the intelligence of rational human beings. Hence there is not much "common" sense in sociology and none in religion and philosophy. Some, indeed, question whether within these fields we can ever reach common agreement except in their simpler categories of fact. We can at least try, and keep trying. For of one thing we are sure, human progress has not come by intuition, but by intelligent analysis, which is nothing less than saying by the accumulation of facts and by their interpretation in the common sense of science.

The Knowledge of Science

A recurring obstacle to scientific progress is the belief, born in a new guise with every age, that we can *know* things in some occult fashion aside from the evidence of our senses and the process of reasoning. Belief in this efficacy of divination and kindred arts appears well rooted at the beginning of history, and the success of fortune tellers and quack physicians and spiritualists attests its survival to the present day. Even the educated incline toward mysticism and intuition, upon slight provocation; while among the uneducated the influence of such beliefs is a potent factor. As a race, we are not yet convinced that we live in a universe where things do not happen by accident but through adequate causation.

Among our forefathers, these beliefs were even more widely held, and one of the silent victories of science has been the liberation of civilized man from superstitions that once held him in bondage, restricting alike his spiritual and material progress. Glimpses of the past may be caught in nations less advanced than those of western Europe. Thus, one cannot read a book like Professor Ross's *The Changing Chinese* without being convinced that the Chinese of today are in the mental condition of European man in the Middle Ages, with the burdens of witchcraft, of sorcery, and of belief in ghosts, lying heavy upon them; and that just as medieval man emerged from this slavery of soul so the Chinese will, doubtless, emerge in the future. Only their progress seems likely to be the more rapid because of contact with the western nations. We pride ourselves that we have gained so much and even boast in the strength of a supposedly superior race; and yet our civilization is honeycombed with superstitions, which hamper the best of us and which are a grievous burden upon the less fortunate members of society.

While the biologist must consider these cruder thought-survivals, as they affect those he seeks to influence through teaching, he needs, on his own account, to consider other mental processes, which, despite their refinement, are opposed to the advance of science. For example it has been often insisted by philosophers and others that scientific knowledge is only secondhand knowledge, that there is a method of reaching valid conclusions other than that of science, that intuitive processes yield even more certain truth than do the methods of science. The word intuition has had a variety of meanings, but in general is applied to a faculty for understanding things quickly without due process of reasoning,—to a kind of royal road toward the solution of any problem. Without venturing within the mazes of philosophy, we may consider the intuitive process as it is paraded in everyday life. Here, as with the philosophers, intuition is regarded as a mysterious short cut by which one arrives at conclusions, without the labor of drawing logical inferences.

When we consider the intuitive process, the following propositions are evident: Intuitions are effective only within the field of complex phenomena; they are most emphasized by persons not in the habit of careful analysis; they were formerly applied to many phenomena since brought within the grasp of science. All of which leads us to suspect that the matter is reducible to the proposition: What is simple we reason out; and what is complex and, therefore, not susceptible of exact analysis, we settle by a mental process of the same order as the "hunch" or the "lucky guess" of the plain citizen. A century ago, even a generation ago, an appalling amount of medical diagnosis rested upon an intuitive foundation. Today, an increasing amount rests upon a scientific knowledge of organisms and specific substances within the body. The history of science is filled with such examples of the unknown and supposedly unknowable of one age becoming the known and the controlled of the next. This being so, is it not a fair presumption that what we decide today by intuition may, at a later day, be brought within the ken of science, and thus the realm of the intuitive become a lessening one, its name synonymous with the unknown or incompletely known, not with the unknowable? Is it not that we have intuitions regarding what we do not as yet understand, and that intuitions fade where scientific analysis establishes a foothold?

A banker does not decide whether a company is fairly capitalized, nor does he keep his books, by an intuitive process. He does these things by painstaking arithmetic. But he may loan money to one man rather than to another, because of an intuitive feeling that the one will meet his obligations while the other will not. Intuition, which in such an instance is probably nothing but "subconscious experience," probably tells the banker that one man "couldn't lie if you paid him," while another deliberately misrepresents the facts. Without believing that psychology will shortly relieve bankers and administrators of their need for intuitions, we may nevertheless regard such cases as susceptible of formulation in terms of heredity, environment, and in the vasomotor responses which psychologists are today postulating for all liars however calm to outward appearance. Even with our present knowledge, we can conceive of the banker's decision resting upon a complex of understandable phenomena of which he is unconscious at the time. For just as we judge distances by imperceptible or unrecognized changes of the eye muscles, or hit a billiard ball by motor responses of almost unbelievable delicacy, so the banker, who gives his answer as soon as his customer has finished speaking, may have his decision unconsciously influenced by the stimuli coming to him from the flicker of a muscle, a twisted phrase, or a look in the eyes, as well as from grosser matters like the man's reputation or the principles of safe investment. In a word, I can well conceive of the analysis of thought processes, as physically expressed, some day reaching a point where many things now vague and incapable of analysis will be reduced to scientific statement of fact. It may never be well for a banker to put his customer through a machine test. A good judge of character can perhaps do the work more expeditiously, and well enough for banking purposes. But in war we are coming to select certain mental types for certain duties under the advice of our psychologists. And I see no reason why chauffeurs, and engine drivers, and even honest men may not be so chosen at some time in the future. What this means is that mental behavior, once regarded as beyond the domain of science, is being shown to follow a causal sequence in a few cases. But we see no reason why these few cases should not be extended to include an increasing number of mental phenomena; and if this happens we can set no limit to the banishment of intuition as a source of knowledge regarding human behavior.

Other examples might be given. An investigator does not draw the conclusions his experiments justify by intuitive processes, although his speculation may be of this nature. A teacher comes to a mastery of his subject only by its methodical organization. But in the vague state of our knowledge concerning effective methods in education, he may say he has an intuition for the presentation which makes a lecture acceptable to his students. If a man is in the habit of speaking to the dogs he passes on the street, even calling them from a distance, he is sometimes pleased at his success in manipulating dog psychology. He might call it intuition as to how dogs will react. But it is possible that the man "sizes up" his dog, much as we unconsciously measure distances with our eye muscles, and tries the stimulus likely to work. The dog's reaction is very complicated. It depends upon his past experience with strangers, upon his training at home, upon his experience with this man, upon his hereditary make-up; and yet it is by no means certain there are elements involved which can never be analyzed by science. If a man knew all these facts for a particular dog, he might be able to predict what response would follow a given stimulus. And if the dog could be as well informed, he might know what to expect from the man.

The biologist neither affirms nor denies that such a series of phenomena as the dog's reactions will some day be thus analyzed. He does not know. He is making some headway in explaining animal behavior in these terms, and so long as he can make headway, he hesitates to set limits to his future progress. Life is not likely to become stale in the near future because all things have become predictable in scientific terms. We shall continue our inroads upon the intuitive process for a long time without exhausting the residuum. Only, so long as we can see a receding vista ahead, it takes boldness to assert the existence of a remainder not susceptible of scientific treatment. We may well question whether intuitions are in any sense a method of acquiring knowledge, whether they are knowledge at all, and whether intuition means anything but ignorance of complex phenomena, however effectively it seems to fulfill its functions in a given instance.

Another weakness of our intuitions is their individual bias. They are the product of a single mind, not the collective agreement of individuals who have examined the same data. As such, they are open to the suspicion of being influenced by delusion or prejudice. Moreover, they work differently with different persons, exhibit to a large degree the personal equation, and have all the "ear marks" of processes which are not and never can be reliable as methods of thought.

The scientist, therefore, believes the method of intuition wholly unsatisfactory as a source of knowledge. When he says he "knows" a thing he means that any normal individual, who puts himself under similar conditions, will receive similar sense impressions and will draw the same conclusion. The scientist does not claim to know everything. He does claim that the intuitions of daily life are not knowledge, in the scientific sense, for they presumably represent either the vagaries of the individual mind or thought processes too unorganized to be used as a basis for knowledge.

Neither is the "intuitive knowledge" of religion or philosophy to be placed in the same category with the "common" knowledge of science. For this, like the intuitions of daily life, rests upon no safer foundation than the caprice of the individual mind. If a field of mental activity does not permit a beginning of organization in terms of common assent it is not subject matter for science, and is, therefore, not a matter of which we can have knowledge in the scientific sense. The scientist protests against dignifying individual opinion by the term "knowledge," which he reserves for conclusions resting upon collective judgment. It is the contention of science that its method of "common" sense is the only method which has yielded knowledge of permanent value, that the only thing we can designate as knowledge is reached in this fashion. Other brands are the whims of individual minds, and can never be substituted for the one kind of knowledge which is the knowledge of science.

Courtesy of Paul G. Howes and the New York Zoölogical Society

FEAR DOES NOT QUICKLY OVERCOME HER BROODING INSTINCT

Hoactzins look more or less like pheasants. They are very quarrelsome among themselves, however, and when pugnacious lose all resemblance to any other living bird. They erect the plumed crest, spread wide the flapping wings, and with strange flouncings and contortions, hiss, grunt, and croak in a high key. The utterances of an excited colony blend into an indescribable confusion of sound, sometimes as doleful as though the birds were mourning for all the extinct of their race. That this species has endured so long may be owing, at least in small measure, to the strong fetid odor of the adult bird. Hoactzins have feeble wing muscles and fly only short distances, across the stream or from point to point along its banks. They wander little, therefore, and unlike most birds can always be found in the same locality every month of the year

The Hoactzin—Only Survivor of an Ancient Order of Four-footed Birds*

Discovery of the quadrupedal character of the young, and first-hand observations on habits and home of the species

By EDWARD M. BRIGHAM

Curator Public Schools Museum, Battle Creek, Michigan

IN April, 1881, while collecting vertebrate embryos in the interior of the island of Marajo, at the mouth of the Amazon, I discovered that the young of the *Opisthocomus hoazin* is distinctly quadrupedal.[1] Toward the end of incubation two toes on each forefoot (wing) were so completely produced that I was confident they would be functional in some manner after the birds were hatched. A little later I saw the birds actually using the toes, and using them in a highly significant way.

The adult bird has long been known to science. It is known on the lower Amazon by its Portuguese name, *cigana*. It has also a long list of local names as each tribe of Indians in the Amazon Basin has a distinct language. The species is generally known as the "hoactzin." It is of such size and its habitat is so exposed that it could not have escaped the notice of anyone traveling far along the Amazon. But the remarkable quadrupedal character of the young bird had hitherto not been observed. The adult hoactzin, in size and general appearance, reminds one of a pheasant although it bears no near relation to that bird. In fact it has no near relatives living—it is the sole surviving species of the order Opisthocomi, an order of which geologists have found fossil representatives.

The hoactzin may be described briefly as pheasant-like in size and aspect (about 21–25 inches from tip to tip), with a very dull coloration above of varying shades of reddish brown streaked with dirty buff — and buff below.

The hoactzin is gregarious. Its habitat on the lower Amazon is limited by a single species of plant—*Caladium arborescens*, called by the natives *aninga*. This plant is a tall amphibious aroid, related to the jack-in-the-pulpit and the calla. It has large heart-shaped leaves, calla-like flowers, and fruit remotely resembling a pineapple. The plant often grows to a height of fifteen feet, but averages perhaps eight feet when fully grown. It forms in dense masses on the low, flat, muddy margins of the islands and borders of the water courses, frequently standing many yards out in the muddy shallows.

Imagine a broad hedge of tall stout-stemmed *aningas*, with a score or more of hoactzins scattered over the top, seated on the leafstalks and feeding on the leaves of the plants, or making their way with flounces and hisses from one plant to another, and you will have something like a picture of this strange bird in its lower Amazon habitat. I never saw the bird alight on the ground. Although the *aninga* leaf is a frail and yielding perch, the hoactzin seems to prefer it to any other. The bird

[1] The discovery that the hoactzin is functionally quadrupedal during a part of its life, was announced by the author of this article, in a paper read at a meeting of the Chicago Academy of Sciences in 1884. The paper was published in full at that time in the *Chicago Tribune*. (Oct. 18, 1884.)

* With illustrations from *Tropical Wild Life in British Guiana*, through the courtesy of the Author, Mr. C. William Beebe, and of the New York Zoölogical Society.

Courtesy of Paul G. Howes and the New York Zoölogical Society

A typical haunt of the hoactzin, Canje Creek, British Guiana.—In this locality the species is now protected by the British Government, a special fine of five pounds sterling being imposed for killing one of the birds

breast on the bent leafstem and hisses, tottering awkwardly with outstretched wings and tail until the *aninga* ceases swinging. The habit of steadying itself on its perch by squatting on its breast has caused a thickening of the skin, a piling up of epidermal tissue into a hard callosity which is so firmly fastened to the bone that a strong knife is needed to separate it when removing the skin. The hoactzin is so accustomed to squatting on the *aninga* that even when on other perches it is rarely seen erect. I have never seen it fly farther than across a narrow stream, from one *aninga* hedge to another.

The hoactzin is a very quarrelsome bird. When its pugnacity is manifest, its pheasant-like appearance vanishes, and it then looks like no other bird. It erects its sparsely plumed crest and awkwardly flaps its wings while trying to keep a balance on the unsteady perch. It throws its neck into contortions as if it were really choking, and in a ludicrously awkward manner menaces its fellow, which is having equal difficulty in retaining its perch while retaliating from the swinging leaf of a neighboring *aninga*. While the birds are thus strangely gesticulating, the noise of their flapping wings is accompanied by hissing, grunting, roaring, and shrieking. There are times of general uprising when the mingled utterances of the colony make a confusion unearthly and indescribable. Sometimes they join in most doleful sounds as if suddenly moved to mourning for all the extinct Opisthocomi. Periods of general and extreme demonstration usually occur in the night. Such is the resemblance of some of their cries on these occasions to some of those of the jaguar,

builds its nest of twigs and other coarse vegetable matter in the *aninga* tops and in overhanging branches of trees or matted vines. It does not leave the water margins. Only on rare occasions, as when one is tormented beyond endurance by its fellows, does it venture into the forest and then not so far but that a few flaps of its wings will place its feet on the yielding, swinging *aninga* leaf again. There it rests its that upon being awakened by them I have reached for my rifle and held it in readiness until other and characteristic sounds followed which assigned the cries to the medley of the hoactzin.

One day in June, on a later expedition, when paddling along the margin of the lower Rio Negro, the natives pushed our canoe into a strip of marginal *igapo* or flooded forest. The water was well up into the tops of the trees. Hard-featured alligators gurgled, grunted, and roared as they slunk away among the half-submerged tree tops. Huge iguanas, which were basking and feeding in unusual numbers on the topmost branches at a height of from ten to twenty feet above us, started suddenly from their perches and plunged headlong through the branches into the *igapo*. I never witnessed a more interesting reptilian scene. Interest in the situation was greatly heightened by the presence among the topmost branches of the flouncing and hissing hoactzins. As I was aware of the reptilian suggestions in the birds' anatomy the scene was to me impressive and significant. I

Courtesy of C. William Beebe and the New York Zoölogical Society

The *aninga* (*Caladium arborescens*), characteristic of the hoactzin's haunt, is related to the jack-in-the-pulpit and the calla. It forms dense hedges averaging eight feet in height along the muddy banks of streams, often growing many yards out in the shallow water. In a scene like this there might be a score or more hoactzins perched in the tops of the *aningas* or flying awkwardly from one plant to another. The curved stem of the large leaf is the favorite perch of the bird, where, however, it must squat close to balance itself. The bird's breast where it presses against the plant has a hard callosity (a thick cushion of epidermal tissue, so firmly grown to the bone that in skinning a dead bird a knife is needed to separate the skin from the bone at this point felt that I was witnessing the nearest approach possible in this age of the world, to a typical Mesozoic scene. While intent upon these incidents, my attention was suddenly diverted from the upper to the lower branches by a plunge different from that of the iguana —as if some animal had toppled off the lower branches into the water. In the near vicinity of the plunge I saw a young hoactzin seated on a low branch. Then my natives said it was a young *cigana* that had toppled over into the water. I told them to shoot the remaining bird. They shot, but the bird plunged and we did not see it again. Soon, however, we saw the first bird emerge and climb from the water on to a dipping branch on the farther side of the tree top, and *it climbed on to the branch on all fours.* An Indian shot the bird and I preserved its skin. With the bird in hand I showed the natives the *front* feet. They expressed astonishment, and after some reflection an old man said, "The young *ciganas* climb out of the water with those feet." Evidently the presence of the toes on the fore limbs explained a performance with which he was familiar although the modus had hitherto been a mystery.

As the anterior limbs are functionally scansorial during a considerable part of their post-oval growth, we should expect them to attain only the low degree of volery power which they possess. The wings of the adult bird are exceedingly feeble. The sternum is without a keel. It does not seem possible that the young birds could raise themselves from the water in any other way than by climbing. If the wings had sufficient power it seems certain, in view of the fact that the feet are webless, that the young bird would use its wings to enable it to escape from its enemies, rather than to attain safety by plunging into the water.

The geographical range of the species has been given as the "estuaries of the Amazon and mouths of the lower tributaries of that river and the Orinoco." My observations however show a vastly wider range. I shot the hoactzin in Peru, 2100 miles up the Amazon, and I saw it still farther up the river, probably to within 350 miles of the Pacific. It certainly has an east and west range of more than 2000 miles. Its Amazonian range appears to be coextensive with the flood areas of the great river and its tributaries. Although the flood season varies greatly between different parts of the hoactzin's Amazonian range, I found that throughout the length of the vast region in which I observed the bird, its breeding period was coincident with that of the floods. The broods invariably develop through the functionally quadrupedal stage before the water becomes too low to afford the young a retreat from danger. Hence it is clear that the young birds are absolutely dependent upon the water beneath their perches for safety. The relatively inflexible conditions of reproduction restrict the species to its marginal habitat during the flood season—its breeding season. The conditions appear to be even more restrictive for, from all my personal observations and inquiries, the bird does not leave the margin during the time of low water. It may be found along the margins of the main river and its tributaries, along the margins of the innumerable side channels and the confluent lagoons, or places where there are lagoons in the flood season. I cannot find that it has ever been seen away from the borders of streams, or some opening in the forest which is occupied by water during the whole or part of the year, and which directly or indirectly opens to the river. The hoactzins are not known to wander.

The place farthest from the mouth of the Amazon in which I found the hoactzin was nearly dry. There was too little water for the young birds to dive in. It was a mucky swale a stone's throw in length and hardly half that in

Courtesy of C. William Beebe and the New York Zoölogical Society

The hoactzin invariably builds its nest out over the water, either in the *aninga* tops or in the overhanging branches of trees or vines. The breeding season is coincident with the rains and high water in the streams. The nest is made of twigs and often rests on the foundation of an older nest. It has scarcely any depression and would seem to be a place of uncertain safety for the eggs

breadth. I saw this place early in the season of low water. Later the little swale may have been quite dry. But the broods of the season had matured and there was evidently no need of more water until the next flood season, the next breeding season of the bird. There were several nests among the branches, always overhanging the swale. There were no young or eggs to restrain

Courtesy of Paul G. Howes and the New York Zoölogical Society

Before the young hoactzin hatches from the egg, the wing (or forefoot) shows two toes well developed, and within twenty-four hours after the bird is hatched the two toes are functional—the bird is distinctly four-footed and proceeds like a reptile or mammal and unlike any other living bird. The long safety of this species in South America is probably largely the result of the young bird's instinct when threatened by danger to clamber on all fours to the edge of its flat nest and *dive* into the water below. Thus becomes evident the value to the species of the coincidence in the development of the young through this four-footed stage and the time of high water in the stream above which the nests are built

Courtesy of C. William Beebe and the New York Zoölogical Society

THE YOUNG HOACTZIN IS FOUR-FOOTED LIKE A LIZARD

Studies of a young hoactzin to illustrate its ability to climb by means of feet and neck and especially through use of the two toes developed on the wing. After a young hoactzin has dropped into the water under its nest and the danger is past, it proves its four-footed character by climbing out of the water on some branch, using the two toes of the front feet (wings) as vigorously in the performance as it does the four toes of the hind feet the birds, but, although I shot into them repeatedly and from all sides, they would not leave the marginal vegetation. It seemed evident to me that the muddy swale marked the place of a former lagoon which was connected by an open channel, or *igarpe*, with the river, and that, in the ceaseless and rapid shifting of lines of water, land, and trees of the Amazon Basin, the lagoon had been landlocked and then diminished in area by each succeeding flood deposit. The question arose as to whether the bird could get away,—whether, as the opening in the forest closed, the little group of hoactzins would not dwindle with it and become extinct.

The Amazon flows near the equator and subparallel with it. On account of this position the gradational work of the river is of a magnitude disproportionate even to its relative size. The rains follow the sun and according as the sun is in either tropic, the northern or southern tributaries are swollen and their respective flood areas covered. The immense volumes of water poured into the main stream from one side shove the current strongly against the opposite bank, and at times even force the waters of the sluggish tributaries upstream—an estuary action of these annual "tides." During the flood season long strips of forest are cut down by the force of the current pushed against its borders; hundreds of acres in a linear body are often cut away by the resistless current. At times the great stream is so filled with floating vegetation resulting from this havoc that navigation is impeded and becomes dangerous to light craft. Occasionally great masses of matted vegetation supporting erect trees of considerable size may be seen. There can be no doubt that these floating islands detached from the river borders transport hoactzins from upper to lower positions along the river. Such mingling of stock might explain the fact that the species exhibits little if any variation in its vast Amazonian range. The great range is doubtless due to the simplicity, continuity, and extent of the general conditions of the habitat, together with the frequent accidental transportation of the birds by drifting marginal vegetation from one to another of more or less widely separated points, a process which must have endured through a long period of time.

Also, a very slow migration upstream is not impossible. Doubtless the fluctuations of the river bring about topographic changes destroying the congenial marginal conditions of the established location of a colony. The hoactzin rendered homeless by such a catastrophe would doubtless clumsily flop its way to another favorable place on the river margin, and this might, of course, be upstream. There is nothing to prompt the bird to wander or to induce regular migrations—its food is always ready and the rainy season is its breeding season.

The lowering of the water leaves a more or less extensive tract of mud outside the marginal vegetation so that the water is separated during the dry season from the habitat of the hoactzin. But I have never seen the adult bird reach the ground or approach the water. It is a remarkable fact that such a weak-winged, defenseless bird, in such an exposed habitat, has escaped extinction in a region abounding in powerful Raptores and other carnivorous enemies. A means of preservation is suggested, however, by the marked fetid odor of the adult bird. The young are protected by immersion, and later, as the bird approaches maturity, it acquires this offensive odor.

The hoactzin represents one of a group of vertebrate types of vast geological antiquity which constitute a marked characteristic of the fauna of South America. A long isolation of the continent has been inferred from the persistence of these old types.

NOTES BY A COLLECTOR IN THE COLORADO ROCKIES

BY ALBERT E. BUTLER

With a series of illustrations from photographs by the Author

LONGS PEAK AND THE CONTINENTAL DIVIDE AS SEEN FROM ESTES PARK [1]

The Front Range of the Colorado Rockies with its crest of perpetual snow stands as the most eastern outpost of the Great Divide. From the point where this picture was taken Longs Peak appears as a rather smoothly rounded mountain, but from the top of the Divide it is seen as a great square block of granite. Its crevices are filled with snow where the wind has not blown this away, and down its side flows a small glacier, the last remnant of an ice sheet which piled the huge moraine in the valley

[1] Of the many natural parks of Colorado, Estes Park has been the one most frequented as a resort. The magnificent cañon of the Big Thompson River admits the autoist or tramper entering from the east, but the way to the south and west is barred by the precipitous rise of the Great Divide, at this point a veritable wall rather than a range. The valley of Grand Lake, whose waters flow into the Colorado River, lies only thirty-five miles westward.

In 1915 the Longs Peak region, about 229,000 acres including part of Estes Park, was established by the Federal Government as the Rocky Mountain National Park and forms, with Mesa Verde Park in the southwestern part of the state, one of Colorado's two large national preserves. It is fairly accessible by a number of railroads, but sufficiently remote always to insure its beautiful wildness

SYMMETRY OF THE ISOLATED YELLOW PINE

Perhaps the most picturesque of Colorado trees is the Rocky Mountain yellow pine (*Pinus scopulorum*). It occurs on the plains southeast of Denver up through the foothills to as high as 9000 feet. At times it is found in forests but it reaches its greatest growth when more or less isolated. It is capable of more diversity of form than perhaps any other of the pines, sometimes taking on a most grotesque appearance and again exhibiting a perfect symmetry but always fitting into the beauty of the landscape, as is evidenced by its frequent use as a subject by painter and photographer. Its commercial value is very great as it produces more high quality lumber than any other tree in the state

A WILD FLOWER OF THE COLORADO ROCKIES

One of the delights of travel in the Rockies of Colorado is the abundance of wild flowers. Sixteen hnndred varieties are accredited to the Estes Park region alone. The showy yellow, purple, or variegated gaillardia is well known in the florists' shops of New York and other eastern cities. In season one may gather an armful of it along the Colorado roadway in a very few minutes, and it is a sad fact that this is too often done, for the enthusiasm of the visitor at seeing the conservatory door open and the sign of welcome out overcomes his better judgment and he picks until there is not a flower left in sight. Mnch propaganda for the protection of the wild flowers, however, is being spread, and it is hoped that no species will be entirely destroyed.

Some of the most delightfnl spots in all Colorado for wild flowers are fonnd on the slopes of Lookout Mountain immediately back of the town of Golden. It is a commendable tribnte to the population of this little mountain community that wild flowers are still to be found in abundance right at their back door. As Golden is now a gateway to Denver's wonderful system of mountain parks, these wild flowers add mnch to the charm of the seventy-mile trip that tonrists enjoy

IT CLOTHES THE MOUNTAIN MEADOWS IN PURPLE

There are several species of loco commonly found in the Colorado Rockies, all of which grow in the open along the roadways or in the meadows of the parks. The most common is a brilliant purple variety (*Astragalus nitidus*) which sometimes covers the meadows as thickly as does the familiar field or ox-eye daisy of the Eastern States. The variety shown here is quite the most handsome of its kind both for its size and color. The flowering heads are from six to eight inches in length and the individual blossoms full half as large as a sweet pea, the color varying from a greenish or pure white to a delicate purple. A moist meadow profusely carpeted with this mountain flower in all its many hues is a veritable fairyland of beauty

A ROADWAY, AND LODGEPOLE PINES AT HIGH ALTITUDE

Lodgepole pine (*Pinus murrayana*) is probably the most common and typical tree from 9000 to 10,000 feet altitude. It forms the most dense forests of the Rocky Mountains, sometimes being almost impassable even to the traveler on foot. The beautiful, tall, slender trunks make excellent material for the woodsman's cabin, and in fact this tree was used by the Indians in erecting their tepees. Now it serves for telegraph poles, railway ties, fence posts—and wherever long straight timber is desirable.

Mountain roads make the Rockies of Colorado easily accessible for the autoist, even into the very high altitudes in some localities; but the traveler who wishes to see and enjoy these great hills will take his pack upon his back and brave the lodgepole forest and the rocky cliffs. If he is alert, he will be well repaid for all the discomfort he may suffer, for there is no region in all our land so full of interest for the nature lover

A WELL-FRUITED SPRAY OF THE LODGEPOLE PINE[1]

On exhibition in the forestry hall of the American Museum of Natural History

The lodgepole pine often forms mountain woodlands which seem unending, and the man who has ventured off the beaten trail to cross a belt of lodgepole, can testify to the density of its growth

[1] *The story of its collecting.*—The greatest surprise that awaits the collector of tree specimens in the Colorado Rockies is the distance one must travel to find them. The wooded hills apparently have no bounds and there are vast tracts of dense timber, but a tract miles in extent may afford only one or two species.

One day in August I made an early start from Estes Park, about 7500 feet elevation. A trail breaks from the roadway a short ride beyond the village. It soon leaves behind the scattered western yellow pines, and at about 8000 feet abruptly enters the dense growth of lodgepole pine. Here the trail becomes steep and rugged, rising 2500 feet in about three miles, and wanders back and forth over the rocky wooded slopes, sometimes following for some distance a wild, rushing, snow-fed stream. The object of the trip was often interrupted by the sight of a deer or the flushing of a grouse, and my attention continually wandered with delight over the unexpected gardens of wild flowers.

The lodgepole forest which began so abruptly at 8000 feet ended in the same characteristic manner at about 9500 feet, where the trail breaks into the spruce and fir belt, reaching to timber line which in Colorado is about 11,500 feet. Thus far I had seen but the two species of pine, the yellow and the lodgepole. Well fruited specimens of these were located but were not collected until we were homeward bound, so as to subject the branches to the least possible jolting. The latter part of the climb was made difficult and uncomfortable by a rain cloud which enveloped us so that at times we could see but a few yards ahead. This made it hazardous to wander into the woods far from the beaten, crooked path, and although the trail was lined with Douglas fir and Engelmann spruce for some distance, we were unable to discover any well-fruited sprays. A good specimen of the alpine fir was taken, however, and, once out of the higher hills, we were in sunshine again and in no time were back on the picturesque lodgepole trail, where the exceptionally fine branch shown above was collected.

Entering again the region of the Rocky Mountain yellow pine, we picked up our previously located branch and hurried on our way in order to pack for shipment the specimens we had collected. The process of packing for the long trip to New York required care, but as little time was lost as possible in getting the specimens to the village express office. I learned with satisfaction a few days later that this package had arrived at the American Museum in perfect condition after its 2000 mile journey. The sprays can now be seen on exhibition in the Jesup collection of woods of North America.—THE AUTHOR.

THE MOUNTAIN FOREST IS HOME TO THE PINE SQUIRRELS

The pine squirrel abounds in the thick woods as is evidenced by the frequent piles of scales from the pine and spruce cones on which he has fed. Whether his excited chatter is a warning to the other animals and bird folk that there is an unwelcome visitor in their forest is not clear, but it is certain that the collector who may be looking for a pine squirrel will have no trouble in locating the object of his search. The little fellows do not readily become accustomed to campers as do many other small animals and birds. The chipmunk is very friendly after the first day or so, the pack or trade rat is notoriously familiar, and the Rocky Mountain jay or "camp robber" has a reputation not less unenviable. Larger game is plentiful and the camper's sleep is often disturbed by the howl of a coyote or, if it be in the fall of the year, by the whistle of a big bull elk, and either will send a chill up the spine of the uninitiated

THE WARDENS OF THE LOST LAKES

Dense forests of Engelmann spruce act as wardens of the Lost Lakes which lie hidden among them. This is at the foot of Flat Top Range in the Wild Basin region of Rio Blanco County. "Lost" the lakes are, indeed, and remote from roads, or from trails except of deer, elk and mountain sheep, so that even old woodsmen at times have difficulty in searching them out. The height of the distant range can be appreciated from the fact that it is more than a mile from the far edge of the forest to the foot of the range and that the rise at this point exceeds 3000 feet, entirely too precipitous to permit of scaling it from this side. In the foreground is seen the scrubby willow on the tender buds of which the ptarmigan feeds in winter. The first heavy snow usually falls in late October

"ADDER'S-TONGUE" COVERS THE HIGH SLOPES WITH YELLOW

A variety of adder's-tongue (*Erythronium parviflorum*) found in the Rockies differs from the eastern form in that the flower is pure yellow and the leaf a light monotone green. Near timber line it literally carpets the mountain side in places. It startles the traveler who, climbing along the woodland trail which suddenly breaks through the last belt of timber, sees what appears to be a vividly yellow mountain. The brilliancy of the golden yellow in the sunlight is beyond description. *The Spell of the Rockies* is the title of a book on travel in the Rocky Mountains,[1] and to anyone who has traveled these hills the expression is full of meaning. We do not need to climb to the top of the highest peak and look across the endless chains of hills and down upon the rest of the world to experience the thrill; the "spell" comes with the ever-changing variety and beauty of the scenery and the wild life.

[1] *The Spell of the Rockies*, by Enos A. Mills. Published by Houghton Mifflin Company. Mr. Mills has explored the Rocky Mountains alone and on foot for many years, especially in the vicinity of Longs Peak. He has written books and articles and given many addresses advocating conservation of life and scenery and is known as the "Father of Rocky Mountain National Park."

A WALL OF THE CRATER OF AN EXTINCT VOLCANO AND TRAILS OF MOUNTAIN SHEEP

On the extreme western border of the new Rocky Mountain National Park are the "Specimen Mountains." The name was given because of the many specimens of geodes found on their western slope which forms a part of the wall of the crater of an extinct volcano. Grotesque formations of rock in vivid and varied colorings rise out of the steep slope of the crater like ruins of an ancient city and give an interest to the scene which is otherwise quite desolate. The greater part of the crater lacks entirely the vegetation which is so profuse on the mountain slopes. In spite of this fact one may at any time see here several bands of mountain sheep for the spot is admirably adapted to their protection. The slopes show a veritable network of sheep trails, plainly visible in the picture. The piping of a cony or the whistle of a marmot is the only other sign of life in this great "hole in the earth," yet there is an interest about it all which attracts the visitor, and he might easily spend a whole day walking about in it and return yet again and again

THE GLORY OF SUMMER TIME IN THE MOUNTAINS OF COLORADO

Perhaps nowhere else in all America is there to be found such abundance and variety of wild flowers. The species in the open spaces and along the streams differ from those along the wooded trail, and again the forms change at timber line. Here in Colorado, at about 11,000 feet, are veritable gardens of flowers which it would seem must have been arranged by a landscape artist. Even the upturned surfaces of rocks where slightly concaved and though several feet above the ground, have gained enough soil to serve as *jardinières*, and nature has not slighted the invitation. The beautiful blue columbine (Colorado's state flower), with the deeper blue of the larkspur, the rose-colored wild geranium, the wild buckwheat, and the painted cup, may dot a few square feet of earth like strokes of clear color from the painter's brush. One of the most interesting, from standpoint of variation in color, is the painted cup, which ranges from brick red in the lower altitudes to the most brilliant purples near timber line. One of the charms of mountain flower life is that so many varieties which bloom in the very early spring in the low altitudes are found several months later in full bloom in the higher parts. Thus the season for many of our most sought after flowers is greatly lengthened

HUGE GRANITE ROCK PILES

Bordering the numerous parks and cañons of the Rocky Mountains, huge masses of solid rock are commonly found from the foothills to the tops of the highest peaks. The traveler soon realizes whence the name of this range has come. The rock is largely a coarse-textured pink granite, and gives to the landscape a delightful variation in color scheme. These huge granite piles the rock chuck, the pack or trade rat, and many other small mammals find excellent cover and make their homes there

Russian Explorations of the Siberian Ocean in 1918*

By A. W. GREELY

Major General, United States Army, Retired

IT is a special satisfaction to learn that the Great War has not entirely absorbed the activities of the world along scientific and adventurous lines. In recent years the hydrographic surveys of the Russian Empire, largely conducted along lines of operations devised by Lieutenant General J. C. Schokalsky, of the Russian navy, have been extended in their fields and important in their results. Summaries of such surveys have been correlated and published by Schokalsky both in Russian and in English journals. It is encouraging to learn that these surveys have been continued in 1918.

It will be remembered that in 1914–15 Captain Vilkitsky, commanding the ice-breakers "Taimyr" and "Vaigatch," made the first voyage of any kind from Bering Strait westward to the Atlantic Ocean.[1] Besides surveying the coast waters of the Siberian ocean, he had already added in 1913 two new islands to the New Siberian archipelago, which discoveries he now supplemented by a new island in the Bennett group, discovered by De Long in the "Jeannette" expedition, 1880–81.

Vilkitsky's great discovery was the archipelago of Nicholas II, directly north of Cape Chelyuskin. This archipelago extends about two hundred miles to the northwest, having been explored as far as 82 degrees north latitude, and 93 degrees east longitude. In his surveying voyage of 1914—when he sailed from Vladivostok—Vilkitsky endeavored to rescue the shipwrecked men of the "Karluk," then in great distress on Wrangell Land. The island was so surrounded by heavy ice that it could not then be reached. With him at that time were Lieutenants N. Evgenoff and A. Nikolsky, of the Russian navy, now on duty at the embassy in Washington. Later explorations of Nicholas II archipelago showed that one island was one hundred miles across from east to west, and its geological structure indicates clearly that it was, in earlier ages, a northerly extension of the continent of Asia.

General Schokalsky reports a renewal of the survey work in the Siberian ocean during 1918, and it is understood that expeditions are now in the field, although it is more than possible that recent war operations may have interfered with the work. The plans for these surveys were drawn by the Hydrographic Administration, the most active members being the Chief of the Administration and Hydrographer E. L. Bialckos. The western section of the expedition, working from the White Sea eastward to Cape Chelyuskin, remains under command of Captain B. A. Vilkitsky. The eastern expedition, surveying from Cape Chelyuskin to Bering Strait, is commanded by Captain P. A. Novopashhennij. Sea surveys will be supplemented by shore stations, where tidal, meteorological and other hydrographic observations will be made continuously for two or more years. The expeditions will be kept in connection with each other by radio shore stations, of which three have been in operation for several years: Jugor-shij, Karskia Strait; Cape Mare-sale, Jamal Peninsula; and Dickson Inlet. As soon as possible other radio stations will be installed in east Matochkin Shar, Obdorsk, at the mouths of the Enissei and Petchora, Nakhodke, Obi Gulf, the mouths of the Lena and Kolima, and at other less important points.

The scientific labors of the expeditions will be supplemented by such studies by experts as may serve to develop the great resources of Siberia from economic and commercial standpoints.

[1] See AMERICAN MUSEUM JOURNAL, Vol. XIII, pp. 347–49.

* This summary of exploratory work in the Siberian ocean was received by General Greely in a private letter from Petrograd.

Recollections of Travel in Peru[1]

By ROLLO H. BECK

ARMED with letters of introduction, I started out the morning after my arrival in Lima, early in January, 1913, with the hope of obtaining a government permit to collect a dozen or so of the innumerable shags or cormorants that had formed one of the sights of the day before as we sailed southward along the shores of Peru. As the Peruvian government derives a yearly revenue of many thousands of dollars from the sale of guano, the birds are carefully protected,—how carefully protected I did not learn for more than five months, at the end of which time permission to collect the birds was finally refused. Although I was introduced to the Government Minister by a leading official of the Peruvian corporation which had the concession for gathering the guano, and although the American Minister to Peru added the weight of his office to my plea, the weeks and months of waiting were in vain so far as government sanction was concerned. Between my semiweekly, weekly, biweekly, and finally monthly visits to the government offices to learn the progress of my petition, I spent my efforts collecting birds which were not government protected.

By far the most interesting birds to me in and about Lima were the black vultures. In California I was accustomed to the wariness of the turkey vulture, which seldom allows approach within shooting distance; therefore these tame scavenging birds in their relation to the sanitation of the city and country afforded constant surprises as well as considerable amusement. At one of the slaughterhouses of the city the birds sat around on the trees, roofs, and fences by the dozens, waiting for the killing of an animal that the health officer would reject as unfit for human food. The diseased carcasses would be hauled out into the street less than a block from the entrance to the yard, and the birds did the rest. One large fat hog disappeared completely in two hours, while a rather skinny cow lasted over night. The tameness of the birds was shown particularly along the railway embankment when the half-hourly trains between Lima and Callao passed. Of a dozen birds sitting on the sloping ground from three to fifteen feet below the rails, two thirds perhaps would fly off a few yards, but the others would remain while the train passed practically just above their heads. Out at Chorrillos, where I often collected, the trail I followed passed the city dump, and one could always see several black vultures walking gingerly about the burning piles of garbage, vying with dogs and pigs and sometimes a burro or two in picking out bits of food from the smoking heaps.

The country roads about Lima were often deep rivers of dust and I soon learned to follow the custom of the country in climbing up and walking on top of the wide adobe walls which are used both as fences and footpaths in many places. I remember what had been my amazement late one afternoon of my first trip into the outskirts of Lima, when, in looking across a small field of growing corn, I saw a large dog trotting along apparently on the top of one of the farthest corn rows. He jogged along unconcernedly and it was not until he passed beyond the cornfield that I saw he was on top of an adobe fence.

Several times the magnificent South American condors were seen between Lima and Callao, slowly circling high above their smaller relatives, the black and turkey vultures. By the end of February, no action having been taken on my permit, I decided to go up to Lake Junin for a month. Lake Junin is situated nearly thirteen thousand feet high and, in addition to being frequented by many of the high Andean water birds, is the home of two or three species peculiar to itself. Through the kindness of the president of the Cerro de Pasco Railway Company we were given the use of his shooting lodge close to the railway line a half mile from the lake, and this proved to be

[1] Peru, visited by Mr. and Mrs. Beck in the early part of 1913, was the first station on their five-year collecting trip to South America for marine birds. The specimens obtained on this expedition are now deposited in the Brewster-Sanford collections at the American Museum. Other accounts of Mr. Beck's experiences are given in the JOURNAL for November, 1917, and for January and February, 1918.

much more convenient than quarters in the village of Junin would have been. The cabin was fitted up with all the necessary articles for keeping house—with the exception of the stove. There had been a stove, but some enterprising railway section boss had carried it off to warm his tent somewhere up the line. Mrs. Beck therefore did the cooking in the fireplace. In walking down to the lake shore during the first week of our stay we saw many golden plover on the open tundra, getting in shape for the long flight to Alaska, where I had met their kind the summer before. Three other species of North American shore birds were also common about the lake, as well as the blue-winged teal, one of the North American ducks.

The most striking birds of the district were the flamingos. Standing in the doorway in the early morning we could see a pink line along the edge of the shallow water as the birds gathered their morning meal, and a little later, when the sun lit up the low, rough, snow-capped peaks of the Cordillera a few miles to the westward, we could see the flamingos take wing and fly on to some safer resting ground far beyond our vision.

Changes of temperature were very sudden about the lake. We might be rowing along, coats off in the bright sunshine, when a lazy looking cloud would come drifting over from the eastward. A chill wind would rise and in a few minutes a snow or hail squall would strike us and raincoats would be donned in a hurry, to be discarded probably a few minutes later when the sun appeared again. It is said locally that Lake Junin is the home of the largest frogs in the world.[1] I saw but one in the lake and then only for a moment as it came up for a breath of air and dived on seeing the boat; but later, at Cerro de Pasco, we saw a number hanging in the market place for sale, and I judged a single leg might be ample for a meal.

One Saturday afternoon we flagged the freight train and went up to Cerro de Pasco, which lies a few miles beyond the lake. We were greatly astonished as well as immediately appreciative when we were ushered into a steam-heated, electric-lighted room, with running hot and cold water and a porcelain bathtub. We found later that the railroad company maintains this building for its employees, and it certainly makes their lot much more bearable at that high altitude. One of the officials showed us about the immense smelter, with all its powerful, up-to-date American equipment, and, later, we had a chance, on the outskirts of the town, to watch the native miners bringing out in leather sacks on their backs silver ore from their small mine, as did their progenitors hundreds of years ago. Close by were other shafts equipped with modern machinery which made the contrasts more emphatic. Another remarkable feature of this barren, treeless, mountain top more than fourteen thousand feet high was the excellence and variety of fruits and vegetables for sale in the public market, all of them brought up from the eastern slopes of the Andes on burro and llama back or on the heads of the Indians. The oranges were sweeter than any we had eaten in Lima, the capital, and the variety of vegetables was fully as great. We walked out over the hill for a mile or so and looked far down a cañon to the eastward, through which a winding trail was visible, and we stood aside from the trail while a herd of llamas passed loaded with green fodder grown in the warmer cañons miles below us. The next day, after buying some bread and vegetables, we returned to our work again. When our diet of wild ducks or snipe palled on us, our Indian helper would go to some Indian village near by and purchase half a sheep, paying therefor seventy-five cents or a dollar, the price depending on the size of the animal. We often bought eggs also which were very reasonable in price. We were especially interested in one village boy about ten years old who used to come over frequently with his spindle and ball of wool which he industriously wound while watching us skin birds. He never made a sound, and each night when the sun went down returned home with a piece of bread and jam.

At the end of a month we packed up our birds and, hailing the freight train one afternoon, left for lower levels. About ten miles above Oroya, our destination for the day,

[1] These frogs, *Bactrachophrynus microthalmus* Werner, although larger than our North American bullfrogs, are not nearly as large as the giant frog *Rana goliath* Boulenger, of Gabun, Africa. *Batrachophrynus* is related to the West Indian "bullfrog" but because of its aquatic habits has developed the general form of aglossal frogs and has lost all but the slightest trace of a tongue.

INDIAN VILLAGE BUILT OF ROCKS FROM THE SOIL

A short distance to the southward of Puno, on Lake Titicaca, is a rocky ridge on which is situated a typical Indian hamlet. The huts are built of the rocks taken from the soil and of mud, and are roofed over with the tough, coarse tules brought up from the lake shore. Affixed to each roof is a roughly made cross. Strongly built stone fences surround each house and serve as corrals for the pigs, cows, and llamas which during the day are grazing nearby under the care of some of the smaller Indian children. The soil is burdened with stones, so much so indeed that the pile removed from a plot in order to farm it sometimes covers more ground than the cultivated area. In all this region of the ancient Incas, about Lake Titicaca, the amount of work which has been done to enlarge and protect the cultivable land amazed us continually the conductor slowed down the train and I jumped off to have my first and only experience with the rare spur-winged ducks. These birds live in swift, tumbling mountainous streams and can proceed upstream, under water, at a rate perfectly astounding to one unacquainted with them. I managed to secure a couple of specimens but lost several that were swept under the banks or through rapids where the eye could not follow them. I walked down the cañon which became continually wider, with small patches of ripening barley and of thrifty potato vines along both sides of the railroad track. Occasionally a patch only forty or fifty feet square would be seen fenced on all sides by a stone wall; one enclosure contained only five rows of ten potato plants each or a total of fifty plants, and I saw other patches with even fewer plants. Rotation of crops was followed evidently by at least some of the farmers, and the well-filled heads of barley were especially surprising at that high altitude, more than twelve thousand feet above sea level.

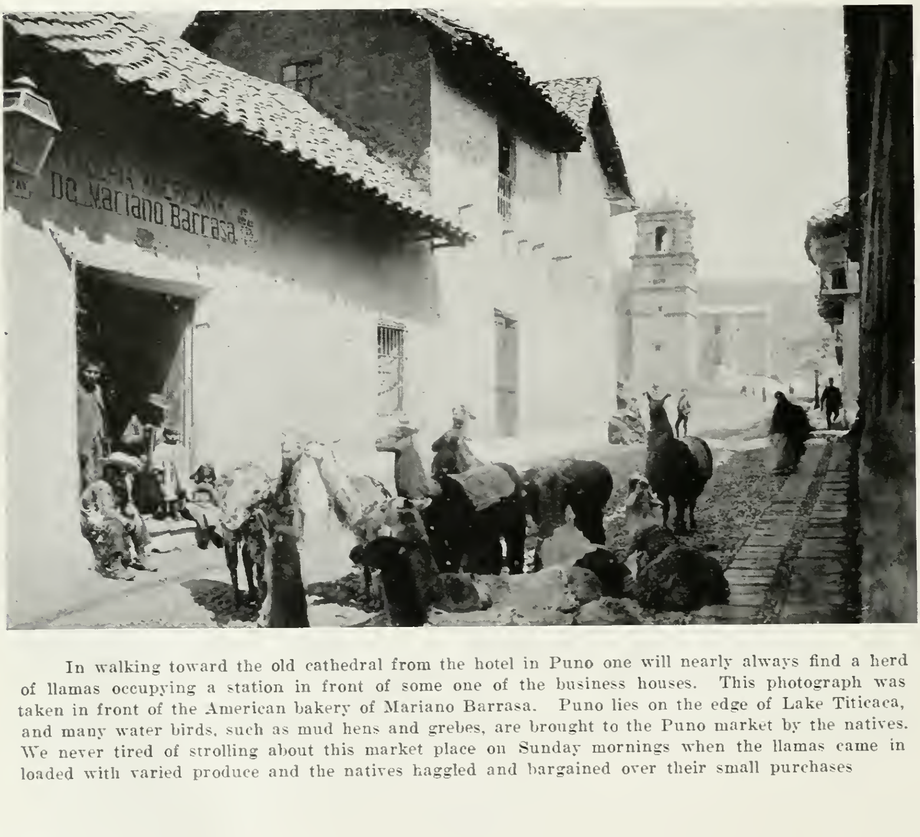
The journey from Oroya to Lima was enjoyed even more than we had enjoyed the upward trip. Being now accustomed to the thin air we were able to get out of the train at Ticlio, the highest point, 15,600 feet, and stroll about the station during the half-hour wait. Here, as at most other stations, a crowd of Indians had gathered to see the train arrive and depart. It was surprising at each station to see the number of the poorest natives that evidently had business at some station farther along the line. The second-class coaches were always full and, as we neared Lima, the first-class became crowded also. In dropping down the hundred miles from Ticlio to sea level more than sixty tunnels are gone through and more than sixty bridges crossed. In the same distance more than a dozen switchbacks are used to negotiate the steep cañon sides along which the railway runs. When one tires of

At one of the entrances to the principal market of Lima, Peru, it is often possible to buy freshly sliced pineapple from small boys who carry some dozens of slices about on large plates. Each piece is sprinkled with sugar before being delivered to the purchaser

At Cerro de Pasco, a few miles beyond Lake Junin, situated nearly 16,000 feet above sea level on the barren, treeless mountain tops, we found a wonderful display of fresh fruits and vegetables in the market place. All of these are brought up on the backs of burros and llamas and on the heads of the natives, from the warm eastern slope of the Andes thousands of feet below. It was here that we saw giant frogs hanging in the market place, so large that we judged a single leg would be ample for a meal. We remained a month in the high altitude of the vicinity of Lake Junin and studied and collected many species of mountain birds, especially ducks, snipe, plover, and other high Andean waterfowl. It was at a somewhat lower altitude, when we were on our way back to Lima, that I had my first and only experience with the rare spur-winged duck, a bird that can swim upstream in the swift turbulent mountain current at an astounding speed

In the small Andean villages it is often possible to get a whole sheep for a dollar from some farmer or his wife, who brings it in to town and sits patiently down in a likely spot until a buyer appears

We found burro loads of green alfalfa for sale at Salaverry, Peru. Alfalfa is grown everywhere up to an altitude of 11,000 or 12,000 feet, above which the traveler has to depend on dried forage or mountain pasture, unless, perchance, llama loads of green fodder have been brought up to the higher markets from warmer cañons below, as we found was the case at Cerro de Pasco. Both the burros and the alfalfa are Spanish importations into Peru, and are well adapted to the country



In walking toward the old cathedral from the hotel in Puno one will nearly always find a herd of llamas occupying a station in front of some one of the business houses. This photograph was taken in front of the American bakery of Mariano Barrasa. Puno lies on the edge of Lake Titicaca, and many water birds, such as mud hens and grebes, are brought to the Puno market by the natives. We never tired of strolling about this market place on Sunday mornings when the llamas came in loaded with varied produce and the natives haggled and bargained over their small purchases looking across the cañon and counting the number of stone fences between the cañon top and the roaring torrent in the bottom, or trying to count the number of llamas in a flock as they climb some precipitous trail homeward, he can turn his eyes heavenward and watch the wonderful sailing of the great American condors as they circle about the cañon. Lower down in the foothills green orchards and plantations are passed and, as Lima is neared, fields of sugar cane and herds of feeding cattle greet the eye.

I was greatly surprised, the day after our return, on inquiring at the government offices, to find that no action had been taken on my application for the collecting permit. So, after working a week around Lima, we went up the coast some twenty odd miles to Ancon, off which are several islands where many sea birds nest. Here I obtained a fine lot of sea birds other than those government protected. There were three species of small petrels quite common five miles offshore and one of these species was nesting on one of the islands. I was interested to find, in collecting several dozen birds near the island, that nearly all were of two species not nesting there. The nesting birds probably went farther out to sea to feed, as they were found later two hundred miles from land. The commonest bird of the three species was Wilson's petrel, which nests hundreds of miles south of Cape Horn. During the Antarctic winter these birds come north on both sides of South America, on the Pacific side seemingly seldom above the equator, but on the Atlantic they are common visitants to at

On Sunday mornings there is usually a fleet of twenty or more balsas tied up near this wharf at Puno. Early in the afternoon the owners begin to straggle down from the town and by sunset nearly all are gone, either poling along the shallow water or, if the wind is fair, using the crude sail made of dried tules which is hoisted only when the wind is abaft the beam. These native hunters obtain many ducks and other water birds in the clumps of tule at the margin of the lake and display them in the Sunday market of Puno. The birds are picked clean of feathers to the bill and sometimes partly cooked; they sell for about five cents gold each least New England, and occasionally they are seen in New York Harbor.

Ancon was formerly thickly populated with Indians, and in the sand hills a mile or two back from the present town is a large cemetery which has been pretty well rifled for treasures it may have contained. We happened to discover the spot one hot Sunday afternoon while out for a walk, and our recollections of Ancon always bring back the memory of dozens of whitening human skulls, with a solitary, lonesome-looking Englishman ruthlessly knocking a golf ball over the sacred ground.

Our return to Lima was again characterized by a futile attempt to get a decision on our modest request, so a schooner was chartered for a month and we went out to sea to collect on the ocean. Fifty miles out and beyond, we encountered several species of ocean birds which usually do not come much nearer land except in the nesting season. One day I was out in the rowboat some distance from the schooner and just in the act of picking up a rare bird from the water when I was thrown backward by some object striking the boat underneath. Looking behind me, I saw a large shark making a dash for the boat. A strong jab with the oar disconcerted him a little but he rubbed himself a number of times on the bottom. I even reached over and scratched his fin, after I had observed that there were several small remoras bothering him. These little sucker fish hang very tenaciously to their host; about the Galápagos Islands in other years we had often hauled sharks and turtles aboard with several remoras clinging to them.

Near the end of the cruise we anchored one night below Pisco Bay some distance south of Callao. Parading along the shore of the quiet bay were forty or more flamingos in company with a great flock of shags, gulls, pelicans, and shore birds of several species. It was surprising enough to see the flamingos in such company, but it was more surprising to see four species of Alaskan birds back already on June 30 from their northern summer homes. The surf birds especially seemed out of place along the warm, calm waters of a protected shore. I associated them with dashing breakers and strong cold winds from the open ocean, for such had been their chosen spots when I had previously met them.

After the government powers had had my application before them for half a year they decided finally that permission could not be granted me to collect specimens of their guano producers, although all other birds were at my disposal. As I had, while awaiting this unexpected answer, obtained series of nearly all the other water birds in the vicinity, we took steamer for Mollendo, southern Peru, and went by rail up to Lake Titicaca where several desired species of birds were known to live. Before beginning our work at the lake we spent a couple of days at Cuzco, the Inca capital. Our ride up to Cuzco from Juliaca, the junction point, happened to take place during the festival season, and at several of the stations along the way groups of Indians were dancing and marching about the villages. Oftentimes women would be prancing and circling about, with heavy children bobbing up and down in the shawls swung over their backs. At one stop, a few rods from that station, we saw a pair of oxen tramping out a stack of grain quite in the fashion of a couple or more thousand years ago.

The astounding amount of work that has been done to enlarge and protect the cultivable area amazed us continually. One field of several acres I remember particularly, where the portion of the ground that had been made fit for use by the removal of the rocks was smaller than that covered with immense rock piles.

One or two of the old cathedrals in Cuzco have far finer hand-worked figures, chairs, and pews than are those of the many churches we entered in the other countries of South America. The beautifully mortised stones along some of the streets and the immense hand-worked rocks forming the walls of the old Inca fort above the town are worth traveling many long miles to see. Mrs. Beck will always remember Cuzco as the place where she obeyed the demand of a devout barefooted Indian who sternly requested her to doff her hat, in the manner of all the men on the sidewalk, when the procession carrying the Holy Image passed on its way to church. The women of that country go to church bareheaded or wear only mantillas over their heads.

Lake Titicaca, 12,500 feet above sea level, bears on its bosom several steam-driven vessels as well as the numerous balsas of the native Indians. On Saturdays and Sundays there was quite a fleet of the latter craft tied up near the steamer which carries passengers and supplies to the Bolivian side of the lake, and the passing tourists had great opportunities to step across the wharf and snapshot the unwieldy looking canoes. Through the kindness of the Superintendent of Railways and Steamers I was furnished with a boat from a steamer in port to do my collecting, as the balsas were slow going, especially against the wind. The native hunters in these balsas, however, obtain many ducks, mud hens, and grebes by poling around the clumps and patches of tule close to shore, and we saw many birds of these species in the market, picked clean of feathers clear to the bill, which were being sold for about five cents gold each. One day I saw more than fifty in a pile ready for Sunday's market, most of them having been partly cooked to keep them from spoiling.

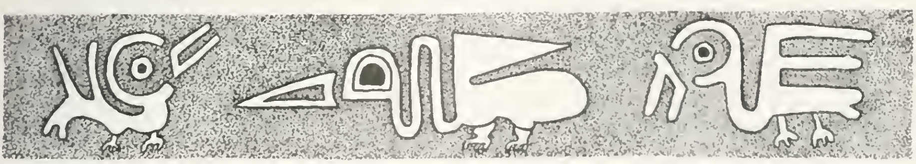
During our stay at Puno, which lies on the edge of Lake Titicaca, the Independence Day of Peru was celebrated, and the very excellent procession and cleverly arranged floats which were a part of the celebration would have been a credit to towns many times larger than this up-in-the-air community. We were particularly impressed with the fortitude of some of the lightly dressed children on the floats, as the procession halted in the cool evening air at various places around the plaza to allow the orators time for their declamations.

We rarely tired of strolling about the busy market place on Sunday mornings watching the llamas coming in with their varied loads of produce, and the haggling and bargaining of the poorer natives as they bought a cupful of grain or beans, it might be, or possibly a hat or a pair of sandals from some one of the dozens of venders squatted down in the open street with wares spread out in front of them.

At the end of a month we had collected the desired birds and, having packed them securely for shipment to New York, headed downward toward Mollendo. The traveling, crescent-shaped sand heaps which are on both sides of the railway for several miles in one desert section of this journey are the most likely-to-be-remembered sights to the traveler. Dozens of the sand dunes are seen, all of them traveling slowly with the wind, the particles of sand from the windward side blowing up over the pile to be buried on the lee side, later to reappear and go over the top again.

The Harvard Observatory, near the famous Mt. Misti, with its very hospitable and courteous staff of American observers will be remembered by all Americans who take the pleasant ride out to it from Arequipa. Arequipa, at more than 7500 feet elevation, is the trading center for a large mountain population. One may see herds of llamas, laden with dried mutton and other mountain products, traveling the same narrow streets on which the electric railway runs; and in the evening one may visit the ice cream parlor, where men are the principal customers, and buy the finest pastry to be found in all Peru. Leaving Arequipa in the morning, we arrived at Mollendo at noon and, after dining, were rowed to the steamer anchored some distance out from the rocky coast on which the town is perched. At dark the anchor was weighed and we started southward to begin our work in Chilean waters.

The very pleasant reception and kindly treatment we received from all the English-speaking people, whether Peruvians, English, or Americans, with whom we came in contact in Peru, will always remain among our most vivid recollections of that wonderful country.



LITTLE RIVER FALLS, LOOKOUT MOUNTAIN, ALABAMA

These two views of the Little River Falls were taken on August 30, 1911, looking upstream, the one at the left from the DeKalb County side, the other, showing the larger fall, on the Cherokee County side. On the rocks in midstream and in moist sand at the edges of the river bed are many rare plants that would be destroyed if a dam were built here

Some Vanishing Scenic Features of the Southeastern United States[1]

By ROLAND M. HARPER

Formerly Botanist on the Geological Surveys of Georgia, Alabama, and Florida

As civilization spreads over the face of the earth more and more of nature's handiwork is necessarily disfigured or destroyed. The primeval forests are cut down to make room for farms and settlements, or are used up faster than they grow for fuel and building material, or in some localities are killed by fire, smoke, or smelter fumes. Picturesque rock formations are converted into building stone or road material, or blasted away in the process of mining, and waterfalls and rapids are dammed up for power or navigation, or both. As progress is the prevailing ideal, the conversion of irreplaceable natural resources into wealth is almost universally looked upon as not only inevitable but highly commendable, especially by those who do not look very far ahead. And of course if no trees had ever been cut or rivers dammed or mines and quarries opened this country would have only a sparse population living mostly on fish and game, as the aborigines did, and much of the scenery that we now admire and enjoy would be "wasting its sweetness on the desert air."

The immediate economic effect of the destructive exploitation of natural scenery is usually to increase the wealth of the individuals or corporations responsible for it, and sometimes to enable persons living in the vicinity, or even at a considerable distance, to get some necessities and luxuries, such as lumber, farm produce, or electricity, a little cheaper for a time; but that, to a true lover of nature at least, hardly seems a sufficient reason for depriving all future generations of the opportunity to enjoy or study the features in question. Moreover, the ultimate effect is merely to allow an increase of population, for that seems to depend on economic opportunities as much as anything else, and the total population of the world or any part thereof tends to keep pace with the total wealth. (This principle of limitation of numbers by opportunities is still more obvious in the case of wild animals and plants.) It is human nature to take pride in rapid growth and large population figures for one's own city or country, but it has not been proved that the inhabitants of congested districts are any happier or freer or more efficient than those who live farther apart, and at all stages of the world's history there have been those who sincerely lamented the passing of the good old days, when people were not so crowded and there was more opportunity for the development of individuality.

Somewhere between the primitive condition of a "howling wilderness" and that of areas almost completely occupied by farms or buildings, like Iowa, the blue-grass region of Kentucky, Manhattan Island, Prince Edward Island, Flanders, and the lowlands of China and Japan, there should be a happy mean, with a certain minimum of natural scenery, say not less than one per cent of every county and five per cent of every state, left intact for the benefit of all who may wish to enjoy it now or hereafter. There is perhaps no purer pleasure than that derived from the contemplation of nature's masterpieces, and a world in which some of them are within easy reach of every one ought to be a happier world than one wholly dominated by commercialistic motives.

It is said that the appreciation of nature is a comparatively modern concept, which hardly existed anywhere a century or two ago; medieval travelers saw nothing but hideousness in alpine scenery, and in primeval forests they were in constant fear of wild beasts and unknown perils. But now

[1] All the illustrations are from photographs by the Author, except those of Tallulah Falls and Stone Mountain, for which he is indebted to Prof. S. W. McCallie, State Geologist of Georgia.

In the few months that have elapsed since this article was put in type the termination of the great war has altered some of the situations described, but it seemed better to publish it in its present form and ask readers to bear this circumstance in mind than to undertake extensive alterations at this time. Another recent development worthy of mention is the organization a few months ago at Waycross, Georgia, of an "Okefinokee Society," whose object is to preserve from destruction the great swamp described herein.

View near the southern end of the Everglades, looking south.—Note the calcareous incrustation on the saw-grass stubble. Photographed March 29, 1909

when a particularly charming bit of scenery that has been enjoyed by thousands and is capable of giving pleasure to millions more if let alone, is threatened with destruction by selfish interests, a vigorous protest is often made, and sometimes is effective. And although many people even yet seem about as indifferent to the beauties of nature as animals are, there is reason for believing that the number of appreciative ones is increasing in spite of the vast development of industrialism.

Most New Yorkers probably are familiar with the long-continued fight to save Niagara Falls from spoliation by power syndicates, and can easily recall how the Palisades of the Hudson were saved for the public about ten years ago, after quarrymen had already done considerable damage. In the West quite a number of scenic features on government land have been set aside in recent years as national forests, parks, or "monuments," and the public is being invited and even urged to go and enjoy them. In California a few years ago there was a prolonged fight—successful in the one case and not in the other—to save the groves of Big Trees from exploitation by lumbermen and the beautiful Hetch-Hetchy Valley from being flooded to form a reservoir.

In the East, where there is hardly any more federal government land, beautiful tracts have been reserved by the states, like the Adirondacks in New York, Mackinac Island in Michigan, and Starved Rock in Illinois, or donated to the public by private individuals, as in the case of a part of Mount Desert Island, Maine, and Letchworth Park, in Livingston and Wyoming Counties, New York. And even in such a supposedly mercenary city as New York about ten per cent of the land area, some of it practically virgin forest, is reserved for park purposes, although it would be worth at least $100,000,000 now for business or residential purposes, and costs a large sum annually for maintenance.

Among places of scenic or scientific interest in the northeastern states which have been partly destroyed by the march of civilization are the Hempstead Plains of Long Island, some of the beaches of southern New Jersey, the Kankakee marshes of Indiana, the prairies of Illinois, and the Dalles or Dells of the Wisconsin River. The present article deals with a number of such places in the southeastern states, equally attractive or interesting but not so widely known, that are about to meet a similar fate, or have already been partly or wholly ruined. Some of them have been written about at considerable length in publications of wide circulation, while others are known chiefly to botanists, zoölogists, and persons living in the vicinity.[1]

Okefinokee Swamp, covering about seven hundred square miles in southeastern

[1] Descriptions of the Everglades have appeared in several encyclopædias, and notices of the Hempstead Plains, Okefinokee Swamp, and Stone Mountain, with references to some previous literature for each, can be found in the latest edition of the New International Encyclopædia (1914–16).

Georgia, partly wooded and partly open marsh or wet prairie, has been visited more by hunters than by sight-seers, but it has charms all its own for those who appreciate the wilderness. A fanciful account of it, based on Indian legends, was published as long ago as 1791 by William Bartram, but most of the literature relating to it is less than ten years old.[1]

The first serious disturbance of this primeval solitude had its inception in 1890, when a corporation organized for the purpose bought the greater part of the swamp from the state for 26½ cents an acre. A canal was soon dredged from the eastern margin to near the center, for the purpose of floating out the cypress timber to a sawmill on the edge of the swamp. It was planned to drain the area later, and convert it into farm land, which the promoters imagined would be very fertile. But the death of the president of the company in 1895 caused a cessation of operations before the swamp forests had been greatly disfigured, and the canal was put to good use in the next few years by hunters and occasional scientific explorers. After a dozen years or so had elapsed the successors of the original lumber company built a railroad from Waycross, the nearest city, into the northwestern part of the swamp, and began taking the timber out that way. This invasion seems to be still in progress, but perhaps it is not yet too late to make at least a part of the swamp a forest and game preserve, if sufficient interest can be aroused in such a project.

The Everglades is a vast saw-grass marsh, averaging about fifteen feet above sea level, and covering about five thousand square miles, in the southern part of Florida. It contains almost no timber or other useful vegetation, except clumps of bushes and small trees near its edges, and the saw grass which flourishes everywhere is a formidable

[1] A good description, with illustrations, published too late to be cited in the encyclopædia article, is that by Francis Harper in the *Brooklyn Museum Quarterly* for April, 1915.

Virgin forest of slash pine (*Pinus Elliottii*) with undergrowth of saw palmetto and other low shrubs, on Bugaboo Island in Okefinokee Swamp. Photographed August 7, 1902

West side of Paradise Key, or Royal Palm Hammock, showing the royal palms towering above the other trees. Photographed March 28, 1909

obstacle to navigation in the wet season as well as to walking in the dry season. Previous to 1890 there was no railroad anywhere near it, and the area was a *terra incognita* to all but the Seminole Indians who dwelt on its edges and to a few adventurous hunters and explorers who had penetrated the marsh for short distances. The extension of the Florida East Coast Railway to Miami in 1896 (and later to the Keys) made the Everglades much more accessible, and brought increasing numbers of sportsmen, tourists, nature lovers, and speculators; and since about 1905 the output of literature about it, both scientific and popular, has been considerable.[1]

Even before the railroad came near this had been looked upon as a potential farm area, on account of its mild climate and supposedly rich muck soil, and after many preliminary investigations and discussions, and a few heated political campaigns, the state began in 1906 the dredging of a series of canals to connect Lake Okeechobee, at the north end of the 'Glades, with the coast, and thus ultimately to drain the marsh. One canal from the lake to New River back of Fort Lauderdale was cut through a few years later, and has been used ever since, except in the driest seasons, by launches and other small craft. Considerable work has been done on other canals, and the water has been lowered a little, enough to allow some agricultural developments and real estate booms on the northern and eastern edges. At the same time a number of lawsuits and scandals have resulted from the attempts of enterprising speculators to sell land in the middle of the 'Glades (that cannot be drained for many years, if at all) at fancy prices to gullible persons living hundreds of miles away.

Chase Prairie, near the center of Okefinokee Swamp, on August 7, 1902

[1] Some of the best popular descriptions of the Everglades are in books and magazine articles by A. W. Dimock. An eloquent plea for the Seminoles has been made by Mrs. Minnie Moore Willson in her book about them, published in 1896 and later editions.

Muck land is not as inexhaustibly fertile as it appears to the uninitiated, however, and after the first few years needs to be fertilized heavily to produce crops; and the present war situation has made the supply of some fertilizing materials very uncertain, and thus tends to delay the exploitation of the Everglades, which would be a large undertaking at best. To drain this vast marsh would not only destroy a scenic feature that has no counterpart anywhere else in the world, but would also nearly exterminate countless birds and other interesting wild creatures, as well as the Seminole Indians, a formerly warlike but now very peaceful tribe. But the Indians have no status either as citizens or wards of the nation, and get no more consideration from the average Everglades promoter than the birds and alligators do.[1]

Royal Palm Hammock, or Paradise Key,

[1] So much has been written in recent years about the supposed advantages of draining swamps and marshes that some readers may be interested in the arguments on the other side of the question in the *Popular Science Monthly* 29:282–283. June, 1886; 73:85–91. July, 1908; *Science* II. 28:525. Oct. 16, 1908; and *Literary Digest* 67:890. Dec. 12, 1908.

The clumps of cypress trees and shrubbery dotting the marsh are known locally as "houses," probably from the fact that hunters sometimes camp in them is a sort of island about half a mile in diameter, at the extreme south end of the Everglades, in Dade County, Florida. It is covered with a dense tropical forest, and is one of the few places in the United States where the royal palm (*Roystonea regia*) grows wild. There are at least one hundred of these graceful palms on the island, and the older ones tower above all the other vegetation, a picture worth going far to see. Several of the other trees, too, are rarely found outside of the tropics.

Until about ten years ago this beautiful hammock was inaccessible and almost unknown; but when the Florida East Coast Railway was extended to the Keys it passed within about ten miles of the spot, and settlers began to push out in that direction. As the soil of the island appeared to be quite fertile, some greedy vandals had thoughts of converting it into truck farms; but before such a scheme was made possible by the building of a road over the miles of jagged limestone and strips of marsh between there and the railroad, the Florida Federation of Women's Clubs became interested, and in 1915 secured the passage of a bill by the legislature placing the tract in their care.

This, however, was perhaps not an unmixed blessing, for the first step in making it more accessible was to build an automobile road right through the hammock, with Cape Sable as its contemplated destination. Then a custodian was installed and a clubhouse built to accommodate visitors, and the traffic has already brought in several weeds and of course will bring more and more, to say nothing of increasing the forest fire hazard. Worse still, it seems to be the in-

Looking up the gorge of Tallulah River shortly before the dam was built; Tempesta Falls in the foreground, Hawthorne's Pool just above, and the foot of L'Eau d'Or Falls beyond. Photographed by A. M. Turner in 1913 tention of some of the patronesses to "improve" the tract by cutting a number of trails through the forest and installing exotic orchids and other plants that nature never intended to grow there, thus further altering its natural appearance.[1]

Passing now to the subject of river scenery, it may be observed that on any stream the most picturesque places are usually its falls and rapids, and it is just these which suffer most from the encroachments of civilization, for every water-power development, or dam for slack-water navigation, disfigures or obliterates one of them. Some of the finest examples of such scenery have escaped until quite recently, however, either on account of the large amount of capital required to "develop" them, or their remoteness from cities, or possibly because public opinion was too adverse to their defacement.

One of the grandest manifestations of unharnessed power in the South was Tallulah Falls, on the headwaters of the Savannah River in the mountains of Georgia. The river there dashed through a narrow rocky gorge about five hundred feet deep, descending six hundred and sixty feet in three and a half miles. The village of Tallulah Falls, close by, was a favorite summer resort for people from the Piedmont region and coastal plain, and had hotel accommodations for about nine hundred persons. Up to 1911 the rugged scenery remained virtually as nature made it, but about that time the temptation to harness the falls proved irresistible, and one of the large hydroelectric power syndicates secured possession. Local nature lovers protested vehemently at the time, and sought to prevent the destruction by legal means, but the prospect of getting cheaper electricity for Atlanta (nearly one hundred miles away) seemed to outweigh all other considerations. The scenery of course has not been totally destroyed, but it is said that Tallulah Falls is much less popular as a summer resort than it was.

Squaw Shoals, on the Black Warrior River in Tuscaloosa County, Alabama, has always been comparatively inaccessible and unknown, but it was a beautiful place, and was of considerable botanical interest as being one of the few known localities for the rare spider lily, *Hymenocallis coronaria* (which grows only on rocky rapids from South Carolina to Alabama, and has already been exterminated from some rivers in the

[1] The most comprehensive description of Royal Palm Hammock, and one easily accessible to many readers of this JOURNAL, is by Dr. J. K. Small in the *Journal* of the New York Botanical Garden, for October, 1916. See also AMERICAN MUSEUM JOURNAL for February, 1918, p. 132.

Dam of the Georgia Railway and Power Company at Tallulah Falls, completed in 1914. Photographed by S. W. McCallie same manner as here), the recently discovered umbelliferous plant *Harperella fluviatilis*, which seems to be confined to Alabama, and a few other species of more than ordinary interest.[1]

About six years ago there was begun the construction of a sixty-foot dam and lock at the foot of these shoals, as a part of a plan for extending navigable water up through the coal fields to Birmingham. The accompanying illustrations are from photographs taken in the summer of 1913, when the construction of the dam was well advanced, but the vegetation and scenery above it were still intact. The completion of the structure was celebrated on May 13, 1915, with much rejoicing and speech-making by the citizens of Tuscaloosa (who apparently have little to gain by it, however), and it is not recorded that there was any one present to mourn the passing of the natural scenery.

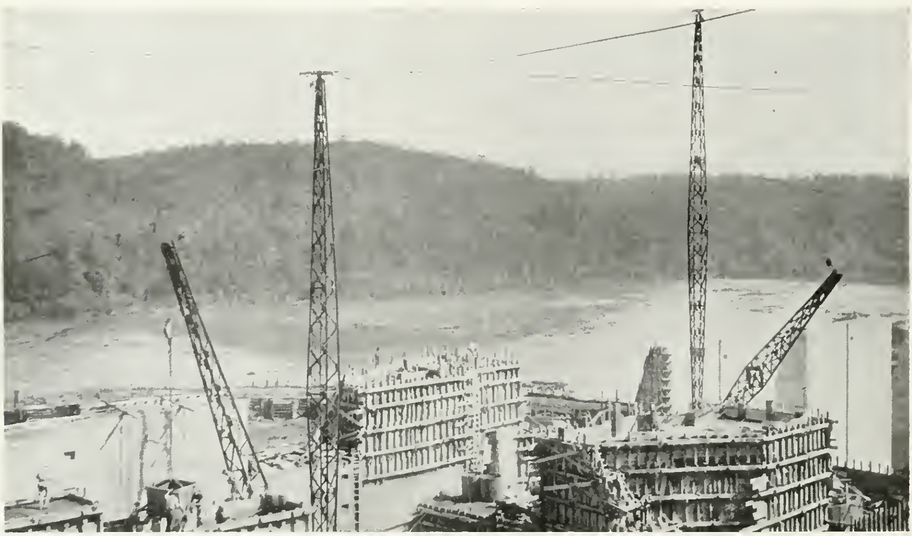
At about the same time a seventy-foot dam for electric power purposes was built on the Coosa River between Chilton and Coosa counties, Alabama, backing up the water to the vicinity of Talladega Springs, and submerging several square miles of land, partly forests and partly farms. This place had no particular reputation for scenery, being several miles from any railroad or settlement, but the ponding of the river flooded one of the few localities outside of the coastal plain for the small palm, *Sabal glabra*, and some splendid collecting ground for mussels, and is said to have almost ruined Talladega Springs as a resort.

The same power company that harnessed the Coosa River also has had designs on Little River Falls, a very picturesque spot on Lookout Mountain in Alabama, where some extremely interesting plants grow.[2] In August, 1911, numerous surveyors' stakes were in evidence there, but the contemplated destruction apparently has not yet been carried out. Perhaps it is not too late yet to save this place, which would not be worth much for power purposes, on account of the small size of the stream.

Mussel (commonly misspelled Muscle) Shoals, on the Tennessee River just above Florence, Alabama, where the river falls eighty-five feet in about fifteen miles, is an obstacle to navigation long ago circumvented by a canal, which did little damage to the scenery, flora, or fauna. But this spot has recently been selected as the site of the proposed government nitrate plant, which will mean a large water-power devel-

[1] For an account of the botanical features of this place see *Torreya*, September, 1914. The genus *Harperella*, discovered by the writer in Georgia in 1902, and now comprising three species, is one of the only two or three genera of flowering plants discovered in the eastern United States in the last three quarters of a century.

[2] Its botanical peculiarities have been discussed in *Torreya* 6:114. 1906; 14:154. 1914.



Lower part of Squaw Shoals, showing lock in process of construction in the foreground and beds of spider lilies (*Hymenocallis coronaria*) in the middle distance. Photographed June 4, 1913 opment there, to which local "boosters" will doubtless point with pride.

Many other recent water-power enterprises in the South could be cited, but it will suffice to mention only one more, which is a little different from the rest. Mammoth Spring, in Fulton County, Arkansas, about a quarter of a mile from the Missouri line, the largest spring in that part of the country, and perhaps the largest in the world outside of Florida, was dammed up at its very source some years ago to furnish power for a flour mill, and further encroachments have been contemplated which may destroy all semblance of its original appearance.

A near view of the spider lilies on Squaw Shoals, in water about a foot deep. Unlike nearly all other aquatic plants, the spider lily has a bulb, the function of which is doubtless to enable it to survive desiccation during prolonged periods of low water

Lastly may be described two rock formations. One of the most interesting in the South, to a botanist at least, is a group of limestone grottoes near the Withlacoochee River in the southeastern corner of Citrus County, Florida, in latitude 28° 40'. It is not very conspicuous from a scenic standpoint, but it is noteworthy as a locality for several rare ferns, some of which are chiefly confined to the tropics, or are not known elsewhere north of the Everglades. Since 1881 this place has been visited by several well-known botanists, some of whom had very interesting and even exciting experiences there. When explored by the writer in March, 1915, it was still in its pristine glory, and there was no sign of any contemplated disturbance; but a few months later came the sad news that a limestone quarry was about to be opened on the spot. Some protests were made, but with little or no effect. The destruction is probably not complete yet, however, and it might still be possible to check it in some way.[1]

In some respects the most striking natural feature in all the southeastern states is Stone Mountain, in DeKalb County, Georgia, about sixteen miles from Atlanta by rail. It is a conspicuous landmark for miles around: a huge dome of granite rising about seven hundred feet above a comparatively level country, and covering about two square miles. The north side is precipitous for about half its height, and fantastically decorated with vertical stripes made by water trickling down, while the other sides slope more gently, and have a sparse growth of trees and shrubs in crevices and hollows. On

[1] For a summary of all available information about this unique and more or less historic spot, see *American Fern Journal*, Sept., 1916.

and around the mountain are quite a number of plants not known outside of Middle Georgia, including among others the rare Georgia oak (*Quercus Georgiana*).

Although the sight of Stone Mountain must have amazed the earliest settlers, who came to that part of the state about 1820, it seems to have been unknown to scientists until near the middle of the century, when it was already quite a resort for sight-seers from near by and even had a rude observation tower on its summit. It is said that the village of Stone Mountain at its base (at first called New Gibraltar, doubtless on account of the resemblance of the mountain to the rock of Gibraltar) had three hundred inhabitants and four hotels in 1849. The Hon. Amelia M. Murray, an English lady of scientific proclivities, visited the mountain during a tour of the United States in May, 1855; but on mentioning it to northern scientists a few weeks later she found none who had heard of it.[1]

For many years, particularly since 1882, granite has been quarried from the northeastern base of Stone Mountain, out of sight of the village and railroad, but so enormous is its mass (estimated at about seven and a half billion cubic feet above the ground) that the stone taken out so far is scarcely missed. In 1900 there was little evidence that anyone had ever set foot on the mountain, notwithstanding its reputed ante-bellum popularity. But since then a boys' preparatory school has been established in the village of Stone Mountain, and a trolley line and automobile boulevard built out from Atlanta; and by 1913 a well-worn path from base to summit could be seen from a passing train, and two or three persons had lost their lives by slipping down the precipitous north side.

About three years ago plans were matured for disfiguring this massive monolith in a manner almost unprecedented, the object of which is not wholly mercenary, as in the cases previously described, but sentimental. Whether the idea originated with the artist or with the local Daughters of the Confederacy is not clear, but at any rate a well-known New York sculptor has been commissioned to carve on the smooth north face of the mountain, with an expenditure of several years' time and several million dollars, some gigantic figures representing scenes in the Civil War. Although the Georgians (of whom the writer was one during the best years of his youth) are to be commended for cherishing the memory of the Lost Cause, in this case they are taking a very extravagant way of showing it.[2]

As Stone Mountain has stood for countless centuries, and will for many more, it does not seem particularly appropriate to deface it irrevocably with nineteenth century scenes from other states, when some future century may well bring forth something equally worthy of commemoration and more directly connected with that locality, and perhaps may produce also a native sculptor to do the work. There are indeed some prominent people in Georgia opposed to the present project, but of course they cannot say much against it without having their sectional patriotism impugned. Outside of Georgia there does not seem to be much interest one way or the other, but there was a thoughtful note of protest in the *Nation* editorial referred to (which appeared first in the New York *Evening Post* of August 4). The present war situation bids fair to hinder the collection of the funds necessary for carrying out this bold project, all of which naturally could not be raised in advance; and perhaps the patriotic citizens who have been promoting it will find some less expensive way of expressing themselves. At the present writing it seems that considerable preliminary work has been done, but no actual carving; so there is still a chance for staying the proceedings. It seems a pity that the whole mountain has not been made a state park, to be protected forever from quarrymen, sculptors, and others who may seek to exploit it for the sake of wealth or notoriety.

In the foregoing pages the æsthetic reasons for preserving natural scenery have been put foremost, but another and still higher motive has been touched upon. An artificial park or flower garden might be just as pleasing to the eye, to most persons at least, as any natural landscape; but from

[1] See her very interesting book, *Letters from the United States, Cuba and Canada* (1857), pp. 312–313, 333. At least two botanists, T. C. Porter, of Pennsylvania, and H. W. Ravenel, of South Carolina, had been on Stone Mountain a few years before Miss Murray, and made known to science some of its peculiar plants.

[2] For additional details about this project, in magazines and weeklies of wide circulation, see *Bulletin of the Pan-American Union*, April, 1917; *World's Work*, Aug., 1917; *The Nation*, Aug. 9, 1917; *Literary Digest*, Aug. 18, 1917.

STONE MOUNTAIN, GEORGIA

This shows the precipitous north side of the mountain with a small patch of forest on the upper slopes. The lowest three hundred feet or so on this side are almost vertical, and it is on this face that the sculptor proposes to place his gigantic carvings, putting the workmen in cages suspended on steel cables and directing their operations from a distant point commanding a view of the whole. Photographed by Dr. T. L. Watson, about 1902 a scientific standpoint there is no comparison between them. Any sort of place can be beautified to the owner's (or the public's) taste by the expenditure of time and money, but when natural scenery is destroyed all the money in the world cannot restore it.

Every interference with nature diminishes the opportunities for studying the working of the laws of nature; and without a knowledge of such laws we do not get as much out of life as we should. Although a shortsighted utilitarian might claim that many natural laws have no possible economic application, no man can say just what the near future may bring forth, and it behooves those who have the rare gift of making correct generalizations from observed facts to embrace every possible opportunity to learn nature's ways. The loss of scientific opportunity through commercial exploitation is perhaps least noticeable in the case of the lifeless and motionless rock formations, which may be worth less for scientific than for scenic purposes. Dams on rivers are more to be deplored, for a river is a thing of life, so to speak, and a dam not only interferes with its normal regimen (making subsequent discharge measurements of little value, as has been pointed out in numerous government reports on stream gauging), but also drowns out the vegetation and fauna characteristic of swift water and not found in the quieter reaches, and restricts the migrations of fish.[1]

Forests are among the most easily destroyed of natural features, and their loss is most disastrous to science, for many types that occupied our most fertile soils have disappeared entirely, and can never be restored exactly by letting the land grow up in trees again, or even by re-planting the same species. Plant sociologists and ecologists could learn many valuable principles that are now unknown if they could select a number of tracts of virgin forest and study them without interference for several or many years in succession, counting and measuring all the trees every year or so, and calculating the percentage and rate of growth of each species. But any tract selected for such a purpose, unless preserved from private exploitation, is likely at any time to be damaged by woodcutters in such a way as to spoil the experiment.

Let us hope that in the not distant future public sentiment will be sufficiently enlightened to oppose the common *laissez-faire* policy of allowing a few individuals for their temporary advantage to deprive all future generations of part of their share of nature's wonders. Fortunately we already have several organizations working toward this end in one way or another. The American Scenic and Historic Preservation Society, incorporated in New York in 1895, was one of the pioneers in this movement, and has been instrumental in preserving Letchworth Park and the Palisades, as well as many spots of historic rather than scientific interest. The Wild Flower Preservation Society, organized at the New York Botanical Garden in 1902,[2] is interested in particular species of plants rather than in vegetation in general, but the preservation of the one of course involves the other to a considerable extent. The Ecological Society of America, organized in 1916, has still more nearly the right point of view, and is now gathering data about places of ecological interest in the United States and Canada that ought to be preserved for scientific study, which data will probably be compiled and published in some form before long. The nation-wide conservation movement of the last ten years, although its object is economic rather than scientific, has doubtless awakened many persons to the realization that our natural resources are not an inexhaustible reservoir from which everyone who can may help himself without limit and without regard for his fellow men.

[1] For a comprehensive discussion of the influence of the new Keokuk dam on the fishes and mussels of the Mississippi River see a paper by Dr. R. E. Coker in Appendix 8 of the *Report of the U. S. Fish Commission* for 1913. The effect of the same dam on scenery and sport is described and illustrated by Orin Crooker in *Forest and Stream* for May, 1915. (The same number contains the first instalment of an interesting article on Okefinokee Swamp by Will H. Thompson, brother of the late Maurice Thompson.)

[2] See this JOURNAL for May, 1917, pp. 350–352.

Nature's Mobilization

By VICTOR E. SHELFORD

(Department of Zoölogy, University of Illinois)

NATURE is a remarkable mobilizer. Instead of all plants and animals reaching the adult stage at the same time, their time of maturity is distributed throughout the best growing season. Each plant matures at a time when it performs its duties of feeding the animals which must be nourished at just the time they require food. It produces seeds, which insure its own existence, but immediately afterward it often falls into insignificance and thus makes way for the plants which are to follow and in their turn for a brief period hold the center of the stage. The animals also of any area appear and disappear, as adults at least, in a similar manner.

To realize what this means one has only to imagine all the plants of a given meadow blossoming during a few days in midsummer, and all the animals (particularly insects and spiders) reaching the adult stage at the same time. Such a state of affairs would produce a grand carnage, an indescribable destruction of living things, a veritable cosmic chaos. Such few living things as were left after the terrific struggle for egg-laying places for instance, a few wrecked blossoms not used as food for the writhing insect hosts or pierced by the innumerable egg-laying individuals, these might appear another year as scattered survivors of the battle for existence, to feed the shattered wreckage of insect life.

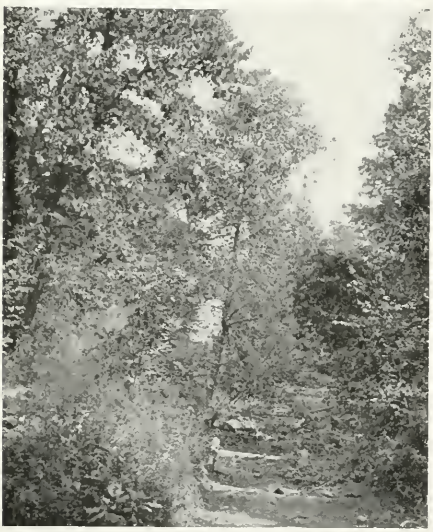
We all realize that this picture may be overdrawn. Another aspect of the matter is of far-reaching significance, namely, the drain on the soil moisture. The crowding of plants alone would cause marked undesirable effects. Nature ordinarily avoids all this confusion—each unit takes its place in time, the food-producing unit just in time to provide for each great army of insects, spiders, birds, or rodents. At the same time the precious soil water supply is not overtaxed—there is no drastic "coal order."

The orderly sequence of nature's mobilization, the time of flowering of plants, the time of nesting of birds, the time at which each insect pest begins its depredations have long been matters of curiosity and observation. The fact that plants flower, fruits ripen, insects appear and disappear in succession one after the other throughout a growing season, needed no statement even to the savage huntsman. The usual succession of appearances are general guides to many operations of primitive agriculture.

Seasonal succession has long been scientifically investigated also. The renowned Swiss botanist, de Candolle, was an early investigator who laid the foundation in 1830 for much that is modern in the work. The analysis of the physiological causes of the usual seasonal mobilization draws on many of the laws of biology merely to formulate the outline, or even a portion, of a life history, as for instance, the answer to the question why apple worms pupate in the spring at a certain time and transform into moths which deposit eggs only on apple trees or their near relatives.

It has often been assumed that the "errors" in the seasonal mobilization of plants and animals in undisturbed nature are few and unimportant. Under agricultural conditions, they are more frequent, and are accompanied by disastrous results. In the late winter of 1907 it was very warm in the southern part of the wheat belt of the United States. The grain aphis or green-bug which reproduces at temperatures at or near freezing and up to 100° F. (a very unusual characteristic for a land animal), multiplied without interruption during a long period, while the more orthodox lady-bugs, aphis lions, and parasitic insects which feed upon them were unable to do so. Low spring temperatures further retarded the development of these latter forms. It was a mobilization of the green-bugs without a mobilization of the enemies to check them. When the green-bug enemies arrived with the coming of warmer weather, green-bugs were so numerous that little impression was made toward reducing their numbers, and the southwestern wheat crop was ruined. There was heavy trading in the Chicago board of trade; advance in prices of grain echoed over the entire country and perhaps the world. What a disaster such an outbreak could have brought to the Allied cause, all due to a little unusual weather!

The writer recalls a visit from a member of the board of trade who, when crossing the plains sixteen years before, had seen myriads of grasshoppers, migratory locusts so called, which swarmed over fields and railroad track. He had these confused with the seventeen year "locusts" or cicadas and expected the condition to be repeated one year later with damage to the wheat crop. He offered half of his "killing" if a timely prediction could be made to raise prices after he had bought heavily. His chief inquiry was, How regular and certain are such appearances of pests? He had seen the effects of an irregularly large number of individuals and his question was exactly to the point.



Two views of the same stream in May and in August, showing the extreme conditions which have to be met by the plants and animals which are its annual residents. The seasonal rotation of adult animals corresponds with the climatic changes, so that each species normally reaches its adult stage during optimum conditions for its feeding and propagation. If all the various species of, say, spiders were to appear at the same time, great carnage would result with total destruction of spider food

Under what conditions does each species mobilize? When and why does time of mobilization vary from the usual time? Under what conditions does it take place? When is it slow and when is it rapid? Millions in food and money are often at stake on such questions as these.

The problem of the beginning of activity or of development is one that has attracted much attention of late on account of the importance of ability to predict the time when various insect pests will emerge from hibernation or will reach a stage of development at which it is necessary to spray trees if such treatment is to prove effective.

In this connection attention has been directed to the effect of various factors such as temperature, moisture, and light, on the development of organisms. Temperature has for many decades received an undue share of attention. A principle stated by de Candolle emphasizes the fact that there is a temperature below which development does not take place in plants, and various authors, including C. Hart Merriam, of Washington, have used this fact in mapping life zones. This temperature is now called the "threshold" of development. De Candolle also laid the foundation for the idea of the "sum of temperatures" above this minimum, necessary for a plant to complete a definite process, such as the ripening of seeds. The daily mean temperatures above the lowest limit of growth, expressed in degrees, are added for all the days, giving a large so-called total "degree-days" or sum of temperatures. If the temperature is higher the number of days is less, but the total "degree-days," according to de Candolle's theory, is the same.

The life histories of plants are so long that the theory could not be experimentally verified by botanists. It remained for Krogh, the careful Danish animal physiologist, to demonstrate the limitations of the theory after several other animal experimenters had paved the way but missed the point. He studied the development of several animals including pupæ of the common meal worm which are commonly raised to feed caged canary birds, and he found that the "sum of temperatures" law holds for only a limited range of temperature.[1] Hence the law of "sum of temperatures" is only a rough guide in dealing with the conditions of our latitude, but still a valuable one when used with some corrections—which are still to be worked out by scientific investigators.

There are marked variations in rate of development brought about by conditions other than temperature. The temperature at which development begins, as well as the rate at which it proceeds, is modified by light, moisture, wind movement, and other causes. Meal worms will live for a long time in air from which all moisture has been removed and, at the same time, on food which contains no moisture, but they lose weight. I once knew a school-teacher who felt sorry for them for having to live in the ordinary air-dry meal in which she had them in the schoolroom, so she added a little water and killed them all. A moderate amount of moisture such as occurs in ordinary indoor air and in air-dry grain is just what they require for growth. In other words there is an optimum moisture.[2]

Food is of much importance to all kinds of animals.[3] With a minimum quantity of food or with an insufficient variety of foods young mammals may be maintained at the same weight without growth. White rats have been maintained at practically the same weight for long periods. They retain their power to grow long beyond the age at which growth normally ceases (335 days) and for periods equal to half the normal life of the species, which is a thousand days. In the case of dogs such treatment results in dwarfing due to the loss of power to grow on the part of the skeleton. Disproportionate growth occurs in underfed cattle. Similar results are to be expected in underfed children. Effects of war starvation on innumerable European children will probably be detectable in adults a few years hence, although careful measurement may be necessary to establish it.

One phenomenon which has been noted repeatedly in connection with studies of nature's seasonal mobilization, a matter of common observation, is the variation in numbers of individuals in different years. The length of life of individuals may have a pronounced effect on the population and succession of species on a given area. It has been stated that the great number of individuals in the plankton of the polar seas in summer is due to the longer life of the individual at low temperature. Unless the low temperature slows the different processes unequally this can hardly follow. For example, if a female green-bug normally lives a week and produces one thousand offspring, and then the temperature is lowered so as to prolong the life to three weeks, unless the different functions were unequally affected by the change, there would be at the end of the three weeks but a thousand, while at the normal rate there would have been a billion possible individuals. On the other hand, if the rate of reproduction remains the same and the length of life of the individual after the reproductive period is increased, the results of lower temperature would be very different. Actual observations along this line are few. In the case of the San José scale, however, it has long been shown that the number of offspring is greatest in the individuals breeding in the warmest weather.

There is, to be sure, much evidence that the tendency to pass the winter in a dormant condition is not very firmly established in some species and that under the stimulation of indoor temperatures such animals may be

[1] That is, degrees above the temperature at which development does not take place, multiplied by the time unit, give a fixed sum only between 64° and 82° F., while development takes place between 55° and 110° F. At temperatures between 55° and 64° F., development is far too rapid and gives a smaller sum, while between 82° and 93° it is too slow and gives a larger sum. In the first case the sum of temperatures is too small, and in the second it is too large.

The temperatures shown as the "sum of temperature" *limits* for a common insect like the meal worm, would both be exceeded in an ordinary spring day as the temperature falls below 64° and rises above 84° F. One or both, the upper and lower limits, would be passed in nearly every day of the growing season for land plants and animals.

[2] This may even be different for different temperatures. Light, like moisture, may have important effects on the rate of development, but we know still less about it. It is known that absence of light is unfavorable to growth of insects which normally develop in light. Light is further known to stimulate the growth of some kinds of animals.

[3] The larvæ of the common museum pest (Dermestidæ) can not only be maintained at a definite weight by insufficient food, but may be reduced from half grown to hatching size several times by repeated starving and feeding. This particular species is especially flexible, as all lower animals usually are to a less degree, and is peculiarly adjusted to its precarious life. Thus it seems that variations in food have effects similar to those produced by variations in temperature.

induced to reproduce nearly continuously, at least for a number of generations. Cessation of development or dormancy[1] in any given case is as much attributable to some factor falling below the threshold of development as to hereditary tendencies. The environment is extremely complex, and the number of factors already found which may cause cessation of development are numerous, including temperature, moisture, light, oxygen, evaporation, quantity of food, or absence of any one of many necessary food constituents.

The reproductive bodies of the large gelatin-secreting bryozoan which grows to be as large as a man's head, are filled with air cells which cause them to float at the surface of the water. They are formed in the autumn but do not germinate until spring after they have been frozen.

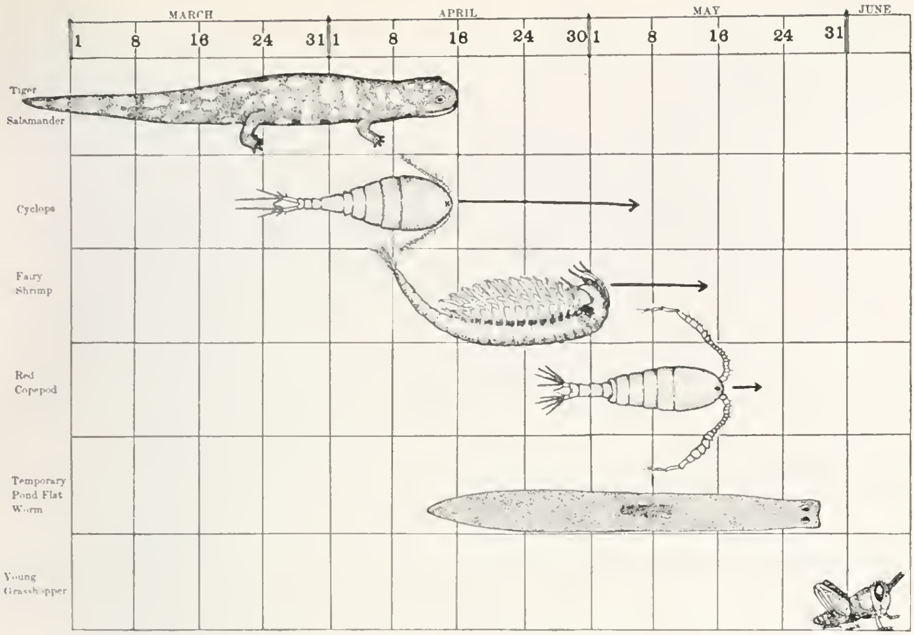
The walking-stick drops its eggs from the tree trunks on to the ground in the autumn but they do not hatch until the following May at the earliest, or they may not hatch until one year from the following May if conditions are unfavorable. The cause of these delays or dormancies are often simple. The decay or rupture of an outer covering most commonly produces development.

A Chicago vacant lot as it appears in April and in August. A small section of this temporary pond does not ordinarily completely dry up, and, therefore, affords a breeding place for the tiger salamander. The seasonal succession in animal life is well illustrated in such a spot as this with its marked differences in temperature, vegetation, and moisture. For the order in which some of the animals appear in this lot see the following chart

The seasonal succession of animals is well illustrated on a Chicago vacant lot. The area chosen for study was covered with water in spring and with grass and weeds in summer. In a small part of it the water was permanent in all but the driest seasons. The parts which did not dry up afforded a place in which the larvæ of the tiger salamander could develop to maturity. The tiger salamander comes out of the soil as soon as the frost is gone, sometimes as early as the end of February or the first of March. The eggs are laid in March and early April and the adults burrow into the mud by the middle of April and are not seen again until the frost leaves the ground the following spring. The eggs hatch and such larvæ as find water which is permanent until the end of summer probably reach maturity. By that time the young are sometimes able to lead a terrestrial life.

The spring pond cyclops (*Cyclops viridis americanus*) occurs only in ponds or parts

[1] When all conditions are favorable for development some animals fail to develop. Their life histories appear to be adjusted to the annual rhythm of conditions. The state in which an animal is when development does not take place although conditions are favorable for it, is called dormancy.



Succession of five of the species—salamander, cyclops, fairy shrimp, red copepod, and flatworm—in a temporary pond on a vacant Chicago lot, from early March to June. The length of the animal's body (plus the arrow where present) indicates the dates between which adults of the given species may be found. The appearance of the grasshopper, a dry land form, is synchronous with the pond's drying up. Disorders in mobilization are not so likely to occur under such natural conditions as under the conditions to be found on agricultural land where great disorders frequently arise, especially among insect species which feed on the agricultural crops

of ponds which dry up in summer. The fairy shrimp (*Eubranchipus*) is a well-known example of an animal with eggs showing "dormancy." The local distribution of the fairy shrimp is likely to differ each spring. It is modified by the rainfall of the preceding seasons. When the rainfall of the preceding summer has been great, this and some other temporary pond species are found only in the smallest and highest (above ground water) ponds. Following dry seasons they are found in ponds which do not usually dry, but which were dry the preceding summer. Their eggs must be dried and frozen before they will hatch. Their distribution, following the seasons of different rainfall, suggests that some definite degree of drying must be attained to insure hatching, also that the eggs may be blown about by the wind. One autumn, about 1900, there was early freezing and cold weather followed by warm weather of a very springlike character in December. It was observed that the fairy shrimps hatched during this period of warm weather. Cold weather came on soon after and most of those that had hatched died before depositing eggs, and for several years thereafter the species was very scarce in the vicinity of Chicago. The fairy shrimp is found most commonly in grassy ponds, possibly because the forested ponds do not dry sufficiently in summer.

The minute red copepod of spring ponds appears to require a less definite amount of drying than the fairy shrimp, although it is found with it as a rule. It is found also where the fairy shrimp does not occur, and becomes adult a little later and disappears soon afterward.

The temporary pond planarian, or flatworm (as observed by Prof. C. M. Child[1]), shows very special adjustments to the peculiar seasonal rhythm of temporary ponds. When the animals first appear, soon after the ice melts, they are mostly only 2–3 mm. in length and commonly light in color. They grow rapidly and soon the dorsal surface becomes very deeply pigmented, so that they appear almost black. They are very active

[1] *Biological Bulletin*, Vol. XXV.

and move more rapidly than most fresh-water planarians. During this period they will eat meat and will gather in large numbers on pieces placed in the water. In about four weeks they attain a length of 12–15 mm., their movements gradually become slower, they cease to take food, become light gray in color, and the food-taking organs disappear.

Within a few days after these changes they begin to divide. As the worms creep about, the extreme posterior end adheres to the substratum and the rest of the animal pulls away and leaves it behind as a small fragment which becomes more or less spherical and within a few moments is covered with a slime which adheres to the underlying surface and hardens into a cyst. This process of division is repeated, often several times within a few moments, so that as the animal moves across a containing vessel it may leave behind it a series of such pieces. Under natural conditions the encysted pieces remain quiescent during the summer and the following winter; in early spring they emerge from the cysts as minute, very active worms which begin to feed. Complete drying under ordinary outdoor conditions is fatal to them; they survive among the moist vegetation of not-too-dry pond bottoms.

By the time the planarians have disappeared, grasshoppers and spiders have begun to appear. At the same time other land animals begin to move about the pond margin. The tarnished plant-bugs, which emerge from hibernation and lay eggs in early April, reach the adult stage in June and are to be found all summer. Adult sawflies emerge from pupæ that have passed the winter and their larvæ are on the young grasses in June. The buffalo tree hoppers hatch from eggs laid in the fall and are found in the adult stage throughout the rest of the summer. These examples illustrate some of the various peculiarities of life histories adjusted to the same climatic rhythm.

The collection and arrangement of the entire fauna of this Chicago vacant lot showed the same thing[1] as the animals just discussed, but proved much less satisfactory than was expected, owing to a lack of knowledge of life histories and an inability to identify young stages of insects. Disorders in seasonal mobilization on such a vacant lot are far fewer than the disorders among insects under agricultural conditions where nature's usual sequence of plants is replaced by corn or wheat.

Disorders of mobilization may occur under the stimulus of peculiar weather conditions, most easily in the closely set fields of agricultural conditions and results are such as we have noted for the "green-bug" in the wheat. This is only one type of disorder observable in agriculture. Others may result from failures to spray at the right time, which mean greatly decreased production, wormy apples, spotted pears, expensive bread, and wormy beans. As yet we know so little in this complicated field, that adequate prediction of insect pests can hardly be accomplished. But its importance is such that we can well afford to struggle through its complications into the light of a knowledge which will make reasonably accurate prediction of the rise of pests far surer than now. This means a careful experimental study of the conditions of such factors as temperature, moisture, and light, under which development can begin, and the rate at which it can continue.

---

[1] Adult and juvenile spiders are among the best animals for such study. In the seasonal order, we start with the spring running spiders (*Pardosa modica*) in April, and we end the season with striped garden spiders (*Argiope trifasciata*), which appear as adults late in the season only.

Where our collections proved at all complete it was shown that the juvenile individuals follow the adults of the early spring species and both precede and follow the species which mature late in the season. Nearly all species are adjusted to the seasonal rhythm of the habitat in which they live. Thus *Dictyna sublata* appears as adult in May and June when eggs are laid, and juvenile forms characterize the late summer and autumn. The striped garden spider deposits eggs in October and passes the winter in the juvenile form. The large jumping spider (*Phidippus podagrosus*) reaches maturity in July, when eggs are deposited, and young occur in both fall and spring. These differences usually represent an innate adjustment of the life cycle to seasonal rhythm, not readily broken up. It is to be expected that *Dictyna* will deposit eggs to better advantage, and that the young hatch better in May than in November, which is the breeding time of the common funnel-web spider (*Agelena nævia*). It is further to be expected that the young stages of some spiders will not go on with development until cooled for a considerable period. Perhaps one of the most interesting questions concerning the whole matter of succession of spiders is to be found in the fact that all these spider life histories involve about the same periods of activity and rest. The rest period falls in different stages of the life history in different species. (For a detailed discussion of this matter, with table showing seasonal succession of adult spiders, see the Author's paper, "Physiological Problems in the Life-Histories of Animals, with Particular Reference to Their Seasonal Appearance," in *American Naturalist*, Vol. LII, pp. 129 to 154.)

Yachting in the Seven Seas

STRANGE SAILING CRAFT, EVOLVED IN DAYS OF PIRACY AND SLAVERY FASTER THAN THE SPEEDIEST YACHTS OF OUR MODERN BUILDERS

By F. A. G. PAPE, F.R.H.S., F.R.G.S.

Illustrations from original drawings by the Author

SINCE the dawn of time, man has gazed upon the mystic deep from shore and hilltop with an unconquerable longing to master the vastnesses beyond that elusive horizon which forever beckons like a Fata Morgana. There is but a single exception to this universal marine *Wanderlust* and that is found in some far southern parts where the dull-witted aborigines never have gone beyond the occasional construction of boats of reeds or bark with which to cross the smaller streams. This lack of enterprise might be attributed to scarcity of suitable building material, the forests of Oceania being preponderately of hard woods, were it not for the example set by the people of the North. The inhabitants of the tropics, on the other hand, were the first to overcome the difficulties of floating on the water, and from this to go on to the construction of vessels designed to ride swiftly over the waves in all sorts of weather. The northerners were handicapped by their inhospitable coasts and rigorous climate, so that all fine lines in boat building had to be sacrificed to the unwieldiness and roundness of form which make for safety.

The first purely floating structure, made of reeds or hide or similar handy substance, determined by the locality in which it occurred, was generally a one-man affair, propelled by paddling with the hands. This form of boat is best represented today by the Irish coble or the bladder boats of India and Mesopotamia, kindred rudimentary contrivances still being used in the enormous estuaries of Indian, Burmese, Siamese, and Indo-Chinese rivers. Boats of this character are made of a piece of soft wood about eight feet long, slightly bent upward and hollowed out to a certain degree. They serve not only to float upon the water, but they slide readily and without much effort over the flat oozy mud banks where to gain a footing would be impossible without sinking to the waist or farther.

Upon reflection it seems quite extraordinary that it took many generations before propulsion by paddle became common. It is not meant to convey the notion that odd pieces of wood or the like were not used in early times for this purpose, but the paddle as we know it today, of graceful line and light workman-like build, was slow to come into vogue, as was also the discovery that more than one would add greatly to the speed attainable. The use of a number of paddles involved the construction of an elongated oval boat instead of a round one, and this was not really feasible until man had learned the use of fire and sharp-edged tools, enabling him to fell and hollow out large trees. In this art of wood-shaping craft the Burmese excel all others. One need only contemplate the keel of one of their enormous but graceful boats to learn this fact. It requires skill of the very highest sort to take a tree trunk, often more than seventy feet in length, trim it, and fashion it into a thing of beautiful outline, with a proper "sheer" to it, the bow and stern rising proportionately above the "waist," while the center itself is artificially pressed and flattened out to accommodate the broad-bilge frame timbers which go to make the stability and carrying capacity of every well-constructed vessel. The full-powered paddle capacity at its maximum of course could be evolved only in localities where suitable timber of great bulk and straight growth could be obtained, as on the Pacific slope of North America, in some of the larger islands of the Pacific, in certain parts of South America, and along the larger rivers of Africa. We find the oar brought to greatest perfection in the northern part of the Old World, in the viking ships, the galleys of the Mediterranean, and the great clumsy craft of the Middle Kingdom.

An immense stride forward in ocean intercommunication was made when man first learned to utilize the wind as a means of propulsion. The deterrent factor, it seems, was not so much the lack of knowledge of the wind's power—for that must have been universally evident at an early date—as of the proper means by which to apply and control it. A tricky and uncertain wind volume is a bad master even now. A proper study of the wind element has not been completed today, when, owing to modern methods of propulsion by steam and electricity, wind power has been virtually discarded. But man still indulges, fortunately, in that most fascinating of all sports, yachting, which will ever hold its own among prime pastimes. It is the poetry of motion, calling at the same time for endurance, tenacity, and pluck of the highest sort. There is hardly an emotion in the human breast approaching the thrill which the evolutions of a well-found sailing craft can produce in the intrepid soul in tune with nature in its restless mood at sea.

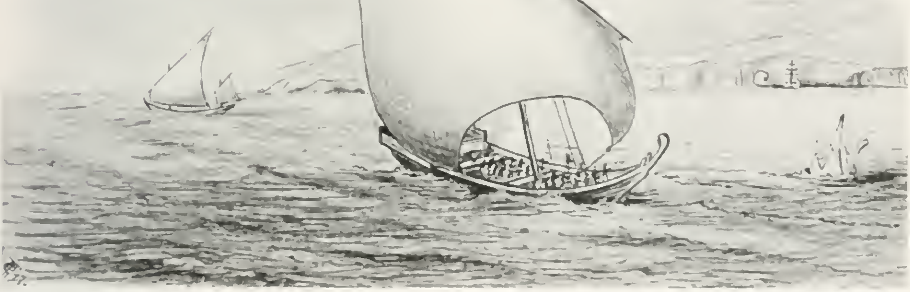
It may be assumed with perfect justification that the tropics furnished the first instances of the application of sails to ships. In the warm latitudes we find almost universally a long season of balmy winds, which only at rare intervals assume the force of gales. It is true that the most violent atmospheric disturbances are within the torrid zones, but these occurrences are confined to certain seasons of the year, and seafarers almost always can guard against them. For that reason the craft of those latitudes are mostly of frail construction and made in such fashion that they can be removed readily from the water, out of harm's way. It is a lamentable fact that speed seems first of all to have been sought for felonious purposes. In war, in piracy, in slavery, speed soon became the decisive factor. Whoever possessed the speediest vessel for pursuing an enemy or eluding superior forces was soon recognized as having mastery on the sea.

As a matter of fact, certain types of sailing craft used in the Indian Ocean today are, under given conditions, faster and more easily handled than the speediest yachts which our best builders put in the water. The smaller type of Arab "dhow," called usually "jahassy," is remarkable for its speed before the wind or with the wind over the quarter. This vessel is from thirty-five to fifty feet long. It has a very fine entrance, without much of a keel, and the stern is full and usually square. The jahassy sits low in the water, and the single mast, with a big rake forward, is stepped well ahead of the waistline. The sail is hoisted on an immensely long yard. The standing part of the halyards is taken quite aft, where the lower triple block is fastened also to the afterthwart. The mast is stayed by two shrouds on each side, which can be unhooked when the vessel goes in stays. The lateen-shaped sail, if well cut and made, can be trimmed up to about five points off the wind. In the slavery days, the squadron of jahassys which patrolled the East Coast and the Gulf had many a tale to tell of their speed and agility in escaping from justice. Nowadays these vessels follow the useful avocation of tenders to the big ocean liners, bringing small lots of produce from out of the innumerable estuaries and creeks of the coast where a steamer cannot well enter. A case in point within the knowledge of the writer was the pitting of a fine centerboard sloop of European build against these native racers on the Zanzibar littoral. In hard windward work the sloop could leave the jahassys out of sight in a couple of hours, but as soon as they got a fair slant they would beat the sloop hand over hand.

It seems that the Indo-Arab sea rovers, who very early penetrated as far east as the Moluccas, left their sailing skill as a legacy to the regions they visited, for we find that the craft in use there today are built along much the same lines as the Arabian ships. The prows, or prahus, of the Malays and Alfuros are similar in shape to those in the western part of the Indian Ocean, with a high poop and a low finely modeled bow. The construction, however, is not quite as solid and staunch as in the latter. A lot of makeshift matting, bamboo, and other contrivances fulfill the local requirements. The poop and the stem are often carved and ornamented most elaborately, as are also the high rudder heads and tiller poles. These swift Moluccan sailboats played their most prominent rôle when big, clumsy, square-rigged vessels from Europe traversed these waters laden with the riches of the far East. Old records contain many a thrilling tale of these elusive wasps of the sea tackling well-armed and well-manned merchantmen and not seldom overcoming by sheer numbers all resistance to their fierce assault. And this peril from sea raiders kept up well into our own days in spite of the vigilant naval patrol of the nations.

In the Straits of Malacca and adjacent regions the Malays have evolved a racing craft which is indeed like unto the wind itself. It is a vessel of very moderate size, often not much more than a canoe, but seaworthy withal, and met with on big open

Often not larger than a canoe, Malay racers are found on big open stretches in the Straits of Malacca and adjacent regions, where on a breezy day they may be seen speeding across the blue waters like a flock of white gulls



Remarkable for its speed before the wind is the "jahassy," a small type of Arab dhow. On account of its agility in escaping when pursued, this type of vessel earned an unenviable reputation in slavery days. In olden times the large single sail was woven of palm-leaf matting

In a latitude where flat calms are suddenly followed by fierce squalls, many sails are a distinct advantage, being quickly furled as a storm approaches and soon spread aloft when it is over. The "country wallah," constructed by the natives of Malabar and Coromandel, as well as by the islanders of the Maldive and Laccadive groups, appears to be smothered in a cloud of canvas

Another type of speedy vessel known as the "hleh" meets the exigencies of wind and tide to a remarkable degree in the Burmese waters of the Mergui Archipelago. The keel is a tree trunk artificially widened, and the Chinese form of sail having bamboo slats across at intervals of eighteen inches or so is used. The "hleh" has two and sometimes three masts, and a cabin is built in the after part stretches of water. The mast is nearly perpendicular and stepped in about the first third of the boat. The tack of the high-pointed lateen sail is fastened in the bow, and the sheet reaches well aft. When the wind is abeam, one of the crew seizes a rope pendent from the mast top. Swinging himself outward, he stands on the weather gunwale, thus preventing the boat from careening too far. On a brisk breezy day it is one of the prettiest sights to watch a fleet of these Malay racers speed across the blue waters like a flock of white gulls.

Farther up the peninsula, in the Burmese waters of the Mergui Archipelago, the lusty coast folk have produced another type of speedy vessel. Its keel is a tree trunk, widened out artificially. The Burmese have borrowed the Chinese style of sail with bamboo slats across at intervals of eighteen inches or so. While this is very convenient for reducing sail, it produces too flat a surface for getting the maximum of power from the wind. These vessels have always two and sometimes three masts. The mainmast is stepped perpendicularly; the foremast tends to rake over the bow. When there is a third or jigger mast, this conforms to the set of the mainmast. Out in the open these "hlehs" attain a wonderful degree of speed. When going through one of the countless channels between the islands and estuaries, where the high-growing mangroves often intercept the wind, these vessels are propelled by means of "sweeps" or long oars, the crew standing on the deck to manipulate them, somewhat after the manner of Venetian gondoliers. The "hleh" has a cabin built into the afterpart. It resembles the high poops we used to see in pictures of galleons or similar mediæval vessels.

The natives of lower Malabar and Coromandel, as well as the islanders of the Maldive and Laccadive groups, construct a swift vessel in imitation of European style with more or less graceful models. They have also adopted the rig in vogue in northern latitudes. At first sight this appears to be a dubious advantage, but when investigated it seems reasonable enough. For the European sail fashion allows of manifold division. These boats, which are locally called "country wallahs," are mostly brig-rigged with a tower of masts and canvas. One can often see sky sails on these diminutive vessels. All this canvas looks ridiculous, but it is best suited to conditions in those latitudes, where there is "either a feast or a famine" with the wind. Protracted periods of flat calms when there is scarcely a breath are suddenly followed by fierce outbursts of squalls. It can readily be seen that in the doldrums the enormous spread of canvas is of distinct necessity. The "country wallah" appears to be smothered in a cloud of it. The lower sails may be hanging flat but in the upper air the wind current fills the topgallant sails, royals, and skysails, and the old hooker sneaks along at quite a respectable gait. On the other hand, the appearance of the sky invariably gives due warning of the coming squall. When the "woolpacks," or heavy hanging cloud masses with a dark fringe underneath, begin to gather and to rise to the zenith, then it is time for all good and well-conducted "country wallahs" to gather in their "linen." In a jiffy the crew swarm aloft and furl the multitude of sails, often no bigger than a blanket, and the vessel is ready to take the fury of the squall, end on as a rule. It does not last long, and when it is over it is but a few minutes before all the canvas is aloft again. Sometimes one sees a whole fleet of these vessels making for a certain point. From afar it looks exactly like a squadron of ancient war ships or a convoy of "John Company's" famous Indiamen. The disparity in size disappears. The illusion is complete. The true lover of the sea conjures up vistas of doughty deeds of old. Here are "full ten sail of the line, and a score frigates" conning the offing for Dupleix's intrepid rovers. The mastery of the East is at stake.

Least of all in size, but not in interest, are the quaint boats made of palm-leaf ribs sewed together with coir fiber, used by a moribund race of people, the Selungs, in the archipelagoes bordering the eastern fringe of the Bay of Bengal. The Selungs live in these boats almost entirely. They subsist chiefly on sea food, which is probably the reason they are afflicted with leprosy. By means of very long bamboo ladders they endeavor to procure *salangan* or edible bird's-nests from the precipitous sides of the immense outcrops of granite, which are nearly one thousand feet high and almost inaccessible. They also gather a few mother-of-pearl and green snail shells to trade for cloth and other necessities. These people are shunned by the Burmese and Malays, who look upon them with aversion.

The Myth of the Monkey Chain

By E. W. GUDGER

Professor of Biology, State Normal College, Greensboro, North Carolina

THOSE who were so unfortunate as to study geography in the "prehistoric days" before Maury and Frye had revolutionized the teaching of that subject, will recall the wonderful picture and the equally wonderful account of how, in northern South America, monkeys by intertwining tails and legs made a living bridge across crocodile-infested streams.[1] This story had as its author the Jesuit priest Padre José de Acosta, whose book[2] was published in an English translation at London in 1604, the original edition, in Latin, having been issued at Salamanca in 1589. Acosta's account (page 315, English translation) reads as follows:

"Going from *Nombre de Dios* to *Panama*, I did see in *Capira* one of these monkies leape from one tree to an other, which was on the other side of a river, making me much to wonder. They leape where they list, winding their tailes about a braunch to shake it: and when they will leape further than they can at once, they use a pretty devise, tying themselves by the tailes one of another, and by this meanes make as it were

In days not so long gone by our schoolboys were regaled in their South American geography lessons by illustrations of a monkey bridge such as is shown in this cut which is taken from Holmes's *Fourth Reader* (1897). The myth of the way monkeys crossed alligator-infested streams started with the report of a Spanish explorer in the sixteenth century. Clinging to one another's tails so as to form a long chain it was said they would swing pendulum fashion until the end "athlete" could grasp a tree on the other side of the stream, after which all the mothers and babies would scamper across on the heads and backs of their accommodating relatives. Needless to say, this feat presupposes an amount of intelligence in the monkey family that it has never been known otherwise to exhibit, while aside from that, it is palpably impossible because nowhere in a tropical jungle could space be found in which to swing such a long chain as the story requires. The famous naturalist, Humboldt, was the first to deny the myth (1814), but it continued to live in schoolbooks and in the tales of travelers for many years

[1] Such a figure forms part of the headpiece to South America, on page 58 of Mitchell's *New Primary Geography*, published in Philadelphia in 1878.

[2] Acosta, Joseph, *Naturall and Morall Historie of the East and West Indies*. Translated by E. G[rimston], London, 1604.

a chaine of many: then doe they launch themselves forth, and the first, holpen by the force of the rest, takes holde where hee list, and so hangs to a bough, and so helpes all the rest, till they be gotten up."

This tale has been handed down from one author to another. And there is little doubt that a careful search through the literature pertaining to northern South America, during the one hundred and fifty years following the publication of Acosta's book and its various translations into Italian, French, Dutch, German, and English, would show many repetitions and variations of the marvelous story.

Lionel Wafer, a companion of the celebrated navigator, Captain Dampier, says[1] that in crossing the isthmus they saw and killed a number of monkeys, and continues:

"They are a very waggish kind of Monkey, and plaid a thousand antick Tricks as we march'd at any time through the Woods, skipping from Bough to Bough, with the young ones hanging at the old ones Back, making Faces at us. . . . To pass from top to top of high Trees, whose Branches are a little too far asunder for their Leaping, they will sometimes hang down by one anothers Tails in a Chain; and swinging in that manner, the lowermost catches hold of a Bough of the other Tree, and draws up the rest of them."

Neither Acosta nor Wafer gives any figure to illustrate his account, but this is supplied us by another South American traveler, Ulloa. In 1735, Jorge Juan y Santacilia and Antonio de Ulloa were sent out as the Spanish members of a joint commission to measure an arc of the earth's meridian on the plateau of Ecuador. Coming by ship from Europe to Porto Bello, they crossed over the Isthmus of Panama to the Pacific side, where they took ship for Guayaquil, whence they made their way overland to Quito.[2] As Ulloa and his companion made the trip across the isthmus, they described as though they saw that which Acosta thought he beheld one hundred and seventy-five years before. At any rate Ulloa says:[3]

"The different species of monkeys, skipping in troops from tree to tree, hanging from the branches and in other places six, eight, or more, of them linked together, in order to pass a river, and the dams with their young on their shoulders, throwing themselves into odd postures, making a thousand grimaces, will, perhaps, appear fictitious to those who have not actually seen it."

Antonio de Ulloa, who crossed the Isthmus of Panama in 1735, was the first explorer to give a picture showing monkeys accomplishing the feat of bridging a stream. He remarks that the tale sounds fictitious to one who has not seen it, but whether he himself saw it or not, he does not say

Ulloa does not explicitly say that he saw this "fictitious" sight, but the inference is

[1] Page 108 of *A New Voyage and Description of the Isthmus of America*, London, 1699.

[2] The two men divided the labor of writing up their expedition. The scientific work was described by Jorge Juan y Santacilia and published at Madrid in 1748. The historical and narrative account of the voyage was written by Antonio de Ulloa, although singular to say, the original edition as well as the English translation (1760) bears the name of both men. Abbreviated somewhat as to the title, it is as follows: *Relacion Historica del Viage a la America Meridional . . . por Don Jorge Juan y Don Antonio de Ulloa.* Madrid, 1748. This obscure title has led to the conclusion that the first author was Jorge Juan Ulloa, whereas his name, as I have been informed by the Library of Congress, is y Santacilia. The book, however, is commonly referred to under the heading "Ulloa, 1748," he being the real author.

[3] George Juan [y Santacilia] and Antonio de Ulloa. *A Voyage to South America . . . together with The Natural . . . History. . . .* 2 vols. London, 1760; vol. 1, p. 109.

that he did, especially as he gives a picture of it.

After this the marvelous tale seems to have gone unchallenged for nearly one hundred years, or until about 1814, when Humboldt gave the weight of his great name in controversion.[1] Speaking of howling monkeys, he writes:

"Whenever the branches of neighbouring trees do not touch each other, the male who leads the party, suspends himself by the callous and prehensile part of his tail; and, letting fall the rest of his body, swings himself till in one of his oscillations he reaches the neighboring branch. The whole file performs the same movements on the same spot. It is almost superfluous to add how dubious is the assertion of Ulloa, and so many otherwise well-informed travellers, according to whom, the *marimondos* [*Simia beelzebub*], the *araguatos*, and other monkeys with a prehensile tail, form a sort of chain, in order to reach the opposite side of a river. We had opportunities, during five years, of observing thousands of these animals; and for this very reason we place no confidence in statements possibly invented by the Europeans themselves, though repeated by the Indians of the Missions, as if they had been transmitted to them by their fathers [the Fathers?]. Man the most remote from civilization, enjoys the astonishment he excites in recounting the marvels of his country. He says he has seen what he imagines may have been seen by others. Every savage is a hunter, and the stories of hunters borrow from the imagination in proportion as the animals, of which they boast the artifices, are endowed with a high degree of intelligence. Hence arise the fictions of which foxes, monkeys, crows, and the condor of the Andes, have been the subjects in both hemispheres."

Apparently Humboldt did not know that this story originated with Acosta. There is doubt also whether Ulloa knew of his reverend predecessor. In any case neither of them refers to Padre Acosta.

The story is found repeated ten years after the publication of the Ross translation of Humboldt, and strange to say in this particular account are to be found the details of how the chain is made and how it works:[2]

"No less remarkable is their ingenious method of crossing torrents and other minor streams which they often encounter in their ceaseless perambulations through the forest. As among men, all cannot swim with equal facility, so it is also with monkeys; accordingly the leaders of the troop, generally the strongest of the party, climb to the spreading branches of some tree projecting over the stream; one of them then twists his tail firmly around a branch, and letting his body hang, seizes upon the tail of the nearest comrade, who in his turn performs the same operation with the next, and so on until a sort of chain or living pendulum is formed, which in obedience to the laws of equilibrium oscillates slowly but constantly from their combined efforts to reach the opposite bank. This finally achieved, the last monkey secures himself to the most convenient tree. The others of the chain, now disengaged from the tree at the opposite side of the stream, wade through the water, each helped by his neighbor assisted likewise by the current. Some are, however, occasionally drowned, the last one in the chain especially, which circumstance has probably given rise to the popular proverb, *el último moro siempre se ahoga*—the last monkey is sure to be drowned."

This account is very circumstantial and if one reads Paez's book and sees how accurate in the main are his natural history observations, one feels inclined to lend credence. Then, too, how natural is the proverb about the drowning of the last monkey. At first I was inclined to think this a slip, for why was not the end of the chain on the other side of the river after the crossing as high above the water as the originating end? A little thought, however, cleared up this point. The lowest monkey of the oscillating chain would lay hold of the first bush or tree or branch with which he would come in contact, and would complete the living bridge, but would be unable to climb any higher because of the great weight of the monkeys pulling on him. Hence when the monkey who originated the chain let go, he would fall into the water.

This is all very plausible, exceedingly so, but as one reads Paez's fascinating narrative, it is seen that our author loves to tell a good story. Moreover, one finds that he quotes Humboldt to demolish any fictions or clear up any matters of which he finds himself on the opposite side, thus showing that he was well acquainted with Humboldt's writings, but he carefully refrains from quoting him on the monkey chain.

A journey was made over this very region

[1] I quote from the *Personal Narrative of Travels to the Equinoctial Regions of America during the years* 1799-1804, by Alexander von Humboldt and Aimé Bonpland, translated and edited by Thomasina Ross, London, 1852.

[2] Page 261 of Don Ramon Paez' *Wild Scenes in South America; or, Life in the Llanos of Venezuela*, New York, 1862.

of northern South America in 1867–68[1] by two travelers, H. M. and P. V. N. Myers. They, too, saw hundreds of monkeys swing from tree to tree, and refer to "the oft-repeated story, familiar to every boy, and which often finds credence among so many, of monkeys crossing streams on aërial bridges constructed from their own bodies," but declare that these bridges exist only in fancy:

"In the course of our travels in the tropics, during which we saw multitudes of these creatures, our observations convinced us that there was no foundation for the truth of the tale of the bridge-building monkeys; and in this belief we were, moreover, further confirmed by the statement of natives, who testified to their having never witnessed such a novel performance."

The last account which has come to the attention of the writer is found in Holmes's *Fourth Reader*,[2] bearing date of publication of 1897, just twenty-one years ago. The series of Readers to which this book belongs was much in vogue two decades ago. The reading lessons, eighty-five in number, are made up of extracts from the writings of the foremost authors of America and Europe. The incident referred to is so very detailed and circumstantial that it is quoted *in extenso*:

A Living Bridge

"I was once sailing down the Amazon, and making short trips up the rivers that flow into it. One night we had ascended a little stream so far that the trees on the banks nearly met overhead, and our boat could go no farther. It was not prudent to go back in the dark. So we anchored in mid-stream.

The air was full of strange sounds, made by strange birds and insects, which kept me awake until just before dawn, when I fell asleep in my chair on deck.

Suddenly I felt a rough blow on my face, and became wide awake. I saw hanging from a tree, and swinging away into the gloom, something that looked like a huge black rope. The end of it had struck me. In a moment back it came, swinging this time behind the vessel.

The rope gave forth a chattering noise; it was alive. A moment more, and it was clear to me that here was a company of monkeys trying to cross the stream. The sight was so novel, the plan so daring, that at once I gave these queer bridge-makers my closest attention.

They were hanging from a tall palm-tree that leaned out over the water. Three or four of the strongest had grasped the branches of this palm with their hands, feet, and tails, and were holding on as if the fate of the monkey race depended on them.

Other monkeys had taken hold of these, and let themselves hang down as far as they could. Then others, and still others, until there was a line thirty feet long and three or four monkeys deep. The last monkey of all did not cling to those above him, but was so held by them as to leave his arms and legs free. He was the gymnast of the troop, and the hero of the present exploit.

The dangling line hung so near the trunk of the palm that the lowest had been able to push against it, and thus cause a little motion. Successive pushes had set the rope swinging toward the opposite side of the stream. It was on one of these swings, when the end of the rope had reached as far out as the middle of the stream, that I was struck in the face.

Little by little the breathing, clinging pendulum kept gaining. Pretty soon it swung out so far that the leader caught a branch of a tree on the opposite bank, when, lo! there was a bridge in mid-air! At once there rose from all the line a chattering that must have been monkey cheers.

As soon as the leader had made good his hold, two or three monkeys ran across to help him. This finished the bridge; so, without further ado, it was opened to the monkey public.

Then there came out of the palm-tree a noisy crowd of all ages. They ran across the bridge as best they could, some on all fours, some upright, some with young monkeys on their backs, and all waving their tails and briskly jabbering, as if they were shouting to those ahead, 'Make haste, or the bridge will break!'

A very old monkey was the last to go over. Perhaps his limbs were stiff. Perhaps he could not see very well. It was certain that he had lost the fearlessness of his youth, for he picked his way along so slowly and nervously, that I could not help laughing outright.

Hearing so unusual a noise, the monkeys who were clinging to the palm did not wait for him, but let go and swung over to the other side. The old fellow narrowly escaped a ducking.

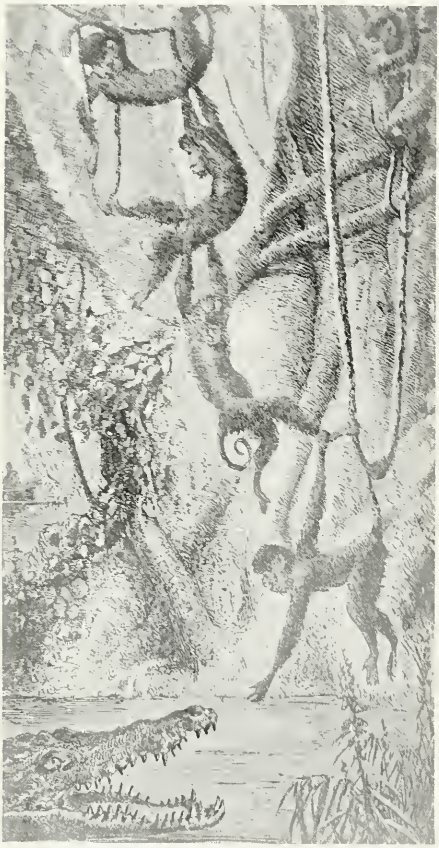
Then followed a curious scene. No sooner had the bridge cleared the water, than the monkeys loosened their grip upon one another. In less time than it takes to tell the story, the bridge dropped to pieces, and—what never happens with a common bridge—the pieces betook themselves to the tops of the trees, and were soon out of hearing in the depths of the forest."

[1] The narrative appeared under the title *Life and Nature Under the Tropics* (New York, 1871).

[2] *A Fourth Reader*, by Prof. George F. Holmes (of the University of Virginia) and Prof. Frank A. Hall (Head master English High School, Cambridge, Mass.). New edition, copyrighted 1887, dated 1897.

To doubting Thomases this is staggering, because of the perfection of its detail, in which it agrees with Paez. The name signed to this short article is that of Charles Frederick Holder, a naturalist and man of high standing![1] I have personally made a careful search through all the works of Dr. Holder, in the hope that the original account might be found. The search proved futile, but it unexpectedly brought to light a confirmatory account. This latter, with a figure accompanying it, bears date of publication in New York just twelve years ago.[2]

[1] Dr. Charles Frederick Holder was the writer of many books and a member of many distinguished scientific societies. He died in Pasadena, California, on October 11, 1915.



A possible source of the bridge myth lies in the interpretation which a not-over-accurate traveler might give to the sight of monkeys swinging in troops from the hanging vines so numerous in tropical forests. The above illustration, from Henri Mouhot's *Travels in the Central Parts of Indo-China (Siam), Cambodia, and Laos* (1864), purports to be drawn from a sketch by that naturalist showing the way in which Old World apes torment their greatest enemy, the imperturbable crocodile, by swinging about his head and tapping him now and again—until some one of the frolickers more foolhardy or less agile than the rest gets his paw caught in the trap and vanishes into the crocodilian interior. The truth of this report is open to doubt, and at any rate the drawing has received additions from the artist's imagination inasmuch as Old World apes do not have prehensile tails

Let us examine Holder's account more closely. First, it was not yet dawn, things could not be seen clearly; second, the stream was so small that the trees almost met overhead; third, the monkeys might easily have been hanging to limbs and making swinging leaps across the narrow stream; fourth, in these tropical countries the vegetation along the streams forms such a dense interwoven jungle that there is no space on the landward side for such a chain to swing back from the bank to get oscillation enough to carry it across the stream; and finally, this account attributes more collective intelligence to monkeys than they have ever been known to show.[3]

[2] *Half Hours with Mammals.* Charles Frederick Holder. New York, 1907.

[3] This is said notwithstanding the fact that S. G. Goodrich in his *Illustrated Natural History of the Animal Kingdom* (Vol. I, page 103, New York, 1859) says: "This account [of the monkey chain] has been doubted by some naturalists, but we are told by Mrs. Loudon that a similar feat is often performed by these monkeys in the Menagerie of the Zoological Gardens at London." If this is true, then it is strange that, so far as the present writer knows, no published statement of such action has come from the eminent men who have for so long reported in the *Proceedings of the Zoölogical Society of London* the happenings in its Zoölogical Garden.

Now Mrs. Loudon before her marriage was Jane Webb, and as Jane Webb she was a very prolific writer of popular natural history books. The British Museum catalogue lists some dozen or more of these works, but unfortunately neither the library of the American Museum of Natural History nor the great New York Public Library possesses any of them, so I have not been able to run down this statement. However, another quotation from Goodrich casts discredit on his whole account.

On the same page, he quotes Dampier, the navigator, in detail as to the formation of the bridge on the "Isthmus of America." Now the standard edition of Dampier's *Voyages* is that of 1729, the sixth I believe, which has recently (1906) been published in fine form under the editorship of John Masefield. In this copy there is *no account whatever* of the monkey chain or of any activities of monkeys in that part dealing with Dampier's crossing of the Isthmus of Panama. Indeed the only place where their antics are referred to is in Dampier's "*Second Voyage to Campeachy,*" and here there is no word of the formation of a chain or bridge.

Now Sabin quotes Stevens that the sixth edition (the standard one) of Dampier's *Voyages Around the World* is a page for page reprint of the earlier editions, but to make sure I consulted the 1698 or "3d edition corrected" and the 1697, the first, edition of the *Voyages* and found the account therein of the *Second Voyage to Campeachy* to agree exactly with Masefield's reprint of the sixth

It seems to me that the possible explanation is to be found in the third point just indicated. Individual monkeys certainly make use of swinging branches and of great palm leaves to enable them to bridge over the space from one tree to another. Using such a swinging fulcrum for a "take-off," they have been known to leap thirty feet, alighting of course at a lower level than the starting point. A procession of monkeys making such leaps from the same point in succession, especially if some were females carrying young, might look like a "living chain."

I have had the pleasure of discussing the matter with Messrs. Leo E. Miller and George K. Cherrie, of the American Museum of Natural History, and few men in the United States have done more exploring work in northern South America. Furthermore, they are not the ordinary type of travelers but are collectors with highly trained powers of observation. They think that there is nothing in the "monkey bridge story" but that it has come about in a perfectly natural way through observation of a procession of monkeys crossing a ravine or stream on a pendent liana.

Professor W. P. Hay, of Washington, has called my attention to an account of Old World monkeys:

"It is amusing, however—for one is interested in observing the habits of animals all over the world—to see the manner in which these creatures [crocodiles] catch the apes, which sometimes take a fancy to play with them. Close to the bank lies the crocodile, his body in the water, and only his capacious mouth above the surface, ready to seize anything that may come within reach. A troop of apes catch sight of him, seem to consult together, approach little by little, and commence their frolics, by turns actors and spectators. One of the most active or most impudent jumps from branch to branch, till within a respectful distance of the crocodile, when, hanging by one paw, and with the dexterity peculiar to these animals he advances and retires, now giving his enemy a blow with his paw, at another time only pretending to do so. The other apes, enjoying the fun, evidently wish to take a part in it; but the other branches being too high they form a sort of chain by laying hold of each other's paws, and thus swing backwards and forwards, while any one of them who comes within reach of the crocodile torments him to the best of his ability. Sometimes the terrible jaws suddenly close, but not upon the audacious ape, who just escapes; then there are cries of exultation from the tormentors, who gambol about joyfully. Occasionally, however, the claw is entrapped, and the victim dragged with the rapidity of lightning beneath the water, when the whole troop disperses, groaning and shrieking. The misadventure does not, however, prevent their recommencing the game a few days afterwards." [1]

When opportunity came to compare Professor Hay's transcript with the original, I found that the account originated with an explorer and naturalist named Mouhot,[2] who died of swamp fever somewhere in the upper part of Indo-China, but whose journals, letters, and scientific memoranda were used by his brother to build up a book. The original picture in this book is of a scene at Paknam-Ven, on the Chantaboun River, Siam, and bears the legend: "Drawn by M. Bocourt from a sketch by M. Mouhot," so it may be considered authentic.

In his text Mouhot speaks of the apes holding on to each other by their paws, but nowhere does he speak of them as using their tails. The figure, however, does show at least three of them using their tails to hold on to the swinging "bush-ropes." This led me to think, until the figure was finally run down, that it was from some book of travel on South America, where the monkeys do have prehensile tails. Mouhot, of course, knew that while the Old World does have long-tailed monkeys, none of them have this organ prehensile, so we must conclude that his artist "improved" on his original sketch.

(*Continued from page 220*)

edition of 1729. So it seems that Goodrich has made Dampier say what he did not say, and if Dampier, why not Mrs. Loudon? As a matter of fact Goodrich has attributed to Dampier an account possibly taken from Wafer, quoted earlier in this article. Dampier was a keen and critical observer of natural history phenomena and anyone who has carefully read his *Voyages* must conclude that had monkey bridges abounded, as Wafer indicates, he would certainly have given us a careful description, as was his wont when anything new or unusual came within his ken. And even had he not seen it, he would in all probability have made mention of it as seen by others, had talk of it been current.

[1] This account and figure are taken from Siam, the Land of the White Elephant, as It Was, and as It Is, compiled by George B. Bacon and published by Charles Scribner's Sons (New York, 1873), as one of the volumes in *Illustrated Library of Travel, Exploration, and Adventure,* edited by Bayard Taylor.

[2] Henri Mouhot was a Frenchman, but the title of his book is *Travels in the Central Parts of Indo-China (Siam), Cambodia, and Laos, during the years* 1858, 1859, 1860, and it was published in two volumes at London in 1864. Mouhot, who lived in England for some years, seems to have had encouragement and possibly some backing from the Zoölogical and Geographical Societies of London in his explorations.

The Remaking of a Museum Collection

REPRESENTATIVES OF THE ORDER OF PRIMATES FROM THE HUGE GORILLA TO THE TINY MARMOSET

By F. A. LUCAS

IT WAS in 1882, that Mr. Robert Colgate, at the suggestion of Professor Henry A. Ward, decided to present to the American Museum, of New York, the most complete collection of apes and monkeys that could be brought together, and as steps were promptly taken to put this plan into execution, the collection rapidly grew to goodly proportions. Thirty-five years ago, however, collecting was much more difficult and collectors were much scarcer than today, so that after a time the supply of monkeys that could readily be obtained was exhausted, and the growth of the collection became slower and slower. Nevertheless, it was an impressive exhibit, occupying the greater part of one of the central halls of the Museum. Later, however, it lost some of this impressiveness, as increase of collections in other halls, without corresponding increase of the building, brought into the exhibit a number of intruders in the shape of the smaller mammals, so that the hall of Primates lost some of its distinctive appearance; also the ever-increasing amount of scientific work by the Museum staff led to the abstraction of many of the skeletons for study and comparison.

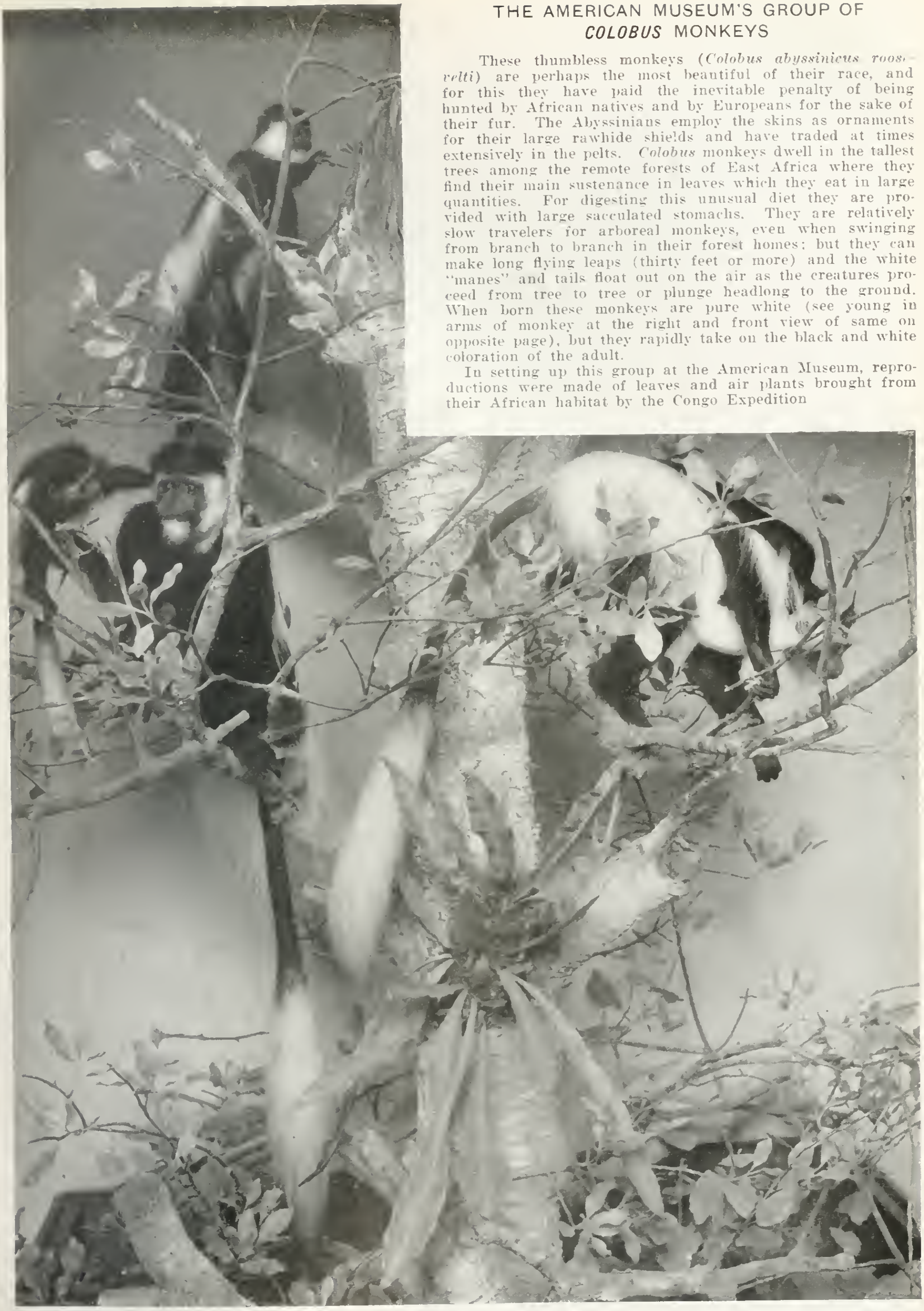
A *Colobus* or horse-tail monkey with its newly born young whose white head may be seen in front of the mother's shoulder. Most monkeys carry their young in this manner, the infant clinging to the parent's fur of its own accord and with its own strength. A side view of this same monkey is seen in the illustration of the group on the opposite page

Quite recently the publication of Elliot's great work, *A Review of the Primates*, caused renewed interest in this particular collection, while collections made by various Museum expeditions in Africa and South America, coupled with improved methods in mounting and displaying specimens, made it both possible and desirable to make such improvements as would bring this hall up to the high standard set by other exhibits. It has been said that some of the greatest reforms have been brought about not by making new laws but by repealing or amending old ones; in the Primates' hall reform has largely been brought about not by discarding the old specimens but by utilizing them to better advantage, and while there have been a few discards, these have been in the way of bright cherry pedestals and of shelves, so that now the visitor is attracted by the animals and not by the supports.

Important additions have been made in the way of groups, four of which have been completed while material for others is in hand; and Man has been represented by figures of the black, yellow, and white races. (See page 235.)

The skeletons formerly scattered through the cases have been brought together, so that the visitor so minded can readily compare the structural resemblances between himself and his more or less distant relatives, or see the general characteristics of the various groups into which the Order of Primates is divided.

The object of the exhibit is to give some idea of the principal species in the Order and their great variety in size and form, which ranges from the huge gorilla to the tiny marmoset, while the habitat groups show characteristic or interesting species in their own haunts.



THE AMERICAN MUSEUM'S GROUP OF *COLOBUS* MONKEYS

These thumbless monkeys (*Colobus abyssinicus roosevelti*) are perhaps the most beautiful of their race, and for this they have paid the inevitable penalty of being hunted by African natives and by Europeans for the sake of their fur. The Abyssinians employ the skins as ornaments for their large rawhide shields and have traded at times extensively in the pelts. *Colobus* monkeys dwell in the tallest trees among the remote forests of East Africa where they find their main sustenance in leaves which they eat in large quantities. For digesting this unusual diet they are provided with large sacculated stomachs. They are relatively slow travelers for arboreal monkeys, even when swinging from branch to branch in their forest homes; but they can make long flying leaps (thirty feet or more) and the white "manes" and tails float out on the air as the creatures proceed from tree to tree or plunge headlong to the ground. When born these monkeys are pure white (see young in arms of monkey at the right and front view of same on opposite page), but they rapidly take on the black and white coloration of the adult.

In setting up this group at the American Museum, reproductions were made of leaves and air plants brought from their African habitat by the Congo Expedition

CROWNED LEMURS FROM MADAGASCAR

Among the unique fauna of the island of Madagascar are found the only extant species of true lemurs. The lemurs, which are the lowest of the ape tribe, resemble monkeys chiefly in their hands and feet, having an opposing thumb like most man-like apes. "Lemur" is Latin for ghost and these animals were so called because of their nocturnal and semi-nocturnal habits. They sleep during the heat of the day and come out in the evening and early morning to feed on fruits and romp in the trees in small bands of six or eight. This American Museum group, of which but a corner is shown, contains two species (*Propithecus verreauxi* and *P. diadema*) set in a reproduction of Madagascar foliage with a background painted from a scene out of Milne Edwards' great work on that island

A SPIDER MONKEY FROM MEXICO

The spider monkeys (*Ateles*), so called from their unusually long arms and legs, are a thumbless genus from the New World. They are very timid and rather stupid animals and live on such fruits as are found in the tropical forests of the two Americas. Their most notable character is the prehensile tail which serves them so remarkably well that the Indians of Brazil claim they catch fish with it. This tail, the under side of which is smooth-skinned at the tip, is always moving here and there grasping branches or objects otherwise out of reach, and is sufficiently strong to suspend the weight of the monkey's body. The number of things a monkey of this type can do at one time is quite astounding.

THE AFRICAN RED GROUND MONKEY

The *Erythrocebus whitei* of Africa is a very shy and active species of monkey which lives in level treeless country, avoiding the high and thick woods where other monkeys usually are found. Its food consists chiefly of grubs and insects, which it obtains by rolling back the sheets of moss covering the rocks—much as one might roll up a rug. Owing to its great activity, as well as to the fact that the level country which it frequents is infested with lions and leopards, native hunters seldom get a chance to kill this species. They attribute to it the power of rendering itself invisible and believe that this power is imparted to the fortunate possessor of its skull, who is thereby enabled to approach and slay an enemy without being seen.

The large baboon (*Papio doguera*) at the right in the group is a representative of one of the most brutal of the genera of manlike apes. The baboons roam in large and well-disciplined bands under the leadership of an old male and are, collectively, formidable antagonists. Only rarely has a baboon been semidomesticated; its disposition is bad and its temper very unreliable

Notes

The geographical and historical basis for a permanent world peace has been the subject of research since the latter part of 1917 by an American organization known as the "Inquiry." This organization has been under the direction of Col. E. M. House, and has maintained its headquarters at the building of the American Geographical Society in New York City, receiving cordial coöperation from every scientific bureau of the United States Government, and being visited in person by President Wilson and Secretary Lansing. Its complete personnel of about 150 persons, carrying with them all prepared effects, sailed for France on the "George Washington" December 4, 1918. The work has been of so confidential a nature that the story in detail is told for the first time in the *Geographical Review* for January, 1919. The Inquiry has, broadly speaking, investigated the political and diplomatic history, the political and economic geography, of all the nationalities in any way affected by the coming treaty of peace, together with the bearings of international law upon these questions. This work has been accomplished through close coöperation of specialists and in consultation with similar commissions in Europe and with representatives of every important nationality of Europe and Western Asia. Among the members of the Inquiry are:

S. E. Mezes, President of the College of the City of New York, *Director*

Isaiah Bowman, Director of the American Geographical Society, *Chief Territorial Specialist*

Allyn A. Young, Head of the Department of Economics at Cornell University, *Specialist on Economic Resources*

Charles H. Haskins, Dean of the Graduate School of Harvard University, *Specialist on Alsace-Lorraine and Belgium*

Clive Day, Head of the Department of Economics at Yale University, *Specialist on the Balkans*

W. E. Lunt, Professor of History, Haverford College, *Specialist on Northern Italy*

R. H. Lord, Professor of History at Harvard University, *Specialist on Russia and Poland*

Charles Seymour, Professor of History at Yale University, *Specialist on Austria-Hungary*

W. L. Westermann, Professor of History at the University of Wisconsin, *Specialist on Turkey*

G. L. Beer, formerly of Columbia University, *Specialist on Colonial History*

Mark Jefferson, Professor of Geography at Michigan State Normal College, *Cartographer*

Roland B. Dixon, Professor of Anthropology at Harvard University

Four officers from the Military Intelligence Division were also attached for special study of problems on strategy, economics, and ethnography: Major D. W. Johnson, Columbia University, Major Lawrence Martin, University of Wisconsin, Captain W. C. Farabee, The University Museum, Philadelphia, and Captain Stanley K. Hornbeck, University of Wisconsin.

In connection with the research carried on by the Inquiry, the cartographers of the American Geographical Society, together with a Government staff, began a great map making program, showing the distribution of peoples and of natural resources, and location of strategic points. The Society prepared a series of base and block maps showing drainage, railways, and relief, of Europe, Asia, and Africa. These maps were later furnished to each unit of the Students Army Training Corps. A small scale edition also has been printed, available for desk use by the students in conjunction with the wall map in the hands of the instructor.

John Burroughs visited the American Museum on January 24 and was entertained by moving pictures in which he had acted the leading rôle. Mr. Burroughs was pictured with several of his family, and with friends, including Mr. Henry Ford and Mr. Thomas A. Edison. The groups had been "filmed" in West Park at "Riverby," "Slabsides," and "Woodchuck Lodge." In connection with this reel, about one hundred colored slides were also displayed. Among them were several of his birthplace in the western Catskills, many were from photographs, by Dr. G. Clyde Fisher of the American Museum, of Mr. Burroughs in his West Park home, and a considerable series showed him with John Muir in California and with Theodore Roosevelt in Yellowstone Park. After the slides had been shown, the local bird hall was visited and the white marble bust of Burroughs, executed by the late C. S. Pietro, was viewed. Mr. Burroughs also examined a number of exhibits in the Museum, including the Florida Group—a group showing Florida reptiles and birds set in a reproduction of a cypress swamp—and visited Mr. Carl E. Akeley's studio where African elephants and rhinoceroses were in process of being mounted. He manifested especial interest in the clay model of an African lion which Mr. Akeley is making as a memorial to Roosevelt. It was a great pleasure to Mr. Burroughs' friends to welcome him to the Museum and to find him in such vigorous health at fourscore years and two.

THE gold medal of the Royal Society for the Protection of Birds (Canada) has been awarded to Professor Gordon Hewitt, Dominion entomologist, and to Dr. W. T. Hornaday, director of the New York Zoölogical Park, "in recognition of their indefatigable services in securing the treaty between Canada and the United States for the protection of migratory birds."

AT the annual meeting of the trustees of the American Museum on February 3, Mr. Herbert L. Bridgman, journalist, explorer, and geographer, manager and editor of the Brooklyn *Standard Union*, and secretary of the Peary Arctic Club, was elected an Honorary Fellow of the institution, pursuant to a resolution expressing "appreciation of the valuable assistance rendered to the Museum by Mr. Herbert L. Bridgman through his service on its committees on exploration, especially in connection with the expeditions of Admiral Peary, the Stefánsson-Anderson Expedition, the Congo Expedition and, more recently, the Crocker Land Expedition—in all of which his wide experience and organizing ability have been placed freely at the disposal of the Museum"—and also acknowledging his "contribution to the advancement of science and education through his editorials and other writings in the public press."

AMONG the names of the officers and founders of the American Ornithologists' Union is that of Robert Ridgway, one of the first vice presidents. Mr. Ridgway lately has completed his fiftieth year on the staff of the Smithsonian Institution, where he occupies the position of curator of birds. He is accounted one of the leading systematic ornithologists of America. His interest in birds began at an early age. When but fourteen he sent a life-size drawing of a pair of purple finches to the Smithsonian Institution and received from Professor Baird, then secretary of the Institution, a letter commending his skill in drawing and offering him assistance in identifying any of his specimens—a service similar to that which Audubon had performed for Professor Baird twenty-five years previously. Systematic ornithology was in its infancy when in 1867 Mr. Ridgway was called to Washington to assist Professor Baird, and its rapid growth may be attributed in large measure to his efforts.

PROFESSOR JOJI SAKURAI, director of the Institute of Physical and Chemical Research in Tokyo, Japan, has been visiting scientific institutions in the United States. The Institute was founded in 1917 by private subscription and government subvention, largely as a result of the effect of the great war in giving government officials, business men, and in fact the whole Japanese nation a new interest in science, relative to such daily needs as dyestuffs and drugs formerly imported from Germany. In order to supply the lack of capable researchers the Institute established a number of scholarships open to university graduates and tenable for two years, and a few of its associate fellows will be annually sent to study abroad. At present the Institute's work is being carried on in the buildings of the universities of Tokyo, Kyoto, and Sendai, but the projected laboratories will be built in northern Tokyo where a site has already been purchased.

IN 1908 foreigners in Peking founded the China Monuments Society for securing "complete suppression of vandalism in China by foreigners, or due to foreign influence or agencies, and the protection of China's antiquities, monuments and all cultural objects, for the benefit of mankind. . . . " Since that date the attention of the Chinese government has been called to the matter at one time and another and considerable interest has been manifested in America toward coöperation in the work of preservation. Priceless objects of art and historic monuments are still, however, in need of protection from both foreign and domestic vandalism, but, owing to the present state of political turmoil throughout China, it is difficult to obtain any organized effort.

Mr. Roy C. Andrews, leader of the American Museum's Second Asiatic Expedition, recently discussed with Mr. Kungpah T. King ways and means of coöperation. Mr. King, a member of the Chinese Parliament and formerly Minister of the Interior, was most active in the establishment of the National Museum of Art at Peking, and is again taking up the question of protection officially in spite of the difficulties in the way of effective action. The Peking Museum was founded with the wonderful collections left in the deserted summer residences of the Manchu emperors at Mukden and Jehol. Four million dollars (silver) were appropriated for purchasing this material from the Manchu dynasty and half of this sum has already been paid.

The following photographs depict scenes in Peking on the signing of the armistice at the close of active fighting in the World War. They were taken by Mr. Roy Chapman Andrews, representative of the American Museum of Natural History

Photograph by Roy C. Andrews

REMOVAL OF THE VON KETTELER MONUMENT IN PEKING

This memorial arch on Ha-ta-mên Street was erected by the late Emperor over the spot where Baron von Ketteler, German Minister to China, was shot by a Chinese soldier. The news of the signing of the armistice in the World War was received in Peking on the morning of November 12. During that afternoon the government gave permission to have the monument removed, and several hundred foreigners attempted to pull the arch down with cables. This attempt was unsuccessful but that night the German inscription was badly defaced and the pillars were chipped and cracked. Later the Chinese government decided to take down the arch, as shown in the photograph and to use the materials in the erection of a "Victory Arch" in Central Park, Peking

Photographs by Roy C. Andrews

GATEWAY TO THE PURPLE CITY

The upper picture shows the massive gateway to the Tung Hua Men courtyard of the Imperial Palace in Peking. The two lower pictures are taken within the court and show the lancers, part of the President's bodyguard, and the President's band. The gateway is one of the most impressive of the series of entrances through which one must pass in entering the Forbidden City. Its base is red and the roof is tiled with the imperial yellow, as are all the imperial dwellings of the city, while before the gate runs a winding canal spanned by beautiful marble bridges. The photographs of the lancers and band were taken just after the President, Hsu Shih-Chang, had passed through to attend the Allied and Chinese review, held to celebrate the signing of the armistice

Photographs by Roy C. Andrews

REVIEW OF CHINESE AND ALLIED TROOPS

The President of China with the Allied Ministers reviewed a parade of Allied and Chinese troops in the great court before the old Throne Room or Hall of Supreme Concord (Tai Ho Tien). This court is large enough to hold 15,000 people. The brilliance of the scene was indescribable; in the background the yellow tiles of the Tai Ho Tien (one of the most superb examples of Chinese architecture) gleamed in the sunlight like molten gold and in the court and on the terraces were thousands of flags and uniforms of every color. In the picture at the bottom of the page the President is shown reading his address from the terrace of the Throne Room (politically and almost geographically the center of Peking). On the left are the foreign ministers; on the right, the foreign military attachés and General Tuan Chi-jui, ex-Premier, with members of his staff

Photographs by Roy C. Andrews

AFTER THE REVIEW

The upper photograph shows General Tuan Chi-jui, ex-Premier of China, with the Allied military attachés: reading from left to right are two members of General Tuan Chi-jui's staff, the Russian and the French attachés, General Tuan Chi-jui, the British, the American, and the Japanese attachés.

General Tuan Chi-jui is one of the most influential generals in China. It was he who dispersed General Chang Hsu's troops in 1917 when the latter attempted to restore the Manchu Emperor. General Tuan Chi-jui is a stanch militarist and will oppose any attempt to limit the powers of the military governors who practically govern China today.

In the lower picture Chinese troops, preceded by their colors, are seen leaving the court of the Tung Hua Men and about to cross one of the beautiful marble bridges

Theodoor De Booy, archæologist and explorer, died February 19, at his home in Yonkers. Mr. De Booy had been in charge of the West Indian archæological work of the Museum of the American Indian, Heye Foundation, New York City, since 1911. Last year he was in charge of an expedition sent out by the University of Pennsylvania Museum, which penetrated unknown regions in Venezuela and Colombia. Few men knew the West India Islands and their archæology as Mr. De Booy knew them. A skillful and tireless worker, with the faculty of making friends wherever he went, he proved a most successful collector. He was the author of several papers on the archæology of the West Indian Islands, and a short time before his death he brought out, jointly with John T. Faris, the book *The Virgin Islands, Our New Possessions, and the British Islands.*

The death is announced of two of the country's distinguished botanists, George F. Atkinson, professor and head of the botany department at Cornell University, and Volney M. Spalding, formerly professor of botany at the University of Michigan.

S. A. S. Albert, Prince of Monaco, has contributed to the Académie des Sciences,[1] of Paris, a paper on the "Route of floating mines in the North Atlantic and Arctic Oceans during and after the war." Prince Albert has for many years made extensive researches into oceanography and mapped the course of the Atlantic currents by dropping objects so constructed that they floated just below the surface and escaped action by the wind. Mines sown in the North Sea, he says, will wander along the northern European coasts until they are finally swept into the fjords of Norway. Those which break loose on the Atlantic coast of Europe, however, will fall into the general Atlantic currents dominated by the Gulf Stream. Barring accident on the Canary Islands or the Antilles, or protracted circulation in the great Atlantic whirl, the Sargasso Sea, these mines will travel down the coast of Europe and of northern Africa, across the ocean to the West Indies and back by way of the Gulf Stream current. After their return to European waters, the mines will either go by the west coast of Ireland to break in the Arctic ice or in the Norwegian fjords, or return a second time over the previous transatlantic circle. Prince Albert calculates the average speed as somewhere around five miles in twenty-four hours. A complete voyage from the vicinity of the Channel and return would accordingly require about four years.

[1] *Comptes rendus hebdomadaires*, Tome 167, No. 27 (30 Décembre 1918).

"The time has arrived when there should be a great awakening in the teaching of geography in America," writes Professor W. W. Atwood, in the *Geographical Review* for January, 1919, "and when teaching must go far beyond what most grown people remember as geography." The importance of both physical and economic geography has been strongly brought to our attention by the war and even to a greater extent by the parceling up of the world, contingent upon the signing of peace. Never again will the United States stand in isolation, either political or commercial, and, as our market is to be the world, so we must study the world's geography.

Geography has never been taught to any extent in America beyond the primary schools. Even the teachers of geography are not trained in any phases of the subject beyond the elements, for virtually no courses in geography are given in the colleges. All the higher institutions of learning should open departments of geography as fast as adequately trained instructors can be furnished. There are many students who would take up this field of work as a profession if America recognized it. Each of the large universities in France has a department of geography; there is a staff of eight specialists in geography at the University of Paris. Great English and German universities also are equipped; and similar progress has been made in other countries, as Austria, Switzerland, Italy, Denmark, and the Netherlands. The time has come when full consideration should be given to the relations between geography and the expansion of civilizations.

Sir Arthur Pearson, the blind founder and director of St. Dunstan's Hostel for blinded soldiers, London, addressed a large audience of blind and their friends at the American Museum on February 5. Sir Arthur spoke of the marvelous work accomplished at the hostel and of the new departures inaugurated there. "Victory over blindness," is St. Dunstan's motto. The hostel impresses upon its new arrivals that it is not an institution for the helpless, but a school where "normal people who cannot see" are reëducated. It is for the blind themselves, said Sir Arthur, to disabuse the public of the belief that blindness is associated with helplessness, and accordingly he believes that the coming of the blinded soldiers in the prime of life from stirring scenes has been the blind's best asset. Play is taken very seriously at the hostel and is considered of equal importance with work; all forms of amusement are encouraged, from boxing to checkers. Dancing is popular with the men. St. Dunstan's Dramatic Club has developed into a regular London institution. Sir Arthur considers outdoor athletics as of particular importance in giving the blind renewed control over their muscles. As they have access to the large lake in Regents Park, rowing is one of the favorite sports, and expert crews are sent to race on the Thames at Putney, while those who have had previous experience in boxing take up this exercise with successful results. Any activity which fosters the competitive spirit promotes rapid development and raises the morale of the men.

The average stay at St. Dunstan's is nine months, during which the men must acquire an occupation, or relearn an old one. They must also learn to read. This last is of the utmost importance, for the mere ability to read continually widens the blinded person's mental horizon and gives him added confidence. In learning an occupation, St. Dunstan's insists that its blind be as capable and stand as thorough examinations as more fortunate competitors in the same field who can see. Among occupations not hitherto thought of in connection with the blind, Sir Arthur Pearson has introduced massage with much success. This is a well-paying profession and is readily learned by those of the blind who are inclined toward the work. Many more trades and professions are suitable for the blind than is generally assumed. The government of the United Kingdom now appropriates an annual sum of two million dollars to be expended in work with the blind.

The Roosevelt Permanent National Committee, appointed for the purpose of choice and erection of a national memorial to the late Theodore Roosevelt, consists of the following persons, representative of industrial, political, scientific, literary, and social life, and including all of Roosevelt's former cabinet members:

Chairman

William Boyce Thompson

Honorary Chairmen

W. H. Taft — Charles E. Hughes

Vice Chairmen

Senator H. C. Lodge
John Mitchell
John T. King
Senator Hiram Johnson
A. T. Hert

Treasurer

Albert H. Wiggin

Members of Committee

Lyman Abbott
Carl E. Akeley
Gov. H. J. Allen
Jacob L. Babler
Gov. R. L. Beeckman
C. J. Bonaparte
Seth Bullock
John Burroughs
Gov. T. C. Campbell
Russell Coles
Willis C. Cook
G. B. Cortelyou
Walter Damrosch
Coleman du Pont
Rep. Simeon D. Fess
Lyman J. Gage
James R. Garfield
Cardinal Gibbons
Mrs. Mary A. Gibson
Gov. J. P. Goodrich
John C. Greenway
Col. George Harvey
William D. Howells
Harold L. Ickes
William P. Jackson
Senator F. B. Kellogg
Senator W. S. Kenyon
Earle S. Kinsley
Irvin R. Kirkwood
Senator P. C. Knox
Albert D. Lasker
William Loeb, Jr.
Pres. A. L. Lowell
Rep. C. N. McArthur
H. F. McGregor
Rev. W. T. Manning
Thomas A. Marlow
Victor H. Metcalf
Robert R. Moton
Senator T. H. Newberry
Rep. John I. Nolan
John M. Parker
Admiral R. E. Peary
George W. Perkins
Gifford Pinchot
Senator Miles Poindexter
Rep. C. F. Reavis
Mrs. Whitelaw Reid
H. L. Remmel
Raymond Robins
Elihu Root
John Sargent
Charles Scribner
W. W. Sewell
Leslie M. Shaw
H. F. Sinclair
Philip B. Stewart
Oscar S. Straus
Patrick Sullivan
J. O. Thompson
Miss H. F. Vittum
Augustus H. Vogel
Henry C. Wallace
Rep. Wallace
David Warfield
Charles B. Warren
Henry J. Whigham
James Wilson
Gen. Leonard Wood
Luke E. Wright
William Wrigley
Robert J. Wynne

That man should not be omitted in the consideration of the Primates is the underlying motive in the installation in the hall of Primates of the American Museum (see page 222 of this issue of Natural History) of models of the Norwegian, Chinese, and African races. While there is some diversity of opinion as to whether there is more than one species of man, there are undeniable well-marked races corresponding to the subspecies in zoölogy. Of these the white, yellow, and black races shown in the present exhibit are the principal types. The figures were made by the Washington sculptor, Mr. U. S. J. Dunbar, who has been very successful in reproducing the races of man; the coloring is the work of Mr. Frederick H. Stoll, of the preparation department of the American Museum; the garments worn are actual articles of apparel collected in the field. The white race is represented by a Hardanger peasant of Norway in the costume of a young married woman. This type is found in its purest form in Scandinavia, where fifty per cent of the population are tall, blue-eyed, fair-haired, and long-headed. The yellow type, depicted by the Cantonese farm laborer, has straight black hair, yellowish or copper-brown skin, oblique eyes, high cheek bones, and projecting ears. In securing a model for the coloring and hair of this figure Mr. Stoll had much difficulty in finding a Chinaman with a queue, this form of headdress being no longer popular with the Chinese. He finally discovered an old Chinese chemist who generously served as a study for this figure. The farm laborer of the exhibit, however, has a skin much darker than the Chinaman seen in the streets of New York.

Perhaps the most interesting figure of the group is the African, inasmuch as it is an actual portrait of Manziga, chief of the Azande. The Azande are famous warriors of Central Africa, having pushed their way by force of arms from the Sudan down into the Congo where they are firmly established. They are also known as *Niam-Niam* (meat-meat) because of former cannibalistic tendencies. Now, however, they are an agricultural people, living chiefly on millet, durra grain, manioc, sweet potatoes, and plantain. From the grains they also make intoxicating drinks. The women of the tribe are kept virtually in slavery. The shield carried by Manziga is covered with rattan fiber and is both beautifully designed and carefully made. In war this chief often carries five or six spears, and when these are exhausted his supply is replenished with others carried by men running behind him. The Azande make also peculiar iron throwing knives which have many points and act somewhat as a boomerang when thrown. The dress worn by this figure is made from strips of fig bark beaten with hammers, soaked in water until very flexible, and then woven into cloth. The designs are stamped on with a die—such a die often consisting of the dried section of some fruit.

The complete dress costume of an Indian chief, comprising a large feather war bonnet, fringed shirt and leggings, with moccasins, pipe bag, and feather-trimmed standard, has been presented to the American Museum by Mrs. Anna Sargeant of Jersey City. The costume was the property of Chief White-eagle, a Cheyenne Indian of mixed blood, who had left a request with Mrs. Sargeant that this costume be presented to the Museum in case of his death. Chief White-eagle passed under the name of Don White-eagle. Before entering the Army he had been for several years connected with Barnum and Bailey's Circus. When America entered the war he was moved with intense patriotism and offered his services in the Liberty Loan Drives, having at one time a tipi in front of the New York Public Library where he appeared in the costume just presented to the Museum, and addressed passers-by on their duty with respect to the loan. These appeals were so successful that he visited other parts of the country on a similar mission. Later, he took part with equal success in Red Cross and War Savings Stamp campaigns. He entered the United States Army in July, 1918, and died in France of pneumonia, October 21, 1918, but not until after he had received special commendation by the general of his division for bravery of action at the front.

As a small help in the work of reforesting woodland areas in France, Mr. Percival S. Ridsdale, secretary of the American Forestry Association and editor of *American Forestry*, in visiting that country recently, carried with him a large number of Douglas fir seeds—"a small package with a big value," cabling after his arrival that the French government accepted the offer of aid tendered by the Association.

We note with satisfaction the great step forward taken by Governor Sleeper of Michigan, in urging the foundation of a system of connected public parks through the state. In Indian days the northern part of Michigan was closely covered with the heavy coniferous forest which extended across the Lake Region as far as Minnesota, and the southern section by the edge of the hardwood growth of the Ohio River Valley. Even today a large part of the state is wooded with a rich and varied forest, representing about a hundred native species. Sectors of woodland along many of the quiet streams and hidden lakes are ideal locations for forest parks. Heretofore, Michigan has given no attention to this form of conservation, so that her fields and woodlands have been rapidly restricted by private ownership. Governor Sleeper's project will involve not only the setting aside of ground, but also extensive work in forest preservation and reforestation.

In connection with the discussion of scenic conservation by Dr. R. M. Harper in this number, we note the progress made in the state of New York as reported by the American Scenic and Historic Preservation Society. Since 1849 New York has bought, at one time and another, about thirty-five public parks and monuments. These are for the most part historical sites, associated with events and persons of importance in American history. Twenty-two of these monuments have been purchased since 1900. Among them is Stark's Knob near Schuylerville where, during the Revolution, Captain Stark built a redoubt to oppose General Burgoyne at the Battle of Saratoga. Temple Hill Monument at New Windsor was presented to the state in 1917. It is on the site of the famous "Temple of Virtue" erected in 1783 in honor of the anniversary of the French Alliance. Here Washington publicly spurned the suggestion that he become king of the Thirteen Colonies. New Windsor is also interesting to us today as the former site of a large military cantonment—the last of the Revolutionary War.

A *Handbook of Travel* has been prepared by members of the Harvard Travellers Club, under the editorship of Mr. Glover M. Allen, secretary of the Boston Society of Natural History. The first part of the book contains practical suggestions on methods of travel in various climates, of observations on camp cooking, firearms, equipment, and of notes on different beasts of burden from Eskimo dogs to camels. Each heading is contributed by an expert in the given field; for instance, the late Oric Bates, famous archæologist and explorer of the Near East, tells how to ride and how not to ride a dromedary; and Langdon Warner, director of the proposed American School of Archæology in Peking, describes the food and disposition of a two-humped camel, and of its Mongol owner. A very fascinating chapter on "Hunting Dangerous Game" is contributed by Dr. William Lord Smith. Dr. Smith's danger order is "elephant, tiger, lion, leopard, grizzly bear, rhinoceros, buffalo, gaur, banteng, other bear." Not the least valuable sections of the handbook are nine chapters, for the most part by members of the Harvard Faculty, on hygiene, astronomical observations, route surveying, photography, geology, meteorology, natural history collecting, anthropology, and "Notes on Traverse Surveys in Tropical South America." The expert here describes for the nonexpert the kinds of observations that may be made by the latter and gives directions how to take and record the facts. The chapter on "Hygiene, Medicine, and Surgery" is particularly complete, embodying not only a treatment of ordinary hygiene but also the diagnosis of common diseases, diseases peculiar to the Arctic and the tropics, surgical practice, and medical methods and equipment. In discussing geology and geography Professor William M. Davis gives considerable advice as to how to record interesting and valuable facts, writing on the assumption that "the traveller proposes eventually to publish an article or a book concerning his travels."

Edward Charles Pickering, Paine professor of practical astronomy and director of the observatory at Harvard, died on the third of February at the age of seventy-three. Before his selection by President Eliot for the Harvard Observatory, Professor Pickering was instructor in mathematics and subsequently professor of physics in the Massachusetts Institute of Technology where he inaugurated the first physical laboratory in the United States for purposes of instruction.

At the Harvard Observatory Professor

TIMBER WOLVES OF THE ROCKIES

Timber wolves on a deer trail at the foot of the Arapahoe Peaks, Colorado, as displayed in a panoramic habitat group recently mounted in the American Museum. The timber or gray wolf (*Canis nubilis*) is widely known for its predacious habits. Even today it is a scourge to game and stock, and in sparsely populated districts has easily held its own against dogs, traps, and rifles. All the wolf-infested states offer generous bounties and the United States Forest Service undertakes to destroy wolves on the forest ranges. The group in the American Museum attempts to reproduce through effects of lighting the coldness and brilliancy of a winter night in the mountains. It was planned by Mr. Hobart Nichols, of New York City, who also painted the view of the Arapahoe Peaks of the Silver Lake Region which forms the background. The wolves were mounted by Mr. Coloman Jonas, of Denver; the foreground of snowdrifts and trees was executed by Messrs. A. E. Butler and W. B. Peters

Pickering was noted for his pioneer work in the field of astrophysics (the "new astronomy"). Great advances in photographic technique were made during the early years of his incumbency and he quickly appropriated photographic methods for his astronomical studies, founding the great Harvard photographic library. He also devised new methods of measuring the brilliancy of stars and of classifying stellar spectra. Professor Pickering was especially known for the great personal interest and assistance he was so anxious to extend to any astronomical enterprise, and in the Harvard Observatory many of our contemporary astronomers received the inspiration for their scientific labors.

Two small monographs[1] on mahogany list the various species of woods that are commercially sold as mahogany and even attempt to redefine the name so as to include many other red timbers. True "mahogany" is the wood of two closely related species (*Swietenia mahagoni* Jacq. and *S. macrophylla* King) the distribution of which is limited to tropical America. Mr. Mell, author of the American volume, gives a list of sixty-one other "mahoganies" from all parts of the world, and Professor Dixon, author of the British book, describes the microscopical character of forty-five species with 138 reproductions of microphotographs. Mahogany was the chief wood used in England and Spain for shipbuilding during the eighteenth century, but with the gradual diminution of accessible supplies and the introduction of substitutes it has gradually disappeared from the trade except for use in the framework of small sailing vessels and the outer planking of yachts. The great mahogany-framed ships have been sold for enormous sums to be cut up for the manufacture of furniture. Today mahogany is a very high-priced lumber employed almost exclusively in joinery and cabinetmaking. Mr. Mell gives the selling price of the best grades in New York in 1917 as from $175 to $200 a thousand board feet.

Fustic wood (*Chlorophora tinctoria*), the wood with which our khaki and olive drab uniforms are dyed, has experienced a period of intensive cutting during the last four years. It is said that fustic has been bringing $45 and $50 a ton in New York, whereas it formerly ranged from $20 to $25 a ton. The wood is imported as logs from Mexico, Central and South America, and the West Indies, and after grinding, is used in the form of a water infusion for producing various shades of yellow, brown, olive, and green, for use particularly upon silks and woolens. It can also be compounded with other dyes for drabs, fawns, and olives, and with logwood for black. The fustic tree grows best near the coast and well drained banks of rivers, but, of course, the most accessible localities have already been cut off. One or two trees to the acre of forest is the average growth, a fact which makes getting out the fustic wood anything but profitable, and this is particularly true where it is necessary to employ land transportation through roadless country.

An important series of descriptive works on the flora of the state of Florida has been issued during the last few years by Dr. John Kunkel Small, head curator of the Museums and Herbarium of the New York Botanical Garden. Dr. Small wrote in the Journal of the American Museum for December of one of his several collecting trips to little explored sections of the Everglades and the islands off the Florida coast. The handbooks are based for the most part on material which he has collected on such expeditions and are much more complete than any survey hitherto published. They include *Florida Trees*, *Flora of the Florida Keys*, *Shrubs of Florida*, *Flora of Miami* (all 1913), *Ferns of Royal Palm Hammock* and *Ferns of Tropical Florida* (1918). The last two are extensively illustrated with drawings of the ferns and photographs of their habitats. Southern Florida constitutes a unique province in the United States, being the only point touched by a strictly tropical vegetation, so that these extensive studies by a distinguished botanist form not only an extremely valuable addition to systematic botany but also practical guides to the identification of the trees, flowers, and ferns of Florida by the interested sojourner there.

Guatemala, with every confidence in her natural wealth of field, forest, and pasture, has traveled far on the route to recovery

[1] H. H. Dixon, *Scientific Proceedings of the Royal Dublin Society*, vol. xv., p. 431, and C. D. Mell. U. S. Department of Agriculture, *Bulletin* 474, February, 1917.

after the great earthquake catastrophes of December, 1917, and January, 1918.[1] New and earthquake-proof structures are being raised of reënforced concrete and galvanized iron. Quick reconstruction was planned for the schools, and President Cabrera seized the opportunity to improve the school system and to establish a National University, whose faculty, under a superior council, will govern the curriculum of the primary and secondary schools of Guatemala. Within six months after the destruction of the city more than a million dollars had been contributed by citizens and friends and the preliminary steps toward reconstruction had already been taken.

The section of books on folklore in the Library of the American Museum of Natural History, which has hitherto been somewhat undeveloped, has acquired by purchase 1034 volumes dealing mainly with European and Asiatic folklore and related subjects. In the selection of these works the Library has been ably assisted by Dr. W. L. Hildburgh, who has made a special study of this branch of literature.

[1] See description of the earthquake by an eyewitness, "The Guatemala Earthquake." By Sylvanus Griswold Morley, AMERICAN MUSEUM JOURNAL, Vol. XVIII, March, 1918.

At a February meeting of the trustees of the American Museum, Messrs. Horace F. Hutchinson, Richard B. Kelly, and Dr. E. W. Gudger were elected life members of the institution in recognition of services rendered. Mr. Frederick Potter was elected a Fellow, Mr. William Averell Harriman, a Patron, and Mr. George F. Baker, an Associate Benefactor in recognition of their generous contributions and interest in the Museum's work.

Mr. G. K. Noble has been appointed assistant curator of herpetology in the American Museum and Mr. Karl P. Schmidt assistant in herpetology. Mr. Barrington Moore, formerly associate curator of woods and forestry, who has been in France with the forestry branch of the Engineering Corps, has been appointed research associate in forestry.

Since the last issue of Natural History the following persons have been elected members of the American Museum:

Associate Benefactor, George F. Baker.

Patron, William Averell Harriman.

Fellow, Frederick Potter.

Honorary Fellow, Herbert L. Bridgman.

Life Members, Major Noel Bleecker Fox, Dr. E. W. Gudger, Messrs. Charles B. Curtis, Gano Dunn, Horace F. Hutchinson, Richard B. Kelly, Huston Wyeth, and Geo. A. Zabriskie.

Sustaining Members, Miss S. D. Bliss and Mr. Geo. W. Mann.

Annual Members, Mesdames Frederick Frelinghuysen, Albert Edward Hurst, William Loeb, Jr., Walter Willson Metcalf, Wheeler H. Peckham, Alice B. Tweedy, John Colin Vaughan, Miss M. R. Cross, Lieut. John King Reckford, The Rt. Rev. Mgr. M. J. Lavelle, Doctors Robert Abrahams, Milo Hellman, Albert R. Ledoux, George Grant MacCurdy, Edward H. Squibb, Messrs. Frederic W. Allen, Frank L. Babbott, Adolph D. Benheim, Nathan I. Bijur, Cecil Billington, Charles M. Breder, Jr., Frederick G. Clapp, George W. Davison, Joseph P. Day, William J. Downer, John W. Everitt, Frank S. Hackett, Frank Morton Jones, G. P. Klaas, Samuel Howell Knight, Joseph G. Liddle, Daniel M. Lord, Judson Lounsbery, S. Mallet-Prevost, Robert Marshall, Wm. M. McBride, Tompkins McIlvaine, Wm. Melzer, Harvey Murdock, C. W. Nichols, William C. Pate, Joseph Read Patterson, Lionello Perera, Arthur C. Rounds, Howard A. Scholle, H. S. Stiles, John Tatlock, Eli S. Wolbarst, and All Hallows Institute.

Associate Members, The Reverend Walter F. Tunks, The Hon. Wallace McCamant, Doctors J. M. Armstrong, James S. Gilfillan, Oscar Owre, M. Robert Weidner, Professor S. C. Schmucker, Messrs. C. F. Adams, J. D. Armstrong, J. W. Clise, A. A. Crane, Gaylord C. Cummin, R. I. Farrington, James A. Green, H. Shumway Lee, Ernest P. Lenihan, William Colhoun Motter, Winthrop G. Noyes, Roger B. Shepard, A. T. Simpson, B. W. Stephenson, Ralph Whelan, Philip T. White, and William O. Winston.

The American Museum of Natural History

Its Work, Membership, and Publications

The American Museum of Natural History was founded and incorporated in 1869 for the purpose of establishing a Museum and Library of Natural History; of encouraging and developing the study of Natural Science; of advancing the general knowledge of kindred subjects, and to that end, of furnishing popular instruction.

The Museum building is erected and largely maintained by New York City, funds derived from issues of corporate stock providing for the construction of sections from time to time and also for cases, while an annual appropriation is made for heating, lighting, the repair of the building and its general care and supervision.

The Museum is open free to the public every day in the year; on week days from 9 A.M. to 5 P.M., on Sundays from 1 to 5 P.M.

The Museum not only maintains exhibits in anthropology and natural history, including the famous habitat groups, designed especially to interest and instruct the public, but also its library of 70,000 volumes on natural history, ethnology and travel is used by the public as a reference library.

The educational work of the Museum is carried on also by numerous lectures to children, special series of lectures to the blind, provided for by the Thorne Memorial Fund, and the issue to public schools of collections and lantern slides illustrating various branches of nature study. There are in addition special series of evening lectures for Members in the fall and spring of each year, and on Saturday mornings lectures for the children of Members. Among those who have appeared in these lecture courses are Admiral Peary, Dean Worcester, Sir John Murray, Vilhjálmur Stefánsson, the Prince of Monaco, and Theodore Roosevelt. The following are the statistics for the year 1918:

Attendance in Exhibition Halls	627,302
Attendance at Lectures	64,036
Lantern Slides Sent out for Use in Schools	72,287
School Children Reached by Nature Study Collections	817,610

Membership

For the purchase or collection of specimens and their preparation, for research, publication, and additions to the library, the Museum is dependent on its endowment fund and its friends. The latter contribute either by direct subscriptions or through the fund derived from the dues of Members, and this Membership Fund is of particular importance from the fact that it may be devoted to such purposes as the Trustees may deem most important, including the publication of NATURAL HISTORY. There are now more than four thousand Members of the Museum who are contributing to this work. If you believe that the Museum is doing a useful service to science and to education, the Trustees invite you to lend your support by becoming a Member.

NATURAL HISTORY

THE JOURNAL OF THE AMERICAN MUSEUM

DEVOTED TO NATURAL HISTORY,
EXPLORATION, AND THE DEVELOPMENT OF PUBLIC EDUCATION
THROUGH THE MUSEUM

MARCH, 1919

VOLUME XIX, NUMBER 3

NATURAL HISTORY

VOLUME XIX

CONTENTS FOR MARCH

NUMBER 3

MARY CYNTHIA DICKERSON, *Editor*

Published monthly from October to May, by the American Museum of Natural History, New York, N. Y. Subscription price, $2.00 a year.

Subscriptions should be addressed to the Secretary of the American Museum, 77th St. and Central Park West, New York City.

NATURAL HISTORY *is sent to all members of the American Museum as one of the privileges of membership.*

Entered as second-class matter February 23, 1917, at the Post Office at New York, New York, under the Act of August 24, 1912.

Acceptance for mailing at special rate of postage provided for in Section 1103, Act of October 3, 1917, authorized on July 15, 1918.

THE AMERICAN MUSEUM OF NATURAL HISTORY

MEMBERSHIP

For the enrichment of its collections, for scientific research and exploration, and for publications, the American Museum of Natural History is dependent wholly upon membership fees and the generosity of friends. More than 4000 friends are now enrolled who are thus supporting the work of the Museum. The various classes of membership are:

Benefactor		$50,000
Associate Founder		25,000
Associate Benefactor		10,000
Patron		1,000
Fellow		500
Life Member		100
Sustaining Member	annually	25
Annual Member	annually	10
Associate Member (nonresident)	annually	3

Full information regarding membership may be obtained from the Secretary of the Museum, 77th Street and Central Park West.

NATURAL HISTORY: JOURNAL OF THE AMERICAN MUSEUM

NATURAL HISTORY, recording popularly the latest activities in natural science and exploration, is published monthly from October to May, inclusive, by the American Museum of Natural History. The subscription price is Two Dollars a year. NATURAL HISTORY is sent to all classes of members as one of the privileges of membership. Subscriptions should be addressed to the Secretary of the Museum.

POPULAR PUBLICATIONS

A large number of popular publications on natural history, based on the exploration and research of the Museum, are available in the form of handbooks, guide leaflets, and reprints. A detailed list of these publications will be found in the Appendix to NATURAL HISTORY. Price lists and full information may be obtained by addressing the Librarian of the Museum.

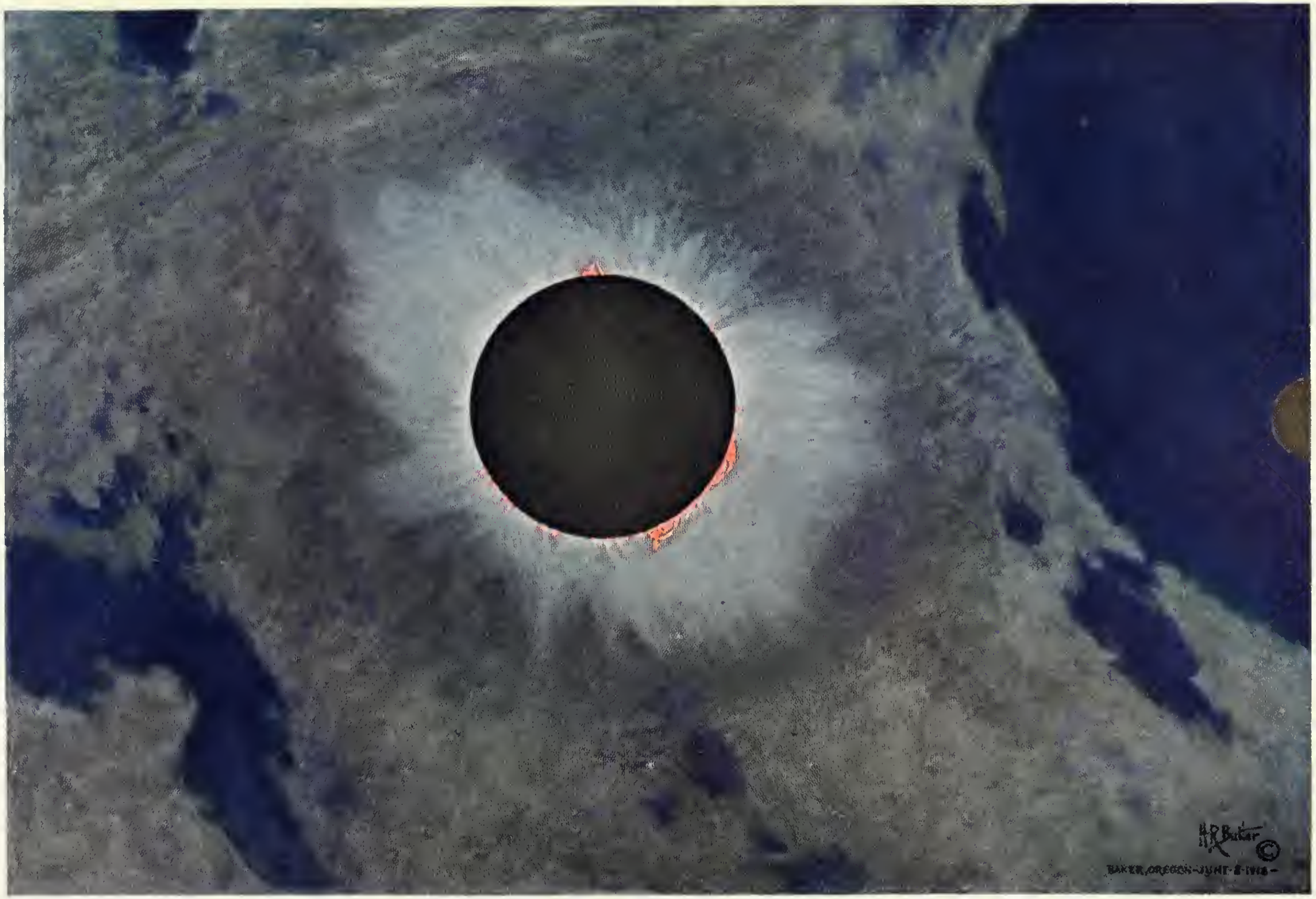
SCIENTIFIC PUBLICATIONS

The field and laboratory researches of the American Museum of Natural History and other technical scientific matters of considerable popular interest are represented by a series of scientific publications comprising the *Memoirs, Bulletin,* and *Anthropological Papers.* A condensed list of these publications will be found on the inside back cover of NATURAL HISTORY. Price lists and complete data may be obtained from the Librarian.

GIGANTIC PROMINENCES ON THE SUN'S LIMB

During the eclipse, flames of hydrogen gas were seen to shoot out from the sun's surface at velocities sometimes as great as a hundred miles a second, reaching such colossal distances as 480,000 miles. The upper prominence in the picture, which resembles some great monster, is at least 47,000 miles high. Fiery streamers trail from each of the outbursts as though blown by an equatorial gale.

This photograph was made at Green River, Wyoming, by Professor E. E. Barnard of the Yerkes Observatory, with a camera of 61½ feet focus. With shorter exposure the lower prominence is shown in delicate detail as made up of thin fiery filaments



TOTAL ECLIPSE OF THE SUN, JUNE 8, 1918

From the painting by Howard Russell Butler, N. A.

The corona and prominences as observed through thin clouds at the United States Naval Observatory Station, Baker, Oregon.
(Original size of painting 49 x 33½ inches)

NATURAL HISTORY

VOLUME XIX — MARCH, 1919 — NUMBER 3

The Total Solar Eclipse of 1918

By S. A. MITCHELL

Director of the Leander McCormick Observatory, University of Virginia

WHO is not interested in a total eclipse of the sun? He who has once seen such an eclipse can never forget it: the slow but gradual obscuration of the sun, the darkness covering the face of the earth even at noontime, and the glorious sight that meets the eye during the few short minutes of totality! It is no wonder, therefore, that in the early days of the world's history these wonderful phenomena should have been looked upon with great fascination and dread, and that the astronomer—and more often the astrologer—should have been regarded as almost a demigod because of his ability to predict the coming of eclipses. But with the increase of knowledge and the progress of science, the astronomer has gradually been dragged from his lofty pinnacle of fame, until now in the twentieth century the popular fancy pictures him as a foolish old man who would rather stay up at night and do his work than act as an ordinary civilized human being.

Not only do eclipses appeal to the popular imagination by their spectacular beauty, but there is also a great fascination to the lay mind in the almost uncanny power with which the astronomer is able to predict, years in advance, the exact time at which an eclipse will take place, where this eclipse may be seen, and how long this eclipse will last. As a matter of fact, Oppolzer's "Canon der Finsternisse" gives the elements of no fewer than 13,000 eclipses, both of sun and moon, partial and total—all the eclipses, in fact, which have taken place since the year 1207 B.C. or which will be seen before the end of the year 2152 A.D. Maps are given in this great work which, almost at a glance, tell when and where an eclipse was seen three thousand years ago, or where an eclipse may be observed two hundred and fifty years in the future.

The earliest recorded eclipse is that which was seen in China in the year 2136 B.C., or more than four thousand years ago! An account of this eclipse is given in one of the ancient Chinese classics. This eclipse, which was not a total eclipse, had rather direful consequences for the two royal astronomers Hi and Ho, who instead of staying in the sober paths of science for this important occasion, went and got drunk. In order that a terrible warning might be given to all future generations of astronomers, who might be tempted to follow in their footsteps, the emperor ordered that both have their heads chopped off.

The progress of science during the last fifty years is nowhere better illustrated than in the attitude of astronomers toward observations at the time of a total eclipse of the sun. Up to the middle of the last century, the only observations that were made at the time of a total eclipse were for the purpose of perfecting the tables of motion of the moon, by noting the exact times of contact of the limbs of the sun and moon. The beautiful corona was watched with awe and admiration, and a few sketches were made of its form, —but there the study of an eclipse ended. In fact, an eclipse was watched only if the shadow happened to cross the observer. So little interest was taken in the phenomena, so few investigations were planned, that no expeditions were sent out.

How different is the scientific attitude in the twentieth century! In the year 1901, the writer of this article traveled halfway round the world to the far-off Dutch East Indies in order to observe the total eclipse of May 18 of that year. In other words, he went as far from home as it was possible to go, and the purpose of this trip was to make observations which were concentrated within the time of six short minutes.

The writer regards himself as very fortunate in having been selected four times to become a member of the party of the United States Naval Observatory, and he has thus seen the eclipses of 1900, 1901, 1905, 1918, and altogether has traveled about 40,000 miles for this purpose.

As a matter of fact, an eclipse is not of the rare occurrence that the foregoing remarks might lead one to believe. Each and every year there must be two eclipses of the sun, and there may be even more. Somewhere on the earth each year two eclipses of the sun may be observed, but usually these eclipses are partial eclipses, the sun being only partly obscured. Since few scientific facts can be learned at a partial eclipse, the astronomer takes little interest in them. It is only when the sun's surface is wholly covered up that the matchless corona may be seen; it is only at the time of a total eclipse that there is furnished the unusual opportunity of investigating the sun's surroundings when the brilliant glare of the sun itself is absent.

About once every two years a total eclipse may be seen somewhere on the earth's surface, but as some of these eclipse tracks lie almost wholly on the water surface of the earth, or fall upon inaccessible portions of the globe, it is only on an average of about once in three years that a total eclipse falls at a habitable spot on the earth, even though that location, as in 1901, may be so far away. On the average a total eclipse lasts for about two minutes, so that in a century, about sixty minutes, or one short hour of time, is given to the astronomer for his investigations. Yet in spite of the brevity of time afforded, some very startling results have been accumulated!

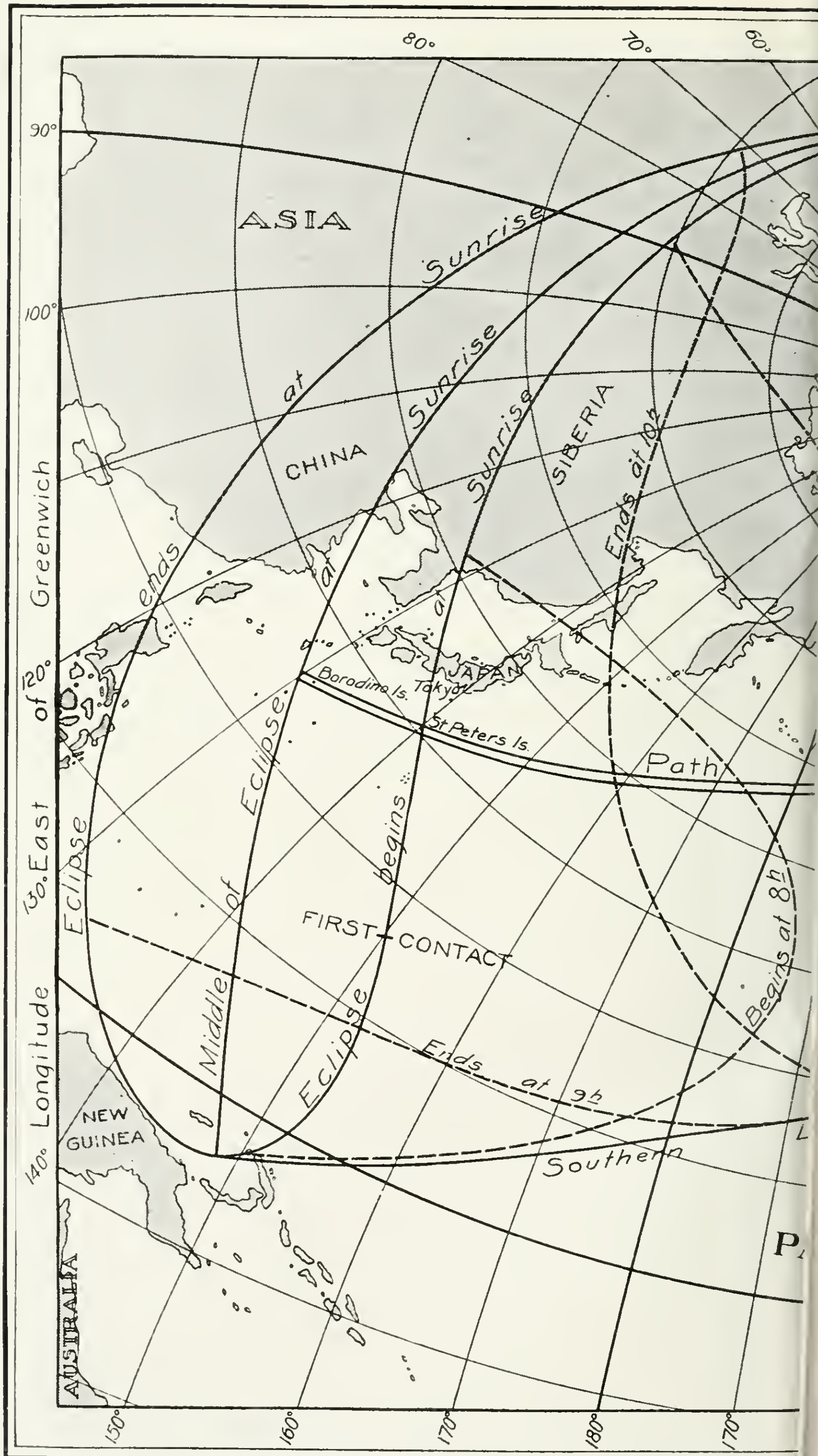
As is well known, an eclipse takes place when the sun, earth, and moon are in a straight line, an eclipse of the sun occurring when the moon comes between the sun and the earth, or when the earth passes into the shadow cast by the moon. The earth makes an annual journey about the sun, traveling in the ecliptic at the speed of more than eighteen miles a second, and accomplishing its journey in 365¼ days. The distance from the sun is on the average of ninety-three millions of miles, but the earth's orbit is not a circle but an ellipse, so that the distance from sun to earth may vary one and a half million miles on either side of the mean. Once a month, the moon revolves about the earth, but it likewise does not move in a circle so that the distance from earth to moon varies considerably on either side of the average of 239,000 miles. Moreover, the moon's path is not exactly in the plane of the ecliptic, but is inclined to the ecliptic by a small amount, a little more than five degrees of angle. An eclipse of the sun can take place only at the time of new moon, so that manifestly it is only at the time of new moon, when in addition the moon is near the plane of the ecliptic, that an eclipse of the sun can take place.

Although the average motions of the moon have for some time been so well known that the general time and locations of eclipses may be predicted at long range with a considerable degree of accuracy, still it may be truthfully said that the moon has given the mathematical astronomer more work and worry than all the millions of stars of the universe, with the result that to predict the time of coming of an eclipse at any one locality exactly to the fraction of a second taxes the ingenuity of the astronomer even today. It is no wonder, therefore, that man should always have regarded the moon as of the feminine gender!

The distance and dimensions of the sun and moon being known, it is comparatively easy to find out the diameter of the moon's shadow intercepted by the earth. The maximum width of the shadow is 168 miles, and when all conditions are most favorable, the total eclipse may last for somewhat more than seven minutes. Under average conditions, the region on the earth where the total eclipse may be observed is less than one hundred miles in width, and the average duration of totality is about two minutes of time. The chance that the stay-at-home might see many total eclipses in his lifetime is very limited. As a matter of fact, in London before the eclipse of 1751, there had not been a single total eclipse of the sun visible for more than six centuries. At any one location, an inhabitant would see many more total eclipses of the moon than of the sun. When the moon passes into the shadow of the earth and is eclipsed, then wherever upon the earth's surface the moon is visible, the eclipse may also be seen. The result is that each total eclipse of the moon is visible over more than half the earth, while on the other hand the total solar eclipse is visible only over a narrow track.

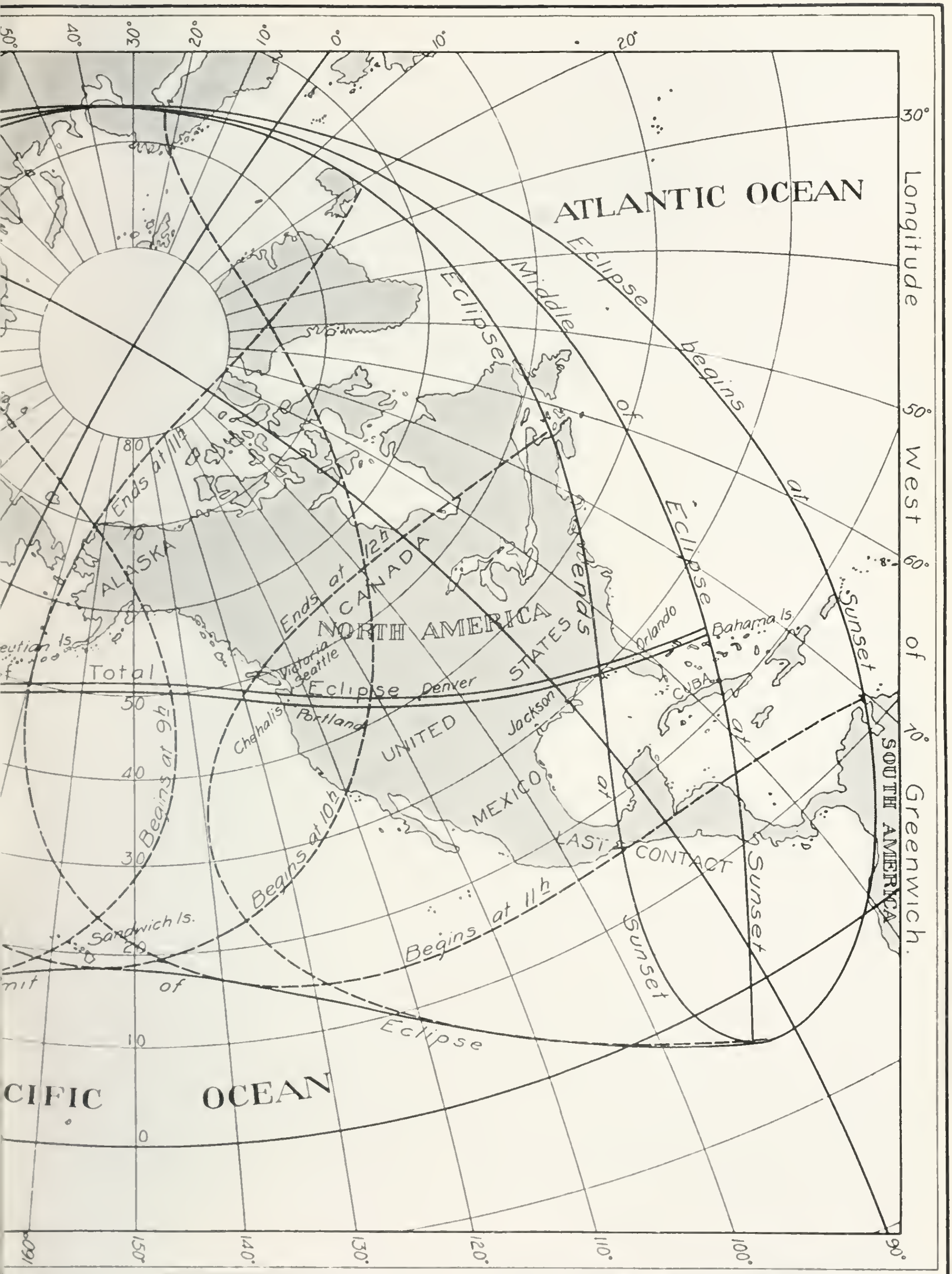
Ordinarily a total solar eclipse attracts astronomers from all quarters of the globe for the purpose of making observations. Thus in 1901, in far-distant Sumatra, in addition to a large party from the United States, there were gathered astronomers from England, France, Germany, Holland, and Japan. For the eclipse of 1905, which took place in Europe, there were congregated in the eclipse track, hundreds of astronomers, professional and amateur, from every civilized nation of the world. The trip in 1901 was a most fascinating one, including as it did a journey across the continent to San Francisco; from the Golden Gate to Manila, stopping *en route* for three days at Honolulu; and ten or a dozen days' stay in Manila while waiting for the United States gunboat which took the party the remaining 2200 miles along the coast of Palawan and Borneo, across the equator, and through the Strait of Sunda to the west coast of the Island of Sumatra. A stay of eight weeks in the interior of the island was necessary in preparation for the eclipse, a site having been chosen at the terminus of the government railroad. The country was picturesque, the manners and customs of the people most interesting, for, belonging as it does to the Dutch, who have peculiar ideas of their own regarding colonization, few foreign influences had been allowed to disturb the primitive lives of the natives. Indeed, ten miles due east of the eclipse camp so little is known of the country that it is said cannibals are still in existence there.

In 1905 there was another attractive trip, when a voyage was made across the Atlantic aboard the U. S. S. "Minneapolis" which was the flagship of Rear Admiral Chester, then Superintendent of the United States Naval Observatory. At Gibraltar, we had the pleasure of viewing the British Mediterranean fleet with Admiral Lord Beresford in command. Eclipse observations were made from the little town of Daroca in the interior of Spain



PATH OF THE TOTAL ECLIPSE OF THE SUN, JUNE 8, 1918

The sun could be seen totally eclipsed only in the area bounded by the two close parallel lines, which is about sixty miles wide. Outside of this area the sun was partly eclipsed. At sunrise the eclipse began in the Pacific Ocean off the coast of China and Japan. The shadow traveled across the Pacific at the rate of more than a thousand miles an hour so that it reached the United States well after noon. It is notable that with the exception of a few small islands the only land touched by the moon's shadow was the American Continent


ATLANTIC OCEAN
Longitude West of Greenwich.
Eclipse begins at Sunset
Middle of Eclipse at Sunset
Eclipse ends at Sunset
Eclipse at Sunset
NORTH AMERICA
CANADA
ALASKA
UNITED STATES
MEXICO
CUBA
Bahama Is.
SOUTH AMERICA
Orlando
Jackson
Denver
Victoria
Seattle
Chehalis
Portland
Total Eclipse
Ends at 11h
Ends at 12h
Begins at 9h
Begins at 10h
Begins at 11h
LAST CONTACT
Sandwich Is.
of Eclipse
CIFIC
OCEAN

FOOTHILLS OF THE ELKHORN RANGE BEHIND THE CITY OF BAKER (UPPER PICTURE)

The city of Baker obtains its water supply from the melting snows of the Elkhorn Range (the pipe line comes over the hills at the point indicated by the arrow). On the day of the eclipse the citizens of Baker repaired to these foothills, from which they could obtain a fine view of the range and the valley, to watch for the shadow of the moon, which rushed across the landscape at the instant of totality with the great speed of about thirty miles a minute

THE CITY OF BAKER, OREGON (LOWER PICTURE)

Baker is situated at an altitude of 3500 feet and promised to afford to the observers of the United States Naval Observatory an excellent opportunity to study the eclipse, with an abundance of clear sky in June; as it turned out, however, cloudy weather nearly prevented the work of the expedition. The city is on the main line of the Union Pacific system to Portland, a fact taken into consideration in the selection of the site on account of the necessary transportation of numerous instruments which had boasted a railroad for only four years, but where civilization had existed for more than 2200 years as was shown by an old Roman fort still in a good state of preservation. A visit from the New World to this old and worn-out kingdom was not without its fascination.

The eclipse of the year 1918 took place on June 8. The shadow of the moon first touched the earth's surface on the Pacific Ocean, far south of Japan. Due to the revolution of the moon about the earth, and to the rotation of the earth on its axis, the moon's shadow crossed the Pacific Ocean at a speed well over a thousand miles an hour. It was well after noon before the shadow reached the American continent, and the eclipse began in the state of Washington. Here the width of the shadow was only sixty miles so that only those fortunate enough to be within this narrow track were able to see the eclipse in its totality. The eclipse passed southeasterly through Washington, Oregon, Idaho, Wyoming, and Colorado in succession. In Colorado the shadow had dwindled to forty miles in width. After passing through some of the central states, the shadow left the United States at Florida and left the earth's surface in the Atlantic, off the coast of the Bahama Islands.

The eclipse was seen almost exclusively from the United States, and so it will be known as the American Eclipse of 1918. As more than half the civilized world was in the grip of the tremendous war, it was necessary for the American astronomers in the year 1916 and early in 1917 to make their plans to see to it that this eclipse should be well observed. Before our own country had become involved in the war, Congress had been asked for and had made a special appropriation to defray the expense of equipment and travel for the party from the United States Naval Observatory.

The exact location of an eclipse site is of the greatest importance, since the utmost care must be exercised to choose one where the chances of clear skies will be as great as possible. Think of the disappointment of finding only cloudy skies on the all-important day! Even one small, dense cloud hanging over the sun during totality would render useless all the active months of preparation, would make of no avail the delicate apparatus carefully adjusted after arduous toil, and make of no account the carefully prepared plans for scientific work. The majority of the members of the Naval Observatory party to Sumatra in 1901 had no results to show for their long trip which consumed about six months. Not only must a location be chosen where good weather is promised, but the location should be convenient to a railroad, and at or near a town so that the observers may be properly housed and fed without the necessity of forming a camp with extra arrangements for cooking, etc. In addition, most classes of eclipse work require a location as near as possible to the central line of the moon's shadow.

In order to help the astronomers make as intelligent a choice of an eclipse site as possible, the Naval Observatory, in 1917, had prepared a large scale map of the United States showing among other things, railroad lines, contour lines, and the location of towns, within the eclipse track. The city of Baker, in eastern Oregon, seemed to be the ideal spot for the government party, since the weather of early June promised an absence of rain, with an abundance of clear skies. This city, of about ten thousand inhabitants, is on the main line of the Union Pacific system to Portland, and at an altitude of about 3500 feet.

In order to set up and adjust the apparatus, five of the party left the East about April 20. The party consisted of Mr. J. C. Hammond, Astronomer of the Naval Observatory, in charge of the expedition, Mr. W. A. Conrad and Mr. C. C. Wylie, assistants at the Naval Observatory, and Dr. L. G. Hoxton and Dr. S. A. Mitchell, of the University of Virginia. After locating ourselves at the Antlers Hotel, we viewed the city in order to find the best site for the eclipse location. Through the kindness of the Chief Engineer of the Union Pacific system, who provided us with excellent photographs and topographic maps, we were not long in deciding upon the Fair Grounds on the edge of the city as the most convenient spot. This was fairly near to the hotel where we lived, the grounds were surrounded by a high board fence which would serve to keep out the idly curious, and the buildings in the grounds were adequate to house our valuable apparatus until put in place. We were in Baker exactly six weeks before eclipse day, and the time was none too long. The apparatus was sent forward by through freight, and although we greatly feared delays, it arrived safely the second day after our own arrival. To assist in the work of erecting the apparatus, the superintendent of the Naval Observatory had requested the services of five sailors from the United States Naval Station at Bremerton, Washington, who were in charge of a chief petty officer. The sailors were carpenters and machinists who assisted the astronomers in splendid style so that ten days before the eclipse, when the rest of the party began to arrive, the apparatus was all erected and partly adjusted, and there remained only the perfecting of the adjustments in order to be ready for the all-important day of the eclipse.

An idea of the scope and difficulty of the work to be attempted may perhaps be best visualized by the realization that it took five astronomers and half a dozen sailors six weeks to have things ready for the final adjustments.

But what, people ask, is to be learned at the time of an eclipse? Why these expeditions which at times go so far afield, these elaborate preparations which must run the risk of accomplishing nothing on account of the clouds? Surely there must be something of great importance to be learned in order to warrant such an expenditure of energy and money. Perhaps the best way to answer these questions would be to take up in detail the scientific program of the party of the United States Naval Observatory which was carried out at Baker, giving a brief account of the apparatus necessary and the problem attacked.

The first problem for a government expedition to attempt must necessarily be the determination of the precise times of contact of the limbs of the sun and moon. The *American Ephemeris and Nautical Almanac* is published each year in Washington at the Naval Observatory. This book gives the exact place of the sun, moon, planets, and stars; for each and every day at noon, in the case of the sun, for each and every hour for the moon, and at longer intervals for the planets and stars. The positions are tabulated three or four years in advance, and the positions determined are constantly checked up by observations. On account of the fact that the moon is such a near neighbor, its motion is very complicated. It is very necessary to make the computed positions agree with those calculated. One of the best ways of finding the exact position of the moon is to note the times of contact of its limbs with those of the sun at the time of an eclipse. At the eclipse of 1905, the programs of observation were somewhat disarranged by the fact that total eclipse took place ten seconds earlier than the calculated time. In 1918, it was expected that the eclipse in Baker would begin about twelve seconds earlier than the time as computed from the *American Ephemeris*. To compute the phases of the eclipse one must know with accuracy the exact latitude and longitude of the eclipse location. This part of the eclipse work in Baker was under the direction of Mr. J. C. Hammond of the Naval Observatory, and in the observations he was assisted by Mr. Wylie, by Mr. Conrad, and, to a lesser degree, by Chief Petty Officer Patrick Welsch. The latitude and longitude were determined by observations on stars on a dozen or more nights during the weeks of preparation for the eclipse. Since longitude is measured by the difference in time between any two places, it was necessary to determine the exact time at Baker, and at the same instant find the exact time at Washington. Since the longitude at Washington with respect to Greenwich is known, this would give the longitude of Baker with respect to Greenwich. In order to determine the difference in time between Washington and Baker, it was necessary to connect the two places with a direct telegraph line. On switching on the current, the beats of the clock could be heard by the relay in Baker, and a record of these could be made by means of the chronograph. Similarly, the beats of the chronometer used in Baker could be recorded in Washington. In this manner signals were exchanged between the two places on four different nights, with the result that the exact location of the eclipse site on the surface of the earth is known within an error that does not exceed fifty feet.

There is a popular belief to the effect that since a telescope is used to magnify objects, and to show them in greater detail, then of necessity a very large telescope must greatly enhance the beauties of all objects in the sky and make the corona even more beautiful than it appears to the naked eye. This, however, is not the case. This splendid feature of the eclipse owes its charm to its delicate shadings of pearly light, stretching at times to two, three, or more diameters of the sun from its surface. But increase of magnifying power usually means decrease in the size of the area visible at one time, so that while a great telescope shows a small portion of the corona highly magnified and in great detail, the beauty of the spectacle as a whole is lost. As a matter of fact, the most satisfactory view of the corona is obtained with the naked eye, though a good pair of field glasses may aid in showing some of the features in better detail. The telescope used by Mr. Hammond on June 8 for observing the times of contacts was not a large telescope, but one of the moderate size of five inches in aperture.

During the weeks of preparation, an opportunity was afforded the citizens of Baker to view the moon and some of the planets and brighter stars through this instrument, and many availed themselves of the chance to see the "Man in the Moon," often standing in line for an hour or more, with the thermometer near the freezing point, in order to get their turn for a "look through."

The scientific program of the party which was readily understandable to the residents of Baker who came to the Fair Grounds to see the apparatus erected was the work of the cameras, large and small. These telescopes or cameras were used on eclipse day to photograph the corona and prominences with a greater or less scale. A camera of short focal length gives only a small sized picture, an ordinary kodak showing the sun about the size of the head of an ordinary pin. The greater the focal length of the camera employed, the larger the resulting photograph of the sun. The largest camera used at Baker had a focal length of no less than sixty-five feet. We are all of us familiar with the use of a kodak and the methods by which snapshots are taken, but how handle such a big camera? There are but two methods. One is to mount the huge instrument in such a fashion that at eclipse time it will point directly at the sun. A simple calculation serves to orient the camera correctly, but the satisfactory erection is a more difficult matter, since any shake given to the camera itself would be communicated to the lens and to the photographic plate. Even a very slight disturbance of the camera would blur the photographed image and make it scientifically useless. But how support such a huge instrument without a tremor? Even a gentle wind would be sufficient to shake it, and eastern Oregon promised an almost certain high wind at eclipse time. This problem was solved by Schaeberle of the Lick Observatory twenty-five years ago, when it was found necessary to build a double tower, the inner one of which supported the lens while the outer one acted as a wind screen. Another complication arises due to the fact that the exposures necessary to obtain the corona last for many seconds of time, sometimes totaling sixty or even one hundred in length. With a telescope of sixty feet focal length, the westerly motion of the sun in the sky causes the image of the sun to move on the photographic plate about one eighth of an inch every minute. Evidently some mechanism must be used to counteract this motion. This is accomplished by a clock mechanism, the details being thoroughly understood.

The Lick Observatory of the University of California has been most assiduous in its observations of eclipses, and more than a dozen expeditions have been sent out to all parts of the globe. This splendid scientific record has been made possible through the generosity of Mr. William H. Crocker, of San Francisco. The Lick parties have always adopted the same method of photographing the corona—that of pointing their camera directly at the sun.

Owing to the difficulty of erecting a double tower, most other astronomers follow the mechanically simpler plan of laying the camera tube horizontally and allowing sunlight to be fed into it by means of a plane mirror driven by clockwork to counteract the westward motion of the sun. Needless to say, the irregularities of the driving mechanism will affect the exact definition of the photograph—this being the chief drawback to this type of mounting. In addition to the sixty-five foot telescope, the Naval Observatory had two smaller cameras, of 104 inches and 36 inches respectively. On eclipse day, the large instrument was in the hands of Mr. W. A. Conrad, of the Naval Observatory staff, and the successful completion of his program demanded that Mr. Conrad remain closed inside his darkroom during the whole of totality with never a single chance to gain even a glimpse of the corona. The other cameras were used by Mr. G. H. Peters and Mr. C. C. Wylie, also of the Naval Observatory staff. Two smaller cameras pointing directly at the sun were employed by Mr. Kempton Adams.

Photographic work of a vastly different character from that of these cameras, large and small, was demanded by the spectroscopic work. At the eclipse which took place just fifty years ago, in 1868, the spectroscope was employed for the first time. By its use, Janssen in India saw the bright lines in the spectra of the prominences which proved that these outbursts from the sun were masses of heated hydrogen gas. These flames from the solar furnace are shot to enormous distances from the surface of the sun, being sent upward at times with a velocity of one hundred miles a second! Such colossal distances as 480,000 miles from the surface of the sun have been reached. How puny in comparison with such outbursts on the sun are the explosions of dynamite, or the deadly TNT on this little earth of ours!

The spectroscopic work at the time of an eclipse is for the purpose of supplementing such information as is gained daily by the same instrument. The most famous observatory in the world devoted to solar research is the Carnegie Solar Observatory on Mt. Wilson in California. There, under the direction of Dr. George E. Hale, many startling revelations regarding the central luminary of our system have been made. The dark lines in the spectrum of the sun are caused by the absorption of light from the white-hot body of the sun as it passes through the cooler layers of atmosphere encircling the sun itself. But these layers of atmosphere are cool only in contrast with the much hotter sun. The gases are in fact very hot, and would give their spectra of bright lines if the still brighter background of the sun could be cut off. At eclipse time the moon comes between us and the sun. As long as there is only a small portion of the sun visible, its light is so intense that the spectroscope gives the ordinary solar spectrum. At the instant that the moon entirely covers up the surface of the sun, the solar spectrum suddenly changes from a spectrum of dark lines on a bright background to bright lines on a dark background. The change is so sudden that Young, of Princeton, who first saw it at the eclipse of 1870, named it the "flash spectrum." This flash spectrum lasts for the brief space of about three seconds of time at the beginning of the total phase, and again at the end. It was not until 1893 that the first photograph was obtained of the flash spectrum. At each succeeding eclipse, the photography of this spectrum has been, perhaps, the most important problem to be attacked. The eclipse of 1905, visible in Spain, gave the most perfect photographs of this phenomenon yet obtained. These photographs furnish us with much information of value regarding the physical constitution of the atmosphere of the sun, the height in miles to which these various gases extend above the surface of the sun, and other details of similar character. It may almost be said that we have more accurate information as to the constitution of the atmosphere of the sun nearly ninety-three million miles away than we have of our own terrestrial atmosphere ten miles above our heads.

The spectroscopic work of the Naval Observatory party for 1918 was planned in the hope of surpassing even the excellence of the photographs of 1905, but mainly with the intention of extending our spectroscopic knowledge much farther toward the red end of the spectrum than had been accomplished by other eclipse observers. Three separate instruments were used, each consisting of a Roland concave grating. The scientists engaged in the spectroscopic program were Dr. P. W. Merrill, of the Bureau of Standards of Washington; Dr. Harriet W. Bigelow and Dr. Mary Murray Hopkins, both of Smith College; and Dr. L. G. Hoxton and Dr. S. A. Mitchell, of the University of Virginia.

Fortunately for the work of preparation, no rain fell during the entire stay of the astronomical party in Baker. According to the "oldest inhabitant," the season was unusually dry even for eastern Oregon. By some mysterious force unknown to the astronomers, the eclipse seemed to exert some potent influence over the weather. At any rate, it was asserted by many of the rural papers that no rain could be expected until the eclipse was over. But if there was an absence of rain, there was no lack of clouds nor were the clear skies we had been led to expect afforded us. As the time for the eclipse drew nearer, the continued appearance of clouds began to cause anxiety among us. Would they interfere with the eclipse, and, at the last, make all the weeks of careful preparation of no account? If this had happened, it would not have been the first event of the kind. Unfortunately for the astronomer, his work is always at the mercy of the clouds and the weather. But to have the whole work fail through the presence of clouds at the time of the few precious minutes of the total eclipse—that is indeed the keenest sort of disappointment! Some astronomers seem to be always unlucky and always experience cloudy weather on their eclipse expeditions, while, on the other hand, others are always lucky, and sometimes, after all hope is abandoned, a rift will appear in the clouds and the eclipse at totality be seen in all its glory. Would we at Baker be lucky or unlucky, would the clouds interfere or not? Nearly all the days spent in Baker, according to the classification of the United States Weather Bureau, were clear. But a "clear" day does not mean one when there is an entire absence of clouds. In fact, clouds gathered almost every day shortly after noon, and this condition was usually accompanied by very high winds, that at times rose to the strength of a mild gale. The eclipse was to occur during the middle of the afternoon, and at this time of day the skies were usually overcast. These same conditions prevailed over the whole of the western United States along the path where the astronomers were located. It was well to be an optimist under such conditions of sky, for the pessimist became more and more wretched as the day of the eclipse drew near and his law of averages showed him the almost certain chance of a thinly clouded sky during the total eclipse.

The writer of this article had so far been among the lucky astronomers. In 1900, at the first eclipse observed, the weather was ideal, not a single cloud in the whole sky. In 1901, he was a member of a rather large party which traveled halfway round the world. Only four of a total of thirteen saw the eclipse, the other nine witnessed the eclipse eclipsed by clouds. The writer was one of the fortunate four. Again in 1905, there were many clouds which spoiled the researches of many parties. At Daroca in Spain, a few minutes before totality a dense cloud covered the sun, but it cleared away before the all-important time, and the total phase was seen through a brilliantly clear sky. Three lucky chances out of three made a fine average. The hope was that June 8 would make it four out of four.

By May 30, the whole party had assembled in Baker. A full week was given up to the final adjustments, and to the drills that were to play such an essential part in the work on eclipse day. During the partial phases of the eclipse, very few observations of importance were to be made; all observations of value came during the period of totality which lasted for one hundred and twelve brief seconds. If a slide of a plate holder should stick in place so that it could not be removed, or a lens were not uncapped at the proper time so as to let in the light, the whole work of an instrument might come to naught. On each day of the week preceding June 8, drills were gone through several times in the morning and again in the afternoon. These drills were so well carried out that on eclipse day each and every one performed excellently the task allotted to him with the result that everything passed off without a single hitch.

As the days in June progressed toward the eighth, there was an air of excitement as each astronomer grew more keyed up to the task before him. Would the day be clear? But more especially, would the two minutes from 4:04 P.M. to 4:06 be clear on Saturday? The skies were anxiously watched during the last days, and almost every day the skies were overcast. The optimist reasoned that if it were cloudy all the days before June 8, then on eclipse day perfect weather would surely be forthcoming; while the pessimist reasoned that so many cloudy days meant still one more of the same character, so there was no use trying to do anything.

Saturday, June 8, dawned with the

sky overcast with thin, filmy clouds. The sun was well visible through these clouds, however, and it was possible to examine again the focus that had been obtained with the spectroscopes and with a touch here and a touch there to decide that everything was in perfect condition. During the morning the drills were again gone through with, and these seemed to promise success. The weather during the six weeks had not held up the work, and everything seemed now to have been done that thought and work could do. The astronomers who had been on the ground for the whole six weeks of preparation had the pleasant consciousness that all of their allotted tasks had been completed, that every little detail had been thought of, and that perfect success would certainly crown their efforts if the clouds would only clear away. But during the course of the morning the clouds grew thicker instead of thinner, and it did indeed seem as if there were little chance of clear skies.

The first contact was to take place at 2:36 P.M. Shortly after noon the city of Baker took upon itself the aspect of a holiday. Though the day was Saturday, all stores were closed from three until five in the afternoon so that everybody could have a chance to see the phenomenon. Naturally everyone in Baker wished to go to the eclipse site at the Fair Grounds to watch the astronomers at work. At the eclipse in Spain, this had been permitted with the result that the whole town was assembled, each inhabitant jostling his neighbor to get as close as possible. Unfortunately, each Spaniard seemed

Photograph of the solar eclipse taken by a 40-foot camera with 1/3 second exposure at the Lick Observatory Station in Goldendale, Washington. The deep purplish blue shadow appearing over the sky was equally as dark as the black surface of the moon and was sufficiently heavy to bring out the brighter stars. The "Eagle Prominence" appears above and to the left to be bent on telling his friend just what was being done, with the result that such a din arose when the eclipse became total that it was impossible to hear the seconds counted off to give warning to the astronomers when to change their plate holders.

That this might not happen again, the residents of Baker were told that the gates of the Fair Grounds would be closed, and absolutely no one would be admitted within the enclosure. The mayor of the city sent a guard of Boy Scouts to see that these orders were obeyed. Most of the town repaired to the hills to the southeast of the city from which there could be obtained a fine view of the valley and the Elkhorn Range, and they were directed to look especially for the shadow of the moon which would come across the landscape at the speed of about thirty miles a minute or 1800 miles an hour. This shadow comes with the advent of totality, and all who have seen the phenomenon say that it is an awe-inspiring spectacle, making one feel that the end of the world is surely at hand.

No appreciable improvement in the skies was observed from noon to the time of first contact. Through a thin patch in the clouds, Mr. Hammond,

Total eclipse as photographed by the 65 foot camera at the United States Naval Observatory Station, Baker, Oregon. This solar photograph with many others are now on exhibition at the American Museum in the form of illuminated photographic transparencies. The "Eagle Prominence" appears at the top. The changed position of this prominence compared with the photograph on the left hand page, is owing simply to the difference in position of plate holders in the two cameras using the five-inch visual telescope, observed the beginning of the eclipse and made a record of it. The clouds, if anything, became thicker after this so that at three o'clock it was impossible to see even where the sun was. Little thin rifts appeared at times, so that with the aid of smoked glass it was possible to see the moon encroaching on the face of the sun. At three thirty, a patch of brilliantly blue sky was seen off to the northwest, and as the precious minutes dragged along it became evident that the clouds were moving in such a way that it was quite possible that the blue patch would reach the sun in time for totality. Fifteen minutes before the total phase, the clouds were so dense that had totality occurred then, the scientific results would have been nothing; but the blue sky was coming nearer and it might arrive in time.

Without looking at the sky, one realized that something unusual was happening. The light of the sun became so feeble that even the birds felt the unnatural aspect of things and sang their songs as if they were going to rest. The cocks crowed on the farm near by. The wind which was ordinarily blowing at this hour was quiet. All nature was hushed. Even the seasoned astronomers who had seen two or three eclipses before felt the thrill of the unusual spectacle. And still the question was, Would the clouds clear away in time?

At five minutes before totality the warning signal was given by Chief Petty Officer Welsch of the United

This photograph was taken during the last seven seconds of totality by the Lowell Observatory Station at Syracuse, Kansas. It shows the detail of the prominences and the great solar storm which was uncovered as the eclipse neared its end. A camera of 38 feet focal length was employed at this station. The "Eagle Prominence" is above and to the left

States Navy who was to watch the chronometer and count the seconds. This signal summoned each man to his post. One last look was given to the apparatus to see that everything was in place, the plate holders were adjusted—and then we waited. "Two minutes" before was called out, and then "one minute," still again "thirty seconds" before the expected time of totality. The clouds by this time had thinned considerably, the patch of blue sky was only a short distance away. The plan had been that after the signal of "thirty seconds" there should be nothing said until the word "Go" told that the total eclipse had begun. I was to watch for this with a pair of binoculars, before one glass of which a direct vision spectroscope had been arranged. But due to the thin clouds at the beginning, it was impossible to see the spectrum lines with the spectroscope, and the signal "Go" was actually given by Mr. Hammond who was using the five-inch telescope. No sounds disturbed the work of the party except the call of the seconds as the time passed, and the brief words of command and the shift of plate holders as each member of the party did his allotted task. Ten seconds after totality commenced, the clouds, thin at the beginning, had still further thinned, and at mid-totality the conditions were even further improved. What a gorgeous spectacle then met the eye! The sun was now in a very thin wisp of cloud with blue sky on either side. Although the cloud would detract from the scientific results, still it greatly enhanced the pictorial effect. The corona could be seen stretching for a short distance from the sun's edge, but most remarkable of all were three great tongues of flame, one immediately at the top of the sun, one on the left-hand edge, and still a larger one on the right edge of the sun. These shone with a brilliant scarlet light, and made the eclipse of 1918 memorable as the eclipse of color. As the end of totality approached the thin clouds became still thinner—and two minutes after the eclipse was over the sun had reached the blue patch of sky. If the eclipse had occurred only two minutes later, or if the party had been only half a mile to the northwest, the sky conditions would have been perfect! If the eclipse had taken place fifteen minutes earlier, the scientific results would have been nothing at all. The optimists had won out.

The developed photographs exhibit the painstaking care of the astronomers in procuring the precise focus with the result that all of the photographs show exquisite definition. The thin clouds did not interfere at all with the details of the prominences or flames surrounding the sun. Those taken with the sixty-five foot camera exhibit the prominences in splendid detail on a scale where the sun is more than seven inches in diameter. The longer exposures for procuring the extensions of the corona were not quite so successful since the thin, fleecy clouds cut down the fainter streams of coronal light. The smaller cameras showed the same results as the larger ones—splendid detail in the inner corona, but the corona not of very great extent. All the photographs unite in showing many polar rays, and they also exhibit some plumed arches of great beauty. The corona was of the sunspot maximum type, but with more polar streamers than were expected.

The spectroscopes procured photographs of exquisite definition, but these photographs suffered also from the clouds which cut down the amount of exposure that at best is none too great.

What was perhaps the most interesting piece of scientific work accomplished at the 1918 eclipse owes its conception to Mr. Edward D. Adams, of New York, who has shown his great interest in science by the founding of the Ernest Kempton Adams fellowship which is awarded each year by Columbia University for researches in the domain of pure science. Upon becoming a member of the United States Naval Observatory party, Mr. Adams took upon himself the responsibility of trying, by some method, by photography, by a drawing, or by a painting, to procure a reproduction which would show the beauties of the corona, and which should be true not only as to form but more especially as to color. Unfortunately for science, it is impossible to obtain a satisfactory representation of the corona and the sun's surroundings by photography. The corona is very brilliant near the edge of the sun, but the intensity fades very rapidly. The eye can take cognizance of the details in spite of the great changes in brilliance, but not so the photographic plate. To obtain the faint extensions of the corona which are readily visible to the naked eye, a comparatively long exposure is necessary. This long exposure causes so much overexposure in the brighter inner regions of the corona that all detail there is lost by being burnt out. Short exposures give us the inner corona in exquisite detail, but the outer corona is then lost through shortness of exposure. Many attempts have been made to cut down the relative exposure by means of mechanical devices —but none of these have been entirely successful. Heretofore, the only success in representing the corona has been obtained by taking photographs with different times of exposure and with different cameras in order to procure photographs with detail both in the inner and brighter parts of the corona, and in the fainter outlying portions. After the eclipse is over, a composite drawing is usually made from the examination of different photographs. This method has given several satisfactory drawings, but they still have left much to be desired. However perfect they may have been as drawings, they took no note of color. Mr. Adams took upon himself the task of finding the right man to draw and paint the corona. Color photography could not help out in procuring the right color, and there was left only the possibility of finding an artist who would have the true scientific spirit, and who could combine an accurate sense of form with a refined perception of color. Mr. Adams was successful in finding Mr. Howard Russell Butler, a portrait painter of note, who has developed a shorthand method of noting both form and color.

During the eclipse, Mr. Butler sat on a lofty perch overlooking the eclipse instruments, and from which he could obtain a fine view of the sun. The task he had taken to himself was no small one. And moreover this was the first corona he had ever seen!

Those who were privileged to see Mr. Butler's picture at the American Museum of Natural History pronounced it a painting of rare beauty. The astronomers who saw the 1918 eclipse and who have seen the picture look upon it as a marvel of perfection, true both as to form and color, a work of art which has the added advantage of being scientifically accurate.

The scientific world owes a great debt of gratitude to Mr. Butler for his exquisite corona, but even a still greater debt to Mr. Adams, through whose conception, generosity, and enthusiasm the painting of the corona became possible. One ventures to predict that this splendid painting will cause the recent total eclipse of the sun to be known as "Color Eclipse of 1918."

INSTRUMENTS ADJUSTED AND EVERYBODY READY, UNITED STATES NAVAL OBSERVATORY STATION, BAKER, OREGON

The first two tents cover powerful spectroscopes and under the third are two cameras. The horizontal tube of the 65-foot camera is seen in the background. Five of the party started work at Baker just six weeks before the eclipse, mounting, testing and adjusting the apparatus, determining the exact geographical position of the site by direct telegraphic comparison of time with Washington, and constructing the housing for a camera of 65 feet focal length. Five sailors (mechanics and carpenters) under a chief petty officer, were also detailed from the Naval Station at Bremerton, Washington, to assist the astronomers in their work of preparation. The most important feature for a government eclipse expedition to determine is the exact time of contact of the sun and moon in order to determine the moon's exact position and make corrections in the *Nautical Almanac* which is used by navigators and geodesists. The movement of the moon is extremely complicated so that errors of several seconds are sometimes made in calculating its position. Another important piece of work is the photographing of the bright line spectrum of the inner layers of the sun's atmosphere. This is possible only for a few seconds at the beginning and end of totality when the moon has just covered the brilliant face of the sun but has not yet passed over the lower atmosphere of incandescent gases.

The members of the observing party, naming from left to right, are as follows: Dr. Mary M. Hopkins, associate professor of astronomy, Smith College; Dr. S. A. Mitchell, director, McCormick Observatory, University of Virginia; Pehling, sailor, United States Navy; Dr. P. W. Merrill, Bureau of Standards, Washington; Dr. Harriet W. Bigelow, director of observatory, Smith College; Dr. L. G. Hoxton, professor of physics, University of Virginia; Messrs. J. C. Hammond, astronomer, G. H. Peters, photographer, and C. C. Wylie, assistant, United States Naval Observatory; Herrick and Kummel, sailors, United States Navy; P. Welsch, C. P. O., United States Navy; Mr. W. A. Conrad, assistant, United States Naval Observatory; Mr. Howard Russell Butler, N. A.

Painting the Solar Corona

By HOWARD RUSSELL BUTLER, N.A.

Illustrations from drawings which give the artist's records made at the time of the eclipse and explain his method of work; also from the artist's paintings of the phenomena of the eclipse, color plate opposite, and frontispiece in color "Total Eclipse of the Sun, June 8, 1918," opposite page 245

IN May, 1918, I received an invitation from Mr. Edward D. Adams, well known as a patron of science and art, to accompany him to Baker, Oregon, where the United States Naval Observatory had established its station for observing the total solar eclipse of June 8, 1918. Professor S. A. Mitchell, director of the Leander McCormick Observatory of the University of Virginia, and Mr. Adams had agreed that a painting of the corona might be made which would have both scientific and artistic interest.

Many drawings and countless photographs (some colored by hand) have been made of solar coronas, but I was told that no record existed of any painting actually made from direct observation. The invitation was therefore accepted as a unique opportunity.

As a portrait painter I have usually asked for ten or twelve sittings of two hours each: now I was asked to render my subject in 112 seconds. The method of procedure therefore became all-important.

The first step was to study the reports in astronomical and popular works of previous eclipses and thus familiarize myself with all attempts to describe or record the form and color of the corona and prominences. Of these attempts there are a great number. They describe an outer corona, varying in extension from a fraction of a diameter of the moon to many diameters, the color usually being described as pearly and variously tinged; an inner corona, more brilliant than the former; and the prominences of incandescent hydrogen, variously described as red, ruby colored, pink, and blood-red. In addition to these, my picture would have to show the dark surface of the moon, and the sky with whatever color value it chanced to have at the moment of observation.

As regards the shape and the extension of the outer corona, a theory exists that it varies inversely in size as the combined area of sun spots, and this seemed to be confirmed by about twenty drawings of previous eclipses, which I made from photographs and prints and reduced to the same scale. Thus in the eclipse of 1900, when sun spots were at a minimum, the corona exhibited wide extensions, having interesting shapes, two of which became known as the "Angel Wing" and the "Herring Tail" extensions. As the number and size of sun spots seem to vary quite regularly, so that the maximum is reached about every eleven years, and as we were near a maximum period, wide extensions of the outer corona were not to be looked for. We expected about three fourths of a diameter on each side and this is about what we saw.

All reports of the so-called "inner corona" agree that the part nearest to the sun is very brilliant and this inner corona is usually described as whitish in color. The transition from this inner portion to the far less brilliant outer part is quite abrupt, but one of the questions on which there seems to be a difference of opinion concerns an absolute demarcation between the inner and the outer coronas. I found none.

As regards the prominences—while often discernible with the naked eye, it

The approaching shadow of the moon, Baker, Oregon, June 8, 1918

Details of the hydrogen prominences, June 8, 1918, including the "Eagle Prominence."
In outline this prominence looks like an eagle alighting on the top of a cliff.

is necessary to have a good glass to get the details of shape and to study the color rightly. The Naval Observatory put at my disposal a fine pair of Zeiss binoculars, which proved of the greatest value. I realized in advance that my hardest task would be to portray these prominences in their proper color and brilliancy. According to Professor Mitchell, I was to expect them to have a color not unlike that of the hydrogen line Hα in the spectrum, possibly slightly modified by the much fainter bluish line: and ample opportunity to study these lines in the spectroscope was given to me. How best to render this color in paint and to give it its luminous character was the problem. Realizing that this would necessarily be the brightest tone in the picture and that it would have to stand out brilliantly against the tone of the inner corona, also bright, I set to work to produce the brightest possible red: that is, the one which stood highest in a scale of values of which varnished ivory black was zero and the best lead white (commercially known as silver white) was 100. I tried French pastels and water colors, the latter over Whatman paper, but ultimately found that I could do best with oil paint.

The process of obtaining this red decided upon for the final picture, but which takes more time than I had at Baker, was to prepare a hard surface of silver white, well dried, to paint over that a thin coating of zinc white tinged with orange cadmium, and, when that was perfectly dry, to glaze it richly with rose madder or garance rose doré. This gave the tone with its fiery quality, but alas, its value, while the highest that I could get, was down to from 65 to 70 in the black and white scale. The highest value obtained by mixing wet colors at Baker was about 60.

Granting this to be the highest note that I could have in my picture, I next addressed myself to the lowest. Would this be the sky or the dark surface of the moon? Regarding the color and value of the clear sky during solar eclipses, there were varying opinions. Many drawings show the moon as black against a sky represented by a medium gray. These I believed to be incorrect and found them so. The moon, having a less luminous quality than the sky and surrounded by the brilliancy of the corona, should appear slightly darker by optical illusion. The sky value was at any rate the safer note to work from and, except for the slight variation alluded to in the moon, it would surely be the darkest value in the picture.

Assuming then a sky value of say 25 and a prominence red value of say 60, the total variation in values would thus be limited to 35 points—surely a small range with which to reproduce so brilliant a phenomenon.

The method of working finally adopted may be called a shorthand method. It was to have a sheet of white cardboard on the easel with a series of concentric circles and radii drawn upon it in advance. One of these circles was to have the same diameter as the photographs of the moon to be taken in the sixty-five-foot camera, namely, seven and three-eighths inches. There was to be an inner circle of half this diameter and outer circles whose diameters were respectively one and one half, two, and two and one half times that of the inner circle. I expected to use the seven and three-eighths inch diameter, and did actually use it, but I was thus prepared, in case of an unexpectedly extended corona, to reduce the scale to one half and get everything on the cardboard. In front and beneath my cardboard was a finished sample picture of a corona, painted in advance as I *expected* it would appear, and my plan was to indicate by initials at points on my cardboard the variations of color from this picture: thus *b* was to mean a variation toward blue from the sample picture, and y more toward yellow. I wrote out the procedure as follows and tacked it alongside the easel. Practice enabled me to allot a certain number of seconds to each item.

Procedure	*Seconds*
Note value and color of sky	10
Draw value line on moon	10
Note colors of moon	10
Draw outline of corona	20
Use Zeiss binoculars	20
Record positions of prominences	10
Note color and value of prominences	10
Note colors and values of corona, etc.	20
	110

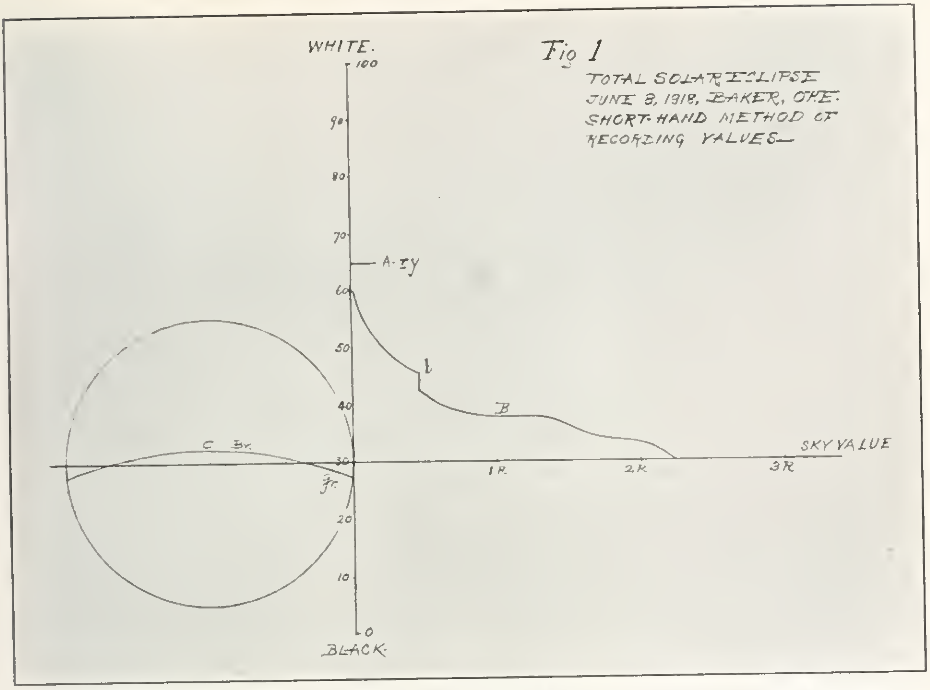
Then my plan was to paint a first picture from this resulting memorandum, while the impression was vivid, and as soon as there was sufficient light to proceed by.

Several methods of still further shortening the process naturally presented themselves, which can best be understood by a simple diagram. Thus let the vertical axis (Fig. 1) represent values in the black and white scale and the horizontal axis distances in terms of lunar radii. Then a simple stroke A at 65 gives the value of the prominence, and the added expression <u>*ry*</u> means "rose very strong with a tinge of yellow." The line B represents the values of the corona. Any distinction between an inner and outer corona could be noted by a quick fall, as at b, in the line. Two tangents were drawn in advance on my cardboard for use as vertical axes. The line C would show the moon to be light in the center and dark on the edges, in this case tinged with green and brown. After the actual experience, I cannot think of a better plan than this one.

The observation station was in the Fair Grounds at Baker, about a mile and a half from the center of the town. It was surrounded by a wall and low buildings, which insured privacy. A grand stand ran north and south with a double door opening from the top aisle. This door, intended as an exit or fire escape, opened upon a platform with flights of steps descending both ways. This platform was assigned to me and on it I erected a strong easel and shelves extending to right and left and making an angle with each other. Wind guards and braces were added. The platform faced west and, as the sun at the time of the eclipse was to be about 12° south of west, the position could not have been better. It had also a great advantage in being so high up that I could look over the surrounding walls and low buildings and get a fine view of the valley and of the Elk Horn Range in the direction of northwest along the line of the approaching shadow. By keeping the north half of the door into the grand stand closed and boring a small hole through the door, an excellent camera obscura was obtained, the image of the sun appearing on a tilted white covered board on the inner side of the door. I had been advised and had determined not to look at the sun for a considerable time before totality so as to avoid what is known as retina-fatigue, which is certain to result from looking at the brilliant crescent. The camera obscura gave all the information wanted as to the diminishing crescent and yet left me free to watch for the approaching shadow.

As the day drew near drills were instituted, eight or ten of which I attended; each time I went through the procedure as outlined, drawing an imaginary eclipse. The counter, a naval officer, called each minute from five before to one before, and then gave the call, "thirty seconds." The word "go" was given by Mr. J. C. Hammond, astronomer of the Naval Observatory. (On the occasion itself this word was given, of course, from actual observation of the eclipse.) The counter then called seconds from 1 to 112, when the performance would supposedly be over. These drills were invaluable.

At first contact, June 8, 2.47 P.M., all was ready, but the sky was so cloudy

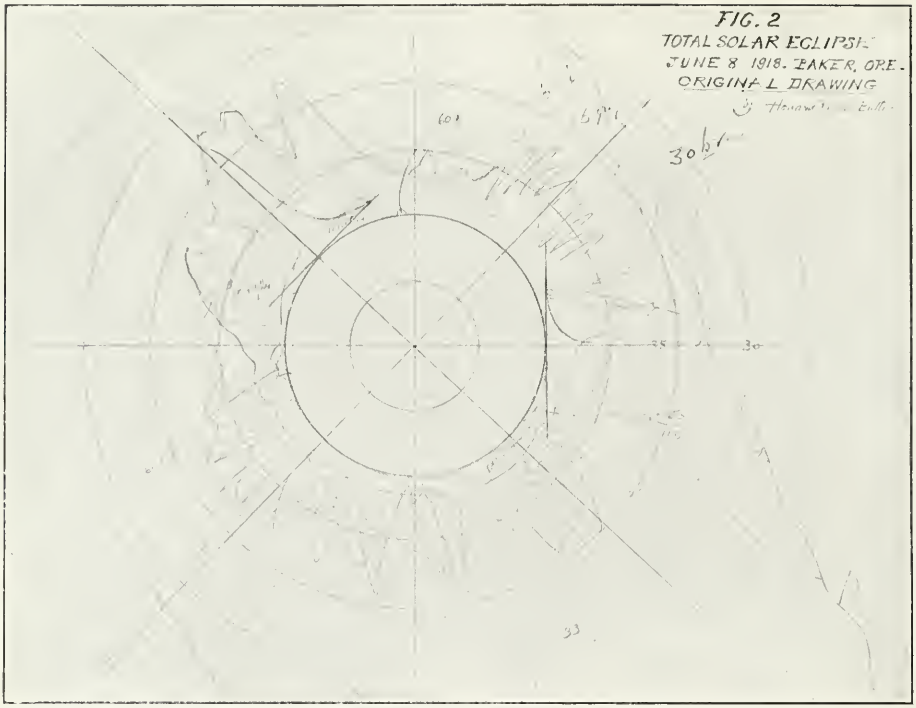


Two diagrams combined, one illustrating the artist's shorthand method of recording during the few seconds of the eclipse the brightness of the colors in the corona, the other a method of noting the depth of shadow on different areas of the moon's disk. One diagram consists of the two perpendicular lines, or axes, and the curve B. The vertical axis represents a scale for measuring the brightness of a color, considering ivory black as zero and silver white as 100. Distance on the horizontal axis measures distance on the sky beyond the moon's edge measured in radii of the moon ("1R" equals a distance of one radius or half the moon's diameter from the moon's edge). This horizontal axis is drawn through 30 on the brightness scale, that being the estimated brightness value of the sky during the eclipse. A curve drawn between the axes shows the variation in brightness of the corona at any given point, beginning at the inner edge of the corona and passing outward to the dark sky; that is, the color in the inner corona close to the moon is 60 on the scale (or in other words the tone of the inner corona is about three fifths as bright as silver white). From the curve drawn downward from 60 we see that the corona at 1R (one radius distant from the moon's edge) had fallen to a brightness of about 40, and slightly beyond the length of 2R it disappears, blending with the sky. The line A is the artist's shorthand to indicate that the prominences had a brightness value of 65 and "*ry*" is a quick way of recording it if they were "very rosy, tinged with yellow." These two axes were drawn on the cardboards on which the eclipse was to be drawn, in advance, on two sides of the circle of the moon (see Figure 2), being represented as tangents to the moon's circle (see right hand and upper left hand of figure). By means of the curves drawn in on these axes with great speed during the eclipse, we can read off the brightness of the corona's colors at any distance from the moon.

The line C in the other diagram (the moon's disk at the left) is a shorthand way of indicating that the moon was lighter in the center than at the edges and that these edges were darker than the sky. The "Br." and "Gr." indicate a tinge of brown and green respectively

that few of the eighteen members of the party expected any good results. A gloom more dense than the cloud overhung the spirits of the camp. But at half past three the clouds had grown decidedly thinner, and at ten minutes of four a large area of blue sky appeared to the right of the sun. Then the sky cleared so rapidly that all hopes were revived, in the belief that when totality would take place at 4.03.52 the sun would be found in an absolutely clear sky.

Standing with the sun back over my left shoulder—it was at an elevation of about 45°—I looked at the diminishing crescent on the face of the camera obscura until the call "one minute" was heard. Then, turning my eyes to the northwest, I gazed at the north end of

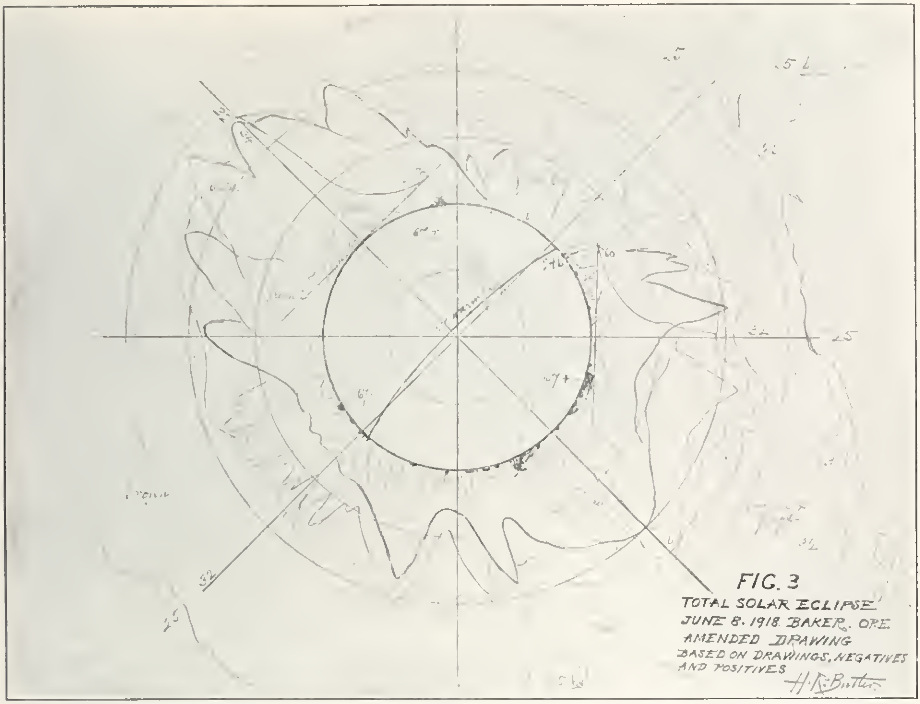


This is a reproduction of the actual original sketch, made at the time of the eclipse, on a cardboard on which the radial lines, circles, and tangents had been prepared in advance. This is the artist's record, not only of the general outlines of clouds and corona, but also of the colors which are indicated by initials or words (underscored when the color is intense), and of the brightness of the various parts of the corona, indicated by numbers and by curves such as are explained in the preceding figure. The artist had painted previously a picture of the way in which he "expected" the eclipse to appear and no time was wasted putting in colors or tones which were approximately correct in the prepared sketch

the Elk Horn Range and the intervening valley. Roosters were crowing loudly on the neighboring farm; a greenish pallor overspread the landscape—but it was not very dark. To the northwest, however, the sky was growing dark. The last half minute seemed long. My eyes were fixed on the sky line. Suddenly the entire range fell to a deep low-valued blue, and simultaneously the lower part of the sky above the range turned to a rich yellow inclining to orange streaked with two horizontal blue-gray clouds. Above me the sky darkened rapidly. For an instant the valley retained its light green color and then the shadow seemed to rush toward us and all was engulfed as the call "Go" was shouted. The accompanying color illustration of the approaching moon shadow (opposite page 264) is from a "memory" painting made the next day, the time ten seconds before totality.

Turning on my heel, I looked at the corona, blazing steadily in the heavens as if it had always been there. The clear space in the sky had not quite reached the sun. The thin intervening cloud extended to right and left of the sun and stood out with its edges illuminated and sharply defined against a velvety night sky of wonderful bluish violet.

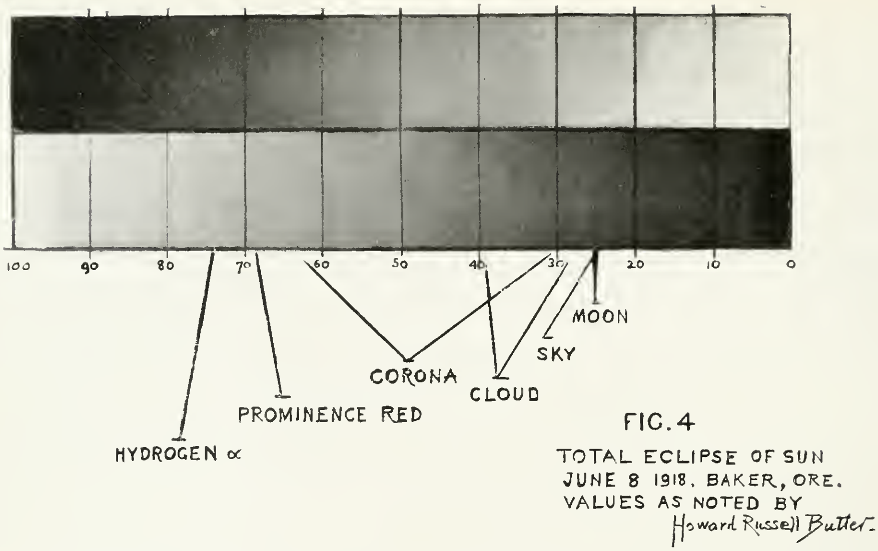
Here was a new problem. I had not expected the cloud. I began by drawing the outline of the cloud (slightly nearer the sun than it actually was so as to get both cloud and sky well on the



The artist's original drawing as amended later by reference to photographs made of the corona. The details of the polar rays and of the prominences had been left for the cameras to record. Careful drawings of these features and of the variations in shading of the corona resulted in this composite picture on which was based the painting of the corona (see plate opposite page 245). The lines outlining the corona in this figure may be regarded as contours of luminosity, showing the range and extent of certain degrees of brilliancy around the disk

cardboard), then entered the value and color of the sky as 30 *bv*, and the cloud edges which were higher and silvery. The cloud itself, of varying thicknesses, was warmer in tone than the sky and played, I estimated, between 30 and 40. The moon was about the same value and much grayer than the sky. I was not conscious of any considerable variations of value in the moon and failed to put in the value line. The blackishness of the moon and the center lighter than the edges were undoubtedly optical illusions. Next a quick outline of the corona was made, most attention being paid to the larger rays. Then the binoculars (which had been previously adjusted and focused) were used. Two splendid prominences, slightly pinker and lighter than I had expected, appeared—one near the top of the sun and the other on the left side below the horizontal. I gave these the highest value which I then thought could be produced by mixing oil paints, *viz.*, 60*r*. A rose-colored glow stretched along the lower right side of the limb, the value of which was first recorded on the chart as 50.

I recorded two lines of values for the outer corona. I saw no distinct separation of the inner and outer coronas. On the upper left extension greenish and yellowish tones were recorded. No time was wasted on tones thought to be correct in the sample picture. On the whole the corona was less blue than my sample and it retained brilliancy farther out than I expected. Had it been seen against the blue sky it probably would have extended still farther and its disappear-



A graphic representation of the scale of brightness values of the various colors found in the eclipse phenomena.—Varnished ivory black is taken as zero and the best white lead (silver white) as 100 for the points of reference. The most brilliant shades were found in the prominences which consist for the most part of incandescent hydrogen gas with a color approaching that of the red hydrogen line of the spectrum. By careful painting the brightness of the reds used in portraying the prominences was forced up to 67, and a very fiery quality given to them. The brightness of the sky was pitched at 25, as was the moon, while it was estimated that the clouds ranged from 30 to 40, and the corona from about 30 to 60

ance might have been more gradual. Two sections of the so-called inner corona were very brilliant, although of course not as high in value as the prominences. These were next to the limb and were very neutral as to color. I outlined them and marked them "whitish," but got one of them in the wrong place. This brought my eyes to the picture for several seconds. About the ninety-fifth second I looked up and was surprised to see that the pink glow had lengthened out and risen in value. This change was due to the motion of the moon, which had by that time uncovered a magnificent solar eruption, but I had no time to take up the glasses. I outlined this glow, its value fully up to 60, which I entered afterward. Figure 2 is a reproduction of the original drawing.

Toward the end I re-outlined the corona, indicating rapidly the polar rays, for the accurate drawing of which, as well as for that of the prominences, I intended to rely on the photographs. These rays were decidedly apparent. Suddenly I was blinded by the first of the "Baily's Beads," or the first glimpse of the solar crescent broken by the rough limb of the moon. It looked like a miniature sun radiating in all directions. And all was over.

Thanks to the privacy of the grounds and the consideration shown me I was able to proceed at once with my first oil sketch, and for two hours worked uninterruptedly. The next day, June 9, I painted the picture of the approaching moon shadow over the Elk Horn Range as I remembered it and also a second oil of the corona.

While disappointed in not seeing the corona in a cloudless sky, the thin veil had its advantage from the artist's standpoint. It added mystery and the effect was picturesque. The brilliant corona burned through the thin veil as if it were not there. Probably only the outside edges of the corona were affected.

On the tenth the photographic negatives were shown to me. Those of the sixty-five-foot camera were seven and three eighths inches in diameter, the others considerably smaller. I now saw, in minute detail, the two prominences which I had recorded and the mighty cyclone which had been increasingly revealed as the eclipse neared its end, because of the direction of the moon's motion. We are told that this group of prominences was forty-six thousand miles high. There were many other minor prominences.

I now made careful drawings of these prominences from the negatives and of the variations in shading of the surrounding corona. Many arches were found springing over the prominences, and a few rifts or dark channels radiating from the limb but never coming very close to it. The negatives showed very clearly the hairy polar rays, not always radial in direction, and the beginning of a wing springing from the upper right-hand limb of the sun.

By careful process painting, as already described, I have been able to force up the value of the prominence reds, which appear in Figures 3 and 4 at about 67. I also concluded to reduce the value of the clear sky from 30 to 25, thus obtaining a range of 42 points instead of 30, an increase in the ratio of 7 to 5. In this new scale the other values take their proportional places. Thus a value of 35 (30 + 5) in Figure 1 becomes 32 (25 + 7) in Figure 3.

In Figure 3 the corona lines, derived from the drawing and many photographs, may be regarded as a sort of composite, suggesting contours of luminosity very much as contours of elevation appear on a map.

Three paintings were made, the first immediately after the eclipse, the second on the succeeding day, and the third after all data had been secured. This final painting is the one reproduced in conjunction with this article.

Returning with Professor Mitchell, we stopped at Williams Bay, Wisconsin, and I had the great pleasure and advantage of discussing the problems of the final picture with Professor E. E. Barnard and Dr. E. B. Frost, of the Yerkes Observatory. They also showed me excellent photographs taken at one of the Yerkes stations and spectroscopic photographs of the prominences taken at the Yerkes Observatory (at the time of totality at the Green River Station), apparently identical as to drawing with those taken at the Baker Station. I wish to acknowledge my indebtedness to these eminent astronomers.

Photograph by Donald B. MacMillan

WILD FLOWERS "FROM GREENLAND'S ICY MOUNTAIN"

Between lonely rocks and wild crags grow the flower gardens of the Arctic—poppies with nodding buds and ornamental leaves, the small white clustered *Draba* flowers, and green heads of Arctic timothy. There are about 120 species of flowering plants—and probably "new" species waiting to be discovered—in the ice-free land where the Smith Sound Eskimos live, along the northwestern coast of Greenland between Humboldt Glacier on the north and Melville Bay on the south—a strip made narrow by the ice cap above and the iceberg-studded sound below. Long months pass when the botanist has few specimens to work with, however. Not until the ice breaks out and midsummer is at hand are many flowers in bloom. There is no spring in the Arctic like ours, or rather, there is only our spring, and no summer. All the plants awake together and hasten to their fruitage as if to make the most of the few weeks of comparative warmth. With equal suddenness at the end of summer, the vegetation is caught in full activity, and stiffened as it stands, with seeds half formed, or perhaps with buds, or open flowers

The Plant Life of Northwest Greenland

By W. ELMER EKBLAW

Research Associate, American Museum of Natural History; Research Fellow in Geology, University of Illinois; and Geologist and Botanist on the Crocker Land Expedition, 1913–1917

FEW people of our pleasant southland even dream that under the shadow of the North Pole, almost a thousand miles within the Arctic circle, more than one hundred species of flowering plants flourish and maintain themselves against the frigid conditions of their far northern home. Yet, in the country of the Smith Sound Eskimo, a narrow belt of ice-free land between the gleaming ice cap and the iceberg-studded sound, from Cape York to Humboldt Glacier, botanists have already recorded 120 species, and the list is no doubt yet incomplete. No tall trees or branching shrubs, no trailing vines or waist-high grasses give character to the landscape, but the rocky slopes and ledges are dotted in summer with brilliant blossoms or carpeted with low, soft growths of grass or sedge.

Photograph by Donald B. MacMillan

The botanist of the Crocker Land Expedition at North Star Bay

When the explorer from the southland approaches the rock-bound, glacier-ribboned coasts of Greenland, his first impression is one of bleakness and barrenness. The frowning cliffs, stern and unchangeable, the gleaming glaciers, cold and immobile, suggest no possible refuge for flowers, no likely niche for ferns or grasses. But in summer when he enters some little bay, or goes up one of the deep fiords and sets his foot upon the land, he finds that Greenland is not so cold, nor so bleak, nor so barren as he imagined. Every little crevice in the rocks is foothold for some fern or glowing flower, every little pocket of soil refuge for a bit of verdant turf, and every little slope or ledge shelter for willow, heather, or smiling poppy.

How can they grow and blossom and fruit in the short summer, when the snow begins to disappear only in mid-June, and killing frosts come in mid-August; when the warmest noonday has never a temperature higher than sixty degrees and storms often blanket the whole land with snow, even in mid-July? It is because the plants that hold their homes under these rigorous conditions are adapted to make the most of the twenty-four hour sunlight that shines upon them, to survive the blanket of snow if it last not too long. They are the frontiersmen of the plant world, hardy, inured to difficult conditions, tenacious of life in the most desperate struggles for existence.

The climate of northwest Greenland is insular in character, much milder than most lands so far north, and than many lands much farther south, because the strong tides and currents in Smith Sound keep open water along the shore, or not far away, usually throughout the year; and open water means warmer, moister air. This milder, moister climate of northwest Greenland is naturally the principal reason why the vegetation is relatively so luxuriant; but the reason the flowering plants succeed so well is because in addition, during the short summer season, the sun shines every day all of the twenty-four hours, and gives them opportunity to use every hour of their active life.

Yet, even with this favorable milder climate and the continuous sunlight, the vegetation could not survive if it were not fitted to endure the long frozen period, cold and dry, the destructive changes from warmth to almost blighting cold. In response to these conditions the plants are usually low creeping or tufted forms with tough, hard tissue, and are nearly all perennials, so that if fruiting cannot take place every year the species will not perish.

Some of the plants that constitute the vegetation of northwest Greenland are widely and generally distributed. It would be hard to find a place where the purple saxifrage (*Saxifraga oppositifolia*) does not grow or the Arctic poppy (*Papaver radicatum*) does not flourish. The alpine chickweed of the north (*Cerastium alpinum*) and the Kentucky blue grass (*Poa pratensis*) are common. The pretty little Arctic heather (*Cassiope tetragona*) and the mountain avens (*Dryas integrifolia*) are perhaps the most numerous of the plants of the region, for they seem to be able to grow almost everywhere. Many others occur all along the coast and one expects to see them wherever one lands.

But many plants are found widely scattered. Of several species I found a single station or collecting place. *Androsace septentrionalis,* a delicate, inconspicuous little flower, never before recorded from Greenland, I found growing on a little gravel slope just west of Borup Lodge, our headquarters house. In 1898 my good friend, Simmons, the noted Swedish botanist, when traveling along this coast with Sverdrup's expedition, visited the delta on which, later (1913), our house was built, and must have passed over the very path beside which I found this little plant, and also a beautiful, luxuriantly growing fern, *Dryopteris fragrans.* That these two plants eluded his careful, critical search, illustrates how easily even a specialist may fail to notice some of the small plants of the Far North.

As a further illustration of how a plant may escape discovery, I like to cite my own experience at North Star Bay. Throughout the summer of 1914 I lived at the little mission station there, studying carefully the vegetation of the large area of ice-free land that lies about Wolstenholm Sound. Only a few feet from the front door of the station lies a small bog, in which I collected numerous plants, and helped my good colleague, Dr. M. C. Tanquary, to collect insects and plankton. Throughout the summer I thought I observed carefully every plant that grew in the bog, yet in 1916, when I again spent the summer at North Star Bay, I found there, growing in profusion, and in full bloom, the little red-stemmed, red-leaved *Montia lamprospermum,* which I had eagerly sought in 1914 without success.

In passing, I may state that nowhere in the region did I find so satisfactory

Photograph by E. O. Hovey

OPPORTUNITY FOR STUDY OF PLANT ECOLOGY IN THE ARCTIC

[illegible] plants of certain different kinds grow always associated with one another, and these definite associations may be isolated in [illegible] in the Far North, because species are few in number and there is no competition from lack of space. The photograph shows an association of [illegible] arranged in three zones: floating far out in the water in an 'outer zone' are two members of the buttercup family (*Ranunculus hyperboreus* and *Ranunculus* [illegible]); [illegible] the shore in a 'middle zone' is mare's tail (*Hippuris vulgaris*), and on the moist shore itself grows an 'inner zone' made up of [illegible] (*[illegible] Senecio* [illegible]) and a third species of the buttercup family (*Ranunculus sulfureus*).

Such [illegible] of the melting snow [illegible] never wholly evaporate because of the quick return of freezing temperatures. The scene is at North Star Bay. Saunders Island, where great numbers of eider ducks nest, is visible in the background at the left.

a place to study the plants as at North Star Bay. Within half a mile of the station I found eighty plants; the habitats are so varied, and the general conditions so favorable, that it is a botanist's paradise. It is also a splendid place in which to make a careful study of the much-worked-over and much-discussed *Draba*, for I think almost every northern form of this genus is found there in abundance, and in confusing variation.

The study of plant association and plant societies in this region is fascinating. A slight change in the quantity of some one factor,—it may be one of the primary components of the habitats, or one of the secondary,—produces a change in the vegetation that is all the more easily recognized because of the simplicity of the association or the society. The struggle for survival in the North is not one so much of competition between the plants for light or food, as it is one against the climatic conditions. Generally speaking, there is no crowding of individual plants as there is in regions of denser vegetation. Light and room enough there are for all that can withstand and survive the stern climatic conditions.

Photograph by Donald B. MacMillan

The yellow flowers of the Greenland arnica (*Arnica alpina*) look like small sunflowers of temperate climes, but they are lowly in stature like all other Arctic flowers.

In the lower right-hand corner of the photograph appear a few glossy, oval leaves of the Arctic willow (*Salix arctica*). This most common and tallest of the "trees" of Greenland never attains a height of more than three inches, although its branches may spread over several square feet of ground. Stems of Arctic willows more than fifty years old, as proved by the number of their rings of wood, may be no thicker than a man's thumb. Another willow species (*Salix herbacea*) must be the smallest tree of the world. It grows one inch tall and has two leaves and one tiny furry catkin each summer. The botanist in Greenland finds many interesting plant problems for his consideration, especially that of distribution

Among the groups of plants that may be readily distinguished are the luxuriant grasses (*Alopecurus, Poa*, etc.), and the scurvy grass (*Cochlearia officinalis*), association of the cliffs and slopes where the numerous Arctic birds nest; the sedge (*Carex*) and the cotton grass (*Eriophorum polystachium*), association of seepage-water swales; and the heathlike association, on warm, airy, sunny slopes, of cat's-paw (*Antennaria alpina*), arnica (*Arnica alpina*), and reed-bent grass (*Calamagrostis*). Many other similar distinctive groups help to form as interesting a vegetation as one finds anywhere, even although the number of species is not so large,

Photograph by Donald B. MacMillan

Cheery cinquefoils with saffron-centered flowers measuring an inch wide (*Potentilla Vahliana*), relatives of the roses, sometimes cover and beautify whole acres of dry Arctic slope. To make so astonishing a showing of flowers in the short two months of summer, even with perennial stems and the protected position of the plants closely hugging the ground, there must be a minimum of interruption from summer snowstorms and frosts. The Crocker Land Expedition found a half dozen species of cinquefoils at the North, all with yellow flowers. The plant known in the North as "scurvy grass" (*Cochlearia officinalis*) belongs to the cress family (a family represented by sixteen species in northwestern Greenland). It is used as a preventive for a disease which has brought death to the ranks of so many Arctic expeditions. The Eskimos also sometimes eat the *Cochlearia* as a sort of salad, a pleasant variation from their meat diet

and the interrelationships not so complex as in that of more favored lands.

Of northwest Greenland it can hardly be said that one cannot see the forest for the trees. The tallest tree does not rise more than three inches from the ground; the view, then, is not appreciably obstructed by the forests. This tallest tree is the Arctic willow (*Salix arctica*), and it is the commonest. Although it grows so low, it often spreads over about a square yard or more of ground. Some of these trees, of which the trunk is not thicker than one's thumb, are more than fifty years old, as I determined by counting the rings of growth. The soft, fuzzy catkins on these trees rise above the ground farther than the trees themselves, and tempt the swiftly flying, nervous Arctic bumblebees as few others of the flowers can. Another willow (*Salix herbacea*) is about as tiny a tree as one can imagine. It rarely grows more than an inch high, and has but two little leaves and a tiny catkin each summer. No smaller tree grows anywhere, I am sure. The dwarf birch (*Betula nana*) has been recorded from the neighborhood of our lodge, but I was unable to find it, even after the most careful search where it was supposed to grow.

To the lover of rhododendrons, the little Lapland form which flourishes on the warm, sunny, well watered slopes, is most interesting. Its pretty little rose-purple, plumelike blossoms star the brown basalt rocks about North Star Bay, first cousins to the gorgeous forms that color the ledges of the Appalachians. Two northern species of the cranberry family (*Myrtillus uliginosa* and *Vaccinium Vitis-Idaea*) bear numerous little pink bell-shaped flowers, sweet and delicate as lilies of the valley; but they rarely set fruit, except on the warmest slopes where the summer snows melt as fast as they fall.

Photograph by W. Elmer Ekblaw

Kearsen Steppe, North Star Bay, looking over Wolstenholm Sound.—a typical heath slope of the Arctic, grading to bog at the foot. Such slopes are rarely bright green, for frequent summer frosts continually nip the growing ends of the plants. In late July and early August when the killing frosts begin to come, such slopes may show for a few days stretches of warm autumn coloring, the browns of mosses and the yellows of diminutive willows

The curlewberry (*Empetrum nigrum*) grows in a few favored spots, where its pretty, purple, velvet flowers make it conspicuous, but it bears few berries. The Eskimos like to use it and the fragrant branches of the heather (*Cassiope tetragona*) to make outdoor fires over which to boil their tea or coffee.

The so-called Arctic heather (*Cassiope tetragona*) is one of the prettiest flowers of the northland, and it grows almost everywhere. Its dainty, cream-white bells color some of the rocky slopes. This, and *Dryas integrifolia*, a starry blossom of the same hue, are perhaps the most numerous of the conspicuous Arctic flowers. These two flowers begin blooming early, and continue until August comes with its frosts and freezes.

A group of pretty flowers usually found on rocky ledges that the ptarmigan is wont to frequent, is that composed of the northern arnica (*Arnica alpina*), a smiling, bright, golden-face, not unlike a diminutive Kansas sunflower; the woolly cat's-paw (*Antennaria alpina*), smaller than its cousins of the far southland, but otherwise quite like them; the dainty pink and white shinleaf (*Pyrola rotundifolia*), its thick, glossy leaves and fair blossoms seemingly modeled from wax; the modest and lonely little bluebell (*Campanula uniflora*) rising blue and gentian-like on its fragile stem; and with them a strikingly beautiful, dark purple grass (*Trisetum spicatum*), of which the plumed tufts are noticeable rods away. This group of plants often includes one or another of the other sun-loving plants of the dry slopes, but they are not so definitely confined to the one habitat.

The lousewort, or beefsteak family, numbers at least three representatives. Of these *Pedicularis hirsuta* grows everywhere along the coast. Its first cousin, *Pedicularis lanata*, a much prettier rose-red cluster of flowers, is not so generally distributed, but at Lifeboat Cove, north of Etah, its bright blossoms dot the moors. At Etah grows *Pedicularis capitata*, a plumelike, golden cluster; it has been found nowhere else in Greenland.

Bluebells (*Mertensia maritima*) I found in profusion at but one place, the little Eskimo village at Sonntag Bay, and there the delta of a small mountain torrent was carpeted with them. On the same delta I found the most abundant growth of *Statice maritima*, a beautiful, dark pink globelet of florets.

Of the cinquefoils (*Potentillæ*), of the rose family, I found six species, all profuse-flowering and golden. But Vahl's cinquefoil is the cheeriest of them all, for its inch-wide blossoms with their saffron centers, shine from every dry slope.

The early purple saxifrage (*Saxifraga oppositifolia*) ushers in a succession of ten of the family, of which none is so beautiful as the leader. It is the earliest of Arctic flowers to burst into bloom; often purple pennants of its gorgeous blooms even border the snowdrifts.

Sixteen species of the cress family inhabit the region. Nearly all of them are white-flowered, but one notable exception is the purple rocket (*Hesperis pallasii*), sweet with the odor of plum blossoms, the only fragrant flower in the North. The *Drabæ* comprise ten of the sixteen cress species. It is to this family too, that scurvy grass (*Cochlearia officinalis*) belongs, that far-famed, reputed preventive of the dread disease, scurvy, which has decimated so many Arctic expeditions. It tastes bitter, like cress. Few of the Arctic plants are eaten by the Eskimo, but they occasionally eat this scurvy grass; more often though, they gather *Oxyria digyna*, a round-leaved plant, sour like our sheep sorrel.

Buttercups, waxy golden and bright, are numerous and varied. Most of them are yellow, but one tiny white form (*Batrachium paucistamineum*) grows in the ponds, its starlike little flowers floating on the water during about two weeks of midsummer. The favorite flower of many explorers is the dainty pink *Silene acaulis* that grows in dense clumps on gravelly slopes, but I could not help feeling that its hard stems were too stiff. The Alpine chick-

Photograph by W. Elmer Ekblaw

It was surprising to find that edible mushrooms grow abundantly at Etah. They attain considerable size, some nearly as large as a dinner plate, and were delicious when cooked.

The climate of the coast of northwest Greenland is far milder than would be expected for the latitude, because strong tides and currents keep open water in Smith Sound not far from the land usually all the year through. This open water produces a moister air and thus accounts in large measure for the relatively luxuriant vegetation of the Smith Sound region

Photograph by W. Elmer Ekblaw

Even before the snow melted away, the plants on southern slopes at North Star Bay were budded for blossoming. On land that is level the rays from the low Arctic sun strike only obliquely, but they strike the slopes of course more nearly perpendicularly. Therefore, if the slope be southern and thus protected from cutting winds, the temperature of the soil may rise rapidly. Under the influence of this warmth and of the moisture of the fogs so frequent in summer, the low shallow-rooted plants of the Arctic flourish

weed grows cheerfully everywhere, seemingly undaunted by the most unfavorable conditions. One of its near cousins (*Melandrium triflorum*), an Arctic catchfly, is found nowhere but in Greenland.

The dandelion, so despised in the southland, merits more respect and consideration in the northland. Besides the bright, golden forms, closely resembling ours, a white-flowered form (*Taraxacum arctogenum*) with pink border grows in profusion about Etah, and grows nowhere else in the world, so far as known. It would attract attention anywhere as a pretty flower.

It is to the sunny-faced Arctic poppy, however, that the explorer is always ready to give the highest praise. To the farthest northland that man has yet attained, this fragile, but hardy little blossom, has preceded him. On the

Photograph by W. Elmer Ekblaw

The tundra in general view appears barren and monotonous, but reveals variety and beauty of detail when studied close at hand. The most characteristic plant of the heath-forming association that grows on warm sunny slopes is the andromeda (*Cassiope tetragona*) with white bell-shaped flowers. In places it forms a continuous carpet (as shown in the background in the photograph). Rarely one finds the curlewberry (*Empetrum nigrum*) growing with it on the protected slopes of deep fiords

Photograph by E. O. Hovey

At North Star Bay, in the summer of 1914, the botanist of the Crocker Land Expedition found eighty species of plants within a radius of one half mile. Every day he made long tramps over the rough interior country, or sledge journeys to points along the sound. This year of 1914 was one of misfortune—except as to work. In March he had led one of the advance parties across Ellesmere Land ready for the Crocker Land search over the sea ice, but had been obliged to return to Etah because of badly frozen feet. Afterward, in April, he proceeded to North Star Bay to engage in a botanical survey. Misfortune followed him. At one time, he experienced for several days the agonizing pain of "snow blindness." At another, he narrowly escaped drowning when the ice gave way under him, his sledge and dogs—rescue being effected largely through the continued struggle of his big white king dog. And for several weeks here at North Star Bay he faced starvation, while only 130 miles away at Etah, but unobtainable, was food in plenty. Throughout the summer the party was on extremely short rations, always hungry, and always watching the point on the horizon where a relief ship might appear.

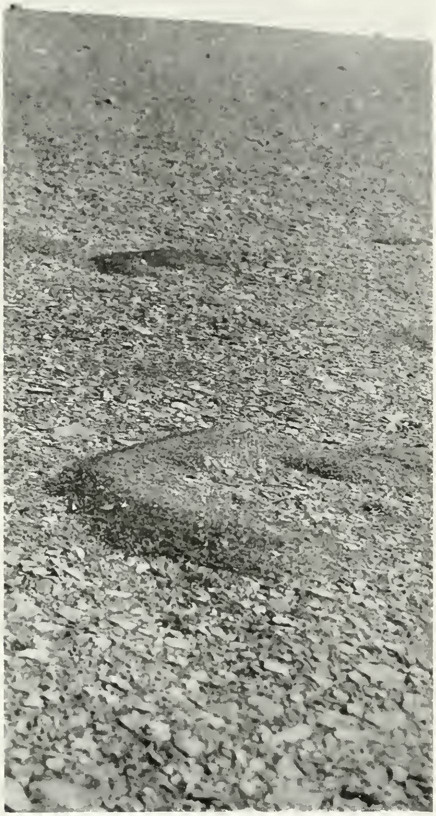
The photograph shows Dundas Mountain, 700 feet above sea level, and at the right about one mile from its base, the buildings of Thule Station, a base for Danish exploration (See AMERICAN MUSEUM JOURNAL for May, 1918, page 391)

most lonely and desolate coasts it greets him all summer long whenever he travels there. Along the icebound seashores, upon the bleakest plateaus, in every lonely valley, wherever a crevice in the rocks or a pocket in the cliffs gives it foothold, it is sure to establish itself. Great fields of it flamed about Etah, and about our headquarters house it grew abundantly.

No great, green meadows or pastures carpet any part of the far northland, but on the sunny slopes where some of the numerous Arctic birds have formed a rich guano soil, the turf becomes thick and soft. The frequent frosts that come through the summer, sear the delicate tips of the grasses so that they never appear verdant; a real green slope, therefore, is a rarity in the Far North. The most lush-growing grass is the misnamed Arctic timothy (*Alopecurus alpinus*) upon which the Eskimos depend for padding to place between their stockings and boot-soles and under the skins of their bed platforms, and for dishcloths or towels with which to wipe dry their few pots and pans. Many blue grasses grow in Greenland, but about the Eskimo villages, Kentucky blue grass (*Poa pratensis*), tall and thick, is the most common form. In a few of the shallower ponds along the coast grows the beautiful little *Pleuropogon sabinii*, unique in its genus.

Pretty, plumy cotton grasses (*Erio-*

phorum polystachium and *E. Scheuchzeri*) wave their white tassels along the banks of the streams and pools and in the wet swales; graceful little rushes and reeds (*Juncus* and *Luzula*) grow with the numerous sedges (*Carex*) to form mats of turf where no grass grows; harsh scouring rushes (*Equisetum arvense* and *E. variegatum*) form mats on some of the flatter stream beds, and a yellow-green club moss (*Lycopodium selago*) dots the upland swales; all of these help to create variety in the Arctic vegetation.



Photograph by W. Elmer Ekblaw

Mats of mountain avens on crescent-shaped areas of earth resulting from the disintegration of the rock. This disintegration has been accomplished through the action of overlying snow, drifted by fierce blasts of wind down the fiords. The hardy little *Dryas* (its flowers are shown on the opposite page) is probably the most common plant in Greenland. It is absent from few places where there is any vegetation at all, maintaining a foothold even on plains of bare rock débris. It flowers by the middle of June and continues to blossom throughout the short summer

Rather unexpected, but none the less welcome, four diminutive ferns that grow on the rock ledges carry one back in memory to the southland. *Cystopteris fragilis,* the commonest fern of the North, grows abundant and luxuriant in moist crevices on the steep cliffs. *Aspidium fragrans,* rigid but beautiful bronze-green, is a sweet smelling fern found on sunny shelves. Two little woodsias, *Woodsia glabella,* a Lilliputian form scarce an inch high, and *Woodsia silvensis,* not much larger, complete the list of ferns.

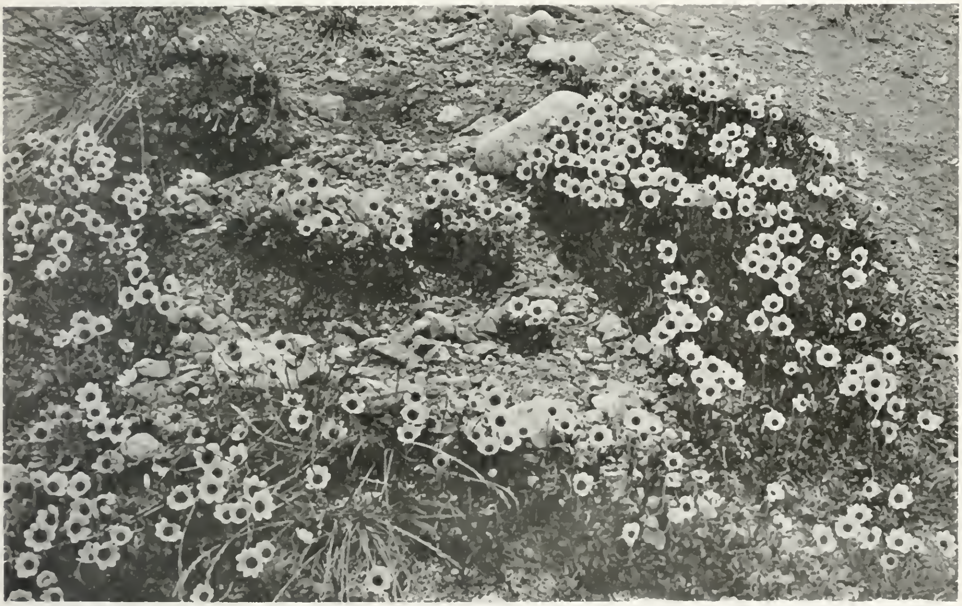
To end the account of the vegetation of the northland without mentioning the large, edible mushrooms at Etah would be to leave the list incomplete. They are of a species probably not hitherto known. Some of them grow as large as dinner plates. They could stand for days, unspoiled and untouched by insects, and still be almost as good to eat as when fresh. Dr. Hunt and I gathered many, cooked them, and ate them. We considered them excellent.

The plants and flowers of northwest Greenland have hardly two months in which to grow. As soon as the snow melts, the first flowers begin to appear, usually only a few days before June first. At that time the midnight sun is a month and a half high and gives almost as much heat at midnight as at noonday. Even so, frequent summer snows and cloudy weather often retard the development of the plants so that they cannot blossom before the killing frosts begin to come in early August while yet the midnight sun graces the northern sky. In mid-July even, the little willow leaves begin to turn yellow, and a week or two later the autumnal golds, and tans, and browns indicate that the season of growth is ended.

The flora of Greenland is a mixture of European and American forms. Many interesting problems present themselves in the occurrence and distribution of many of these forms, and much work has been done toward their

Photograph by W. Elmer Ekblaw

At the time when the ptarmigan were courting on warm, dry, Arctic slopes where the snow had melted early, the botanist could always be certain of finding a particular association of small, low, sun-loving plants. Among these were the yellow arnica, white woolly heads of "everlasting" or "cat's-paw," waxen pyrolas, and fragile, solitary bluebells (see page 278)



Photograph by Donald B. MacMillan

The white starlike flowers of the little mountain avens (*Dryas integrifolia*) are found on the inland plateaus and moraines which otherwise would be quite bleak and desolate. This small representative of the rose family seems to be able to maintain itself everywhere and its multitudes of flowers often give color to the whole mountain-side

solution. As yet, however, the evidence for definite conclusions is not available, but it is to be hoped that the collections and data obtained by the Crocker Land Expedition will make a considerable contribution to the knowledge needed.

Photograph by E. O. Hovey

VIGOROUS PLANT GROWTH IN A SUMMER ARCTIC POND

Such a pond (like the one shown on page 275) has probably come as a residuum of melting snows. Snowdrifts on Arctic slopes give rise to sporadic streams (see upper cut, page 288), but in flat country without drainage, to lakelets or ponds, frozen at the bottom in the deeper portions and freezing early from the bottom upwards. In the grasses and sedges about such ponds the red-throated loon nests, feeding on small fish which come into activity in the pond each season. The beautiful little Polar grass (*Pleuropogon sabinei* f. *aquatica*) which grows in the shallow parts of the pond among the rocks and covers the water with its narrow green leaves spread out in floating mats, and its tiny heads of "seeds" thrown above the water like minute rosy flags, is interesting in having also a small dry land form (f. *terrestris*) growing in crevices of the soil.

The view is at North Star Bay looking up Wolstenholm Sound, with Moltke Glacier entering from the left and Rasmussen Glacier from the right

Photograph by Donald B. MacMillan

GREEN GRASSES COVER RUINS OF DESERTED IGLOOS

Yellow brown is the color of the tundra seen in general expanse from a distance. Spots of vivid green are likely to indicate an Eskimo camp, possibly some ancient camp, with ruined igloos, because the Smith Sound Eskimos move their camps from place to place along the coast, driven by lack of food and led by abundance—of narwhal, of walrus, or of seal. Various species of blue grasses (*Poa pratensis*) grow on these relatively fertile spots, among them the Kentucky blue grass, also the so-called Arctic timothy (*Alopecurus alpinus*). It is the timothy, dried, that the Eskimo depends on for many domestic purposes—especially he stuffs his boots and mittens with it before putting in his feet or hands, thus adding many layers of nonconducting air to the protection, and he piles dry timothy on the bed platform before spreading out the caribou and polar bear skins

Photograph by E. O. Hovey

SUMMER STORMS BLANKET THE EARTH

North-facing cliffs have little plant life, but those facing the south are likely to be the homes of countless little auks and to have the talus slopes and the ledges covered with the green of grasses and the yellow and white of flowers. The strong gales and the dryness of the atmosphere greatly retard plant growth at the North. The low temperatures of both air and soil slow up growth. Also the continuous sunlight day and night for the greater part of the growing season (June, July, August), while allowing plants to make speed in seed production, inhibits growth in length of stem and spread of leaf (plants manufacture starch in daylight, the powers of growth are facilitated in darkness). We must expect a stunted and meager flora on circumpolar lands. The limit of trees reaches north of the Polar Circle in Siberia but is considerably south of it in Labrador. Beyond, wherever the land is ice free, is the "tundra," a vast open expanse covered sparsely and irregularly with grasses and lichens, intermixed with stunted grasses, sedges, and other flowering plants. The photograph shows valley and cliffs (700–900 feet high) at Parker Snow Bay, between North Star Bay and the great glaciers of Melville Bay

Photograph by Donald B. MacMillan

FRONTIERSMAN OF THE PLANT WORLD

It takes more than a summer snowstorm to dull for long the gold of Arctic poppies. The Crocker Land Expedition recorded purple saxifrage (ushering in a series of ten members of the saxifrage family) as the first flower to bloom at Etah (June 9), but that soon afterward the poppies began to open—among many other yellow flowers, such as arnica, buttercups, and dandelions. That different species can endure different degrees of cold is probably inherent in the protoplasm and a matter of heredity. Poppies are hardy and prove it by flourishing to the very edge of the Polar Sea only 370 miles from the North Pole. Many flowers at the North appear unusually large because of contrast with the dwarfed stems and leaves, and their color is always vivid. Arctic poppies are usually transparent mandarin yellow in color but in some localities a white form grows abundantly

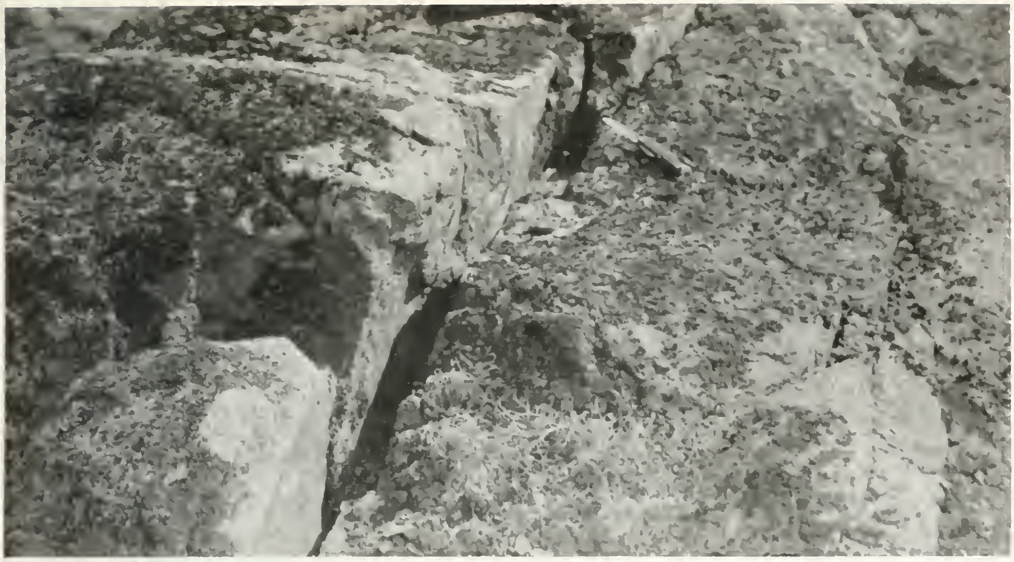
Photographs by W. Elmer Ekblaw

A BARE AND BLEAK LAND, EVEN WHEN ICE FREE

Along a narrow stream at North Star Bay (picture above), the heath and moor are finely carpeted with the pretty Polar rhododendron, with creeping cranberry, and with Arctic willow

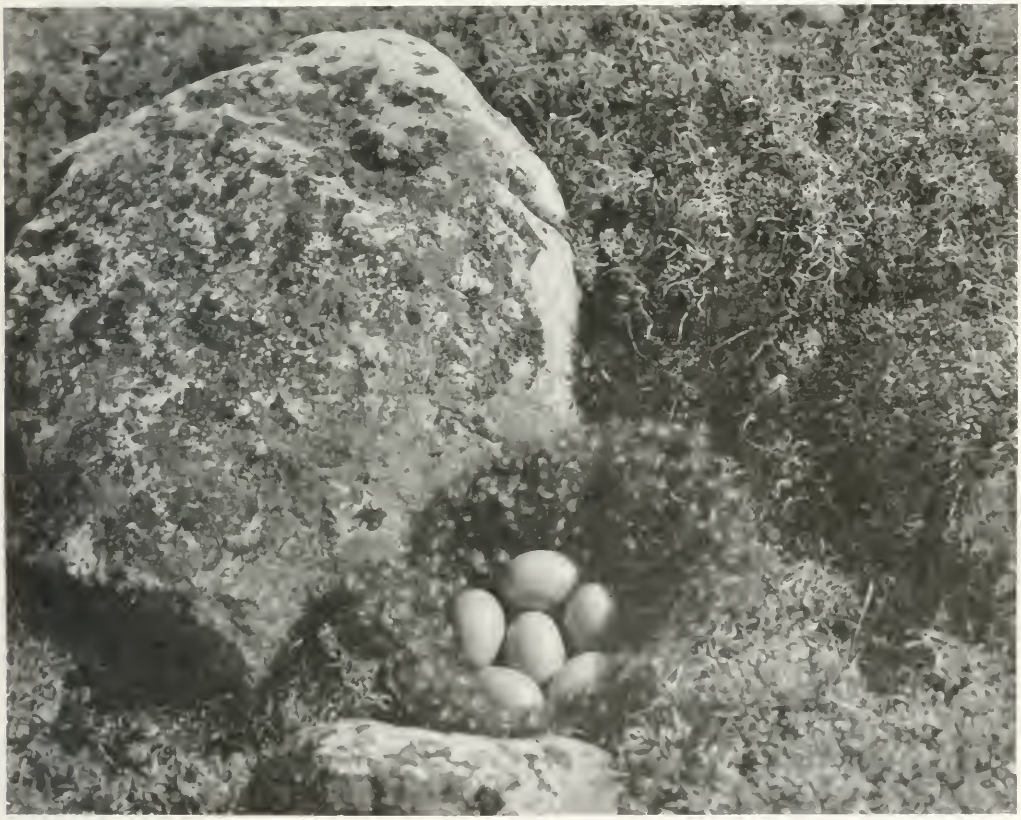
At this walrus hunting camp on Sonntag Bay (middle photograph) the botanist collected three species of plants which he found nowhere else along the whole North Greenland Coast. Many plants of the North are thus restricted in distribution

On Arctic slopes soil-flow streams move slowly, like veritable "glaciers" of rock and soil (photograph at bottom of page). They present conspicuous scalloped fronts, covered in this case with cranberry, and the very edge of the advancing soil is outlined in northern heather



Photograph by E. O. Hovey

In many places at North Star Bay, in July, bright orange lichens, brilliant as flowers, adorn the rocks and give the dominant tone to the landscape. Lichens and mosses largely make up the flora of the coldest Arctic tundra, tending to be distributed in different local areas. The crevice in the rocks indicated in the photograph by the pocketknife opens below into the nest of a snow bunting, which each summer comes from southern regions to make its home in this far northern spot



Photograph by W. Elmer Ekblaw

On the dry inland slopes where the old squaw (*Harelda hyemalis*) hides her nest, often miles from water, grow many lichens, sedges and grasses, and dry heath plants

Photograph by Donald B. MacMillan

Like the crimson poppies of Flanders Fields, these yellow poppies grew where have been wrought heroic deeds which live in history. The golden Arctic poppy (*Papaver radicatum*) for a few weeks in summer greets the botanist with good cheer wherever he may wander. He has known Greenland during the long Arctic night as a stern land of bleakness and desolation. But some day in summer when he enters one of the forbidding fiords, shutting out a view of the ice cap above and the icebergs on the sound outside, he concludes that Greenland after all is not a grim, barren spot. For every little crevice in the rocks is foothold for some fern or g'owing flower, every little pocket of soil refuge for a bit of verdant turf, and every little slope or ledge shelter for willow, heather, or smiling poppy

Photograph by E. O. Hovey

There were about seventy-five poppies in this gleaming mat of yellow on the bare shingle flats (North Star Bay). In favorable localities they are so abundant that it is no exaggeration to speak of "fields of poppies." These northern pioneers in no way lack in beauty of hue or of texture when compared with the golden poppies of California. Many Arctic species bloom profusely. *Draba* plants may be rounded out into spheres wholly yellow or white with the multitudes of flowers

Photograph by Donald B. MacMillan

How bleak and drear and lonely is the general landscape of the coast lands! This is at the head of Port Foulke, two miles southwest of Etah, where the ground is made up of the barren rock of an ancient seabeach. The Hayes Expedition of 1860-61 had its winter quarters here. The grave (see the center of the photograph) is that of August Sonntag, an explorer-scientist who lost his life in the ice of Smith Sound in December, 1860, while a member of this expedition. He had also served as astronomer with Kane, the first American explorer, on his expedition of 1853–55. The chiseled slab at the head of the grave, bearing the inscription, still stands against the weather

Photograph by Donald B. MacMillan

Helping to gather poppies at Etah in June.—The Eskimos delight in the brilliant flowers of their picturesque country, but are on the whole, of course, far less observant of plant life than of birds and animals

Our Centrifugal Society

Is our current expansive philosophy of life, based upon liberty, equality, and self-expression, a safe and sufficient guide for the development of a high social order? Should it not be balanced by the unifying and integrating forces which come from self-restraint and control, moderation, and the limitation of desires? These may lead to a far higher self-realization

By G. T. W. PATRICK

Professor of Philosophy, State University of Iowa

OUR present reconstruction period differs fundamentally from other such periods following other great wars. It is not quite safe, therefore, to rest in any easy assurance that in a few years all will be well, since a period of painful reconstruction must follow every great war. It is becoming evident now to all of us that we are confronted, not merely with a political and economic reconstruction, but with a radical social reconstruction.

Long before the war it had come to be believed that society was on the sick list, needing drastic treatment, if not a major operation. We had become painfully conscious of certain social "evils," and our attention was fixed more and more upon certain loudly advertised "cures" for these evils. Among these evils were the unequal distribution of wealth and opportunity, the constant clashes between labor and capital, the unjust exclusion of women from political and economic privileges, the alcohol evil, social diseases, poverty, crime, and the falling birth rate. Among the proposed "cures" were the further extension of democracy, socialism, syndicalism, votes for women, national prohibition, and coöperation.

Then came the war, and at once our attention was focused upon this as the worst evil of all. That such an awful calamity could suddenly befall the world increased still further our distrust in our whole social system, and we began at once to search for some cure for this further evil, and hoped to find it in a League of Nations, international agreements, and the self-determination of peoples.

The Spark of Divinity in the Human Mind

It is characteristic of our age to be peculiarly sensitive to its evils. This sickening feeling that the world is in a very bad way and needs redemption is illustrated in the book written by Alfred Russel Wallace shortly before his death, in which he bewailed the degeneracy of the times, dwelling upon the prevalence of poverty and crime, and frightful social diseases, and social injustice, in a note almost of despair.

Certainly it is a hopeful sign that we have become so sensitive to injustice, so conscious of social evils, so intolerant of wrong doing, so repelled by the horrors of war, that our own era, which is really clean and wholesome and peaceful and righteous as compared with past periods in human history, seems to us so imperfect. There is thus at any rate this element of hope in the situation that there must be some spark of divinity in the human mind, since we compare the present, not with the real past, but always with the ideal future.

Conscious Control of Man's Future—Will it be Intelligent and Beneficial?

The special characteristic of our time is therefore not the presence of evils, of which to be sure there are quite enough, but the peculiar consciousness of them and the resolute will to cure them,—a will so persistent and so determined that it is certain that the twentieth century will see profound changes in our social order. But it does not follow necessarily that these changes will be beneficial. They will be experimental. This is the first time in history that man has consciously and with determined purpose entered upon the task of directing his own fortunes. Hitherto he has been a puppet in the hands of cosmic forces: evolution, climate, the struggle for existence, the industrial revolution wrought by mechanical inventions and the discovery of coal, iron and petroleum, and finally, the retroactive influences of the American and Pacific frontiers. Now the period of conscious control has come.

But is this conscious control to be intelligent control, or is it to be the kind which the newly rich suddenly acquire over their material surroundings? So far as we can see at present, the era of intelligent control lies far in the future, and the control which is to mark the twentieth century will spring from an impulsive idealism characterized by a keen sensitiveness to our present social evils rather than by a comprehensive grasp of the whole social situation. We are to enter upon the deliberate attempt at social reconstruction but with a kind of adolescent impetuousness and a fatuous, almost fanatical faith in the magic of certain social symbols to cure social evils. This is, no doubt, a necessary stage in the progress of social control, but it is not without its dangers. We have gained the power to remodel our social order. Have we gained the necessary poise, the scientific, historical, and psychological knowledge that will make our meddling safe?

There is, in all the discussion of evils and the cures for them, a singular disregard of the psychological and historical factors of the situation, and a strange forgetfulness of the fact that however important social and political readjustments may be, the world cannot be made over as long as the human material, the minds and bodies of men, remains the same. The relatively greater importance of education, of physical and mental health, of racial integrity, of universal intelligence and self-control, is overlooked.

The Present Philosophical Basis of Social Reconstruction

But my purpose in this article is to call attention to the philosophical basis of the reconstruction movements of the day. Underlying all these movements is the philosophy of the full, free and abundant life; of self-expression; of self-determination; of self-realization; of freedom from every kind of autocracy or class rule or oppression or repression; of equality of opportunity; of freedom for self-development and culture; of complete liberty to realize one's own inner needs and one's own personality; of escape from all old and cramping conventions and institutions; of naturalness, initiative, power, will, and efficiency.

These are our ideals and to most of us they are so obvious that they seem to need no discussion. They have found expression in our current drama and fiction, in our moving pictures, in our books and magazines, and in all our plans for social reform. We have come to take them quite for granted.

Is Self-expression an Obsession?

Perhaps it may be worth while to examine these ideas with a little care. As ideals they are obviously good. This may pass unchallenged. But it is not self-evident that they are the highest ideals, nor is it self-evident that they are alone sufficient as a foundation for social welfare. It seems rather that the present age is merely obsessed with these ideas, just as other epochs of history like that of the ancient Hebrews, or that of Greece and Rome, or that of the Middle Ages, were obsessed with a wholly different set of ideas.

For instance, in the Middle Ages, poverty, chastity, and obedience were the monastic virtues, and every ambitious boy aspired to be a monk. We look in vain now for many ardent devotees of poverty, chastity, or obedience. Our attitude toward these medieval ideas is one of humorous superiority, not perhaps fully justified by the relative differences in the two civilizations as measured by such standards as social stability or the development of the fine arts, such as architecture, painting, and poetry.

Still another set of ideas ruled in the best period of Grecian civilization, likewise wholly different from ours. These were temperance in the sense of balance and moderation, measure, limitation, order, form, harmony, symmetry, and beauty. Francis Galton perhaps spoke with some exaggeration when he said that the average intelligence of the Athenian race was at least two grades above our own. But while we may smile at the ideals of the monks, we must take very seriously those of the Greeks as long as we are still using as models so many of their masterpieces of political philosophy, poetry, sculpture, architecture, eloquence, and literature. It is all a matter of historical perspective. Some future period may smile at our child-like devotion to liberty, equality and fraternity, or self-expression, or the full, free and abundant life, to the neglect of many other equally important ideas.

Is the Philosophy of Expansion a Safe Philosophy of Life?

In all our discussion now about social reconstruction and a new social order, is it not a little peculiar that the ideas which we are trying so hard to realize in this new social order,—liberty, equality, efficiency, opportunity, self-expression, and self-determination, —are just the ones that already mark this period when compared with other past periods and past civilizations? We may be deficient in these virtues, but we have them in profuse abundance as compared with other times, and we have them in excess as compared with other virtues, such as love of beauty and of symmetry, proportion, moderation, measure, and limitation of desires. Is it safe to enter so passionately upon the remodeling of our social institutions with our eyes fixed so exclusively upon any one circle of ideas?

Self-expression is perhaps the best single term defining our present day philosophy of life—or, possibly, self-realization, or initiative, or energy. The keynote of modern painting, music, and poetry is expression, and that of modern sculpture is energy. In our educational systems our aim is to develop all the latent energies and possibilities of the child. He must express himself, bring out the full richness of his personality, give full scope to his individuality, develop to the utmost his genius and his talent. When manhood and womanhood are attained, old social conventions must not stand in the way of this inner need of self-realization and self-expression. Our laws must be remade and our social institutions reconstructed so that each individual may enjoy his full rights and come into possession of his full share of the world's goods. It would be a shame if others had superfluous wealth while any lacked the means of self-development and self-culture.

This is the expansive philosophy of the age, the centrifugal motive in society, moving from within outward. But the ancient Greeks thought it better to draw from without inward, to observe limits and measure, to strive for inward poise and harmony. This is the centripetal motive in society, the unifying and integrating tendency.

Germany's Experiment in Self-expression

It would be interesting to attempt an evaluation of these two methods. When Plato was unable to find the definition of justice in the case of the individual, he solved the difficulty by examining the idea as magnified in the state. So just recently we have had an instructive example of the trial of this philosophy of self-expression in the case of a great state. Germany five years ago had a deep longing for self-expression. She felt that she must expand, bring out the full richness of her personality, develop to the utmost her genius and her culture, give full scope to her peculiar individuality. Old international conventions and treaties between states must not stand in the way of her inner need of self-realization and self-expression. Old laws must be reinterpreted so that she might have her full share of the world's goods. It would be a shame if other nations had superfluous colonies while she lacked the sphere of self-development.

But Germany made the unhappy discovery that there were other peoples who also desired self-expression, who also had a personality to conserve, a "mission" to fulfill. Five years ago self-realization was within Germany's grasp. She had valuable traditions of education and science, of art and philosophy. She had great wealth, vast industries, and a fruitful commerce, and she had the friendship and the respect of the world. Self-realization in the larger sense she could have had through the practice of the Greek virtues and the minding of her own business.

Limitations and Dangers of the Centrifugal Motive

It is important to understand the meaning and value of this new idea of the full and exuberant life. Its value we all recognize. Its limitations perhaps we do not realize. To many in the present day it seems like the very word of promise. It emancipates us—so we think—from all the narrow and cramping and dwarfing and galling restrictions of the past and sets us free to enjoy, to live, to breathe deeply, to develop as we please. It emancipated our slaves. It is emancipating our women. It will emancipate our laborers. If this new gospel of energy, of affirmation, of spontaneity, of self-expression, does not work well in the case of nations, there must be—so we imagine—some error in the analogy, for as regards the individual it is the very evangel of our modern era. If there is any one idea prevalent now it is that there is something intrinsically sound and helpful in this renouncing of old authorities and traditions in favor of our primal instincts. Instinct, impulse, nature, the spiritual life—to dampen these, to dampen this inner need of self-expression, this demand for joy, is the only sin.

This modern gospel of self-expression takes innumerable forms. With Nietzsche it is the will to power, gained through tragic suffering and pain. In Christianity it is the triumphant realization of an essentially divine and spiritual individual life revealing itself in the typical modern expansive virtues—faith, hope, and charity. In Bergson it appears as the exaltation of instinct and primal creative impulse. In Goethe it is pictured as salvation through successive forms of objective experience. In Browning it is seen in the wild joy of living, in buoyant faith, optimism, and love. Even in the modern mystic it is no longer passive resting in God's encompassing arms, but, as in *Jean Christophe*, an intoxication with the madness and fury of living. In the modern psychological novel it is the coming into some mysterious larger and fuller life through the conflict of motives and through rich subjective experience. In the modern drama, sometimes nothing but the experience of sin itself will bring it to complete fruition.

In all these forms of self-expression, the common motive is the centrifugal motive, marked by a craving for excitement, impatience with restraint, a longing for freedom and expansion, for the enhancement of life, for the intensification of consciousness.

With this note dominant in our modern life and literature, it is foolish to speak of social or racial or national decadence. Clearly, the world is not suffering from age and decadence. It has the virile enthusiasm of youth, but with it also the defects of youth, an almost childish impetuosity and imprudence, a tendency toward no remoter end than the mere intensification of the momentary mood of joy and strength.

Need of the "Inner Check"

What is lacking in all these forms of self-expression is the "inner check," the motive of restraint and reserve, the discipline of the wise man who looks beyond the present.[1] In Platonic phrase, it is "justice," the justice which the young man owes to his coming years, the justice which each generation owes to the next, the justice which each individual owes to society. Every young man is free to live the full and abundant life up to the point of not infringing upon the strength and integrity of his coming manhood. Every generation is free to live the full and abundant life up to the point of not infringing upon the health and happiness of the next generation. Every individual is free to live the full and abundant life up to the point of not infringing upon the full and abundant life of all the others in the group.

But the limitations come quickly and fast. Therefore, restraint is necessary; and will be increasingly necessary. There is no error here in the analogy between the nation and the individual. Germany complained before the war that she was fettered by a surrounding iron ring. To be fettered by an iron ring is painful. She longed for expansion. But the world has had a wholesome lesson from the war. Hereafter expansive nations will understand that they must do their expanding within their own borders. The days of territorial expansion are gone by. And it is to be feared that there will soon be a limit to economic and commercial expansion. In fact perhaps the virtues of the future will be not expansion, not self-expression, but self-control and limitation. And can we be sure that these latter may not be the surer road to peace and happiness? Possibly there is a higher kind of self-realization than that found through self-expression. Self-realization may indeed be the highest goal of human endeavor, but the self to be realized may be the larger self of our collective being, including succeeding generations.

This is nothing, of course, save the age-old antagonism between liberty and justice. It is merely the habit of our modern thought that we have become so enraptured with the first of these that we have overlooked the vital importance of the second. Of course, we hear a great deal now about justice, but it is social justice that we have in mind, that glorious social state in which each class shall enjoy all the fullness and richness of life that any other class enjoys. It is not at all that kind of justice which Plato taught us, consisting not in *having*, but in *doing* one's full share. Plato understood, as all the older teachers did, that the centripetal forces in society must balance the centrifugal forces, if we expect stability in our social life. With Plato justice was the centripetal integrating principle. It was realized when every class, and every individual, performed its function in the state—in plain terms, did its duty. It was a socialistic state, but evidently the fundamental purpose was different from that of our modern socialistic state, in which the attention is focused more upon our rights than upon our duties.

Socialism as it exists in theory today involves, unfortunately, no radical change in our current spiritual ideals. It accepts without much question the philosophy of the full and abundant life, and proposes usually a series of administrative and industrial changes,

[1] Compare Paul Elmer More, *Platonism*, Chapter V.

which it is hoped will do away with certain evils of the time, such as inequality of wealth and opportunity, and the selfish exploitation of the laboring classes. The emphasis in all these modern movements is put upon getting one's full share of the good things of the world—food, clothing, wealth, leisure, and opportunity—to the end always of comfort, happiness, self-expression, self-realization, self-development.

The ancient socialistic state, on the other hand, was one in which the attention was focused, not on the individual benefits to be enjoyed, but on the loyal part in the whole undertaking which each was to play to the end of having a healthy and permanent society. And they well understood that in the long run the individual found his greatest happiness, his highest good, when he fixed his attention on the permanence, stability and health of the social group. A social group in which the human units focus their attention upon getting each his full share will not bring to its members as full and abundant a life as a group in which the attention is fixed upon doing each his full part.

Our modern conception of the perfect state is one in which certain "evils," such as poverty, inequality, intemperance, clashes between classes, and wars between states, are to be absent. Poverty is to be abolished, not by self-denial and a limitation of desires, but by the increase of wealth through efficiency, scientific management and new mechanical inventions, and by new *laws* regulating the production and distribution of wealth. War between nations is to be abolished, not by curbing our instincts of pugnacity, not by education in restraining our expansive desires, but by some new political contrivance such as a League of Nations. Intemperance is to be done away with, not by making men strong to resist temptation, but by an act of legislation removing the occasion of temptation. Disease is to be abolished, not by assisting nature in providing powers of resistance to disease, but by devices to protect men from the causes of disease. Inequality between the sexes is to be removed, not by fostering respect for womanhood and motherhood, but by votes for women and political privileges.

I would not be understood as belittling the absolute value of democracy, and socialism, and feminism, and prohibition, and a League of Nations; but we over-emphasize their total relative value for social welfare, even if we consider only the welfare of the present generation. No society will survive without the integrating motive—the presence of justice in the Platonic sense. The world is stirred today by powerful centrifugal forces. Like a wheel, it will fly into pieces unless it is held together by equally powerful centripetal forces. These integrating forces are measure, self-control, obedience, respect for law and authority, restraint, limitation of desires, the feeling of obligation. As one writer has said, we have a superabundance of vital energy; what we need is vital control.

The finishing touch has finally been given to our philosophy of expansion by Freud, who has shown us that the repression of our instincts and desires is dangerous. Why, yes,—dangerous now and then for the individual, but singularly wholesome for society! It is really very naïve, this discussion about the danger of inhibiting our natural impulses. Freud might have read in a certain ancient writing of a certain wise teacher who said, "If any man will come after me, let him deny himself and take up his cross and follow me."

The great cry now is for equality of opportunity. But opportunity for what? If pressed for an answer, we say opportunity for self-development. Really it is opportunity for advancement, for wealth, for power. We seem to be blind to the existence of other higher and more enduring values. The society which we picture for the future is always built on the Chautauqua plan. What we think we want is physical comfort, leisure for self-improvement, peace and quiet in which we may work, freedom from interference and escape from fear; but actually life is something very different. Our socialistic society of the future pictures man as surrounded by comforts, working six hours a day and "enjoying" ten hours of leisure which he is supposed to spend in self-development; and when all this happens it is assumed that he will be happy and contented and peaceful.

A very little knowledge of human psychology ought to dispel this dream. Life is anything but a Chautauqua gathering. Life is a struggle and must have the zest of struggle. There are values higher than comfort and leisure and material goods, and other virtues which we need to emphasize more than faith, hope, and charity. In an age of despair and depression for the masses of people such as the beginning of the Christian era, the expansive, outward and upward-looking Christian virtues were like a great light from Heaven. In a vital, expansive, centrifugal period like the present it may be necessary for us to return to the integrating and harmonizing virtues of the Greeks,—wisdom, temperance, moderation, and restraint; and it may be necessary for us to revise our list of highest values and in place of wealth, leisure, liberty, equality, and opportunity, write for a while conservation, limitation, integration. The great things of life, wisdom and art and literature and heroes, have sprung from periods of storm and stress. It is such periods that have given birth to *opportunity;* but it was not opportunity for self-development, but opportunity for self-control, yes, even for heroism and for love.

To be sure, we hear much about love, but it has come to take the forms of sympathy and charity. Of both of these we have a great and abundant measure. What we are trying to do in all these modern forms of social reconstruction is to hit upon some social or political device by which we may live the full and exuberant life and allow our neighbor to do the same. There never was so much world-wide sympathy for the neighbor who does not live the full and exuberant life as there is now. We love and sympathize with every oppressed class and every down-trodden man. We are taught to love our neighbor, and we have learned to love him with such intensity that we allow no one to exploit him but ourselves. As Professor Babbitt says, "Our twentieth century civilization is a singular mixture of altruism and high explosives." We love our neighbor and we wish him every joy. In his need we shower him with charitable gifts. If others abuse him, we are ready to fight for him; but our conception of love does not quite extend to the notion of limiting our own desires for our neighbor's good. It does not quite suffice to check the megalomania of our capitalistic classes, nor persuade them voluntarily to bear their just proportion of public taxes, nor teach them willingly to share their profits with their workers. It does not quite suffice to lead our laboring classes, when once they find power in their hands, to use this power in accordance with reason and moderation.

It is owing to accidental reasons that the necessity for restraint and limitation has not been laid upon us in recent times. The discovery of America, the industrial revolution, the Pacific frontier—all these have opened to us a new world which has allowed the human spirit an indefinite expansion foreign to its long history. There has been for a short period in human history little need of the "inner check," and it has been almost forgotten.

To be sure, this wild display of centrifugal forces has brought no essentially valuable human product, no great literature or art, no Grecian temples, no Gothic cathedrals, no Shakespearian drama; nor has it brought peace among men, nor physical stamina of race, nor freedom from vice and misery and crime, nor justice, nor reverence. In the midst of plenty, it has not abolished greed, nor graft, nor strife. But these defects have been little noticed, and meanwhile there has been stirred within us only a desire for still more rapid expansion.

Only lately have the first signs appeared to teach us that limitation belongs to the nature of things and cannot be escaped. In the crushing defeat of Germany, the first emphatic "No" has been spoken to this cult of universal expansion. The whole world has awakened to its senses and recorded its ancient and instinctive protest against that ultimate injustice which flows from the theory of limitless expansion in the case of nations but it has not thought of applying this to the individual.

Our little world is getting filled up and the need for the practice of restraint and the limitation of our desires increases yearly. The rapid growth in the population of Europe and its still more rapid increase in the Americas, makes self-control and self-denial increasingly necessary if social order is not to give way to anarchy.

A Whole Civilization Might Collapse in an Attempted Readjustment to New Moral Values

Nietzsche was well aware that the full and exuberant life which he preached involved a "trans-valuation of all values." But the trans-valuation of moral values is a hazardous business. It is life itself which has determined these values, and they cannot be revoked by the mere will of heralds of revolt. The values which they would revalue represent the residual experience of long ages of human life and society, during which mankind has discovered that there are certain rules of conduct which are necessary if men will live in social relations in peace and security. The trans-valuation of these old racial values has been attempted many times and always something unpleasant happened. These unpleasant happenings may be deferred for many years. They may light upon one's mother, one's family, one's children. They may affect society or posterity—but they happen.

One would think that many of our hasty writers of recent fiction and drama regard our old rules of conduct, our moral codes, as the arbitrary pronouncements of some external authority, God, or the king, or parents, or the Church. We always think of our laws as being "handed down," and we resent having our laws handed down. We want to make them. But what we forget is that we *have* made them and that it has taken centuries—ages, to do it.

The critical importance of such questions as wars between nations, the equitable distribution of wealth and opportunity, political justice toward our women, intemperance, has blinded us to other problems which affect the very existence of society, namely, social order and social stability, and physical and racial health. And since the whole world at present is in a very radical and iconoclastic mood, halting at no thorough-going change in political and social institutions, it has become vital that we shall turn our thoughts to these other problems.

What are to be the elements of order, the centripetal forces in the new society? The forces working toward chaos and anarchy are many. Any newspaper page reveals them. The intense individualism inherent in all modern thought, the disintegration of states and of old established political programs, the constantly growing lack of respect and reverence for old institutions, in fact the suspicion of anything that is old and established, the powerful influence of modern fiction and the modern drama, the loss of the religious faith with which our moral sanctions have been closely associated, and the pragmatic philosophies of all kinds that rule in the present—these are some of the forces working against social integration.

This is not to say that any of the old ideas or these old institutions are perfect, or holy, or even good. It is only that the obedience to laws, the restraint and self-control which are necessary for social order, have been in the human brain associated with these things. A wholly new set of motives for social order is perhaps conceivable, resting upon none of these old institutions, but the human brain changes slowly, and an entire civilization might collapse in the process of a crude and reckless attempt at readjustment.

The disintegrating forces in society are many, and apparently increasing. It is necessary, if our civilization is to be saved, to turn our attention very seriously, and at once, to the integrating forces, to the forces which look to social stability, to law and order.

In the past there have been three great institutions which have acted as powerful forces of integration—the State, the Church, and the Family—the integrating power of these institutions depending not merely on external sanctions, but on the powerful motive of personal loyalty and allegiance. Since in the new society we have probably to look forward to the constantly decreasing authority of these three institutions, it is of the gravest importance to inquire what is to take their place.

In particular we must inquire what is to take the place of nationalism in the new order. When the state is small and its emblems are ever present to the senses, or when it is unified by art and religion, as in ancient Athens, or when the very existence of the state is threatened by rival states, as in the recent war, then social integration within the state is relatively perfect. Then the group spirit, the community spirit, keeps the group itself a healthy organic unit, the members of the group all loyally, willingly, eagerly performing severally their proper functions. Then justice prevails within the group, laws are obeyed and order is preserved. A League of Nations, to prevent that form of social suicide which a modern war has become, seems, as it truly is, a great step forward in human progress, but in the long history of human development social integration and social order within a state have depended to a large extent on the menace of danger to the state from without. When that menace shall be withdrawn, social integration within each state will be increasingly difficult.

The spirit of nationalism at the moment, to be sure, burns brightly, but the whole trend of the time is toward internationalism, due to the community of world interests in international labor movements, international commerce, banking, science and education.

The trend of events, therefore, forces us to believe that loyalty neither to the state, nor to the church, nor to the family, is going to be a powerful integrating force in the new society. The vital things now are labor unions, workingmen's councils, women's federated clubs, manufacturers' unions, trusts, and combinations, and countless other self-protective organizations and combinations of every sort. The old loyalty to the state and the church and the family has been in large measure replaced by loyalty to these countless social groups; but unfortunately there is no promise that loyalty to these groups is going to be in any sense a principle of social integration. On the contrary, it appears often to be a source of social strife.

The discussion of this problem in its positive aspects does not lie within the purpose of this article. Possibly a solution is not to be found in any political, economic, or social readjustments, but only in a change in human ideals.

American Indian Poetry

By HERBERT J. SPINDEN

THE myths and songs of the American Indians are part of our national heritage along with the hills and plains that were wrested from their creators. These pieces of unwritten literature, first transcribed into strange hooks and symbols by ethnologists and then translated into direct and unvarnished English, are sources of inspiration for our poets as potential as the Mabinogion or the tales of Merlin in the literature of Wales and England. They are products of the environment that we have made our own and they express deep human feelings in relation to that environment.

When Longfellow wrote Hiawatha he took the name and character of his hero from the Iroquois, the incidents of his story from the myths of the Ojibwa, and he cast these materials into the poetic mold of the Norse saga of the Old World. But writers of today are prepared to keep closer to the sources and to consult native pieces in translation. In a recently published book[1] we find an interesting anthology of American Indian poetry and a presentation of "interpretations" in the spirit of this poetry. While this book presents much that is new to the public, it leaves unvisited many pleasant fields known to special seekers.

There are tender or tremendous pictures drawn in the simple words of many Indian poems. For instance there is something we understand in this one:

> The Sioux women
>   pass to and fro wailing
>   as they gather up
>   their wounded men
> The voice of their weeping
>   comes back to us.

But it is something of a shock to be told that this is not a Song of Compassion, but a Hymn of Hate. More appealing to us in its psychology is this song of love-hurt that comes from the same tribe:

> Although he said it
>   still
> I am filled with longing
> When I think of him.

Or this from the Northwest Coast:

> My child says:
>   Look around at the waves,—
> Then she fools me
>   with unripe salmon-berries.

Or this from the Kiowa of the open spaces where the winds ride with loosened rein at night:

> That wind, that wind
> Shakes my tipi, shakes my tipi,
> And sings a song for me,
> And sings a song for me.

And what a striking phrase is contained in the following Navaho song to the magpie:

> The Magpie! The Magpie! Here underneath
> In the white of his wings are the footsteps
>   of morning.
> It dawns! It dawns!

The simple and direct matter contained in the poems quoted above does not offer great difficulties in translation. Even more sustained efforts like the following passage from the *Iroquois Book of Rites*[2] can be rendered in a natural and straightforward manner, although the construction of English varies widely from that of Iroquois, as may be seen at a glance. The translation runs exactly across from line to line:

[1] George W. Cronyn, Editor. *The Path On the Rainbow.* An anthology of songs and chants from the Indians of North America. Boni and Liveright, New York, 1918.

[2] Horatio Hale. *The Iroquois Book of Rites* (Brinton's Library of Aboriginal American Literature. Number II.), p. 153. Philadelphia, 1883.

Haihhaih!	Woe! woe!
Jiyathontek!	Hearken ye!
Niyonkha!	We are diminished!
Haihhaih!	Woe! woe!
Tejoskawayenton.	The cleared land has become a thicket.
Haihhaih!	Woe! woe!
Skahentakenyon.	The clear places are deserted.
Hai!	Woe!
Shatyherarta—	They are in their graves—
Hotyiwisahongwe—	They who established it—
Hai!	Woe!
Kayaneengoha.	The great League.
Netikenen honen	Yet they declared
Nene kenyoiwatatye—	It should endure—
Kayaneengowane.	The great League.
Hai!	Woe!
Wakaiwakayonnheha.	Their work has grown old.
Hai!	Woe!
Netho watyongwenteuthe.	Thus we are become miserable.

There is a class of Indian compositions midway between the emotional outburst of the short songs and the long ceremonial pieces that are blocks in a great philosophical structure. Among the Eskimo, for instance, we find colloquial poems full of excellent character drawing and understandable humor. It would be difficult to improve upon the matter of these verses in which Savdlat and Pulangit-Sissok pay their respects to each other in terms of raillery.[1]

Savdlat speaks:

The South shore, O yes, the South shore I know it;
Once I lived there and met Pulangit-Sissok,
A fat fellow who lived on halibut, O yes, I know him.
Those South-shore folks can't talk;
They don't know how to pronounce our language;
Truly they are dull fellows;
They don't even talk alike;
Some have one accent, some another;
Nobody can understand them;
They can scarcely understand each other.

Pulangit-Sissok speaks:

O yes, Savdlat and I are old acquaintances;
He wished me extremely well at times;
Once I know he wished I was the best boatman on the shore;
It was a rough day and I in mercy took his boat in tow;
Ha! ha! Savdlat, thou didst cry most pitiful;
Thou wast awfully afeared;
In truth, thou wast nearly upset;
And hadst to keep hold of my boat strings,
And give me part of thy load.
O yes, Savdlat and I are old acquaintances.

Very different in feeling but of equal merit as a sustained effort is a love poem of the Tewa Indians of New Mexico.[2]

My little breath, under the willows by the water side we used to sit
And there the yellow cottonwood bird came and sang.
That I remember and therefore I weep.
Under the growing corn we used to sit,
And there the little leaf bird came and sang.
That I remember and therefore I weep.
There on the meadow of yellow flowers we used to walk
Oh, my little breath! Oh, my little heart!
There on the meadow of blue flowers we used to walk.
Alas! how long ago that we two walked in that pleasant way.
Then everything was happy, but, alas! how long ago.
There on the meadow of crimson flowers we used to walk.
Oh, my little breath, now I go there alone in sorrow.

The religious poems that are found especially well developed among the Pawnee, the Navaho, and the Pueblo tribes of the Southwest may have been inspired, in part at least, by the ancient literary products of Mexico and Central America. Unfortunately the anthology

[1] D. G. Brinton. American Aboriginal Poetry (*Proceedings, Numismatic and Antiquarian Society of Philadelphia*, 1887–1889), pp. 21–22.

[2] H. J. Spinden, Home Songs of the Tewa Indians (American Museum Journal, Vol. XV, February, 1915), p. 78.

before us gives no examples of Aztecan or Mayan poetry and only one piece from Peru.

I will therefore sketch briefly the best products of literature in these regions where something close to the drama was developed in connection with spectacular ceremonies and where specially composed verses were recited on occasions of great rejoicing or solemnity. To begin with Peru, there are names for four different sorts of plays among the Incas, covering the range from tragedy to farce. Sir Clements Markham has given us the Inca drama of *Apu Ollantay* in two states, literal and literary. But this drama is so much like the drama of Europe in form that doubts have been cast on its authenticity. It surely contains native material, modified somewhat by European influences. In one scene the chorus sings the following harvest song that has an allegorical reference to the love plot in the play. Tuyallay—my little tuya—is the name of a small finch, and Ñusta means princess.[1]

Thou must not feed,
  O *Tuyallay*,
In Ñusta's field,
  O *Tuyallay*,
Thou must not rob,
  O *Tuyallay*.
The harvest maize,
  O *Tuyallay*.
The grains are white,
  O *Tuyallay*.
So sweet for food,
  O *Tuyallay*.
The fruit is sweet,
  O *Tuyallay*.
The leaves are green
  O *Tuyallay*.
But the trap is set,
  O *Tuyallay*.
The lime is there,
  O *Tuyallay*.

We'll cut thy claws,
  O *Tuyallay*.
To seize thee quick,
  O *Tuyallay*,
Ask *Piscaca*,
  O *Tuyallay*,
Nailed on a branch,
  O *Tuyallay*,
Where is her heart,
  O *Tuyallay?*
Where her plumes,
  O *Tuyallay?*
She is cut up,
  O *Tuyallay*,
For stealing grain,
  O *Tuyallay*.
See the fate,
  O *Tuyallay*,
Of robber birds,
  O *Tuyallay*.

More ponderous and impressive are hymns to Uira-cocha, the unknowable, all-powerful and ever-benevolent Supreme Being of the Incas. I quote[2] but a portion of one of these:

O Uira-cocha! Lord of the universe,
Whether thou art male,
Whether thou art female,
Lord of reproduction,
Whatsoever thou mayest be,
O Lord of divination,
Where art thou?
Thou mayest be above,
Thou mayest be below,
Or perhaps around
Thy splendid throne and sceptre.
Oh hear me!
From the sky above,
In which thou mayest be,
From the sea beneath,
In which thou mayest be,
Creator of the world,
Maker of all men;
Lord of all Lords,
My eyes fail me
For longing to see thee;
For the sole desire to know thee.

The literary remains from Central America are scanty, especially those containing verse. Bishop Landa tells us that in northern Yucatan dramatic representations took place on prepared stages or platforms. In Mayan cities that flourished in the fifth and sixth centuries A.D. we find the ruined remains of courts surrounded by stepped walls. These probably served as amphitheaters.

Of the poems recited by the Aztecs on gala occasions we have fragments that make us realize the world's loss in the destruction of this literature.[3] The

[1] Sir Clements Markham, *The Incas of Peru*, pp. 353–354. New York, 1910.

[2] Idem, p. 100.

[3] Daniel G. Brinton, *Ancient Nahuatl Poetry* (Brinton's Library of Aboriginal American Literature, Number VII.) Philadelphia, 1887.

sixty songs of King Nezahualcoyotl were held by the Aztecs as examples of the poetic art at its best. They admirably expressed the philosophy of eat, drink, and be merry. Nezahualcoyotl is addressed in these words by a brother poet:

> And thou, beloved companion, enjoy the beauty of these flowers, rejoice with me, cast out fears, for if pleasure ends with life, so also does pain.

A responsibility above mere pleasure was recognized, however, in subsequent lines, and a permanence for good deeds as contrasted with human vanities.

> I fear no oblivion for thy just deeds, standing as thou dost in thy place appointed by the Supreme Lord of All, who governs all things.

Poetry was flowery speech to the Aztecs and the symbolism of flowers is repeated in lovely phrases. For instance:

> Weeping, I, the singer, weave my song of flowers of sadness . . .
>
> I array myself with the jewels of saddest flowers; in my hands are the weeping flowers of war; I lift my voice in sad songs; I offer a new and worthy song which is beautiful and melodious; I weave songs fresh as the dew of flowers . . .
>
> Let my soul be draped in various flowers; let it be intoxicated by them . . .
>
> The divine flowers of dawn blossom forth . . .
>
> O youths, here there are skilled men in the flowers of shields, in the flowers of the pendent eagle plumes, the yellow flowers which they grasp; they pour forth noble songs, noble flowers; they make payment with their blood, with their bare breasts; they seek the bloody field of war. And you, O friends, put on your black paint, for war, for the path of victory; let us lay hands on our shields, and raise aloft our strength and courage.

The religious chants preserved by Sahagun are written in archaic Nahuatl. The phrases must have sounded as strangely in the ears of the common Indian of those days as the verses of Chaucer do in our ears today—perhaps more so. Even when carefully translated these chants are unintelligible to persons ignorant of Aztecan beliefs and usages. Therefore I have found it wise to follow this chant with a fairly detailed explanation.

SONG OF THE YELLOW-FACED ONE[1]

I.

In Tzommolco, my fathers, shall I affront you?
In Tetemocan shall I affront you?

II.

In the temple of Mecatlan, O, my Lords, the yucca tree booms.
In Chiueyocan, the House of Disguises, the masquerade has come down.

III.

In Tzommolco they have begun to sing
In Tzommolco they have begun to sing
Why come they not hither
Why come they not hither.

IV.

In Tzommolco human beings shall be given
The Sun has come up!
Human beings shall be given.

V.

In Tzommolco now ceases the song
Without effort he has grown rich, to lordship he has attained,
It is miraculous, his being pardoned.

VI.

O little woman utter the speech
Lady of the House of Mist utter the speech abroad.

[1] Eduard Seler, *Die religiösen Gesänge der alten Mexikaner.*

Commentary.—I. The "Yellow-Faced One" is a descriptive name of the Fire God who had many other names. Tzommolco was a temple to this god in Tenochtitlan (Mexico City) and Tetemocan is probably a second name for the same building. The question "shall I affront you" means "shall I withhold from you the prescribed sacrifice." It is a formula that is often used. The plural "my fathers" may have been addressed to the several priests in charge of the ceremony who were regarded as representatives and impersonators of the god.

II. Mecatlan was possibly a temple of music; at any rate the "yucca tree booms" refers to the beating of the drums which were made of the hollow trunk of the yucca. The next name, Chiueyocan, may be translated "Place of Eight-ness," —but even then the term is cryptic enough. It was possibly a temple where dancers donned their animal masks and other ceremonial regalia.

III. and IV. These stanzas relate the progression of the ceremony and call the priests to a sacrificial rite with human victims. The Fire God appears to have been the same as the Sun God and the sacrifice was made at sunrise.

V. These words refer to the rewards given by the Fire God to the person on whose vow or petition the ceremony had been called. This divinity was also God of Wealth and Honors. He was pleased by worship and he heaped sudden wealth and high rank upon his worshipers.

VI. The last stanza doubtless has some esoteric connection with the preceding stanzas. The person referred to is possibly a mountain goddess connected in some mythical way with the Fire God. Possibly she is requested to herald his fame and powers.

This Aztecan chant takes up events in succession and gives enough detail to indicate this succession to anyone familiar with the words and the religious background. It must be evident to the reader that the feeling of mystery and illusion gained from the first perusal largely disappears when we are in possession of even a portion of the facts and formulæ known to the creators. In the absence of this knowledge we get an emotional reaction, it is true. Our intelligence, that naturally strives to make sense out of words, is teased and thwarted.

The religious poems of the Pueblo Indians, of the Navaho, Pawnee, and Omaha, are filled with formulæ and with more or less esoteric and priestly phrases that the Indians call "high words." For instance, the repetition of a prayer to the four directions and to the above and the below is a formula of universality. The association with these world points of special colors, hunting animals, game animals, birds, etc., is a pictographic device probably taken over by the northern tribes from the highly developed cosmology of Mexico. The greater gods of the northern Indians lack, in general, the definite characterizations that we find in Mexico. They are formless powers that move in clouds and floods. But there are lesser gods who are commonly personifications of animals, plants, etc. Of course, the names of these gods can never have associations for us of the same sort that they do for the original Americans.

Indian invocations often carry a dreadful sincerity and give a sense of impending divinity. The argument is consistently made through objective reality to subjective ideality. Note how the Sia appeal through the eye and ear to the reasoning mind that would know the Makers of Storms:

Cover my earth mother four times with many
 flowers.
Let the heavens be covered with the banked
 up clouds.
Let the earth be covered with fog; cover the
 earth with rains.
Great waters, rains, cover the earth.
 Lightning cover the earth.
Let thunder be heard over the earth; let
 thunder be heard;
Let thunder be heard over the six regions of
 the earth.

To these Indians the æsthetic arts are useful and filled with magic. Their songs are prayers for rain as are likewise the designs they paint on pottery or weave on cloth. They live immersed in beauty, but it is the beauty that does, not the beauty that seems. While the Navaho god created he sang as follows:

In old age wandering on the trail of beauty.
 For them I make.
To form them fair, for them I labor.
 For them I make.

In these words is expressed the philosophy that beauty is truth and perfection in use and being.

The question soon asked by a person skilled in the use of words on reading American Indian verse is this: "How much of the effect is real and how much is adventitious?" Someone has somewhere observed that when you learn a new language you acquire a new soul. Words are not merely the carriers of thought, they are also to a large extent the molds of thought. New sets of words involve new ways of thinking because they establish new associations between objects and ideas. Literal translation may put into the language of the second part some original quality of the language of the first part, but more often it puts in a new and picturesque something that comes from mere contrast between two systems of word order and word association.

Language makes possible the transference of ideas from one human mind to another only because articulated sounds—or graphic symbols that substitute for them in writing—rest upon a social basis of common acceptance for the word and common experience for the meaning. But just as the art of weaving varies from one place to another because tools, materials, and ideas of construction vary, so the art of presenting thought in sounds or preserving it in sound symbols, is modified and limited by the mechanical possibilities and suggestions inherent in the particular language. Textile design, properly speaking, must follow the lines of construction. Poetry is design in words and in any particular language it must also adjust itself to construction. The device of rhyme, for instance, is not always possible. Rhythm of one kind or another is usually present because primitive poems are usually sung. Accent is common in polysyllabic languages but the primitive singer does not hold himself strictly to these accents. Syllables may be slurred, lengthened, reduplicated, etc., to meet the requirements of the singing voice. Repetition often gives rise to stanza forms especially when there is an orderly variation combined with the repetition. Thus in an extempore song of virtues in a funeral ceremony a qualifying phrase may vary between set phrases. For example:

> She is dead, *the generous one*,
> My daughter is dead, dead!
>
> She is dead, *the loving one*,
> My daughter is dead, dead!

In the translation of poetry there are the prose and the poetical methods. The prose method is to translate simply the thought, and the natural tendency of the followers of this method is to translate the thought into English which is devoid of any emotional quality. The poetic method is to translate the thought as directly as possible into words of emotional quality. The difficulty with this method is that it is hard to match emotional qualities between languages. Moreover, the persons who naturally prefer it have subjective rather than objective interests. American Indian languages are rich in terms that single out details of the outside world and in classifications of the states of matter but they are weak in words that present or qualify the subjective world and the states of mind. Yet, far from being materialistic, the Indians recognized a persistent duality in nature and each thing had its soul.

Some anthropologists, especially Frank Cushing, Alice Fletcher, Washington Matthews, and Jeremiah Curtin, have treated Indian songs and myths in literary fashion. But they have worked from native texts and so have not gone far astray on the fundamental meanings of the original words. The criticism of their translations lies not so much in denotation as connotation. An English word may have approximately the same meaning as an Indian word and yet have entirely different associations. They have given a poetic quality where there should be a poetic quality—but perhaps they have endowed the rose with the fragrance of the violet.

When it comes to a second remove such as is seen in the "interpretation" of Indian verse we are on still more doubtful ground. Even the most pretentious interpreters of Indian modes of thought make mistakes. For instance, one might place greater faith in the emotional and intuitive judgments of Mary Austin if the poem chosen by her to represent the quintessence of Indian art were not a flagrant fraud long since exposed. The epithalamium of Tiakens was written by a French student of languages named Parisot when scarcely twenty years of age. The daring youth fabricated the grammar, vocabulary, and texts of a language which he declared to be that of the now extinct Taensa tribe and was successful in deceiving the world for several years.

Of course what the interpreters want are new themes and freshened expressions. They can get these by imitating the objectivity of Indian poetry that pictures causes and circumstances and lets the mind of the hearer or reader interpret for itself. Sometimes the word association or the sentence structure in a foreign language can be transferred legitimately into English. For instance, in a song given above let us take the Tewa terms *p'in'e* and *hâ'e*, the diminutive forms of *p'in* and *hâ*, that mean "heart" and "breath." These terms of endearment are different from the ones we use in English but are understandable because we ourselves make use of the affectionate diminutive (as in little mother, motherkin, etc.) and we associate the heart and the breath with love and life. The exotic quality that exhales from Burton's translation of the *Arabian Nights' Entertainments* is partly due to peculiar similes and recurring phrases that strike forcibly upon our western imaginations. To eastern readers these are conventions pure and simple and the signs of real excellence something entirely different.

A translation that is first and last the carrying over of a thought and all its associations from one language to another, is essentially a new creation. A human mind must intervene and receive the terms and construction of the language of the first part and give out not the form but the content of the message in terms and constructions of the language of the second part. Poets who attain the grotesque by half translations make an unfair use of Indian verses.

Constance Lindsay Skinner, in the terminal essay to *The Path On the Rainbow*, unconsciously makes clear that her reaction to Indian verse is involved and subjective and that she sees only through the eyes of the English language albeit sympathetically. She says: "The Indian water-song is poetry to me because of a memory:—an old chief, his hair grayed and his broad brown face deep-lined by a hundred and ten years, his sightless eyes—almost hidden under sagging, crinkled lids—raised to the wet air." After all it is the subjective of our own culture rather than the subjective of Indian culture that is stirred by Indian poems.

I believe that the study of primitive American poetry should have a wholesome and stimulating effect upon modern American literature. It is open, sincere, and inspiring, and it has an engaging quality of directness and simplicity.

There is today, however, a pseudo-primitive school that in painting, sculpture, music, dancing, and poetry affects the mold but ignores the content of art that is genuinely primitive. The work of this school lacks communal acceptance, undivided purpose, and innate sincerity, and is essentially individualistic and revolutionary. Nevertheless, good may come out of such efforts if only the public learn sufficient discrimination to select gold from dross. Real primitive art has behind it a tradition of untold centuries while pseudo-primitive art can boast only a doubtful present. If a choice were to be made between the atavistic muse of Dr. Frank Gordon that sings:

By south-way, east-way, shore-land place,
Men come,
Boats come,
Float fast,
Handsome.
Man-who-Paints, much-talker, he much-
walked
Easterly, south also,
All-time stalked— . . .

and the untutored savage of the Painted Desert whose immemorial gods of cloud and bush have taught him to say:

May their roads home be on the trail of
peace,
Happily may they all return.
In beauty I walk,
With beauty before me, I walk,
With beauty behind me, I walk,
With beauty above and about me, I walk,
It is finished in beauty,
It is finished in beauty.

What would the verdict be?

A NUT PALM BESIDE THE JUNGLE TRAIL

The nut palm is one of the most common of Panamanian palms. About every fifth palm has a family of opossums occupying the hollow center where the branches start. The photograph also shows typical second growth jungle about as high as it ever gets

Unknown Panama[1]

By TOWNSEND WHELEN

Lieutenant Colonel, United States Army

I BELIEVE it will surprise most Americans, and perhaps a few of our field naturalists, to learn that right at the back door of the Panama Canal lies an almost unknown jungle wilderness, unmapped and practically uninhabited in the interior except for a few very primitive Indians. Virtually the entire eastern portion of the republic of Panama lying between the Canal and Colombia, roughly three hundred miles long by from fifty to one hundred miles wide, is unknown, and the published maps of this country, except for the seacoast and the location of half a dozen small towns, are all faked.

It was my good fortune to spend the entire dry seasons (December to June) of 1916 and 1917 exploring a part of this country. We found it necessary to know something of that portion of it nearest the Canal, and it fell to my lot, assisted by Companies E and H, 29th United States Infantry, to make a preliminary exploration with a view to planning and expediting its accurate mapping by the Engineer Corps.

The coasts of Panama are all accurately charted. In the vicinity of the city of Panama are a few fair-sized towns on the larger rivers, and their location, as well as the general course of the rivers on which they lie, is indicated with fair accuracy on existing maps. Some of the mountain ranges which can be seen from the sea have also been set down. The remainder is unknown. Moreover, it will of necessity remain so. The Panamanian is not a pioneer. Exploration does not appeal to him and, in fact, he dreads the jungle at his back door. No guides to this country can be procured. The Indians of the interior are hostile to the invasion of the country by the whites. There are no roads or trails, and practically no navigable rivers, back packing being the only practical means of transportation. Even maps are not available, and probably it will be very many years before they become so, owing to the necessarily confidential nature of such accurate maps as exist, because of their connection with the defense of the Panama Canal.

It is because this little piece of jungle probably will remain virgin and unspoiled for many years that I think it ought to be brought to the attention of our field naturalists. It is so easily accessible, and yet only the borders of it have been scratched by the scientist. No one yet knows what is in the interior, what secrets it contains, what new fauna and flora its exploration will reveal.

In the Canal Zone, which extends five miles to either side of the Canal, practically all of the jungle forest has long since been cut off, and in its place has grown up a dense, impenetrable second growth of small trees, palms, creepers, thorns, and coarse grass. The casual visitor to the Canal never sees the real jungle, nor dreams of its existence. In fact not 5 per cent of the inhabitants of the Canal Zone and the cities near by have ever seen the virgin jungle. To them the second growth is the jungle, uninteresting, impossible, terrifying.

But if one cuts his way through this tangled growth for about five miles in from the Canal he comes to the real jungle, standing up like a gigantic wall of green verdure. Once in it all is different, even the very climate itself.

[1] The illustrations are from photographs by the Author.

Here one can wander at will, unimpeded by thorns and creepers. It is even easier traveling here than in the woods of our own Northeast, because as a rule there is much less "down" timber. It is like a new world, a world that one has not even read about. From the blazing sun and sweltering heat of the second growth one enters what is almost an underground world, cool and balmy. Everywhere the giant trees go up limbless for from one hundred to two hundred feet, and then spread out their verdure, literally hiding the sky. Beautiful slender palms grow in great profusion in the semi-darkness forming the lower growth, impeding one's view but not one's progress. Scarcely ever can one see more than fifty yards, and never does the explorer get an extended view, even from the tops of the highest mountains. When I first entered the jungle it was with an indescribable feeling of awe and wonder, and this feeling has never left me; nay, it persists, drawing me, calling me to come back, more insistent even than the "Call of the North."

That part of the jungle in which my most intensive exploration was conducted lies to the east of the city of Colon, between there and the town of Nombre de Dios, and extending from the Caribbean coast inland to the headwaters of the Chagres River system. Between the Chagres basin and the Caribbean coast rises the cordillera of Cerro Bruja, a mountain range that starts about ten miles east of Colon, and rises steadily, culminating in the peak of Cerro Bruja (3200 feet) about fifteen miles south of the town of Porto Bello. East of Cerro Bruja peak the Rio Piedras rises almost in the basin of the Chagres, flows north around the base of Cerro Bruja, then west, and empties into the sea halfway between Colon and Porto Bello. The Piedras is one of the largest rivers of Panama, but you will not find it on any map, even its mouth having been mistaken for a lagoon of the sea when the coast line was charted.

The Rio Grande, figuring largely on existing maps, is an insignificant little stream, several miles long, really unworthy of a name. Beyond the valley of the upper Piedras rises a really imposing range of mountains called Cerro Saximo, culminating in a peak somewhere south of Nombre de Dios, which must attain an altitude of from six thousand to eight thousand feet. I think I am the only one who has ever viewed this range, as it seems to be invisible from any place where there is any trace of human beings, and its presence is barely noted on only one old map, with no indication as to its altitude.

Beyond Saximo neither I nor anyone else knows what. There are rumors that the interior beyond is inhabited by Indians of the San Blas (Cuna-Cuna) tribe, and that they are very hostile to invasion of their country by whites. Today one can enter the jungle ten miles east of the city of Colon, and travel eastward through this jungle wilderness for more than three hundred miles, and except for a few marks of my machete, he will not see the trace of a civilized being.

In January, 1916, I established a base camp at the end of the extreme northeastern arm of Gatun Lake, and from there extended my explorations. Trails were cut for about fifteen miles into the jungle, and other base camps were established from time to time. Sketch maps were made of the surrounding jungle, the work being done by Companies E and H, 29th United States Infantry, which companies I commanded from time to time. The extended exploration, however, could not be done in this way. The difficulties attending the supply of a large number of men in a country without trails or horse feed made the work very slow. So I was forced to fall back on the most primitive of all methods of

THE BASE CAMP OF COMPANY E, 29TH INFANTRY, ON RIO VIEJO

All the equipment was packed on the backs of the men for more than twenty miles. The jungle here was so thick that before it was cleared off we could not see more than ten feet ahead. The men's sleeping quarters are on the left. On the right are the large cheesecloth mosquito bars (12×9×7 feet) which the men used in the evenings for reading and recreation. Below 1000 feet altitude the mosquitoes are so thick at night that it is impossible to remain out of doors with any comfort, although the mosquitoes are not dangerous except where they have become infected by biting natives suffering from malaria. It was from this camp that the author started on a number of his explorations into the distant jungle

THE FIRST STEP IN MAKING A JUNGLE BED IN PANAMA

First a thick, springy mattress of palm leaves is cut (palm boughs in Panama taking the place of balsam boughs in northern woods), then the little jungle tent, with waterproof silk floor and roof and mosquito net sides, is pitched on top of the mattress, making a most comfortable bed, insect proof and cool. At every camp site there were always plenty of palms within a distance of twenty-five yards with which to make the bed

THE MOST CONSPICUOUS OF PANAMA TREES

While the Cuipo tree (*Cavanillesia platanifolia*) is not the largest of Panamanian trees, it is by far the most conspicuous. It always grows in the most prominent places and rears its head like a gigantic umbrella far above the surrounding jungle. Rings in the bark surround the trunk about every four feet, the trunk rising without a limb for one hundred and twenty feet. The buttressed trunk reminds one of a gigantic elephant leg and foot exploration, that of small parties of four or five men, packing all their supplies on their backs, and remaining out as long as their supplies lasted, or as long as they could subsist on the country. In this manner I made a number of trips of from two weeks to a month's duration, deep into the jungle, and learned something of what was beyond the edge. We saw the jungle at its best, became familiar with it, and learned to depend on it for shelter and most of our food.

I must confess to absolute incompetency when it comes to a description of the flora of the jungle, incompetency both scientific and linguistic. I doubt if the jungle as a whole can be described—it can only be marveled at. It is beautiful, appealing, terrifying. I never cease to wonder at the trees—giant moras, borigon, cavanillesia, ceibas, rubber, and fig. The enormous trunks with great buttressed roots rise a hundred feet without a limb, and then spread out literally to hide the sky. Limbs, so high that one can scarcely see them among the leaves, drop lianas to the ground—long tangled lines like the wrecked rigging of some masted ship. Then there is the secondary growth, a hundred varieties of tree ferns and palms, suited by nature to grow in semidarkness, robbed of the sunlight by their giant neighbors.

One of the things to beware of in jungle travel.—The black palm is a common tree in the virgin jungle of Panama. The thorns which cover it are very sharp, and the newcomer in the jungle invariably receives many painful wounds from it before he learns to look first instinctively when about to lay his hands on small trees to push them aside as he walks through the jungle. The wood of the black palm is very beautifully colored in alternate longitudinal layers of black and white, and is much in demand for canes

Between my first and second year of exploring, I came north in desperation and appealed to the Smithsonian Institution[1] at Washington for some knowledge of the flora of this region. The reply I received was discouraging, and yet should be an incentive to every botanist and naturalist: "One man could spend a lifetime studying the flora of that jungle, and then not know it; more than 80 per cent of the jungle growth in Panama is unknown to science."

My ignorance of the flora extends also to the fauna, except that from many years of wilderness loafing and big game hunting in the North I have naturally come to a sort of practical method of study all my own, and have learned to observe with some little truth, but with very little science. In fact, except temperamentally and physically, I was in no manner equipped for a scientific study. Nor with my many military duties connected with

[1] To Professor Henry Pittier, who probably knows this jungle more intimately than does any other scientist, having spent many years of field study in Costa Rica, and who has actually taken one trip into the very country in which I was working.

exploration, mapping, and the management and supply of my men, was I able to devote much time to natural history. The first year I was totally unprepared. The second year I went better equipped from a scientific point of view, and I believe I made a collection of specimens, notes, sketches, and photographs that might have been of some little value, but unfortunately these were all lost by the capsizing of my cayuca a mile out at sea when returning from my longest expedition.[1] Right here I cannot refrain from intruding a word of caution to men inexperienced in jungle field work. Put not too much faith in the waterproof qualities of canvas bags or the tin containers provided for waterproofing photographic films. Avoid the dug-out cayucas, particularly those with little freeboard, when traveling with precious material. Put no trust in the native judgment.

The bird life is no less wonderful than the vegetation. The Panama jungle is alive with birds. The variety and coloring are truly remarkable. Even before I had begun to read anything on tropical birds I had noticed the remarkable restriction of the activities of certain birds to certain areas or "zones" of the jungle. In the region where I did most of my work there seemed to be three areas of bird life dependent on the altitude, and three or more dependent upon the jungle construction. In addition to these there is what we may call the second-growth area, the birds in this being seldom seen in the virgin jungle. As regards altitude there are the sea-level or low-country area, the two-thousand-foot area, and the area above three thousand feet.

As regards the jungle at any point we can distinguish four areas, which we may designate as the ground, the low-bush, the medium, and the tree-top. On the ground I observed several varieties of quail, tinamou, and pheasants. In the low-bush area are wrens, humming birds, thrushes, ant birds, and a variety of other species either common to the United States or unknown to me. In the medium zone, halfway to the leafy ceiling of the jungle, dwell doves, guans, owls, motmots, and trogans. High up in the roof are parrots, parrakeets, macaws, toucans, and cotingas.

Many birds seen in large numbers in

Young peccary captured from a herd of about forty in the Cerro Bruja Mountains.—After capture this little animal was kept in a cage for five days, when it managed to escape. We thought it gone for good, but several hours afterward it came back to the kitchen and grunted to be fed. Thereafter it could not be driven away from the kitchen, and was the inseparable companion of one of the cooks. It was living and in good condition six months after capture

[1] When we emerged from the jungle we were away down the Caribbean coast near the San Blas Indian country. With a couple of natives and a large dugout canoe I started to cruise up the coast to Colon. A few hours after we started we encountered rough seas off a point of land and the canoe was swamped, spilling us all out in the ocean, which was infested with sharks. Fortunately no men were lost and we were blown ashore finally on a practically uninhabited coast. But I did lose all my outfit except a little pack which contained my maps, films, and camera. The camera was totally ruined, and although all the exposed films were in so-called waterproof cans, they filled with salt water and all the photographs were spoiled.

the low countries we found absent at high altitudes. I never saw guans below one thousand feet, nor toucans above that altitude. The yellow and black orioles build their hanging nests everywhere in the low country but they were not seen in the mountains. Please understand that what I write should not be taken as establishing anything. The time for observation was too short, and my own observations, while I think they were accurate, were not based on scientific study. What I want to point out, in fact the whole reason why I have undertaken this sketchy description of the Panama jungle, is that I believe the region is very worthy of intensive study by a first-class field naturalist. Particularly that very high part to the south of Nombre de Dios should be investigated, as it may be found to contain new forms, or to mark a northern limit of some forms hitherto believed to be confined to the Andean regions.

The mammal life of the jungle is also very abundant. The ordinary traveler, however, will see little of it owing to several conditions which only a man with extensive hunting or collecting experience will realize. The constantly shifting winds of the jungle carry one's scent far and wide. The rustling of the vegetation and other noises as one walks, alarm the game. Moreover, everywhere in the jungle are sparks of bright light, the result of the filtering of the intense tropical sunlight through small openings in the leafy roof overhead. These sun patches sparkle like diamonds everywhere. I think that the game watches these patches and is particularly alarmed when they are hidden by sudden shadow. At any rate, when I began to avoid these sunny spots, and to take

The jungle is entirely uninhabited except for a few natives who live on the Caribbean coast and never venture into the interior. They subsist on coconuts, bananas, yams, and fish. They gather ivory nuts, raise bananas, and make charcoal for a living, selling their produce to small sailing vessels which visit the villages every three months or so. They are expert canoe men and their cayucas are works of art. The coast cayuca always has a turned up bow and stern and is equipped with a small sail. Invariably these natives of the coast have not the slightest knowledge of any of the country other than the route to the next village extraordinary precautions as to wind and noise, I began to see animals. Among those I observed were tapir, deer, peccary, agouti, paca, sloth, coati-mundi, kinkajou, anteaters, monkeys, otter, puma, jaguar (spotted and black), ocelot, squirrels, opossums of many varieties, and rabbits.

Snakes were fairly numerous, the harlequin snake, boa constrictors, and a very long and thin bright green tree snake being the most numerous. In the two years I observed only two fer-de-lance. It is said the bush master is met with occasionally, but I have never seen one. The snakes are most decidedly not a menace. In the fifteen years of American occupation of the Canal Zone the hospital records include only one case of snake bite. In fact, practically the only dangers attending jungle exploration are those of malaria and getting lost, added to injuries that may come from falling limbs and nuts.

One night in permanent camp a limb fell on my cook shack where the three company cooks were sleeping, breaking the cots of the men, and pinning them down to the ground, but fortunately not injuring any of them severely. I made the remark after the accident that that was probably the safest place in the whole jungle now. Afterward, we abandoned this camp for about a month, and on our return discovered that the same shack had again been completely wrecked by an enormous fallen limb.

There is one tree which bears a green nut about the size and shape of a football, and weighing seven or eight pounds. I have frequently noted nuts of this kind, that in falling to the ground have buried themselves three or four inches below the level of the earth. A blow on the head from one of them might easily kill a man. Monkeys feed on them, gnawing a circular opening about three inches in diameter through one end of the shell, and then removing the contents with their hands. The hollow vessel thus formed makes a most interesting and convenient water jug or vase.

I cannot say that the dangers of the jungle ever caused me any loss of sleep. I do not believe they are any greater than the dangers of our own Canadian woods, certainly not as great as the dangers of our Rockies, and far less than the dangers of a modern city street.

I was always interested in the impression that the jungle seemed to make on my men. For my long trips I always selected men having the characteristics of the pioneer—ability to travel without getting lost, physique capable of hard work including heavy packing, love for hunting, and a knowledge of camping and woodcraft. Splendid men they were, every one of them. They enjoyed the work, just as any red-blooded young man would enjoy a camping trip in the woods. But there always came, after a time, a difference in the way they regarded the jungle, and this difference in attitude always came at the same corresponding time, three or four days in from civilization. It would be just at dusk, camp made, the little mosquito-proof tents up, supper cooking, and the hush of evening started. Then far off would begin, "Wough, wough, wough, O wough-h-h, wough, wough," booming from hill to hill, resounding through the whole jungle, terrifying, paralyzing at first until one knows what it is. It is seemingly the howl of some large wild beast, but in reality it is the call of the howler monkey. It is typical of the jungle, speaking at once of jungle peace and jungle war. From the time that my men would first hear this call, they would regard the jungle differently. They were now of the jungle, they had felt its spell, they were coming back; the call of the jungle was in their blood never to leave. And so some day, God willing, I too shall go back, just as I do now in memory.

NATIVE HUTS OF PANAMA ON THE AGUA CLARA

The photograph clearly shows the banana plantation of the natives, with the second growth trying to choke it out, and beyond, the wall of the virgin jungle. There is always this clear demarcation between the second growth and the virgin forest, as clearly defined as the difference between a cornfield and heavy woods on a farm "down East." Sometimes for many days we were confined to wading the rivers, there being no other way of getting through the country

A VIEW ABOVE THE JUNGLE OF PANAMA

It is seldom that one gets an extended view such as this in the virgin jungle. Even from the tops of high mountains one cannot see more than twenty-five yards or so until a vista has been cut, and this often requires many hours' labor by good axmen. On the near hilltop to the left may be seen the top of one of the wonderful cavanillesia trees (see page 313) which are quite common on the Pacific side of the Isthmus, but seldom seen on the Atlantic side

IGUANAS BASKING IN TROPICAL SUNSHINE

These lizards (*Iguana tuberculata*) frequent the banks of all the lakes and pools, and can be seen sunning themselves on the limbs of trees overhanging the water. If disturbed they usually jump into the water, no matter what the height of the limb. When an iguana six feet long jumps one hundred feet into a still pool, the splash can be heard for a mile. Occasionally an iguana will endeavor to hide by circling the limb like a squirrel. This lizard is extremely good eating, the flesh tasting like tender chicken. It reaches a maximum length of six feet, two thirds of which is tail

NEAR THE SOURCE OF THE RIO PIEDRAS, IN UNKNOWN PANAMA

This is one of the largest rivers of the Republic but it was unknown and unmapped before discovered by the Author. Eleven days were spent wading this river from source to mouth without seeing a single habitation, or a sign of human being until within a mile of the sea. As a rule the jungle on the bank was so thick that the party was compelled to wade all day long. Fish, in appearance like shad, and with a maximum weight of about two pounds, were very plentiful in the stream. Many howler monkeys were seen and heard along the upper reaches of the river, but no crocodiles or iguanas were seen anywhere on this stream. At the point where the photograph was taken the stream bed is at least one hundred yards wide. From this fact some idea of the height of the jungle on either bank may be gained

The Senses of Fishes

By C. JUDSON HERRICK
Professor of Neurology, University of Chicago

OUR human world is a very limited part of nature. The unaided senses of primitive man open a few doors of communication between the individual and his surroundings, through which the sum total of his knowledge of things as they are must be derived. Science has greatly enlarged the efficiency of the natural sense organs—the microscope and the telescope have extended the range of vision, the periscope enables us to see around a corner, the spectroscope, photographic plate, X-ray machine, and innumerable other aids have enabled us to see deeper into nature. But no new senses have been developed and our furthest scientific advances and most recondite philosophical theories must be based in last analysis on such fragmentary knowledge of the cosmos as is revealed to us by our senses. Great realms of nature remain wholly unexplored, although new artificial aids permit constant advances into the hitherto unknown—Hertzian waves and wireless telegraphy, ions and the new chemistry, electrons and the new physics.

Fortunately the traditional five senses do not represent our whole physiological equipment for this task. In fact, the human animal is endowed with about twenty distinct senses, including two in the ear, at least four in the skin, and numerous others in the deep tissues such as muscle sense, hunger, thirst, and other visceral senses.

It is well known that fishes and other lower vertebrates possess numerous types of sense organs quite unlike anything in our own bodies, and it is quite impossible for us to form any conception of what the world appears like to these animals except in so far as their sensory equipment is similar to our own. Even the companionable dog, who responds so sympathetically and intelligently to our moods, lives in a very different world. Recent experiments have shown that his sense of vision is very imperfect, especially for details of form, and everybody knows the inconceivable delicacy of the hound's sense of smell. With us vision is the dominant sense and our mental imagery is largely in terms of things seen. Even a blind man will say, "I see how it is," when he comprehends a demonstration.

What sort of a world is it to a dog, whose finest experiences and chief interests are in terms of odors? And how does it feel to be a catfish, provided not only with large olfactory organs whose central nervous centers make up almost all of the cerebral hemispheres of the brain but also with innumerable taste buds all over the mucous lining of the mouth and gills and freely distributed over the entire outer skin from the barblets ("feelers") around the mouth to the tail fin? We cannot conceive the epicurean delights which such an animal may feel when he swims into the water surrounding a juicy piece of fresh meat, by whose odorous and savory juices he is bathed. One wonders, parenthetically, how far the fish himself is able to conceive or even enjoy the pleasures of life. With how much mind of any sort the fish is endowed is at present an unsolved riddle; but it is certain that his behavior complex is of very different pattern from ours and whatever mind he may have would surely be as different as the pattern of his sense experience is different.

Let us pursue this line of inquiry further and review what is known of the other senses of our catfish. This fish has small and poorly developed eyes and is largely nocturnal in habit, lying concealed in dark corners during the day. The retina has remarkable powers of adaptation to differences in illumination and the fish is very sensitive to changes in intensity of light. But the eye is not the only light-sensitive organ. Experiments with blinded fish show that the entire skin surface is sensitive to differences of light intensity, a not uncommon feature of aquatic animals. The image-forming power of the eye is probably not very good. Some catfishes, it is true, will take a spoon hook, and probably a bait must always be in motion if it is to be sensed by the eye. The usual method of feeding is to trail the bottom with the barblets, which are very efficient organs of both touch and taste, and when contact is made with a worm or other suitable food to turn sharply and snap it up.

Just as the eyes are supplemented in their functions by the skin, which has a very feeble sensitiveness to light, so the highly refined chemical sense organs in the nose and taste buds are also supplemented by a chemical sense in the general skin. In some other fishes which have been carefully tested the general skin surface is found to be very sensitive to chemicals in solution, to some substances more sensitive, in fact, than are the taste buds themselves.

In fishes, as in men, the ear contains two quite different sense organs—the organ of hearing and the organ of the sense of equilibrium. The latter lies in the semicircular canals, which in form and function are similar to those in the human body. Indeed, the semicircular canals probably play a larger part in the behavior of the fish, since maintaining perfect equilibrium is a more difficult matter for a fish suspended in water of about the same specific gravity as the body than for a man walking on solid ground. But when the man essays to fly, his semicircular canals again take a dominant place in his sensory equipment. In the practical testing of the fitness of men who are candidates for the Air Service of the Army the most important point to be determined is whether the semicircular canals are functioning normally.

Whether fishes hear at all has been hotly controverted. That they are very sensitive to mechanical jars and vibrations all agree, but it has been difficult to prove whether their responses to these vibrations are brought about through their ears or by refined cutaneous sensibility. The ingenious experiments of Parker[1] have shown that both of these organs serve and that, in fact, fishes do hear true sound waves of rather low pitch with their ears. To tones of high pitch they are deaf and probably they have no power of tone analysis, that is, they can hear a noise but cannot tell one tone from another.

The fishes can boast no superiority over ourselves in being able to respond to low tones by both the ear and the skin. We can do the same, as can readily be shown by lightly touching the sounding board of a piano or organ when a low tone is struck. The same tone heard by the ear can be readily felt by the finger tips. But for perceiving still slower vibratory movements we, with all our boasted brain power, must admit ourselves inferior to the fishes. They possess an elaborate system of cutaneous and subcutaneous sense organs of which we have not a vestige. These so-called lateral line organs in the catfish comprise a complex system of fine tubes under the skin, the lateral line canals, and two kinds of sense organs in the skin, the pit organs. The canals ramify in various directions in the head and the main lateral canal extends along the side of the body back to the tail. They were formerly supposed to be for the secretion of mucus and are still often called the mucous canals. But they are now known to contain numerous small sense organs which respond to slow vibratory movements of the water. The pit organs are scattered over the skin, the smaller ones each in a flask-shaped pit with a narrow mouth and the less numerous larger ones exposed on the surface.

[1] See recent work on this subject by Prof. G. H. Parker, of Harvard University.

The lateral line sense organs are all supplied by a single system of nerves related to the nerves of the ear and quite distinct from those for the general tactile and chemical senses of the skin and the cutaneous taste buds. That the lateral line organs respond to slow vibratory movements has been clearly shown by Parker, but the distinctive features of the pit organs are unknown and, in fact, our knowledge of the functions of the system as a whole is still very incomplete.

It is clear that cutaneous organs of touch, lateral line organs, and the organs of equilibrium and hearing in the internal ear form a graded series, and all have probably been derived in evolution from a primitive type of tactile organ. When therefore we both hear and feel a musical tone of the piano we are reminded of the long and dramatic evolutionary history of the very intricate human auditory organ, whose first and last stages both may function at the same time in our own bodies.

We cannot here recount the details of the long series of very tedious scientific investigations required to replace the conjectures of amateur naturalists and fisher folk by accurate knowledge of the sensory life of fishes. And even with this precise information we are far from a true understanding of the fishes' minds. To learn the structure and behavior of any animal requires only sufficient scientific skill and industry, but to understand the mind of an animal is the most baffling of all scientific questions.

Our own thoughts are purely personal matters. Even with the aid of language, facial expression, and gesture, we are able to communicate our ideas and feelings to our intimate friends only imperfectly, and this difficulty is multiplied many fold when we try to understand even the most intelligent of the brutes. The only recourse is to see how an animal behaves in a given situation and then in the light of what we know of human and animal bodily structure and function try to imagine how we would think in such a situation, taking into account the animal's limitations of nervous organization. Obviously this is a poor and uncertain method at best, and no wonder many psychologists have given up the problem in despair and decided that the only scientific procedure is to pay no attention to animals' minds and limit our inquiry to their objective behavior. Indeed, so impressed are some of them by the futility of scientific study of even the human mind by introspection that they advocate throwing overboard the whole science of psychology. But this is too much like sinking the ship, cargo and all, to get rid of the rats.

No, if we wish to attain the heights of a true understanding of the significance of mind in evolution, we must keep to the steep trail and not yield to the temptation to take smoother paths leading to the rest shelters by the way. But we must watch our steps. By this I mean that, although we can interpret the animal mind only in terms of our own experience, yet we must not uncritically read our thoughts and feelings back into animals' minds. The only safe rule is to assume that an animal acts reflexly or unconsciously except when it can be shown that the unconscious mechanisms are inadequate to account for the behavior and intelligence alone is adequate. And these are very difficult things to prove in regard to animals so far removed from us in behavior type as are the fishes.

The popular dramatization of animal life and imputation to them of human thoughts and feelings may have a certain justification for literary or pedagogic purposes, the same as other fairy stories. But let it not be forgotten that this is fiction for children, not science nor the foundation for science: and there is a long, long road to travel before we shall be able to understand in any but the most shadowy outlines what a fish's mind is really like.

Recollections of English Naturalists

Few things in life bind together all sorts and conditions of people, irrespective of age, money, or any class affiliation; but natural history is a bond of such charm that it brings all to a common fellowship

By T. D. A. COCKERELL

Professor of Zoölogy, University of Colorado

ENGLAND is a land of amateur naturalists. The organization of British science for public ends, now going forward with extraordinary vigor as a result of the war, has in the past been sadly inadequate to meet the needs of the country. It is true that such institutions as Kew Gardens and the British Museum have rendered incalculable services to the British dominions and the world in general; but even these have not always received adequate support, and the government has never in the past shown any real disposition to foster research.

Yet there can be no doubt that the English, as a people, possess in a high degree those aptitudes which lead to success in science; and when conditions become more favorable who can say what may not be accomplished? The main obstacle, undoubtedly, has been the inadequacy of British education. Not only were the people in general brought up without scientific instruction; but the leaders, who mostly had every advantage which wealth and position could confer, did not, as the phrase is, suspect anything about science. Most of them able and sincere men, they will seem to posterity like valiant soldiers going to battle, having forgotten their weapons.

In spite of all this, brilliant scientific work was done, and the century of Darwin and Huxley, Bentham and the Hookers, Wallace and Bates, and a host of others, will always shine brightly in the annals of biology. One has only to consult a monograph on any branch of zoölogy or botany to see how great and varied have been the British contributions. Not only this, but the country has been and is full of lesser men, spending their leisure moments in the study of plants, insects, birds, or fossils; forming societies and organizing excursions; everywhere worshiping at the shrine of nature, and gathering data for the advancement of knowledge.

As I look back upon the activities of thirty years ago, I marvel at the pure zeal exhibited, the love of nature which could not be suppressed,—and then at the lack of organization for the application of all this energy to public ends. There was, no doubt, even a certain advantage in the disinterested and socially detached position of most scientific men. They were not in science "for revenue only," as is too commonly the case in America. They were not obliged to tilt at windmills, or break their heads against the walls of stupidity and ignorance. No, they were free to pursue their studies as they would, tracing the pattern of life without bias and without hindrance. Darwin, the greatest of their kind, regretted that he had not been able to do more direct service to humanity; but who today, for humanity's sake, can wish him to have done otherwise than as he did? May not the same be said, at least in some measure, of the great host of nonprofessional naturalists who followed in Darwin's footsteps?

Yet, after all, we must have organization; and England came very near to fearful and irremediable disaster because she could not quickly use even the science she had. Although in the last century the English schools were so deficient in scientific courses, the youthful naturalist had access to some excellent sources of information. There were elementary "natural histories," suited even for children, with good colored illustrations. For those a little older, shilling books furnished guides to the butterflies, beetles, common objects of the countryside, common objects of the seashore. The book on butterflies contained a complete account and good figures of every species found in the islands. Then there were the museums. Not only the great British Museum, but many of the towns, such as Dover and Bristol, had museums, with good collections of the local fossils, insects, and other objects. Thus the boy was largely independent of formal instruction, and could puzzle out things for himself.

At the next stage, approaching manhood, the amateur scientific journals assumed great importance. The best of these, now unfortunately extinct, was *Science Gossip*. In its prime this magazine had great influence, of a kind which I think no periodical has today. It was really an organ of the amateur naturalist, in which he recorded his discoveries and advertised his duplicates for exchange. It was the means of bringing together innumerable devotees of the same subjects, who might be in different parts of the country or belong to quite different social groups. Free from commercialism and free from preaching, it really represented the democracy of naturalists, the rank and file. Another much less ambitious paper, *The Naturalist's World*, was published in Yorkshire. It was the organ of a society which carried on its affairs through the mails. It had something of the flavor of Gilbert White, and illustrated very well the saying of William Morris, that the secret of happiness is in the appreciation of the small affairs of life. To the modern rather supercilious doctor of philosophy, these productions would doubtless seem almost contemptible; but I can say, with many many others, that they gave us extraordinary pleasure at the time, and stimulated an interest which will never cease.

In a country like England, where the sorts and conditions of men are so diverse, few things bring all together on a common level. Natural history did this, and herein was one of its greatest charms. My brother and I, ardent conchologists, corresponded and exchanged with people in many parts of England, Scotland, and Ireland. Sometimes our correspondents would come to London, and we would invite them to tea at our house at Bedford Park. On such occasions the whole family would be agog with curiosity to see the stranger. He might be a country minister, an officer in the army, an aristocrat, a man in a small way of business, —almost anything, in fact. In any event, he was a personality, and the bond of interest always made the meeting pleasurable.

The love of snails could bridge all differences of years or social status. It would be hard to exaggerate the uniform kindness shown by older men to us youngsters: the long letters they wrote, the trouble they took in identifying specimens, their generosity with their duplicates. The one we held most in respect was J. Gwyn Jeffreys, the author of *British Conchology*, our standard work of reference. He lived in London, but we never saw him: a post card came from him on the very day he died, the last of a long series of letters and cards: sometimes, when there was much to discuss, coming almost daily. He was greatly disappointed that the British Museum would not purchase his collection. It was eventually sold to the United States National Museum, and Dr. Jeffreys wrote me a long letter about it, contrasting the attitude of the two countries. I fear his extremely flattering opinion of the conchological activity in America was hardly justified by the facts.

It was in an effort to see J. Gwyn Jeffreys that on May 20, 1884, I went to a meeting of the Zoological Society of London. It is a custom of the scientific societies in London to allow visitors to attend the meetings, if a fellow will sign his name after theirs in the attendance book. I think it was J. Bland-Sutton, now an eminent surgeon, then known for his studies in comparative anatomy, who signed for me on that occasion, as he certainly did many times thereafter. Jeffreys was to read a paper on the Mollusca of the "Lightning" and "Porcupine" expeditions, but to my great disappointment he was not able to be present. The president, Professor W. H. Flower, was in the chair, and Dr. P. L. Sclater, the secretary, read the minutes. F. E. Beddard read a paper on the Isopoda of the "Challenger" expedition; Francis Day, well known for his work on the fishes of India, spoke on hybrid Salmonidæ; F. Jeffrey Bell, of the British Museum, gave an account of the Cuvierian organs of the "cotton-spinner," a holothurian. Then Dr. Bowdler Sharpe exhibited a new nuthatch from Corsica, and I think it was Henry Seebohm who showed skulls of Asiatic wild sheep. Altogether a wonderful occasion for a young man of eighteen, just old enough to realize that he was listening to the voices of the gods! After that, thanks to the unfailing kindness of the society, although I was much too poor to think of becoming a fellow, I was allowed to attend the meetings and use the library as much as I pleased.

The library helped me a great deal, as it was close to my residence, and as it was compact and entirely zoölogical, it was very easy to make cross references and find whatever I wanted. Mr. F. H. Waterhouse, the librarian, was one of the kindest of men. He so closely resembled his brother, the distinguished entomologist at the British Museum, that for a time I did not realize that they were not the same person. At the meetings, Flower nearly always presided, though I recall an occasion when St. George Mivart was in the chair. Sir William Flower was head of the natural history department of the British Museum (really a separate museum), and whether seen in that capacity, or as president of the Zoological Society, he was remarkable for a gentle courtesy which seemed to make everything go smoothly. Temperamentally, he was an entirely different man from Sir E. Ray Lankester, who succeeded him at the Museum.

About the time I first attended the Zoological Society, I began to go regularly to the British Museum. When I was a very small boy, my father took me to the Museum, and two things he said, as I marveled at the objects displayed, have always remained in my mind. He said, "My son, this is *your* Museum," and then explained how it belonged to everybody in the country, and all should support it and take pride in it. Then he said, "Perhaps some day, when you grow up, you will find something worthy to be placed in this Museum." I thought that if that ever happened, I should be the happiest person alive. To this day, the place appeals to me with an indescribable romance, and my wife says that when I die, if I get my wish, I shall go to the British Museum instead of to heaven.

At the natural history branch of the British Museum, at South Kensington, the entomological collections are mainly kept in the basement. It is also in the basement that researches on Mollusca are carried on, the specimens required being brought in a large wooden tray by an attendant. The student goes down a flight of steps, and rings an electric bell, whereupon the door opens. He signs his name in a book, and is then allowed to go to the room where he expects to work. If he goes regularly, he has to have a student's card. These precautions are obviously necessary; but once they have been taken, everything is done to facilitate one's work.

I undertook at one time to investigate the slugs (naked land Mollusca) in the Museum, and it seemed a marvelous thing to have before me the historic specimens of famous authors, even including some collected in the eighteenth century by Sir Hans Sloane, the founder of the Museum. When a paper was written, it was necessary to submit it to Dr. Albert Günther, the keeper of zoölogy in the Museum. Günther had none of Flower's urbanity, and we were all rather afraid of him. It was currently believed that the best time to see him was just after lunch. I confess I thought him rather unsympathetic, to say the least; but I now recognize that he had a lot of good sense, and I have only kindly thoughts of him. The last time I saw him was shortly before his death, in the department of fishes. I had grown much older and altered in appearance, and as he did not recognize me, I did not speak. I have regretted that I did not find some way to express my feelings toward him; but doubtless he did not consider that his contact with me had been anything more than that of museum routine, and would have been surprised that I had given it much thought.

Occasionally I went to the meetings of the Entomological and Linnean societies. At the Entomological, the one great event I recall was seeing the venerable J. O. Westwood take the chair, and make a communication on a new plant louse found on the breadfruit tree in Ceylon. Westwood was by all odds the greatest of entomologists, and W. F. Kirby well said of him, in my hearing, "He never gets tired." Physically, of course he did; but his zeal, like that of the botanist Sir Joseph Hooker, never faded until death came in extreme old age. Henry T. Stainton, well known for his book on British Lepidoptera, I also saw at the Entomological. When Stainton died, Westwood read the obituary in the *Entomologist's Monthly Magazine*, and remarked, "The next number will record the death of another old entomologist." So it was, for Westwood had come to the end of his days.

At the Linnean I have the liveliest recollection of hearing Patrick Geddes on anabolism and katabolism, and all the theory he wove out of and around these conceptions. The presentation was brilliant and interesting, and preoccupied the mind for a long time, as does a well-acted play.

A society which I regularly attended was the South London Entomological and Natural History Society, meeting in rooms near the south end of London Bridge. It included collectors and amateurs and, in particular, students of the British fauna. There was always a good series of exhibits, especially of remarkable varieties or rare species. Here one would meet J. Jenner Weir, of Beckenham, well known as a friend of Darwin and close student of the Lepidoptera in their more philosophical aspects. Here also came J. W. Tutt, a schoolmaster by profession, with unbounded enthusiasm and decidedly radical views about entomology. It was Tutt who produced an elaborate study of the variations of the British Noctuidæ, naming all the forms, and who later undertook a vast work on British Lepidoptera in general, which he did not live to finish. He also published a charming series of books on his natural history rambles, and a guide to the British butterflies, and founded that lively journal *The Entomologist's Record and Journal of Variation*. A nervous and sometimes quarrelsome man, he made many enemies; but in the course of time he gained general respect, and the affection of many. He had just been elected to the presidency of the Entomological Society when he died.

Going back to a much earlier date, I count among the most potent sources of my interest in natural history the work of John W. Taylor and W. Denison Roebuck, of Leeds. A notice appeared stating that a *Monograph of the Land and Freshwater Mollusca of the British Isles* was to be published in parts. It was to be fully illustrated, and as exhaustive as possible. It would include not only all British species, but all foreign varieties of British species, with full details about distribution, habits, etc., etc. The author, Mr. Taylor, was to be assisted by Mr. Roebuck, who had specialized in the slugs. My brother and I quickly responded to the appeal to send specimens, as material was desired from every locality, and nothing came amiss. Our joy was great when we found that we had discovered an entirely new variety (*Helix hortensis* variety *lilacina* Taylor) and another new to Britain. Almost every trip produced something interesting in the way of slugs, for England has a splendid slug fauna. Many preliminary papers appeared, but it was a long time before the first part of the monograph was ready. It is still incomplete and, owing to the war, publication had to be suspended; but we may hope that it will be continued, and that Mr. Taylor will be able to bring it to completion. I never saw either Taylor or Roebuck, but there are few persons to whom I feel more indebted.

In recording the above details I have been interested to describe some of the influences which, in my experience, tended to develop and mature an incipient interest in natural science. Taken altogether, these influences constituted a potent environment, without which even a strong inborn tendency might have come to nothing. In a measure, they represent the peculiar genius of the English nation, which cannot be exactly duplicated elsewhere; but in our own way and through the means we have, we should in America strive continually to create conditions more favorable for the stimulation of scientific interests. We have indeed some great museums, learned and influential societies, and excellent publications; but the country is vast, and we are only beginning to develop its intellectual possibilities.

More particularly, I think we should in America regard the amateur, and give him a chance to coöperate in large undertakings. In this period of reconstruction, science must be our guiding star; but in the struggle for wealth and power, science is in peril. Under existing conditions science tends to become commercialized, and economic necessity forces young men into positions where financial gains dominate all other considerations. The State must bid against all this, not by offering larger salaries, but by elevating and dignifying public service and the scientific life.

But even so, it can perhaps count among the faithful only those who have early learned to love research, and to whom science is not merely a means, but an end,—the advancement and elevation of human thought. Thus, whether in leisure moments snatched from a busy life, or in the service of the public, naturalists may remain amateurs in the old-time sense of the word, lovers of a mistress whom they could not betray.

Such a spirit may resist even the temptations of business life, and we may see commerce suffused with new motives, as the distinction between public and private purposes becomes obliterated. So much depends upon the mode of approach; and Great Britain, the land of amateurs, will, I think, in this hour of need find in her service a group of men and women whose sincerity and devotion are beyond reproach.

EDWARD W. NELSON

Chief, United States Biological Survey

As a noted American naturalist, for forty years the friend and student of wild bird and mammal life, Mr. Nelson has accompanied or led many expeditions to the western deserts, to Mexico and Central America, and to the Arctic. He served in several capacities on the staff of the United States Biological Survey and in 1916 was appointed chief. Mr. Nelson's contributions to the technical literature on the North American birds and mammals is very extensive; recently he has enlarged his audience by the publication of a popular book, *Wild Animals of North America*. The value to the layman of this account of our native mammals is increased by an unusually profuse illustration, natural color portraits from paintings by Louis Agassiz Fuertes, track sketches by Ernest Thompson Seton, and many photographs. The book was given preliminary publication in the *National Geographic Magazine* of November, 1916, and May, 1918

Nelson's "Wild Animals of North America": A Review

By JOEL ASAPH ALLEN

Curator of Birds and Mammals, American Museum; Editor of the American Museum's scientific zoölogical publications (1889 to 1918); Honorary Member of the New York Zoölogical Society; Foreign Member of the Zoological Society of London

ONE of the most valuable of the many important contributions of the National Geographic Society to popular education is Edward W. Nelson's account of the mammals of North America,[1] with colored illustrations by Louis Agassiz Fuertes, track illustrations by Ernest Thompson Seton, and half-tone reproductions of photographs of especial interest and pertinence, published, as stated by the editor of the magazine, at a cost of $100,000. The account was originally issued in two parts, "The Larger North American Mammals," in November, 1916, and the "Smaller Mammals of North America," in May, 1918. The two parts are now issued together in book form, greatly facilitating their use as a convenient work of reference, useful alike to the naturalist and the general reader.

Excellent books on North American birds, many of them well illustrated, have long been available, and also a number of magazines exclusively devoted to these easily observed dwellers in our midst, graceful and attractive in form as well as vivacious and songful, their nest building and manner of life open to all observers. It is easy for anyone with the slightest interest in these wonderful creations to know intimately their life habits and to have a fair knowledge of perhaps a hundred species that frequent their home surroundings of field and woodland. On the other hand, it is safe to say that the wild mammals equally well known to them can be counted on the fingers of a single hand, and of only two or three of which will they have more than slight knowledge of their manner of life.

[1] *Wild Animals of North America*: Intimate Studies of Big and Little Creatures of the Mammal Kingdom. By Edward W. Nelson. Published by the National Geographic Society, Washington, D. C., 1918.

Mammals have, as a rule, no vocal powers to attract attention; they are, for the most part, secretive and nocturnal in habits. Of the hundreds of field mice and shrews and moles that inhabit the fields and meadows through which we daily walk only a rare accident may bring even one of them to our ken. Only the hunter and the trapper know the haunts of the fur bearers and the game animals. Only the professional field collector, with his resources of skill and of especially devised traps, has the opportunity and the required knowledge to unveil the mysteries of our smaller mammal life. There is no "color key" or other popular device to aid the amateur in finding out the names and relationships of the forms he may chance to obtain. The recognition of their distinctive features requires more or less technical training on the part of the observer before he can determine the specimen he may chance to have acquired.

The requisites of an author who could successfully prepare a volume like the present one are numerous and varied. Fortunately, Mr. Nelson, chief of the United States Biological Survey, is the possessor of them all in a high degree. Inspired with a love of the wild and, above all, with the spirit of research and discovery, his natural history explorations have taken him throughout the continent from the Arctic tundras of Alaska to the jungles of tropical Mexico, and have made him familiar alike with the life of the desert and the forest. While an ardent ornithologist, he is equally an ardent mammalogist and a broadly trained naturalist able to impart his experiences and observations with sympathy and directness. He has lived with the animals of which he writes and has studied them in their homes; on the technical side he is a monographer of many of the groups of which he so tersely and clearly sets forth the life histories.

The forms (species and local races) of mammals now recorded from continental North America number nearly 2500, yet they are reducible, so far as their distinctive traits are concerned, to a few hundred types. As North America, in the sense of the present work, is mainly the continent north of the tropics, Nelson's biographies of about 120 groups comprise all of the types of this large area which are of primary interest, from the large game and fur-bearing animals to the bats, shrews, mice, and squirrels. Thus, the hares and rabbits, numbering approximately one hundred local forms that are considered worth distinguishing under the "higher criticism" of modern days, are treated as constituting six groups, each illustrated in color, and the distinctive external characteristics and habits of the constituents of each are clearly and satisfactorily presented. Never before has the general reader had placed before him in a connected and well balanced summary so much essential information about North American hares and rabbits. And the same is true of all the other biographies.

Mr. Nelson, in his introductory pages, contrasts the early days of the settlement of North America with present conditions in respect to the larger mammalian life of the continent—the abundance in the seventeenth and eighteenth century times and the pitiful remnants that now remain—and makes a strong appeal for the conservation of wild life. In the introduction to the second part, the "Smaller Mammals of North America," a dozen pages are given to the generalities of the subject, which are condensed under such suggestive subheadings as "Animals that learned to 'dig in,'" "A departure for every need," "Strange adaptations to meet conditions of environment and competition," "Geography and color," "Gnawers most numerous of mammals," "Good housekeeping in rodent land," "The ebb and flow of antagonistic species," "Countless beasts that roam the night," "Animals that put themselves in cold storage," "Defensive and offensive animal alliances," etc. Under these captions are presented a wide range of general statements and philosophic deductions, as the evident close relationship of certain northern forms to Old World types, and the presence on our southern border of a similar affiliation with tropical American types, while others still are distinctly of North American origin with no close relationship to groups found elsewhere.

The special adaptations of species to their particular environments, and to very diverse conditions of life, as arboreal, subterranean, aquatic and aërial, and the modifying effect of climatic conditions, resulting in the development of geographic races in species which have a wide range, are also among the topics presented. The ability of desert inhabiting species to live without drinking, "through chemical action of their digestive tracts, whereby some of the starchy parts of their food are changed into water," is also noted; also the storing of food for winter use by some species, while others pass the winter in a torpid condition and thus do not require food. Molting, or the seasonal change of the coat, is also the subject of comment, and likewise the concurrent change of color from brown to white in autumn and the reverse in spring in many northern animals as a protective provision against enemies. In this connection a misapprehension of former days in respect to how the change in color is brought about is, let us hope, finally given its quietus by this statement of the now known facts of the case: "It was formerly considered that the change of mammals from the brown of summer to the white winter coat in the fall, and from the white to the brown in spring, was due to a change in the color of the hairs, but it is now known that it is entirely due to molt. The time of these changes depends on the season, and this varies several weeks, according to whether the fall or spring is late."

Mr. Seton's illustrations and descriptions of the footprints of a large number of different kinds of mammals, when walking and when running, add a novel and interesting feature from a field that he has made practically his own. The subjects range from bears, coyotes, and other carnivores to deer, moose, and caribou among the larger mammals, and from jack rabbits and squirrels to field mice and shrews. They will vividly recall to many readers the imprints seen by them in newly fallen snow during many a winter walk in the country. In these sketches, entitled "Footprints of Nature's Wild Folk," Mr. Seton tells us he "usually gives the track of a normal adult animal in about one inch of snow, that being ideal for tracking. Some of the smaller kinds are shown in fine dust. The trail goes up or across the page at the ordinary gait of the animal. . . . While there are endless variants in each kind, I aim to give the reader at least one typical set of each." There are nearly sixty of these sketches, which represent the leading types of mammals over a wide range of country.

Mr. Fuertes' colored illustrations are of course of the highest excellence, and give the reader a vivid conception of the varied forms of mammal life in North America. Our foremost bird draftsman may now be awarded equal honor in another field.

The American bison once roamed the central plains and forests of North America as sole monarch, supplying the basis for some of our most picturesque Indian cultures. Even as late as 1870 it was estimated that five and a half million head still survived west of the Mississippi, but today there are not more than 4000 and these are gathered in Canadian and American preserves. Under primitive conditions the buffalo herds migrated northward and southward with the seasons, always following the same trails which were consequently worn into permanent landmarks. Indeed some of our highways and railways folow in the footsteps of these wild travelers

Courtesy of the MacMillan Company

Watching for the first sign of a forest fire.—To protect the vast resources of our National Forests an extensive patrol is maintained. Mr. Boerker tells of the vigilant work of this army of rangers who during 1916 extinguished 5655 forest fires, saving hundreds of thousands of dollars' worth of timber and perhaps many lives. Lookout men are posted in small cabins on prominent mountain peaks or on high hills where they can observe wide areas and watch for fires day and night during the danger season. Telephone lines connect the posts with central stations so that information can travel quickly and the fire fighters be rapidly mobilized

"Our National Forests"[1]: A Review

By BARRINGTON MOORE

Research Associate in Forestry, American Museum; formerly in the United States Forest Service; Major of Engineers, American Expeditionary Force

"Our National Forests" is a book by Mr. R. H. D. Boerker, Arboriculturist, Department of Parks, New York City, a man who was with the United States Forest Service from 1910 to 1917. The book should be considered from two distinct points of view: (1) that of the professional forester familiar with the National Forests and their administration by the United States Forest Service; and (2) that of the general public. The first point of view requires an accurate statement of facts, the second requires that the facts be interestingly presented. It is difficult for any one reviewer to take both points of view at once. If he is a professional forester he will judge the book on the accuracy of its facts, and he cannot avoid having interests which may not have a lively appeal to the general reader. If, on the other hand, he is not a forester, he will know whether or not the book is interesting, but not if it is accurate. The reviewer in this case, having been in the United States Forest Service for five years—on the National Forests, in the District Office and lastly in the central office at Washington—must confess to belonging in the first category, and will judge the book by its accuracy—although it seems to him to be also very interesting in the manner of presentation of its facts.—B. Moore.

THIS new book on our National Forests does not attempt a general description of the National Forests in themselves. Such descriptions we already have from the pens of John Muir, Theodore Roosevelt, and other lovers of our great West. Mr. Boerker gives us rather the human side of these forests as revealed in the work which the United States Forest Service is doing to administer them. He has given us the first

[1] Boerker, R. H. D., *Our National Forests*—A short popular account of the work of the United States Forest Service on the National Forests, pp. i–l; 238; 80 illustrations. The Macmillan Company, N. Y. 1918.

complete and faithful account we have of the activities of the Forest Service and of the relation of the National Forests to the welfare of the people. He sketches briefly the history of the establishment of the National Forests and the development of the Forest Service. He covers in detail the administration of the National Forests and the scientific work of the Service. His account of how forest fires are detected and fought is most interesting. We are told how the timber is sold and cut in such a way as to preserve the future of the forest; the value of the National Forests to the livestock industry, and how the forage is made available to this industry; lastly we are told of the other uses of the National Forests, such as water power and summer camp sites. This is but an outline of the main subjects treated; it would be impossible to summarize in small space all the interesting information contained in the book.

Mr. Boerker, I would say, is not quite fair to the lumbermen (Introduction, page xlii) when he says, "Lumbering has been and is today forest destruction." In the Northeast, particularly in Maine, lumbermen are awake to the evils of forest destruction and anxious to practice forestry. In fact they are practicing forestry, somewhat crudely perhaps, but as well as the present economic conditions permit. Such a statement as this tends to perpetuate unnecessarily the old animosity between lumbermen and foresters, which has died down as each has come to realize his dependence on the other.

In advocating Government control of cutting on private lands (page l), Mr. Boerker goes somewhat farther than even many ardent advocates of forest conservation. In France, where forestry is well established, the owner can cut without consent of the Government and as he pleases, provided he does not reduce the area under forest.

In the historical part of the book (page 14), the author gives credit to President Harrison for creating the first Forest Reserve. This may be correct, but we have always understood that President Cleveland initiated the policy of setting aside public land for Forest Reserves, and that President Roosevelt developed this wise policy to its present point.

The author gives the Forest Service great credit for its remarkable work and high efficiency, but does not sufficiently emphasize two of its most important accomplishments. When the Forest Service took over the National Forests under Roosevelt's administration, much of the grazing land on them was in bad condition through previous overgrazing and abuse. To restore this land by closing against grazing inflicted a great hardship on the stockmen. Accordingly the Forest Service undertook a thoroughgoing scientific study of the problem, and discovered a way by which the range can be fully restored without closing against grazing and without the expense of artificial reseeding. The practice of sheep grazing was revolutionized, much to the benefit of the industry, and the carrying capacity of the National Forests was greatly increased.

The Forest Service has greatly benefited the lumber industry also. A lumberman operating on private lands must buy up enough standing timber to supply his mill for a number of years ahead; often he buys enough for twenty years. Obviously this means an enormous initial investment on which he has to pay interest, taxes, and the cost of fire protection. In operating National Forest timber no such outlay is required. The lumberman simply pays as he cuts, and saves the expense of interest, taxes, and fire protection.

The Forest Service is, as the author states, under Civil Service. It has always jealously guarded against political influence of any kind. We have here an example of the high accomplishment of which our Government is capable when politics are kept out.

Our National Forests should be widely read. It not only contains a rich fund of valuable information presented in a clear and interesting manner, but also represents the first opportunity the people of the United States have had of readily learning what the Government is doing with one of its greatest natural resources.

FOR A FAMILY OF FIVE FOR ONE WEEK

The one hundred and twelve pounds of foods shown will supply a family of five with an adequate and well-balanced diet for a week. It is not feasible to remember the merits and deficiencies of each separate food, but foods naturally fall into about ten groups and the characteristics of these can be easily carried in mind. The three groups, milk, grain products, and vegetables, form the foundation of a diet, and the other groups, meat and fish, nut products, cheese, eggs, fruits, fats, and sugar, are used to give additional energy, protein, mineral salts, and vitamines. (Photographed from the Food Exhibit at the American Museum of Natural History)

Food for a Family of Five[1]

By MARY GREIG

Assistant in the Department of Public Health, American Museum

RECENTLY two investigators in nutrition undertook to find out whether laboratory rats could pick out an adequate diet for themselves if left to choose from a variety of food set before them "cafeteria" fashion. The rats selected a pretty good diet, although perhaps not quite as good a one as the nutrition experts could have chosen for them.

Studies of diets from all parts of the world have shown that human beings, too, tend to choose adequate diets when food stuffs are abundant and varied. But, as a matter of fact, most of us do not have great enough variety in our diet to give this tendency room to work in.

A woman stood looking at the food exhibit in the American Museum. She turned—"Huh. I know how to buy the right foods all right—I guess every mother does, but the prices is so high." The critic partly answered her own criticism. It is just because the prices are so high that instincts do not find opportunity to work themselves out. Science must come to the aid of instinct under the conditions of modern civilized life. Already in one country even the law questions whether parents feed their children correctly just because they are parents: in England in 1906 an act of Parliament was passed to the effect that although a man may think he provides his children with food sufficient for their needs, if a school committee think otherwise, he may be forced to pay for other meals provided by the committee and charged to him.

Probably the other chief reason that we do not choose perfect diets is our individual "likes" and "dislikes." An extreme case will show how this works. A workingman came from a grocery store, eating a bunch of celery. I went in and inquired the price of celery. It was fifteen cents a bunch. At present food prices the lowest sum that will buy adequate food for one grown person for a day is about forty-two cents. This man would need from 3000 to 4000 calories a day, the celery would furnish about 30 calories. The man had spent one third of his money and he had received only $1/100$ of his energy. (The mineral salts in celery can be bought more cheaply in other foods.) If we see a girl shivering in a thin coat and wearing silk stockings and fancy shoes we smile, but we live in a glass house if we buy a "nice thick steak" or a "few lamb chops" before we have told the milkman to leave at our house every morning a quart of milk for every child and a pint for each grown-up. L. B. Mendel, of Yale, has said, "No one should buy tomatoes and lettuce unless he can afford an automobile"—although, as they are both valuable foods, we might buy them occasionally—as we would call a taxi.

Does it "matter" whether we know food values or not? Evidence is accumulating every day that it does. Recent study of life insurance statistics shows that when people are overweight they decrease their "expectancy of life." "After the age of thirty-five, overweight is associated with increasingly high death-rate, and at middle life it becomes a real menace to health."

It is estimated that at least 10 per cent of our school children are undernourished. This condition is not confined to the children of the poor; in a study of more than 5000 children in Boston some of the undernourished children came from well-to-do homes.

A Phipps Institute study of the garment trade shows that "malnutrition is one of the most potent causes of tuberculosis among the working classes."

A recent study of ninety-two family diets in New York City might be summed up as follows: Food deficiencies were frequent where the amount of money spent for food was enough to supply sufficient nourishment had it been spent wisely. The money was spent in such a way as to give high amounts of protein at a sacrifice of energy—59 per cent of the families were getting less than the standard 3000 calories and only twelve families too little protein. One half the

[1] The department of public health of the American Museum has installed in the forestry hall of the Museum an exhibit showing, among other things in wax reproductions of actual foodstuffs, an ideally proportioned diet for a family of five, based on the food needs of the body. The exhibit shows a week's food supply bought for $12 at prices prevailing in New York about December 1, 1918. This selected diet furnishes energy at the rate of fifteen cents a thousand calories, which is about as cheap as energy can be bought now in a diet adequate in other essentials.

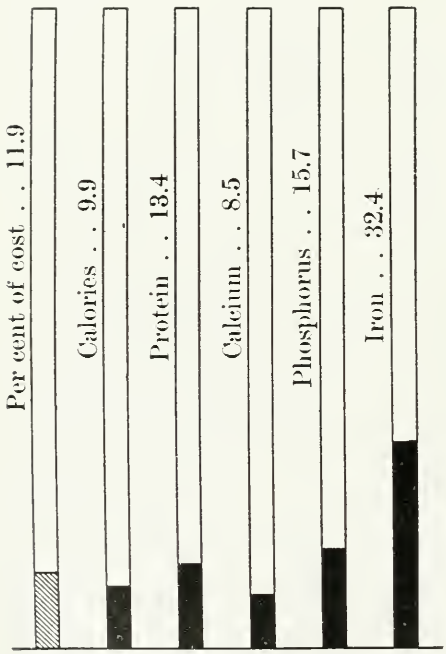
families were spending more than one third of the food money for meat and fish. It was also found that one group of families which spent forty-six cents was getting no more food value than a group that was spending twenty-five cents.

The amount of money spent annually for food in the United States is somewhere around $7,000,000,000.

Intensive investigations made in the last few years to learn how families actually spent their food money, have resulted in the discovery that the average American family spends too much of its food money for meat, poultry, and fish, spends in fact one third when it should spend only one tenth; that it spends not nearly enough for milk and cheese, too much for sugar, and too little for vegetables and fruit.

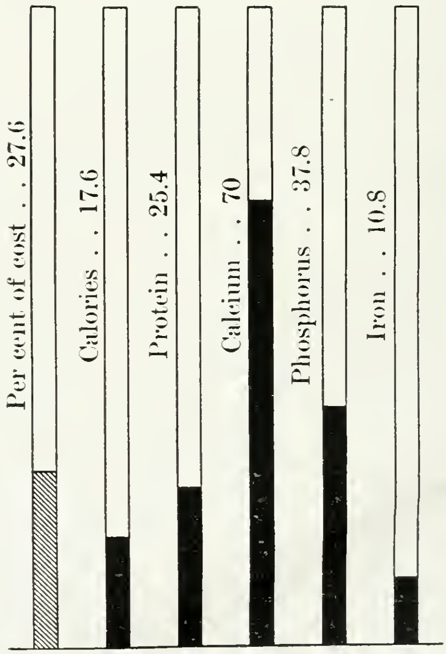
When the National War Labor Board was chosen to look into labor difficulties during the war it became necessary for them to know how much it costs to live. The estimates of the experts whom they called in ranged from $1100 to $1500 a year for a subsistence minimum in a large eastern city for a family of five. If $1500 is selected as the yearly income of such a family, then the amount it may legitimately spend for food will be from 40 to 50 per cent of this, which comes to about from $11 to $13 a week.

The body has need of many more things in its food than the six that we hear so much talk about, namely, calories, protein, calcium, iron, phosphorus and vitamines, but, if we make sure that these are supplied in correct amounts, all the other needed materials will be included.



Per cent of total food values obtained from vegetables

No one group of foods furnishes a complete diet because each is lacking in some essentials and abundant in others. The accompanying three diagrams represent the figures given for vegetables, milk, and grain products, respectively, in the "Percentage of the total diet" table. The total heights of the columns indicate 100 per cent, while the shaded part of the columns marks the actual percentage of the total supplied by the vegetables, milk, or grain products. For example, 11.9 per cent of the total cost of the sample diet was expended on vegetables from which was derived 32.4 per cent of the iron found in the diet



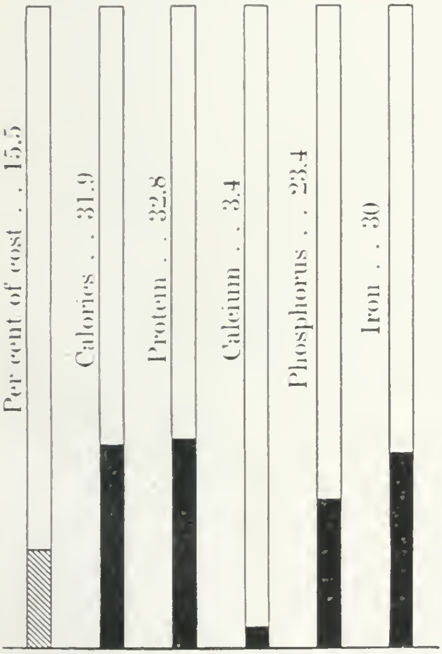
Per cent of total food values obtained from milk

Milk is the cheapest of our common sources of calcium and a fairly cheap source of protein. It is, however, much more expensive as a source of iron than are vegetables. On the whole we spend relatively too little for milk and cheese and too much for eggs and meat. A quart of milk a day for a child is considered as a fair standard for the calcium and protein found in milk make it particularly important in the diet of growing children. Milk is also one of the chief sources of the fat-soluble vitamines considered essential in a healthful diet

Percentage of the total diet

	Protein	Calories	Calcium	Phosphorus	Iron	Cost	Actual wgt. lbs.
Grain products	32.8	32	3.4	23.4	30.3	15.5	19
Milk	25.4	17.6	70.	37.8	10.6	27.6	46
Vegetables	13.4	9.9	8.5	15.7	32.4	11.9	22
Meat	16.5	4.7	.9	9.8	11.3	12.	6
Eggs	1.8	.7	.7	1.3	2.4	3.7	.9
Cheese	4.8	2.4	11.8	6.	1.2	3.2	1
Fats	.6	15.	.6	.5	.6	10.3	3.5
Sugar	....	8.9	....	....	....	3.2	4
Nuts and nut products	2.4	1.6	.5	1.9	1.	1.3	.5
Fruits	2.1	7.	2.7	3.5	9.7	10.6	9

Tabulated above is a comparison of food groups in the diet selected for the American Museum exhibit, showing in terms of percentage, the food values and which foods yield the most for the money spent. This diet will supply all the food needs of a typical family of five, say a father engaged in moderate muscular work, a mother, a boy of twelve and one of six and a girl of ten. The diet covers the six requirements usually considered and therefore all the other essentials.



Per cent of total food values obtained from grain products

Grains are almost the cheapest source of energy among the various foods and as the need for cheapening the diet increases, greater reliance must be placed upon them for supplying the foundation of our nourishment. As the chart shows, however, grain products are conspicuously lacking in calcium. They are also as a rule deficient in vitamines so that grain products should be used with foods high in calcium and vitamines such as milk and vegetables. These three, supplying in the largest quantities all the main elements of a complete diet, when taken together form an excellent foundation which can be supplemented by the other foods

The values for vitamines could not be included because the quantitative aspects of this problem have not yet been fully worked out for man. The need for the water soluble vitamines will be covered by an adequate diet of this character and the need for the fat-soluble vitamines is safeguarded by the milk.

It is easy to pick out from this table the food groups which furnish each of the food needs for the least money. In the lists below the cheapest foods are at the top in each list, the next cheapest second, etc.

Calories	*Protein*	*Calcium*	*Phosphorus*	*Iron*
sugar	grains	cheese	cheese	vegetables
grains	nuts	milk	grains	grains
fat	cheese	vegetables	milk	meat
	meats			fruit

In the accompanying charts compare the height of each of the columns that stand for food values with the height of the cost column. Then it will be plain whether or not those foods furnish that food value cheaply. For instance, look at the chart for grain products: a glance will show that in these foods we buy protein, calories, phosphorus and iron cheaply but that grains are expensive sources of calcium. Compare the chart for milk with this: the values are reversed, as milk is a very cheap food for calcium but rather expensive for calories and protein and too expensive to be considered as a source of iron. Now look at the chart for vegetables: vegetables more or less reënforce the food values of milk. Indeed, in the Orient they are used in place of milk, which is scarce. Milk, grains, and vegetables supplement each other and make a satisfactory foundation diet which can be filled out by other foods.

Photographed by Howard H. Cleaves

STORMY PETRELS "WALKING" ON NEW YORK BAY

Wilson's petrels (*Oceanites oceanicus oceanicus*), or "Mother Carey's chickens," are familiar to all ocean travelers and to all dwellers along the Atlantic seacoast. These scavengers of the Atlantic follow in the wake of ships for days at a time, their black and white forms blending with the rolling shadows of the waves or standing out in sharp silhouette against a glassy sea. The petrels are known especially for their habit of walking (or more properly, skipping) upon the surface of the water as they feed on floating morsels, and accordingly it is said they derive their name from St. Peter, the apostle, who walked upon the waves. Moving pictures show that the birds do not advance step by step, but by a kind of two-footed hop. Mr. Robert Cushman Murphy, curator of the department of natural history in the Brooklyn Museum, has demonstrated, through observations made during a long sea voyage and by examination of many specimens, that the petrels of the South Atlantic and those of the North Atlantic are one and the same species, which breeds in remote parts of the Southern Hemisphere and migrates to the Northern Hemisphere during the Antarctic winter (our summer). Mr. Murphy also observed on this voyage that the petrels can dive most skillfully to a depth several times their length

Scientific Zoölogical Publications of the American Museum for 1918

Summary of work on invertebrates, fishes, amphibians, and birds [*]

By FRANK E. LUTZ

Editor of the *Bulletin of the American Museum*

FOR the most part, papers in the *Bulletin* and *Memoirs* of this Museum are technical in both language and subject matter. Like other papers of the same character they are stones which have been carved for the great Science building and some of them, when viewed separately, may be of no more interest to the unprofessional man than an isolated building stone would be to one who was not an architect. The following brief notes indicate the general setting of these technical publications and point out interesting features of individual papers.

Researches on Invertebrates

One of the *Bulletin* articles[1] describes the anatomy of a leech which lives on the skin of the under side of the flippers of the Floridian green turtle, *Chelonia mydas*. Eight of the *Bulletin* articles and one *Memoir* deal with insects, highly specialized—both in structure and habits—members of the same grand division of the animal kingdom, the Invertebrata, to which leeches belong.

Mr. Olsen[2] reported on the leaf-hoppers which had been obtained from time to time by various expeditions and preserved for study. There are so many thousands of species of insects that no one man can be an authority on all of them; and this Museum has definitely connected with its scientific staff specialists in only three orders. As a result, the material obtained by expeditions cannot be even largely worked up shortly after an expedition returns, but the groups not immediately provided for must await the call of some one actively engaged with the species in question. This was what happened with the leaf-hoppers. Mr. Olsen is an amateur entomologist who is an authority on these creatures, restricting his studies almost entirely to this one family. This paper is, furthermore, an illustration of the mutually helpful coöperation which exists between the American Museum and students and scholars outside of its scientific staff; the Museum stores up more material than its staff is able to study, but this material is eventually used by outside scientists and returned to the Museum properly classified and duly reported upon. It is of interest to note that seven of the nine entomological publications during 1918 were the result of such coöperation.

The department of invertebrate zoölogy has for some time been planning its field work so as to get material for a study of geographic distribution, with special reference to the problems of isolation and of faunal movements between North and South America. As a part of this work the Floridian insects have been carefully studied. The fifth of a series of reports on this part of the work, is by Messrs. Leng and Mutchler[3] on the water beetles of Florida. It lists all the known species and gives distributional and biological notes, together with keys for the identification of certain species.

Mr. Wm. Beutenmüller, when connected with the American Museum, did much work toward the preparation of a monograph on moths of the genus *Catocala*, the moths whose front (upper) wings are usually colored and marked like bark but whose hind wings, covered when at rest, are often banded

[1] MacCallum, W. G., and MacCallum, G. A. 1918. On the Anatomy of *Ozobranchus branchiatus* (Menzies). *Bull. Amer. Mus. Nat. Hist.*, XXXVIII, Art. 12, pp. 395–408, Pls. XXXIII to XXXVIII.

[2] Chris E. Olsen. 1918. North American Cicadellidæ in the Collection of the American Museum of Natural History. Subfamily Cicadellinæ. *Bull. Amer. Mus. Nat. Hist.*, XXXVIII, Art. 1, pp. 1–6.

[3] Leng, Chas. W., and Mutchler, Andrew J. 1918. Insects of Florida. V. The Water Beetles. *Bull. Amer. Mus. Nat. Hist.*, XXXVIII, Art. 3, pp. 73–116.

[*] Summary of work on mammals, recent and fossil, will be published in a later number of NATURAL HISTORY.

with bright colors. After the severance of his connection here, the manuscript and drawings were sent for editing to Dr. Wm. Barnes, a physician who owns the largest private collection of moths and butterflies in America and who employs several assistants to work on it. A *Bulletin* article[1] and a superbly illustrated *Memoir*[2] are the result of this coöperation. The *Bulletin* article contains notes on the life histories of twenty-eight species, the outcome of extensive breeding experiments carried on by Dr. Barnes and his assistant, Dr. J. McDunnough, during several seasons. For the most part the experiments deal with species of which the early stages were either partly or totally unknown. The "text" of the *Memoir* consists essentially of the extensive captions of the twenty-two plates, giving notes on synonymy, distribution, etc. The plates are the work of Mrs. Wm. Beutenmüller, together with several by Mr. S. Fred Prince. Seventeen of the plates are in color, showing a large number of larvæ and the adults of most of the American species wonderfully reproduced by the Heliotype Company.

Dr. E. P. Felt, New York State Entomologist and an authority on the small midges, many of which cause galls on plants, examined and reported upon[3] the type material in the American Museum belonging to the family Itonididæ (formerly known as Cecidomyidæ). When an author describes a species that he believes has not been described before, the material which he has before him at the time and from which he writes his description is known as "type" material, and the author usually designates (he always should do so) a single specimen as "*the* type." Subsequent students refer to these types when revising the classification of a group. In this way Dr. Felt made some important changes in the nomenclature of the gall midges and drew up more complete technical descriptions than did the original author. Unfortunately, many authors keep their types in private collections which are difficult of access and subject to all the dangers of storage in a private house and of possible lack of care when the owner's interest lags or he dies. The American Museum offers exceptional advantages as a repository of type material, being in a city which is a center of travel, and having not only fireproof cases in a fireproof building but also a system for the special care of types as distinguished from ordinary specimens.

The red-eyed fruit fly (*Drosophila melanogaster*, formerly known as *D. ampelophila*) has been much used for a study of the laws of inheritance. Dr. A. H. Sturtevant, who has been very active in such work, is also a good student of classification and has written a paper[4] which furnishes keys for the identification of the relatives of this interesting creature as well as notes on their biology and distribution.

White ants, which are really not ants but are more nearly related to dragon flies, have most interesting habits. The paper[5] by Mr. Nathan Banks does not deal with these habits but will help students of termite habits to identify the species with which they are working. Several new species from the American tropics are described. The same remarks apply to Prof. T. D. A. Cockerell's paper[6] on some bees from British Guiana.

Dr. J. Bequaert has published[7] a very full account of the Vespidæ (social wasps and their relatives) of the Belgian Congo. It is based on the collection brought back by Messrs. Lang and Chapin. Keys to and complete descriptions of the species are given, together with copious notes on habits, distribution, etc. The author says of *Synagris:* "No other genus of solitary wasps offers such an amount of interesting ethological problems. Some of the species are still true to the

[1] Barnes, Wm., and McDunnough, J. 1918. Life Histories of North American Species of the Genus *Catocala*. *Bull. Amer. Mus. Nat. Hist.*, XXXVIII, Art. 5, pp. 147–77.

[2] Barnes, Wm., and McDunnough, J. 1918. Illustrations of the North American Species of the Genus *Catocala* by Wm. Beutenmüller, with Additional Plates and Text. *Mem. Amer. Mus. Nat. Hist.*, III, N. S., Part 1, pp. 3–47, Pls. I–XXII.

[3] Felt, E. P. 1918. Notes and Descriptions of Itonididæ in the Collection of the American Museum of Natural History. *Bull. Amer. Mus. Nat. Hist.*, XXXVIII, Art. 6, pp. 179–82.

[4] Sturtevant, A. H. 1918. A Synopsis of the Nearctic Species of the Genus *Drosophila* (sensu lato). *Bull. Amer. Mus. Nat. Hist.*, XXXVIII, Art. 14, pp. 441–46.

[5] Banks, Nathan. 1918. The Termites of Panama and British Guiana. *Bull. Amer. Mus. Nat. Hist.*, XXXVIII, Art. 17, pp. 659–67, Pl. LI.

[6] Cockerell, T. D. A. 1918. Bees from British Guiana. *Bull. Amer. Mus. Nat. Hist.*, XXXVIII, Art. 20, pp. 685–90.

[7] Bequaert, J. 1918. A Revision of the Vespidæ of the Belgian Congo Based on the Collection of the American Museum Congo Expedition, with a List of Ethiopian Diplopterous Wasps. *Bull. Amer. Mus. Nat. Hist.*, XXXIX, Art. 1, pp. 1–384, Pls. I–VI and 267 text figures.

From Bequaert's Revision of the Vespidæ of the Belgian Congo

AN AFRICAN WASP COLONY

Wasps are conveniently distinguished as social or solitary in accordance with the methods they employ in building their nests. The social wasps live in community nests, most commonly made out of a sort of paper which they manufacture by chewing wood; the solitary wasps construct individual mud houses. Members of the American Museum Congo Expedition frequently found on the under side of thatched roofs (a portion shown in the photograph) hundreds of wasp nests (*Synagris cornuta*) constructed from kaolin—a kind of clay used by the natives in whitewashing the walls of their huts. The wasps had sucked moisture from the brook near by and mixed it with the clay which they had then rolled with the front legs and kneaded with the mandibles into the required shape of the nest. This consists of cells each containing a larva and provided with a bent-necked entrance. Each female builds her own nest and feeds one larva at a time from day to day with ground-up caterpillars until it is fully grown; after which the neck of the cell is broken off and sealed for the period of metamorphosis to the fully developed wasp. Two or even three of the necked entrances, however, can sometimes be seen on the same mud lump (not to be confused with the many small holes made by the full-grown wasps in breaking out); each of these necked entrances is attended by one female wasp. In the habit of nesting in dense colonies and of nursing its larvæ from day to day, the horned synagris forms a sort of connecting link between the solitary and the social wasps.

From Bequaert's Revision of the Vespidæ of the Belgian Congo

The paper nests of these social wasps (*Polybioides melaina*) of the Belgian Congo are found attached to branches overhanging streams. The outside covering consists of several layers of thin brittle "paper" with numerous entrance and exit galleries. Within this outer envelope the combs of cells in which the larvæ are reared hang side by side. Some of the nests are three feet in length so that with their dense population and numerous exits they become, when in the least disturbed, immediate centers of trouble for the intruding observer. Even Stanley, the first white man to enter this region, found the black wasps worthy of comment and attention

From Bequaert's Revision of the Vespidæ of the Belgian Congo

This photograph shows in natural size a tropical African wasp (*Synagris cornuta*) sitting outside the doorway of her clay nest. The nest was found to enclose four irregularly united cells, one empty and the others containing respectively a fully developed wasp, a translucent white pupa, and a full-grown larva. During the larval stage the wasp is fed daily on a meat diet. To rear the larva from the egg to the full-grown larva at the time when the cell must be sealed requires about one month in the case of this species (the habits of this horned synagris have been explained on the preceding page) primitive habit of the Eumeninæ, hurriedly accumulating a provision of caterpillars above the egg, then walling the orifice of the cell, and taking no further care of their offspring. In other species, however, the maternal instinct is much more perfect; the female nurses her young from day to day with caterpillars ground up into a paste; this is evidently a transition toward the feeding habits of the true social wasps. Intermediate conditions between these two extremes are also found."

Researches on Fishes and on Amphibians

Mr. Carl L. Hubbs, of the University of Chicago, has written[1] concerning the variation, distribution, habits, and relationships of fishes belonging to the genus *Atherinops* and living on the Pacific coast of North America. They are smelts of several intergrading varieties. After a consideration of the possible migrations leading up to the present distribution of the genus the author says: "It seems probable, on the basis of the evidence available, that the coarser-scaled type of *Atherinops*, subsequent to the northward migration of the finer-scaled type and to the separation of the southern islands from the mainland, has likewise moved northward, meeting the finer-scaled type on the central coast of California. By the interbreeding of the two forms in this region the peculiar hybrid-like intergrades have probably arisen. Now, if this intergradation should spread more widely, or if the typical form on either side should become extinct or differentiated, then, according to the above explanation, we should have a *synthetic* species produced not by divergence but rather by the fusion of two species which were formerly distinct."

Mr. J. T. Nichols, of the American Museum, contributed two taxonomic papers on fishes. One[2] deals with the genus *Vomer*, the material having come from the mouth of the Congo and from the Antilles. The other paper[3] treats of material brought back from Greenland by the Crocker Land Expedition.

[1] Hubbs, Carl L. 1918. The Fishes of the Genus *Atherinops*, Their Variation, Distribution, Relationships, and History. *Bull. Amer. Mus. Nat. Hist.*, XXXVIII, Art. 13, pp. 409–40.

[2] Nichols, J. T. 1918. On *Vomer dorsalis*, with a Brief Review of the Genus. *Bull. Amer. Mus. Nat. Hist.*, XXXVIII, Art. 18, pp. 669–76.

[3] Nichols, J. T. 1918. Some Marine Fishes from Northwest Greenland. *Bull. Amer. Mus. Nat. Hist.*, XXXVIII, Art. 19, pp. 677–83.

A report by Mr. G. K. Noble, assistant curator of herpetology in the American Museum, covers the amphibians collected by the American Museum Expedition to Nicaragua.[4] The Expedition obtained twenty-seven species of frogs and toads, some of these very rare in collections. Two species of amphibians were described as new. One of these belonged to that curious group of Central American salamanders which have their digits bound together by fleshy webs. These salamanders are equally adapted for life in the trees or on the ground. The other new species was related to those tiny Neotropical tree frogs which, in the course of evolution, have dispensed with their vomerine teeth. Frogs of many different genera have become small, and have lost the vomerine teeth. In the Amphibia, teeth as a specific character are structures easily lost or acquired. Two of the tree frogs collected show remarkable adaptation to their environment: *Agalchynis helenæ* has the appearance of a green leaf which has been attacked by leaf mold; its whole back is vivid green with a few scattered spots of yellowish brown. *Hyla boulengeri* is colored very much like the lichens so abundant on the forest trees of Nicaragua. The scene on the Rio Grande, accompanying the report, was taken in the central part of Nicaragua. It was here that the Expedition camped while hunting the many forms of reptiles and amphibians which frequent the river banks of these remote Central American rivers.

Researches on Birds

Mr. R. C. Murphy, of the Brooklyn Museum, added[5] another "Contribution from the Brewster-Sanford Collection." This one discusses the taxonomy, plumages, migration, breeding, and food of the Atlantic petrels, or Mother Carey's chickens, belonging to the genus *Oceanites*. On page 340 is shown a flock of these birds skipping along the surface of New York Bay.

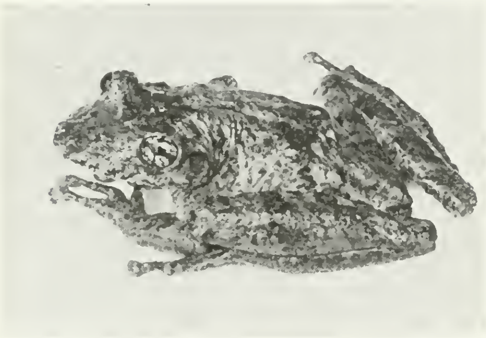
This paper establishes the fact that Wilson's petrel of the North Atlantic is the

[4] Noble, G. K. 1918. The Amphibians Collected by the American Museum Expedition to Nicaragua in 1916. *Bull. Amer. Mus. Nat. Hist.*, XXXVIII, Art. 10, pp. 311–47, Pls. XIV–XIX.

[5] Murphy, R. C. 1918. A Study of the Atlantic *Oceanites*. *Bull. Amer. Mus. Nat. Hist.*, XXXVIII, Art. 4, pp. 117–46, Pls. I–III.

same bird as that found in the far South, the southern bird migrating, after its breeding season, to the North Atlantic. This is proved in two ways: first, by a continuous record of migration made from daily observation of the birds between the latitude of New York and 54 degrees south latitude; and second, by a study of specimens taken at many points in the North, South, and tropical Atlantic. The paper also describes for the first time the immature plumage of the petrel, the sequence of molt, and gives new data on the seasons and rate of migration.

Another bird paper is by Dr. Jonathan Dwight. It deals with the snow birds called Juncos and is illustrated by three color plates. The new aspect referred to in its title[1] is given in the author's summary as follows: "Instead of accepting the presence or absence of intergradation as a guide by which to separate species from subspecies, I have endeavored to show that species may be recognized by qualitative, and subspecies by quantitative characters. Specific and subspecific characters in most of the Juncos are almost wholly confined to color and therefore by mapping the geographical distribution of color we are able to gain from a new angle a fairly distinct impression of relationships in this genus. . . . Even if I am overestimating the rôle played by hybrids we very much need a nomenclature that will indicate better than at present the intermediate as well as the extreme portions of lines of variation. Zoölogists and botanists, by actual experiment, have of late years so revolutionized ideas regarding species and hybrids that systematic ornithologists are likely to be looked upon as backward and unscientific unless they learn more of fluctuations and mutations, of manifestations of Mendelian and other laws, and all the modern theory that goes with them."



This Nicaragua frog, *Hyla boulengeri* (Cope), has previously been known only from the type specimen in the National Museum at Washington, described by Cope in 1887. Note its peculiarly long and flat snout. Its coloration gives close resemblance to the patches of lichens on the trees where it lives

A scene in central Nicaragua along the wooded shores of the Rio Grande, haunt of the rare *Hyla boulengeri*. This was one of the camping sites of the American Museum Nicaragua Expedition in 1916

[1] Dwight, Jonathan, 1918. The Geographic Distribution of Color and of Other Variable Characters in the Genus *Junco*: a New Aspect of Specific and Subspecific Values. *Bull. Amer. Mus. Nat. Hist.*, XXXVIII, Art. 9, pp. 269–309, Pls. XI–XIII.

A New Director for the British Museum

SIDNEY FREDERICK HARMER, F.R.S., ENGLISH ZOÖLOGIST, APPOINTED TO THE POSITION PREVIOUSLY HELD BY EMINENT SCIENTISTS, OWEN, FLOWER, LANKESTER, AND FLETCHER

ANNOUNCEMENT comes from London of the retirement of Sir Lazarus Fletcher, F.R.S., from the directorship of the British Museum (Natural History), and of the appointment of Dr. Sidney Frederick Harmer, F.R.S., the present keeper of zoölogy, to fill the vacancy. The retiring director is noted as a mineralogist. He was formerly keeper of minerals in the British Museum, and succeeded Sir E. Ray Lankester as director of the Natural History Museum in 1910.

The appointment of Dr. Harmer was made at a meeting of the Electing Trustees of the British Museum, namely, the Lord Chancellor, the Archbishop of Canterbury, and the Speaker of the House of Commons. His appointment as the director of the Natural History Departments places a zoölogist of distinction in the place of the distinguished mineralogist. Dr. Harmer will retain the keepership of zoölogy until the end of the year 1920. During that period the assistant secretary, Mr. C. E. Fagan, I.S.O., will assist the director in the details of control of the Natural History Museum. Dr. Harmer was formerly a Fellow of King's College, lecturer in zoölogy, and superintendent of the University Museum of Zoölogy. He is a leading authority on invertebrate zoölogy and has published many papers on polyzoa, and with Dr. Shipley, now vice-chancellor of the University of Cambridge, he edited the *Cambridge Natural History*. In 1907 he was appointed keeper of zoölogy at the Natural History Museum, and at once threw himself into his new duties with vigor. He has studied in particular the fauna of the sea, and, following the example of his great predecessor, the late Sir William Flower, he has paid special attention to whales. He has taken a deep interest in the conservation of animals, and has advised the Colonial Office on the preservation of whales and seals. He is one of the vice-presidents of the Zoological Society.

Any event in the development of the British Museum representing, as it does, the oldest and greatest museum of the English-speaking peoples of the world, is of interest to the American Museum. We like to feel that the welfare of our Museum is closely associated with the welfare of the museum in London. The American Museum of Natural History has historical connection through its scientific founder, Dr. Albert S. Bickmore, with the British Museum of Natural History. More than fifty years ago, Dr. Bickmore, after three years (1865–67) spent in the Dutch East Indies, China, Japan, and Siberia, stopped in London on his way home, where he showed Sir Richard Owen, at that time director of the British Museum, the plans for a natural history museum in New York, which had been maturing in his mind during his long journey in the East. Sir Richard expressed general approval of the plan, thereby greatly encouraging the young traveler. Later, when the great ground plan of the American Museum appeared, Dr. Bickmore incorporated in it a large central lecture hall, the feature included in Sir Richard Owen's plans for the British Museum.

Another indebtedness that we feel to the British Museum came through the engagement of Mrs. E. S. Mogridge and her brother, Mr. H. Mintorn, to prepare the first of our bird habitat groups, after methods which had been introduced in the British Museum. They prepared thirty-seven of these small groups for the American Museum, the first series being placed on exhibition in 1887, and the second series a year later. A third, and still stronger bond of union sprang from Sir William Flower's influence on museum development, not only upon the museums of Great Britain, but upon those in this country as well. Sir William was for many years director of the British Museum.

Still another bond exists because of the courtesy of the older institution in welcoming members of the scientific staff from New York to study within the hospitable walls of the British Museum. Such coöperation has been given in the researches of Dr. J. A.

Allen on birds and South American mammals; of Dr. William K. Gregory on fossil and recent primates; of Dr. Daniel Giraud Elliot, for whose great monograph on recent primates every facility was accorded, not only in placing material at his disposal but also in aiding Mr. A. E. Anderson to make many of the photographs for that work at the British Museum; of Professor Bashford Dean and Dr. Louis Hussakof in their work on fossil fishes; and of Professor Henry Fairfield Osborn on the Mesozoic Mammalia, a work which has proved to be of great influence in palæontology. Indeed, there is scarcely a member of the American Museum staff who has not at some time enjoyed the facilities courteously placed at his disposal by the British Museum.

Finally, the two institutions have been brought together more than ever before through the close bonds of allied scientific sympathy which have been created in the great war. Steps are being taken to unite more than one division of the respective museum staffs into similar scientific organizations.

The National Research Council of America, one of the best outgrowths here of the war, is endeavoring to internationalize all the sciences, through a permanent coöperative society. Affiliation in chemistry, astronomy, and palæontology is under way. This suggests and leads the way to affiliation and coöperation between the museums. The American Museum hopes, not only to renew and strengthen the bonds which already exist between the American and British institutions, but also to bring about new means of coöperation and interchange of ideas, with exchanges of specimens and of methods of exhibition.

During the publicity and discussion which have come in England at this time of change of administration in the Natural History Museum there have been expressed certain ideals of the British Museum and of its office of director. These concern the scientific and educational status of the institution and as such are of interest because of their possible wide application. We quote from the London *Times* of February 27, the following, with full agreement: "The director has to represent natural history to the public, to other scientific institutions at home, in the Dominions and Colonies, and in foreign countries, and to the many Government Departments with which the museum has relations. There are few posts with such possibilities of advancing the natural history sciences, of making them useful to the nation, and of interpreting them to the public."

From the *Times* of March 5, we quote the following in order to help in refuting it: "Work in natural history is divisible into two—the formation and study of collections on the one side, and teaching on the other; the former mainly done at museums, the latter at universities."

The truth is that both universities and museums are *teaching* in character although they employ different general methods, and at the present rate of growth of the museum as a practical educator, its future competition with the university is likely to bring modification of method in both institutions.

The further truth is that both institutions are fundamentally *research* in character, with the educational output based on this research. An eminent English naturalist has answered in part this old-fashioned distinction between universities and museums, writing in the *Times* of March 9: "The classification of naturalists into those who teach and those who form and study collections is very loose and misleading. Teaching in science is bound up with research, and research in laboratories is knit into one with research in museums. [The museum research laboratory should differ in no way from the university research laboratory!] There is no sharp division of interest such as your correspondent assumes, either between the universities and the national museums, or between teaching and the collections within the universities themselves."

In the history of museum growth there has been a preliminary time of development of collections, and of accomplishment of a laborious mass of systematic and descriptive work on them. For most groups this work has been pretty well in hand, however, for some years; and the idea that a museum is limited to collections and taxonomy is nowhere extant except in the minds of a few who have not kept themselves informed as to the development of the modern museum.

The Climbing Fish[1]

By R. D. O. JOHNSON

UP IN the Andean heights of the Department of Antioquia, Republic of Colombia, there is a climatic stratum marked by a uniformly cool temperature and great humidity. The rainfall is enormous in quantity. The topography included within the stratum is mountainous in the extreme. The streams are many and torrential in character, and their waters rush roaring down the steep and tortuous channels to the placid rivers of the plains below—they are but a series of falls, cascades, and blustering "riffles." The country rock is schistose in character and comparatively soft and the erosion of the stream beds is very rapid.

Ancient stream beds high up on the cañons' sides are pitted with many potholes of unusual interest to the student of dynamic geology. There is not a waterfall in the region today so small or insignificant that it is not busily engaged in boring out a more or less cylindrical hole in the rock beneath. The falling water at the point of impact seems inevitably to set up a rotary motion, carrying stones, sand, and gravel around with it, and the resulting wear bores out the pothole.

Into these potholes falls the drifting, gold-bearing quartz with which the upper Andean regions abound, and within these mills of nature it is ground to an impalpable powder, and the gold freed from its matrix finds lodgment in the gravels and the alluviums of the plains and the river bottoms. It was the lure of the gold that indirectly drew my brother and myself so far into the jungle—jungle that answers the most rigid definition of the term.

We were employed to install a hydroelectric plant to be used in connection with the operations of a company engaged in placer mining. A permanent camp had been established in niches cut in the steep sides of the cañon and was located at an elevation of 115 feet above the roaring Santa Rita Creek.

Since power streams were numerous, we selected the one most convenient to the camp for beginning our work. The bed of this power stream held an average angle of thirty-eight degrees from the horizontal and, for a considerable distance, slipped down over the smooth surface of the worn rocks in a thin broad sheet.

Our first efforts were directed toward ascertaining the volume of flow of the stream. To do this it was necessary to introduce a measuring weir at a point above the take-off of the plant. The weir was soon established and the deflecting dams were built in. When the water was turned, a part of the bed of the stream lay uncovered, exposing a couple of old gravel-filled potholes. Since such potholes not infrequently contained gold, my brother proceeded to dig out one of them while I was engaged in taking the readings from the weir.

He had been at this task for only a few minutes when he called out to me:

"Say, here's a fish."

I replied saying something about his "seeing things," and proceeded to expatiate upon the impossibility of his finding a fish in such a place, and upon the utter inability of any fish, even among the best swimmers, to surmount the difficulties of such a stream.

I pointed out the absurdity of imagining a fish swimming with nine-tenths of its body out of the water, as it would have to be, up that part of the stream where the water passed in a thin sheet over the smooth rocks. "He'd have to be an aviator," I said. So I pooh-poohed the idea recklessly.

Harry listened with suspicious patience to my lengthy dissertation, while I, from a theoretical standpoint, utterly demolished his unthinking assertion, then he blurted out:

"Well, are you all through? Here's the fish! This is a fact, not a theory you've butted up against."

He held in his hand a living fish, and a catfish at that, resembling the catfish or horned pout of the North. I took it and looked it over. There it was, a real live fish, nearly a half foot long. There could be

[1] "Notes on the Habits of a Climbing Catfish (*Arges marmoratus*) from the Republic of Colombia." By R. D. O. Johnson, *Annals* New York Academy of Sciences, Vol. XXII, pp. 327–333, December 20, 1912.

no possible doubt about it, in spite of the utter impossibility of the thing.

Harry had his laugh and returned to his digging. I was completely puzzled—but I had pressing work to do. I carefully placed the fish in a small pothole at one side. This hole was about four inches in diameter and twelve inches in depth and held perhaps two or three inches of water. Catfish are hardy, so I figured that there was enough water to last this little fellow until I could give him more attention.

After I had finished my work at the weir, I returned to the little pothole to give that amazing fish a closer scrutiny.

He was not to be found, so I called out, "What did you do with the fish, Harry?"

Harry asserted that he had not taken the fish and that he had paid no attention to it. That certainly was a mystery. I did not think it possible for a five-inch catfish to jump out of a four-inch pothole twelve inches deep. I concluded, however, that that was the only way of escape and contented myself with this rather lame explanation.

Before we returned to the camp that afternoon, Harry had caught two more "cats" in another pothole. These we carried down to the camp in our dinner pail. We arrived at the camp just as the late afternoon meal was being served. I hastily poured the water and the fishes from the dinner pail into a three-gallon galvanized bucket and set it in an inconspicuous place outside the kitchen. After dinner I sought the bucket to get a better look at the fishes which had destroyed a good theory. They were not in the bucket. I inquired of several who might possibly have freed the fishes but no one knew anything about them. This mystery was getting too thick for comfort.

The next day I made a special trip up the power stream and managed to secure two more of these fishes. I brought them down to camp and placed them in the same pail that had held the others and sat down to watch their maneuvers.

For a time they were content to swim about, butting their blunt noses against the sides of the vessel. Then, to my amazement, one of them thrust its "nose" out of the water and began creeping up the side of the pail. I watched it hitch itself up by short longitudinal movements until it had reached the top edge and fell outside of the bucket. I put it back and watched the performance repeated. Then I transferred one to a tall glass jar and through the glass watched the operation of the creeping mechanism. I caught others and dissected them and studied them until I was in possession of their secret.

This lies in the combined action of two sucking mechanisms. One of these is the ordinary sucker mouth, surrounded by a soft flap, very thin and flexible at the edges. The other is an interesting structure consisting essentially of a bony plate beneath the skin on the under side of the fish where the ventral fins are attached. These fins are broad and flat and their surface is studded with small sharp teeth pointing backward. The bony plate is given a shuttle action by muscles attached fore and aft so that the fins may be moved lengthwise of the fish through a distance equal to about one sixth its length. With this apparatus the fish is able to create a suction pressure, and by means of the alternate action of the two suckers, it is enabled to crawl, inchwormlike, on a smooth vertical surface.[1]

Shortly after this, the mining company undertook the cleaning out of a large pothole which was eight feet in diameter and twenty-two feet in depth. Before the bottom had been reached, the water that remained in the pothole was found to be full of these climbing catfishes. They were naturally greatly agitated by the action of the workmen who were shoveling out the gravel. Several times some of them started to climb out but were frightened by the men and dropped back. I surmised that as soon as the work was stopped for the lunch hour these fish would essay the long climb to the top. I was not mistaken and my watch-

[1] The climbing catfish which Mr. Johnson describes is not the only species of fish which is able to climb by means of its ventral musculature. In the Himalaya Mountains—so similar to the Andes in ruggedness—there occur several species which have adapted themselves in various ways to this environment. *Nemachilus rupicola* and perhaps other species of mountain cyprinids adhere to the rocks by means of their smooth, ventral skin and enlarged lips. The silurid genera *Pseudecheneis* and *Glyptosternum* cling by means of a well developed abdominal sucker. The mountain torrents of the Himalayas form the nursery for many species of frogs. Their tadpoles, like the fish, have become adapted to these terrific floods. Some of the tadpoles, such as *Megalophrys parva*, cling by means of their lips and the ventral musculature, while other species, such as *Rana afghana*, possess a well developed ventral sucker. —G. K. N.

ing was rewarded by seeing four climb up a distance of eighteen feet to the pool of water above. They followed a thin film of water that trickled down the rock. This water kept their gills wet and sustained them on a climb that must have been arduous. It required half an hour to make the ascent.

To my own satisfaction I had answered the question of how it was done; there remained the question of why. The fish was evidently a case of extreme modification and adaptation to fit a peculiar environment. Some catfish do not climb, why should these? An analysis of the environment brought the answer.

I found that the Andean torrents were the habitat of myriads of these curious creatures, "capitanes" they are called by the natives. The individuals I had examined were living in a torrential stream almost daily subjected to the sudden fury of sweeping floods. The violence of these floods is unimaginable to one who has not witnessed them. It seems that nothing unanchored in the stream bed can withstand their wild energy. As swimmers, however, these fishes are clumsy and inept. To witness their awkward, wriggling, swimming movements is to know at once that they could not by that means of propulsion alone make any headway against even moderate currents.

We can understand that to remain at home in time of flood, these denizens of the wild waters anchor themselves by means of their sucker mouths. Yet these catfishes are to be found in all parts of the streams, from the slender spring branches of the high mountains to the sluggish rivers of the plains. Travel they must and by using the climbing mechanism I had seen operate—the alternate action of mouth and ventral suction plate. That they are able to surmount even great falls is evident from their presence in the Santa Rita Creek, for this stream falls into the Santo Domingo River over a precipice more than two hundred feet in height.

Notes

Mr. Edward D. Adams has presented to the American Museum the oil painting of the solar eclipse of June, 1918 (reproduced in color in this number of Natural History), by the artist, Howard Russell Butler, N.A. It is the first time in the study of such astronomical phenomena, that the colors of the corona and its prominences have been observed by a trained artist, and recorded at the moment, eliminating the chance of inaccuracy. In connection with this most remarkable painting Mr. Adams writes of the especial interest attached to the 1918 eclipse from the fact that observations of it were confined to the area of the United States. It is true also that it was observed only by people of the United States and Canada, as the great war prevented foreign astronomers from coming to this country to witness the event. The resemblance of the flame at the tip of one of the prominences to the outspread wings of an eagle prompted the association of the eagle with the astronomical event (it was just at the time of the victorious advance of the American and Allied armies) and suggested the use of the term "eagle prominence" in referring to the corona of the eclipse of 1918.

Lawrence M. Lambe, the well-known Canadian palæontologist, died of pneumonia on March 12, 1919. He had been on the palæontological staff of the Canadian Geological Survey for thirty-five years, and for the last fifteen years had devoted especial attention to vertebrate palæontology. In recent years he had come to be regarded as one of the leading authorities on dinosaurs. When the Geological Survey collections were moved to the Victoria Memorial Museum at Ottawa in 1910, he took charge of the fossil vertebrates and succeeded in building up a remarkable collection, especially rich in the Cretaceous dinosaurs of Alberta. In securing this fine material he availed himself of the aid of the veteran American collector, Mr. C. H. Sternberg, and of his sons. The American Museum staff has followed with interest the work and success of Mr. Lambe, as he studied vertebrate palæontology in 1903 under Professor Henry Fairfield Osborn and learned here much of the field technique and methods of research which he applied to Canadian palæontology with such notable results. His unexpected death in the midst of a busy and successful career comes as a shock to his many friends and as a great loss to the science to which he had devoted his life.

A Roosevelt Memorial Exposition to commemorate the life and achievements of Theodore Roosevelt will be held by Columbia University in the Avery Library during May. The University has previously established in Columbia House one of the first of the college centers for Americanization in the country and will establish there a permanent memorial to Colonel Roosevelt.

Professor and Mrs. Henry Fairfield Osborn, accompanying Mr. C. William Beebe, left New York February 26 to inspect the unusual facilities for research at the New York Zoölogical Society's station in British Guiana. Colonel Roosevelt in 1915 wrote of this station enthusiastically as marking "the beginning of a wholly new type of biological work capable of literally illimitable expansion."

The Tropical Research Station of the New York Zoölogical Society in British Guiana has reopened for scientific investigation, after a lapse owing to the absence of most of the staff with the American Army. Mr. C. William Beebe, the director, sailed for Bartica on February 26. Bartica is favorably situated for the study of both fauna and flora and its climatic conditions are ideal for the work. General ecological investigation will be made on the relations of plant and animal life in the jungle while special work will be carried on by individual investigators. Professors William Morton Wheeler, of Harvard, Ulric Dahlgren, of Princeton, and Alfred Reese, of West Virginia, will make special study of ants, electric fishes, and crocodiles, respectively, while Director N. L. Britton, of the New York Botanical Garden, will make a survey of the forests. The New York Zoölogical Society assumes the financial support of the project through the generosity of five members of the board of managers, Colonel Anthony R. Kuser, Messrs. C. Ledyard Blair, Andrew Carnegie, George J. Gould, and A. Barton Hepburn.

Dr. Livingston Farrand, president of the University of Colorado, formerly professor of anthropology in Columbia University (in 1903–4 assistant curator of ethnology in the American Museum), has resigned his administrative work in the university to become executive head of the American Red Cross.

The establishment of a new Jardin des Plantes is proposed for France in the park of Versailles between the Trianon (villas of Louis XIV and XV) and the Forest of Marly. The new garden of about fifteen hundred acres will be, to a large extent, supplemental to the old Jardin des Plantes in Paris, the further expansion of which has been shut off by the growth of the city.

Dr. Henry Allan Gleason, assistant professor of botany at the University of Michigan, was recently appointed first assistant to the director-in-chief of the New York Botanical Garden, to succeed Dr. W. A. Murrill who occupies the newly created position of supervisor of public instruction.

The New York Aquarium is to have constructed a seaworthy well boat for purposes of marine collecting. Such a boat with a 10×11 foot well for preserving the fish alive will make possible hereafter the transportation in good condition of not only the local fish of Long Island shores but also the tropical species that migrate in summer up the Gulf Stream, and other large fishes reported taken in the trap nets of local fishermen.

An example of the development of modern museum methods of instruction in connection with university work is shown in the expansion of the museum of the University of Illinois. The plan includes, in zoölogy, both general synoptic series illustrating the principal forms of animal life, living and extinct, and ecology groups, such as life in and about an old decaying log of the local woods. The first of a series of economic groups to show the presence and activities of common insect pests is also completed.

The fight of the entomologist against insect pests has been greatly increased during the war. Dr. L. O. Howard, chief of the Bureau of Entomology at Washington, has recently reviewed the work of his Bureau and of the subcommittee on medical entomology of the National Research Council. The

SHARK LIFE IN THE WARM WATERS OF THE SARGASSO SEA

Photograph of a group in the American Museum, recently constructed under the supervision of Dr. Bashford Dean

The blue shark (*Prionace glauca*) is the common surface shark of the open sea, being widely distributed over the Atlantic and Pacific oceans. This species of the high seas is a more slender and graceful fish than most of its relatives and much bluer in color than those species found near the shore. Although not large, it is very voracious and destroys countless smaller fish, even pursuing them into the fishermen's nets. Blue sharks follow ships at sea and collect around whaling vessels to feast on the whales these have taken. The whalers retaliate by eating the sharks. Members of this species sometimes attain a length of ten feet. So far as is known only one specimen has been taken in the vicinity of New York City; this one was caught in 1911 by Mr. Alfred Frank near City Island and was presented by him to the American Museum.

The Blue-shark Group, recently completed at the American Museum, was modeled from a cast of a female shark formerly on view at the New York Aquarium. The shark, with its young, is mounted as though seen from below the surface of the ocean in that tract of comparatively still water in the Atlantic known as "Sargasso Sea" where seaweed and wreckage collect from the ocean currents

Friends of 1st Lieut. Charles L. Camp have learned that at a recent divisional review in France he was awarded the French War Cross with gold star for services in the Argonne. Lieutenant Camp was working in vertebrate palæontology and in herpetology at the American Museum and Columbia University previous to his entering the Army. He has served with the 7th Field Artillery, 1st Division. At present he is giving courses in history to the men of the 18th Infantry. In telling his father of the honor he has received, he wrote, "Those who most deserve the decorations are, however, underground."

fighting of disease carriers occupied the attention of all governments from the very first. Body lice, carriers of typhus and, as was later discovered, of the very general trench fever, were thoroughly investigated and reported upon in England, France, and Germany before the United States began massing troops; but extensive experiments were later conducted in this country, in coöperation with the Chemical Warfare Service, as to the possible utilization of war gases as fumigants against this pest, and an overhauling of army laundering processes was undertaken with a view to complete sterilization of clothing.

The work of the Bureau in protecting crops, ground supplies, and lumber is perhaps more generally familiar to the public, although Dr. Howard says the preëminently practical men who have been working for years along this important line were "chagrined to find that even in certain high official circles the old idea of the entomologist still held—that he was a man whose life was devoted to the differentiation of species. . . ." The stimulation of food and lumber production was one of the most important of our home activities. In assisting the farmer the duties of the Bureau were, as usual, multifarious, as, for example, the heading off of a plague of grasshoppers in Kansas, thereby saving about $3,000,000 worth of wheat and $2,500,000 worth of alfalfa. The cultivation of castor beans for their oil arose as a special war measure inasmuch as the entire Mexican crop was bought up and shipped to Spain, probably to German agents. A large acreage of these beans was planted in the United States which the southern army worm and other insects quickly discovered and the entomologists were called in to prevent an insect raid. Inspection and protection of the great stores of grain, lumber, and wooden implements also fell to the entomologists and they found it necessary to investigate the ways and means of getting out logs so as to prevent their destruction by borers. Aside from this coöperative research, entomologists were also commissioned in the Army for medical work and their services received well merited praise from the Army authorities.

A TALE of "pheasant farms" in China where thousands of golden and silver pheasants supposedly are raised for their plumes has grown up and lately been brought to the attention of the United States Treasury Department with reference to a proposed importation of the plumage. The New York Zoölogical Society has investigated the matter and found the report untrue. Mr. C. William Beebe, curator of birds at the Zoölogical Park and author of the recent monograph on the pheasants, and Mr. Roy C. Andrews, leader of the American Museum's expeditions to China, both deny the existence of any such farms in southwestern China. Dr. Hornaday wrote also to the French Consul at Mongtseu who further denied the reports.[1] The golden and silver pheasants, the consul reports, have never been domesticated and usually die in captivity. Certain of the aboriginal non-Chinese tribes of Yunnan do keep male pheasants for decoy birds in order to attract the hens in spring, but such decoy birds bring $13 (Mexican) while a pheasant for the table can be purchased in the mountain country for thirty or forty cents. The exportation of living pheasants or their plumage is absolutely prohibited in China and Indo-China, and the authorities are very much interested in preventing commerce in the feathers for, if the price should chance to rise, the natives would soon destroy the species.

A Chinese encyclopedia[2] has recently come from the Oxford Press. This is the first work of the kind that has ever appeared on China. "I send out the *Encyclopædia Sinica*," writes the editor, "in the sincere hope that it may help to interpret and open up China to the foreign reader, and may increase mutual respect and knowledge between East and West." Many topics on the natural history of China are included and extensive bibliographies given; for example, under "ornithology" Mr. J. D. de La Touche lists 155 articles and books. Mr. Norman Shaw, author of *Chinese Forest Trees and Timber Supply*, contributed most of the material on the products and exports of China and supplied many of the statistics. Many other distinguished authorities and Government Ministries and Services contributed important articles.

[1] *Bulletin de la Ligue Française pour la Protection des Oiseaux*, Nov.–Dec., 1918.

[2] *The Encyclopædia Sinica*, by Samuel Couling, formerly Honorary Secretary and Editor of the North China Branch of the Royal Asiatic Society, London, 1917.

In spite of revolutions and brigandage in China, the academic work at the West China Union University, Chengtu, has continued at maximum capacity. Chengtu lies not far from the inland port of Chungking. It is the capital of the rich province of Szechwan, the governmental and educational capital for 45,000,000 people and an important center of commercial enterprise and political reform. The city is located at the beginning of the ancient caravan route to Tibet and is even today the center for the great drug exporting trade from that almost unknown plateau. The last ten years have seen the creation of this modern university in Chengtu and its hearty approval by the Chinese. Not the least successful feature of the university is its buildings modeled after Chinese designs. Western attempts to imitate Chinese architecture have usually been failures, but the Chinese designs of the university's colleges and halls were an important factor in winning Chinese approval of the institution.

The Reverend Harry R. Caldwell, representing the Methodist Episcopal Church as missionary at Yenping, Fukien Province, will join Mr. Roy C. Andrews in October for field work in China under the auspices of the American Museum. The Reverend Mr. Caldwell assisted Mr. Andrews in 1916–17 in the Fukien Province, notably in an attempt to shoot a melanistic Chinese tiger, the "blue tiger," the story of which was narrated in the American Museum Journal for May, 1918.

In answer to a question regarding the speed of the Mongolian antelope (*Gazella gutturosa*), Mr. Roy C. Andrews writes from China again that he has "no hesitation in placing this at sixty miles an hour." "At one time," he says, "our car was running at forty miles (by the speedometer) and a herd of antelope which had started when nearly opposite to us and about three hundred yards away, ran parallel with us for some distance and then gradually drew ahead and crossed in front; they kept about the same distance away all the time. In other words while we were running forty miles in a straight line they were going in a semicircle about us and still keeping almost the same distance away —perhaps they lost fifty yards, but not more. When we began to shoot, the animals increased their speed very considerably and the man with me estimated then that they were running about seventy miles an hour; there is no doubt that they can run sixty miles with comparative ease. I never knew what running was until I saw those antelope—they simply flew, and one had a strange impression that they were skimming the ground, for their legs appeared only as a blur."

To meet the growing demand for trained gardeners, and to afford convalescent soldiers and sailors opportunity for preparation for such work, the New York Botanical Garden has inaugurated a two years' course in practical gardening. The remarkable natural facilities of the grounds comprising the Botanical Garden in Bronx Park, New York City, offer an unusual opportunity for training in this subject, while in addition the extensive library of horticultural books and the well equipped laboratories will be at the disposal of students. The instruction by the staff of the Botanical Garden will combine indoor lecture and laboratory classes with outdoor gardening. During the first year, classes will be conducted in such elementary scientific studies as elementary botany, zoölogy, plant physiology, and chemistry, and practical training given in greenhouse practice, flower gardening, and vegetable and fruit gardening. The second year's course has not yet been announced, but will include such advanced subjects as surveying, garden design, garden pathology, and garden mycology.

THE artistic planting of trees along roads not only adds beauty to the countryside, but also helps to preserve the roadbed and to break wintry winds. The possibilities in this form of highway improvement have just been presented for public consideration in a *Circular of the New York State College of Forestry* by Professor Henry R. Francis. New York State, with its network of improved highways, offers a splendid opportunity for roadside tree planting. Roadside conditions at present are entirely haphazard and the care of the trees has been neglected or left in the hands of those unskilled in either landscape gardening or arboriculture. Recently a bill has been introduced in the state legislature to amend the highway law with a view to such improvement, providing for the appointment of a highway tree warden who shall be a scientific forester with practical experience along the lines of landscape engineering. The bill asks for an appropriation of $10,000 for carrying out the provisions of the act, and $10,000 for an initial demonstration on the state highway between Syracuse and Utica.

THE Springfield, Massachusetts, natural history museum is to have special classes conducted Saturday afternoons by the junior high school art teachers. This plan grew out of the exceptional results obtained by school children of the city who have been working with pencil, brush, and clay on various museum subjects. One boy, becoming interested in the dinosaurs, executed a clay model of such merit as to warrant its receiving a place in the permanent exhibit of the museum. The Saturday afternoon lectures which have been given on various subjects have proved an inspiration to these youthful artists and it is expected that the inauguration of art classes will attract many students. This coöperation between art and natural history is an illustration of the complementary nature of much of the work of institutions traditionally looked upon as far apart in interests.

ONE of the best known founders of the American Ornithologists' Union is Mr. William Brewster, of Cambridge, Massachusetts, who served as its president from 1895 to 1898. Before the organization of the Union and for many years since, Mr. Brewster has been president of the Nuttall Ornithological Club, the oldest bird club in America, still in existence. He has devoted much attention to the development of his private ornithological museum, a unique institution at which the Nuttall Club holds its meetings and which recalls many pleasant memories in the minds of those bird students who have been fortunate enough to enjoy its hospitality. While primarily a systematic ornithologist, Mr. Brewster has always devoted much attention to the study of birds in the field, and as an accurate and skillful describer of their habits he is today without a peer.

THE marine research of the Carnegie Institution[1] was somewhat modified during the

[1] "Department of Marine Biology," Carnegie Institution of Washington, *Year Book* No. 17, pp. 149–172.

past year on account of the war, and the work begun at Tortugas, Florida, had to be postponed, the yacht "Anton Dohrn" being in the service of the Navy. The director, Dr. Alfred G. Mayor, accompanied by Professor A. L. Treadwell, Duncan Gay (artist), and Mr. John Mills (engineer), made a two months' trip to Tobago, British West Indies, where collections were obtained and extensive studies were made of siphonophores (jellyfish, etc.), and of the Eunicidæ (marine worms). Especial attention was paid to the question of the southern distribution of the West Indian marine fauna and the influence of South America upon it.

Further trips to the West Indies being prevented by the appearance of enemy submarines off our coast, the director, with Professor L. R. Cary and Mr. John Mills, visited Pago Pago, American Samoa, to continue studies of the coral reefs begun the previous year. The results of these two voyages show that certain stony corals (Madreporaria) of the Pacific grow twice as rapidly as do similar corals of the Atlantic. An *Acropora*, for example, increased sixty-eight ounces in the fifteen months. This genus is the most important element in the outward growth of the Samoan reefs. The *Porites*, which form irregularly rounded masses dangerous to navigation, grow at the rate of about one inch a year. Drilling through the fringing reef at Pagopago, Professor Cary found it to be 121 feet thick and underlain by volcanic rock. Further study will be taken up on another trip when examination of the precipitous outer edge will be made by the use of diving hoods. The more rapid rate of growth of the Pacific corals evinces the fact that the present reefs may have attained their growth during the last 30,000 years or since the last Glacial Epoch. The greater rapidity is probably due to a better food supply.

During the voyages continual tests were made of the acidity and alkalinity of the surface waters of the ocean and the results obtained may be of importance to navigators. For example, the water of the Gulf Stream is much more alkaline than that which drifts down the east coast of North America, so that a navigator, entering or leaving an Atlantic harbor, could easily determine his position with reference to it. Arctic water and water from great depths is more heavily charged with carbon dioxide than warm surface waters and so maintains a higher state of acidity.

"THE Superb Position of New York City as a Center for Physiographic Study" is the title of a paper by Dr. A. K. Lobeck [1] which

[1] *Annals of the New York Academy of Sciences*, Vol. XXVIII, pp. 1–50.

Poh-we-ka (Little Blue Corn Flower), or Marie Martinez, a young Tewa woman of San Ildefonso pueblo who is attempting to keep alive the ancient symbolic art of the pottery of her people. Some of the best pottery of the eastern Pueblos was made at San Ildefonso. The designs are filled with meaning and refer mostly to clouds, rain, mountains, and vegetation; in fact, these designs are in part prayers for the life-giving rain. Marie Martinez and her husband are fully acquainted with the ancient pottery excavated from villages in Pajarito Park (one of our national monuments) as well as with the more recent productions of San Ildefonso. (Photograph by courtesy of *El Palacio*) points out the unusual variety and completeness of the illustrations of earth sculpture within a radius of three hundred miles of the metropolis. In fact a great wealth of geological and physiographical material may be reached by half-day trips, or even within the city's limits. The various agencies of erosion are all typified in the vicinity. Both young and mature rivers are found and indeed the Bronx River alone illustrates both stages in its upper and lower stretches respectively. The Hudson presents the very old stages of river ageing with further reference to repeated uplift and renewal as is seen in the stepped peneplains of its valley walls. The relation of streams to dividing ridges and the subject of stream "capture" may also be mentioned, especially the excellent example in the Catskill Mountains where the Kaaterskill has diverted the headwaters of Schoharie Creek.

The great continental glacier reached its maximum expansion at New York so that here we find the various effects of ice erosion, terminal moraines, and erratics, or rocks carried in the ice from great distances.

Well defined coastal plains lie within easy reach to the south, especially along the New Jersey coast, and here are illustrated the economic dependence of people on topographic features and the determination of routes of travel by them. In the Alleghenies, throughout Pennsylvania and New York, we find examples of folded mountains, while among the Adirondacks, the White, and the Green Mountains stand carved and worn down masses of complex ranges. The only important feature not well represented is the phenomenon of volcanicity although there are roots of old volcanoes like Ascutney Mountain in Vermont and long intrusive ridges like those forming the Palisades.

Not only is this region most accessible to the student located in New York City, but, in addition, there is no section of the country which has been so thoroughly worked over, mapped, and described so that both the amateur and the expert geographer and geologist have at their command a great wealth of literature. Dr. Lobeck gives an extensive bibliography of the region.

Mrs. Henry Fairfield Osborn has recently presented to the Osborn Library of the American Museum a number of private letters written by Charles Lyell, the great English geologist. These date from 1836 and are addressed to Dr. Benjamin Silliman, founder of *The American Journal of Science* (which celebrated its centenary in July, 1918), and at that time professor of "chemistry, mineralogy, etc.," at Yale.

Lyell's fame was world wide and his works on systematic geology were the standard world treatises and texts in that science. Most of the letters are concerned with business items relative to the publication and sale of these books in the United States—a matter which Professor Silliman, as America's most noted geologist, was eager to promote. Lyell's volumes were undergoing constant revision as contemporary investigation advanced and as he himself traveled into new lands, and the proposed edition of the *Elements with notes and additions in American Geology* came in for discussion with Professor Silliman, especially in that part of the correspondence exchanged during Lyell's American trip. Continual personal mention of Darwin and other historical characters gives an added interest to the manuscripts. Mrs. Osborn's gift reverts attention, in these days of stenographers and typewriters, to the time when the world's greatest scientists and most industrious investigators laboriously wrote their letters with pen and ink on both sides of the paper.

M. Félix Sartiaux is preparing a French translation of the *Origin and Evolution of Life*, by Prof. Henry Fairfield Osborn, which will be issued from the press of Masson et Cie. M. Sartiaux, the author of *Troie—La Guerre de Troie* (1915) and *Morale Kantienne et Morale humaine* (1917), is an authority both in the archæologic and philosophic fields.

The close of hostilities has released considerable discussion on the question of marine camouflage and its relation to the theory of protective coloration of animals. There are two general types of marine camouflage: (1) the low visibility patterns intended to make the ship invisible or indistinct at medium ranges; (2) the British "dazzle," constructed of prominent patterns which serve to break the outline of the ship and to render calculation as to her length, speed, direction, and distance inaccurate. In order to "paint out" the ships it was found that monochromes were never as effective as the contiguous application of the various colored constituents of the shade of gray. Accordingly the ships bore spotted coats of red, green, and violet, either one of which colors will predominate as the light changes in the resultant gray transmitted to the eye.

Mr. Robert Cushman Murphy,[1] curator of the department of natural history in the Brooklyn Museum, has pointed out in this connection the interesting living example of low visibility, the whale bird (*Prion*) of the subantarctic Atlantic, whose dominant hue is practically identical with "omega-gray," the color devised by the Navy for low visibility in high latitudes. The invisibility of this bird against the waves is also due to shading and a slight pattern of light and dark bands. A combination of this nature was ultimately found to be most successful for protecting ships. By means of stripes and other "dazzle" figures all vertical and horizontal lines are eliminated so that it is nearly impossible to see the prow or tell in what direction it points. These stripes also destroy the perspective to such an extent that a range finder will miss the range by many meters. In addition to the

[1] "Marine Camouflage," *The Brooklyn Museum Quarterly*, Jan., 1919, p. 38.

Courtesy of Sea Power and the Brooklyn Museum Quarterly

Early attempts at the production of a "dazzle" were not very effective. This photograph of the British transport "Tuscania," taken the day before she was sunk, represents rather the vagaries of vorticists than any systematic method of deception. The practical effectiveness of the later types of camouflage is well established, however, as naval records show definitely the greater "chance of life" of the protectively painted ship

Courtesy of Sea Power and the Brooklyn Museum Quarterly

The "Vaterland," the largest ship afloat, stripped of her dazzling lights, rechristened the "Leviathan," and given a new "dazzle," represents the best in marine camouflage. The "Leviathan" is here shown painted with a low-visibility dazzle, the essential elements of which are (1) the juxtaposition of colors which, when seen at a distance, will combine to form a neutral tint, and (2) the "painting out" of all horizontal and vertical lines which might fit the scale of a range finder. Especially noticeable are the series of dark triangles at the bow. These triangles gave the impression of a series of prows and so completely confused judgment as to the ship's direction that she was almost a menace to her convoy

Courtesy of Sea Power and the Brooklyn Museum Quarterly

A living example of protective marine coloration is found in the whale bird (*Prion*) of the subantarctic Atlantic. The color of this petrel is a neutral blue-gray, not unlike the "horizon blue" of French field uniforms and of substantially the same wave length, saturation, and reflecting power as "omega-gray," the shade used by the Navy for low visibility. It is said that the latest British experiments in airplane camouflage point toward designs and colors similar to those of *Prion*

confusing dazzle, however, the color scheme for the stripes and figures is so selected that the color combinations fuse at a distance into a blue gray of low visibility.

A MODEL of a killer whale, the so-called "wolf of the sea" (*Orca orca*), posed as if making an attack on a sulphur-bottom whale, is now completed and on exhibition in the American Museum. The killer is a small whale of no commercial value but distinguished from other whales by its great strength and ferocity. It preys on warm-blooded sea animals such as seals and sea lions and attacks other whales, biting off the ends of their flukes and flippers and tearing out their tongues. Killers hunt in "packs." When attacking, they bellow in a way that paralyzes their prey with fear. The present model is a life-size reproduction, twenty-two feet long, built with a wooden framework planked diagonally in basswood and covered with wire netting. This surface is filled with a coating of white lead and whiting over which the final paint is laid. A structure of this nature eliminates the great weight which would encumber a plaster cast. Mr. Otto Block, of the American Museum's preparation shops, constructed the model under the supervision of Director F. A. Lucas, from measurements and photographs taken by Mr. Roy C. Andrews, of a specimen captured on the Pacific Coast.

THERE has recently passed out from within the American Museum's walls an organization whose work has now become history. Local Board, Division No. 129, of the city of New York, here since the inauguration of the draft, has quietly proceeded in its work of choosing men for the United States Army. On the occasion of final departure the President of the Museum received a letter of appreciation from Mr. Julius Henry Cohen, chairman of the Board, in the course of which he said: "There appears nowhere a record of this contribution which the American Museum has made to the great service of winning the war, but our Board has an indelible record; it has a very definite memory of the spirit of cordiality and helpfulness displayed by every one connected with the Museum with whom our work brought us in contact."

MR. GEORGE K. CHERRIE, ornithologist and field naturalist, has returned from Venezuela with a large collection of birds for the American Museum. Mr. Cherrie, well known to readers of NATURAL HISTORY and of Colonel Roosevelt's *Through the Brazilian Wilderness*, has had a long and varied experience as a collector in South America, making twenty-eight expeditions into tropical America and visiting every country in the southern continent except Chile. Mr. Cherrie took his latest journey alone, except for an attendant, and lived for weeks at a time on the native diet of corn and goat's milk. His recent collection contains about eight hundred specimens of great variety and scientific interest.

"A MOST interesting modern development," observes the Report of the British Educational Mission, "is the increasingly important part played by the museums, not only in respect of educational visits of school children, popular lectures, etc., but, as at the Natural History Museum of New

York, by means of traveling collections sent out to schools." In this connection it is interesting to report that the Department of Education of the City of New York has made a supplementary appropriation of $4100 to renew the popular lecture courses for children and the distribution of nature collections to the schools, which had been suspended for a time for reasons of war economy.

THERE are only two remaining colonies of gannets on the North American coast, one on Bird Rock near the Magdalen Islands, the other on Bonaventure Island in the Gulf of St. Lawrence. The rookeries of the latter are described in a recent *Ottawa Naturalist*. The seaward face of Bonaventure Island is a vertical cliff rising about three hundred feet from the sea. "Approaching this side from the sea, one is aware that every ledge and shelf is covered with white as though snow had piled in drifts upon them, allowing only the overhangs to show dull red between the glistening surfaces. A wind seems to stir the white masses, and they blow off in eddies and clouds of great white birds that swirl about the cliff faces and circle round the intruder amid a pandemonium of hoarse cries. These are the gannets, the solan geese of older authors, each as large as a goose, pure white with black wing tips. . . ." NATURAL HISTORY will publish in its next issue an article by Director John M. Clarke, of the State Museum at Albany, on the protection of these bird colonies.

THE possibilities in the utilization of peat are illustrated by a large exhibition at the Commercial Museum of Philadelphia. We usually associate peat with poor communities which cannot afford coal and must turn to the swamps for fuel, but in some places in Europe peat commands a higher price than the coal for which it is supposed to be a substitute. In this country we have about 11,188 square miles of peat bog which would produce more than twelve billion tons of fuel. So far this natural resource has been almost unexploited. Numerous other uses of peat are explained in the Philadelphia exhibit, such as the spinning of fibrous peat into yarn and its manufacture into paper; its use for packing; and its value as a preservative because it contains large amounts of humic acid. Ground up peat may also be used as a filler for fertilizer, making possible the use of slaughterhouse waste, and as a filler for stock feed, such as molasses, which could not otherwise be fed to animals. Insulations, sound-proof boards, paving stones, and even alcohol are among its manufactured products.

Two publications[1] in the field of California zoölogy have recently appeared. One is an exhaustive treatment of the game birds of that state, including an account of their life histories, which should appeal to the hunter as well as the naturalist and serve as a basis for intelligent legislation on the matter of bird protection. The other treats of the ground squirrels of California and supplies information of importance to the farming interests with reference to a number of species inimical to the crops.

[1] *The Game Birds of California.* By Joseph Grinnell, Harold C. Bryant, and Tracy I. Storer. Octavo, pp. 642, with 16 color plates by Louis Agassiz Fuertes and Allan Brooks.
The Ground Squirrels of California. By Joseph Grinnell and Joseph Dixon.

SINCE the last issue of NATURAL HISTORY the following persons have been elected members of the American Museum:

Annual Members, MESDAMES THOMAS K. GALE, J. H. LANCASHIRE, MISSES HATTIE W. PERKINS, EUDORA D. SNYDER, CAPT. CLINTON PELHAM DARLINGTON, DOCTORS ANDREW N. AVINOFF, EDWARD S. COWLES, HENRY F. MERRIAM, J. B. PARDOE, W. C. TWISS, MESSRS. C. LUDWIG BAUMANN, FREDERICK S. BLACKALL, CHARLES ANDERSON CASS, ROBERT M. DONALDSON, GEORGE B. GORDON, WILLIAM WEBSTER HALL, WILLIAM F. HEIDE, EDWIN W. INSLEE, FRANÇOIS KLEINBERGER, ERNEST A. NEILSON, M. NEWBORG, HAROLD OTIS, ALBERT F. THALHIMER, SAML. G. TIBBALS, S. W. TRAWICK, and JOSEPH B. WHITNEY.

Associate Members, MRS. ELIZABETH M. MOLINEUX, MISS ROSE DOUGAN, DOCTORS ALBERT H. FREIBERG, W. P. MANTON, WALTER E. NEWCOMB, H. W. OSBORN, MESSRS. FRANK DABNEY, DANIEL HOWLAND, EDWIN F. MACK, EDWARD P. WELLS 2D, WALTER D. WILCOX, ROBERT C. WRIGHT, and GEORGE W. YORK.

The American Museum of Natural History

Its Work, Membership, and Publications

The American Museum of Natural History was founded and incorporated in 1869 for the purpose of establishing a Museum and Library of Natural History; of encouraging and developing the study of Natural Science; of advancing the general knowledge of kindred subjects, and to that end, of furnishing popular instruction.

The Museum building is erected and largely maintained by New York City, funds derived from issues of corporate stock providing for the construction of sections from time to time and also for cases, while an annual appropriation is made for heating, lighting, the repair of the building and its general care and supervision.

The Museum is open free to the public every day in the year; on week days from 9 A.M. to 5 P.M., on Sundays from 1 to 5 P.M.

The Museum not only maintains exhibits in anthropology and natural history, including the famous habitat groups, designed especially to interest and instruct the public, but also its library of 70,000 volumes on natural history, ethnology and travel is used by the public as a reference library.

The educational work of the Museum is carried on also by numerous lectures to children, special series of lectures to the blind, provided for by the Thorne Memorial Fund, and the issue to public schools of collections and lantern slides illustrating various branches of nature study. There are in addition special series of evening lectures for Members in the fall and spring of each year, and on Saturday mornings lectures for the children of Members. Among those who have appeared in these lecture courses are Admiral Peary, Dean Worcester, Sir John Murray, Vilhjálmur Stefánsson, the Prince of Monaco, and Theodore Roosevelt. The following are the statistics for the year 1918:

Attendance in Exhibition Halls	627,302
Attendance at Lectures	64,036
Lantern Slides Sent out for Use in Schools	72,287
School Children Reached by Nature Study Collections	817,610

Membership

For the purchase or collection of specimens and their preparation, for research, publication, and additions to the library, the Museum is dependent on its endowment fund and its friends. The latter contribute either by direct subscriptions or through the fund derived from the dues of Members, and this Membership Fund is of particular importance from the fact that it may be devoted to such purposes as the Trustees may deem most important, including the publication of NATURAL HISTORY. There are now more than four thousand Members of the Museum who are contributing to this work. If you believe that the Museum is doing a useful service to science and to education, the Trustees invite you to lend your support by becoming a Member.

NATURAL HISTORY

THE JOURNAL OF THE AMERICAN MUSEUM

DEVOTED TO NATURAL HISTORY, EXPLORATION, AND THE DEVELOPMENT OF PUBLIC EDUCATION THROUGH THE MUSEUM

APRIL–MAY, 1919

VOLUME XIX, NUMBER 4–5

NATURAL HISTORY

VOLUME XIX

CONTENTS FOR APRIL–MAY

NUMBERS 4–5

M. C. DICKERSON, *Editor*

Published monthly from October to May, by the American Museum of Natural History, New York, N. Y. Subscription price, $2.00 a year.

Subscriptions should be addressed to the Secretary of the American Museum, 77th St. and Central Park West, New York City.

NATURAL HISTORY *is sent to all members of the American Museum as one of the privileges of membership.*

Entered as second-class matter April 3, 1919, at the Post Office at New York, New York, under the Act of August 24, 1912.

Acceptance for mailing at special rate of postage provided for in Section 1103, Act of October 3, 1917, authorized on July 15, 1918.

THE AMERICAN MUSEUM OF NATURAL HISTORY

MEMBERSHIP

For the enrichment of its collections, for scientific research and exploration, and for publications, the American Museum of Natural History is dependent wholly upon membership fees and the generosity of friends. More than 4000 friends are now enrolled who are thus supporting the work of the Museum. The various classes of membership are:

Benefactor		$50,000
Associate Founder		25,000
Associate Benefactor		10,000
Patron		1,000
Fellow		500
Life Member		100
Sustaining Member	annually	25
Annual Member	annually	10
Associate Member (nonresident)	annually	3

Full information regarding membership may be obtained from the Secretary of the Museum, 77th Street and Central Park West.

NATURAL HISTORY: JOURNAL OF THE AMERICAN MUSEUM

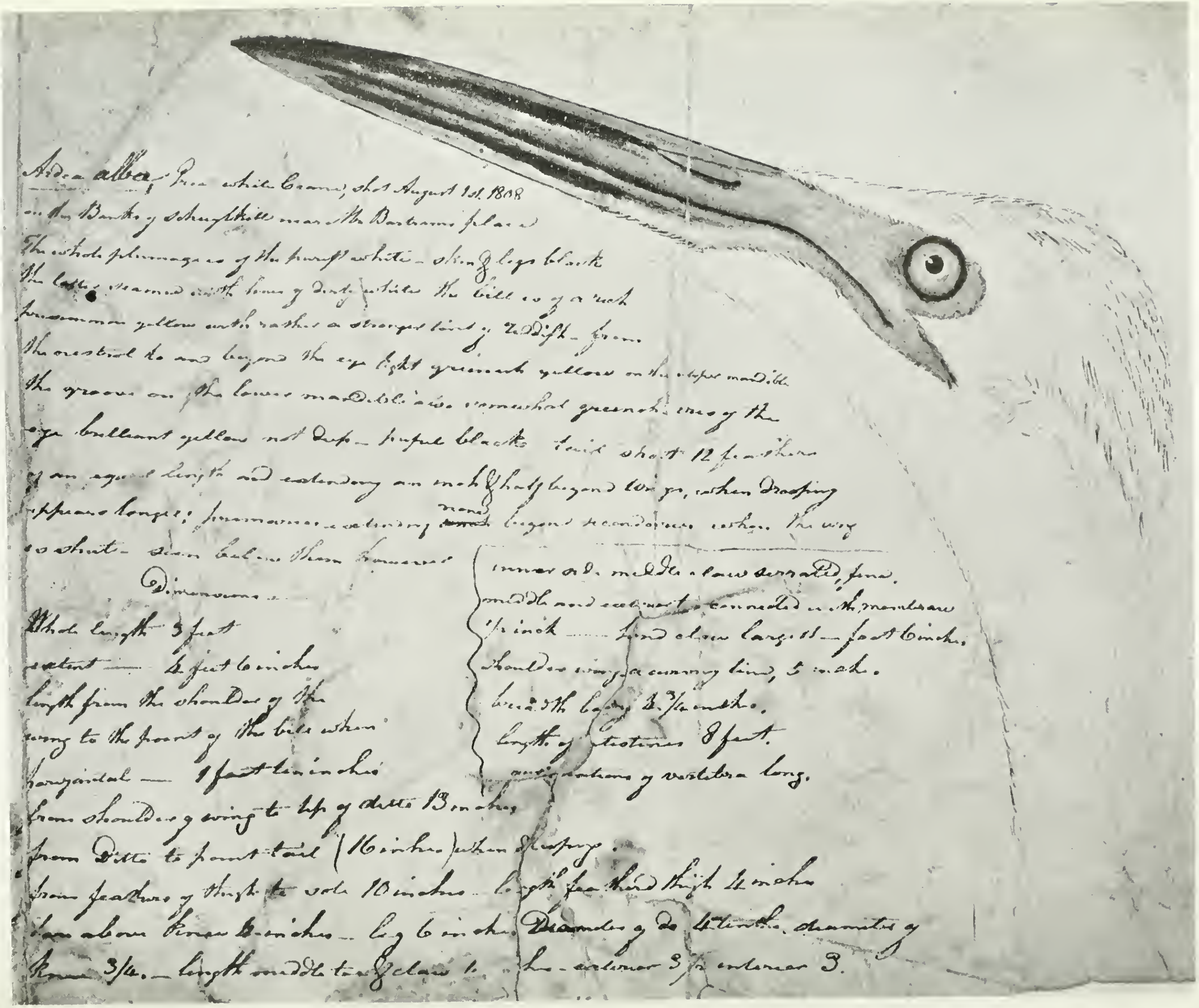
NATURAL HISTORY, recording popularly the latest activities in natural science and exploration, is published monthly from October to May, inclusive, by the American Museum of Natural History. The subscription price is Two Dollars a year. NATURAL HISTORY is sent to all classes of members as one of the privileges of membership. Subscriptions should be addressed to the Secretary of the Museum.

POPULAR PUBLICATIONS

A large number of popular publications on natural history, based on the exploration and research of the Museum, are available in the form of handbooks, guide leaflets, and reprints. A detailed list of these publications will be found in the Appendix to NATURAL HISTORY. Price lists and full information may be obtained by addressing the Librarian of the Museum.

SCIENTIFIC PUBLICATIONS

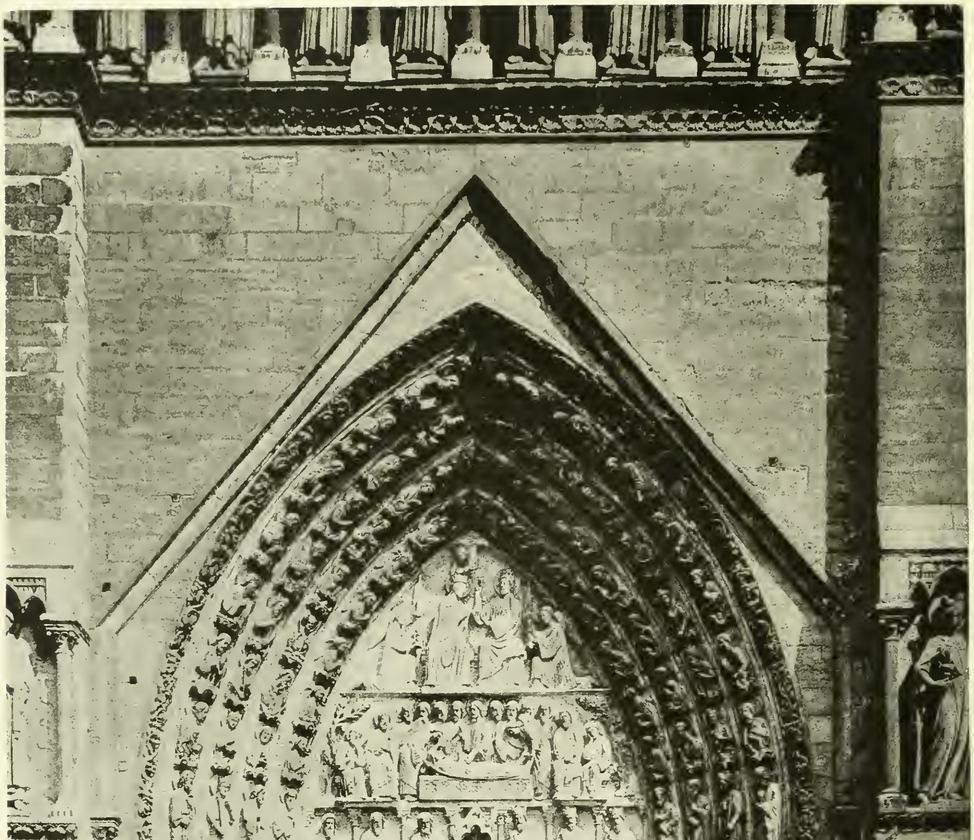
The field and laboratory researches of the American Museum of Natural History and other technical scientific matters of considerable popular interest are represented by a series of scientific publications comprising the *Memoirs, Bulletin*, and *Anthropological Papers*. A condensed list of these publications will be found on the inside back cover of NATURAL HISTORY. Price lists and complete data may be obtained from the Librarian.



DRAWING AND NOTES BY ALEXANDER WILSON

Among the valued possessions of the American Museum is a yellowed paper, bearing this drawing in color of the head of the great white crane, and this description, the work of the pencil and brush of Alexander Wilson in 1808, five years before his death. The document was given by Wilson to George Ord, his friend and the companion of many of his field journeys, and came to the Museum in the effects of Titian Peale (youngest son of Charles Willson Peale, another naturalist friend of Alexander Wilson and George Ord see p. 211, AMER. MUS. JOURNAL, March, 1917). It is a pleasure to give a reproduction of the plate in this issue of NATURAL HISTORY which prints James Lane Allen's story of the life of Wilson (p. 397)

366ª



PORTAL OF NOTRE DAME TO ILLUSTRATE SCULPTURE IN CORRECT RELATION TO ARCHITECTURE

The world rejoices with France that the war did not reach Paris

Every figure in this portal of the Cathedral of Notre Dame, in Paris, expresses with infinite skill the beauties of Gothic architecture—the pose of the heads in the tympanum, the lines of the draperies and the shadows are all designed with reference to the structure. Even the voussoirs of the great arch are expressed by the shadows under the canopies over the saints' heads. The central post is the acme of architectonic sculpture

—From "Zoölogical Sculpture in Relation to Architecture," page 449

NATURAL HISTORY

VOLUME XIX APRIL–MAY, 1919 NUMBER 4–5

New College of Fisheries in the Northwest

DEPARTURE IN TECHNICAL EDUCATION PLACES AMERICAN FISHING INDUSTRIES ON A SCIENTIFIC BASIS

By HUGH M. SMITH

United States Commissioner of Fisheries

THE recent establishment by the University of Washington of a college of fisheries is of such importance as almost to mark an epoch in the history of technical education and in the development of the fishing industry in America.

This event is of great interest to the United States Bureau of Fisheries because the bureau welcomes every agency that extends knowledge of and increases concern for the welfare of the American fisheries and the creatures which make those fisheries possible—and also incidentally because the director of the college is a former valued assistant of the bureau. The founding of the new college is particularly pleasing to the present commissioner because of his long and continued advocacy of technical instruction in fisheries and because it is the outcome of a special recommendation to and conference with the authorities of the University of Washington.

The new college of fisheries provides a four-year course, divided into three sections, namely, commercial fisheries, technology or the methods of preparing aquatic products for foods and for use in the arts and industries, and aquiculture. The instruction will be both didactic and practical, but for the last two years of the course the students will be expected to devote a large part of their time to practical training at fishing establishments and fish hatcheries.

The college has a strikingly fitting environment. Seattle is the principal city of one of the great fishing states, and, as pointed out by the university authorities, is the only American city within whose corporate limits or in territory immediately contiguous may be found in active operation practically every type of plant for turning raw aquatic materials into human food and other useful commodities. Fishery operations are conducted in the very harbor of Seattle; the great fleets of vessels resorting to the Alaska fishing grounds make Seattle their principal headquarters for outfitting and for discharging their catch; the salmon fisheries of the Puget Sound-Fraser River-Strait of Fuca system are the most valuable in the world. Internationally the region is of special fishery interest. The Fraser River, the principal red salmon stream in the world, is in British Columbia, and all the spawning grounds of the red salmon frequenting the international waters are in the Canadian province, while the major part of the annual tribute exacted by man from the salmon schools is taken in Washington. From the fish-cultural standpoint, the operations by nation and state in the waters of Washington are on a scale of almost unequaled mag-

Panoramic view of part of the campus at the University of Washington, showing Meany Hall and (on the opposite page) Science and Denny halls. The University is expanding its present instruction in ichthyology into a technical college of fisheries to train fish-culturists for government and private fishery work

nitude, and every species of Pacific salmon abounds, spawns, and is artificially propagated in the local streams. The wide expanse of waters that may be regarded as the real campus of the fishery school is rich in other life, and ample material is afforded students for work on the anatomy, physiology, embryology, and life history of important creatures whose conservation is a matter of public concern.

A practical point in connection with the college of fisheries is that the graduates in the various courses may expect to find congenial employment in national, state, and private fishery work. The demand for fish-culturists has far exceeded the supply in recent years. The need for young men and women qualified in aquatic zoölogy, in the use of fishing methods and appliances, and in the technology of fishery products and byproducts is very real and is certain to increase. In the fishery department of every state, there should be, as a part of the permanent staff, men with expert knowledge bearing on all the duties and problems that arise in connection with the administration of the local waters and their inhabitants.[1] Some states have already realized and acted on this responsibility: other states may be expected to fall in line as the growth

The Hatchery Building of the newly established College of Fisheries is situated on the government canal connecting lakes Union and Washington. Regular instruction and research in the subject of fisheries begin at the new fall term when two new professorships are to be established to amplify the work of the zoölogy department in this line. Coöperation will also be effected with government agencies and private industries

[1] In this connection, see one phase of necessary expert knowledge in Prof. Baker's article on "Fresh-water Farming," pp. 479–488.—The Editor.

The University of Washington is most favorably situated for the study of fisheries. Seattle lies in the center of the great northwestern fishing industry, and is the headquarters and discharging station of the Alaska fisheries

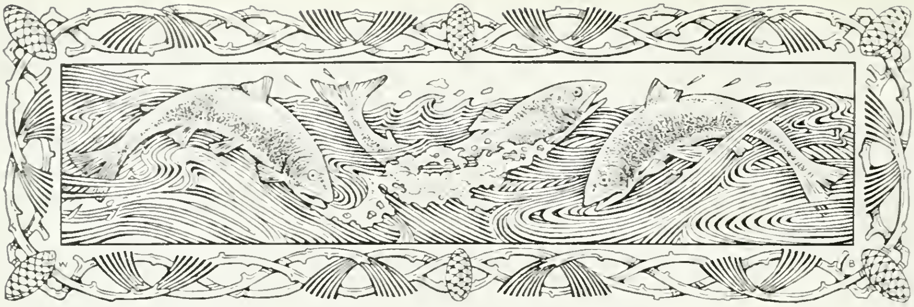
of public sentiment demands it and as qualified assistants become available.

The University of Washington, while entitled to all the prestige and honor that deservedly belong to it as a pioneer, should not indefinitely enjoy a monopoly of a college or school of fisheries. Other universities favorably situated should follow suit: and at the present time there should be serious attention given to the establishment of such institutions on the Atlantic and Gulf coasts, on the Great Lakes, and in the Mississippi Valley.

Colleges of fisheries, through the influence they exert at large and through their graduates, can do much to guide fishery legislation and should become potent agencies for molding the public sentiment that should be back of all beneficent laws for the conservation of aquatic resources and the regulation of the industry. An improvement in the quality of legislative fishery measures should confidently be expected through the working of the leaven of fishery graduates in all parts of the country.

One of the chief boons that colleges of fisheries can hope to confer on fishery work throughout the country will be the substituting of accurate observations and sound biological principles for the unscientific methods that have often characterized fishery procedures.

Fisheries Hall, University of Washington.—The campus extends to the edge of lakes Union and Washington and the scientific work of the university can be closely connected with the practical work in fisheries



The Red Salmon

A FISH WITH AN INSTINCT FOR LAKE WATER

By DAVID STARR JORDAN

THE habits of the red salmon (*Hypsifario nerka* Walbaum) are absolutely unique among fishes. The fish casts its spawn in the fall, but only in small streams tributary to some lake. After hatching, the young fishes slip downward tail foremost, with the current, into the lake. There they mostly remain through the first year, then dropping downward, head always against the current, to the seas.

In the sea they remain until the fourth year, when they start upstream to the spawning grounds. Whether they go to the same grounds or not, no one knows. The idea that they do reach substantially the same streams is borne out by some evidence. Yet that this instinct should be minutely accurate is not conceivable.

After entering the river, the fish feeds no more. The digestive organs shrivel and the fat and cell-substance are gradually consumed. On arriving at the spawning grounds, the fishes, male and female, are battered and exhausted. The jaws are greatly elongated in the male, the front teeth enlarged, and the color changes from clear blue to dark dull-red. On the way upward the fishes pair off. The male scoops a furrow in the sand or gravel. The female fills it with eggs. The sand is smoothed over, after which the fishes drift back into the current and float downward "tail foremost in the old salmon fashion," every one dying in the course of a week or so, none ever reviving or reaching the sea.

A few spawn prematurely at three years: others are belated and spawn at five years, these being of larger size than the others which range from about seven to eight pounds.

The age of the salmon, as Dr. Charles H. Gilbert has demonstrated, can be determined by the study of the scales. The scales are marked by close-set concentric rings of growth. These are widest apart in the summer, when feed is best, and become close together in the winter. By these, the age of the fish can be ascertained, in a fashion analogous to finding the age of a tree by its rings of growth.

The most remarkable fact is that the red salmon never enter a stream which has no lake. So far as their range goes, northern Japan to Bering Strait and south to Oregon, there is not a stream with a lake which they do not enter. And the time of starting to run in the spring bears some relation to the distance they have to go. In the Yukon, the first lake, Labarge, is about fifteen hundred miles above tidewater. Yet red salmon reach the head of Lake Labarge. Another notable salmon stream is at Boca de Quadra in southern Alaska, not a mile long, less than ten feet wide, and shallow at that. It heads in a beautiful lake with fine spawning grounds, and the stream is crowded with red salmon.

The red salmon (locally called "blueback") runs in moderate numbers in the Columbia, a *river* with few lakes. At one place, above Umatilla, there is a bridge across the forks of a tributary, one branch heading in a lake, the other without a lake. From this bridge, Dr. Gilbert has watched the two species of salmon as they run. The bluebacks all turn toward the lake, while the Chinook salmon (*Oncorhynchus tschawytscha*) move apparently indiscriminately either way.

No one has ever seen a red salmon in any lakeless river. Mr. J. P. Babcock, Fish Commissioner of British Columbia, tells of an experiment of piping water from the outlet of a lake into the sea. The red salmon gathered around the mouth of the pipe, as though recognizing the peculiar kind of water, though they naturally could not ascend the pipe.

It is probable indeed that the salmon has some sort of instinct by which it recognizes lake water in whatever form. It makes no difference whether it is ice-cold and milk-white from the foot of a glacier as in Chilkoot River, or clear spring water as in the Boca de Quadra or at Yes Bay.

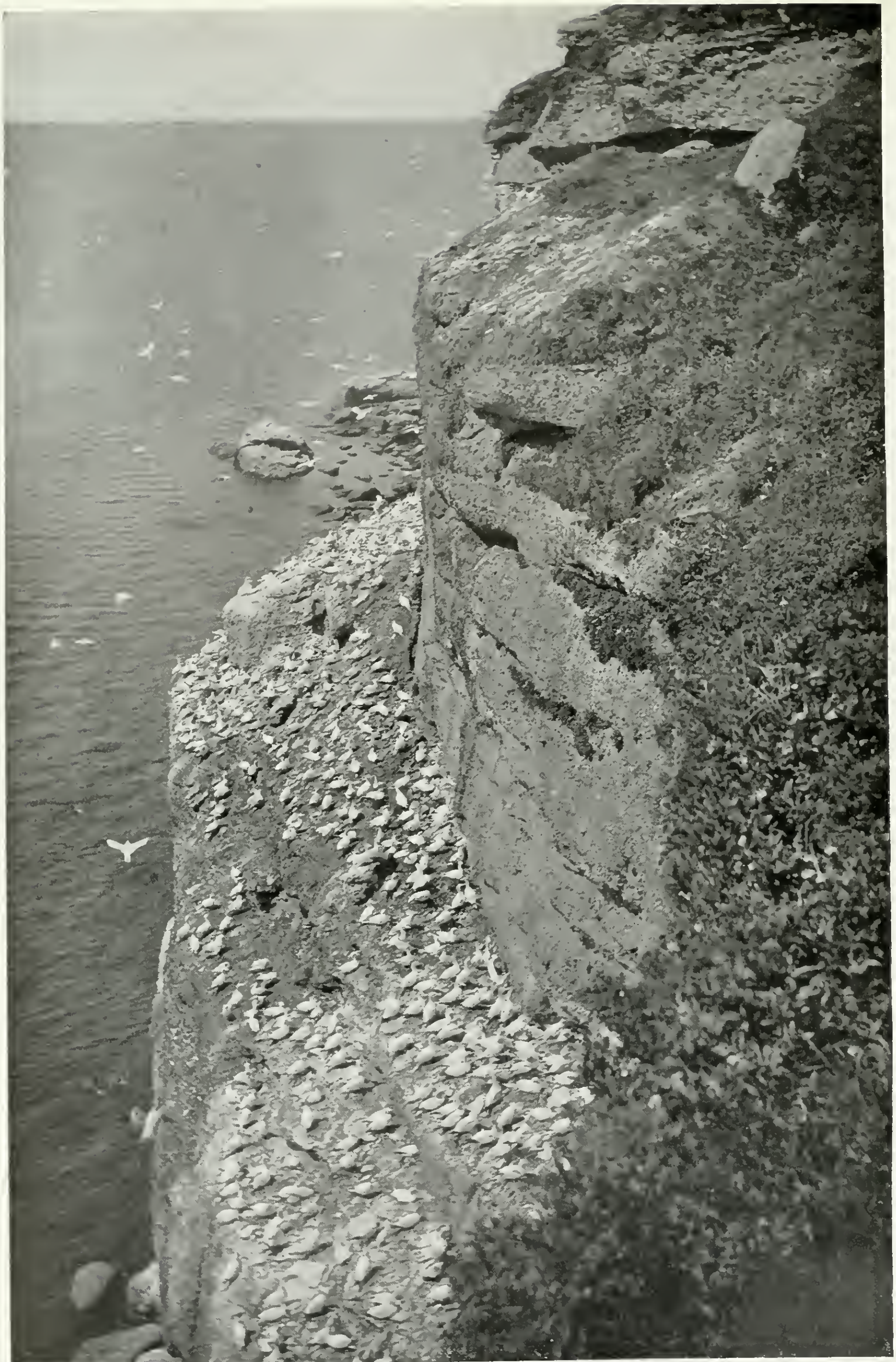
A certain number of red salmon never leave the lake. These mature at a weight of a pound or two and at first were naturally taken to be a distinct species (*Hypsifario kennerlyi*). Such dwarf lake-locked salmon are found in almost every deep lake from Idaho around to northern Japan.

By some unexplained freak, the run in Puget Sound and Fraser River is every fourth year about double the ordinary run. The cause of this goes far back into the history of the species and is unexplained.

In Puget Sound, the humpbacked salmon (*Oncorhynchus gorbuscha*), which lives but two years, runs in enormous numbers on alternate years, being almost wanting in the odd year. Neither species shows this trait of alternation in any waters other than Puget Sound.

The red salmon is known by various local names as "Krasnaya Ryba" (redfish), "nerka" in Alaska and Kamchatka (although none of us has ever heard it so called), "sockeye" (Sukkegh) in British Columbia, and "blueback" in Oregon. Its flesh is not so pleasant to the taste as that of the much larger Chinooks, but it is redder in color and therefore sells better.

The red salmon is the most valuable single species of fish in the world, as it occurs in uncounted numbers especially in the streams about Bristol Bay, the Karluk River of Kadiak Island, and in the Fraser River of British Columbia.



Photograph by A. J. Cramp

THE SHEER CLIFFS OF BONAVENTURE

The cliffs of Bonaventure are exceedingly difficult of access and many of these photographs have been made only at great risk. This is one of the broader gannet ledges. Happily, the races of sea birds that frequent this remarkable breeding place have now come under government protection in Canada by the law just passed establishing Percé, Bonaventure Island, and the Bird Rocks as bird sanctuaries. Thus are saved to the world certain species of water fowl which were rapidly becoming extinct

The New Gaspé Bird Sanctuaries

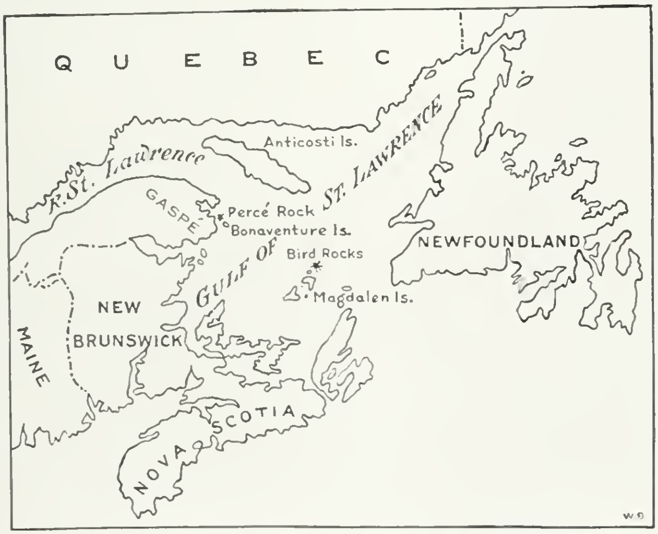
By JOHN M. CLARKE

State Geologist and Palæontologist, and Director of the State Museum, Albany

FOR nearly four hundred years the navigators of the Gulf of St. Lawrence have wondered at the immense colony of sea fowl which nest upon the ledges of the Isles-aux-Margaulx—the "Bird Rocks," as they are known to modern English geography. These remote bits of bare rock lie about ten miles to the north of the Magdalen Island group, and as they are constituted of the same rocks, they must be assigned to the same little archipelago.

The Bird Rocks are three in number now. In the early days the two little fragments now called the "Little Birds" were one, but the sea has broken them apart. The "Great" or "Northern Bird" is a flat rock table, not so large as some ice floes, with sheer vertical walls on all sides, rising one hundred and fifty feet from the water to the base of the lighthouse which constitutes it the lone outpost of civilization. Ever since the days when Audubon visited this spot on his voyage to the Labrador, the islet has been the object of much visiting, collecting, and writing by students of birds. It is probable that a century ago the bird colony here was the largest on the Atlantic Coast, but this is no longer true, for, while the inroads of the eggers which so depleted this colony and brought to extinction many of the bird colonies on the Labrador have ceased, other damage has been done; partly because the presence of the lighthouse with its noisy accessories for warning vessels of their proximity to the rock has helped to diminish the census of the bird population; partly from the invasions by the Magdalen Island fishing fleet: and the greedy "bird lover" who collects birds' eggs "for exchange" is not without blame in this matter.

The Great Bird Rock, in spite of its isolation and remoteness, is an island gem of much beauty: its level grassy top covers about seven acres of ground, and aligned on all the ledges which make up its gray steplike bastions are the ranks of gannets, the most beautiful of all waterfowl; of murres and kittiwakes; of guillemots, razor-billed auks and puffins; a short list of species



The Gaspé Bird Sanctuaries.—Percé Rock and Bonaventure Island, off the Gaspé Peninsula, and farther out in the Gulf the Bird Rocks of the Magdalen Island group, have been for centuries the breeding places of several species of birds which rarely or never nest on the mainland. These rocky islets, because of their isolation, are ideal resorts for sea fowl

The beautiful village of Percé at the point of the Gaspé Peninsula faces squarely the waters of the Gulf of St. Lawrence. It is one of the oldest settlements in eastern North America, having been established as a fishing station before the year 1600. Percé Rock, which lies off the point of Mt. Joli, often figures in the relations of the early navigators and missioners. Bonaventure Island, in the background, is also an ancient station and had a church as early as 1671

Photograph by A. J. Cramp

Bonaventure Island is in itself an object of great natural beauty and during the tourist season is visited daily. A climb to the summit from the wharf on the low western shore affords an effective distant view of the gannet ledges, while the boat trip around it gives a close view of its feathered community, considered one of the wonders of the Atlantic Coast

Photograph by A. J. Cramp

The verdure-capped summit of Percé Rock is the home of a colony made up of herring gulls and crested cormorants. This assemblage has been here since the beginnings of human history on the coast, and the upper surface of the rock has never, so far as records show, been the breeding place of any other species. This picturesque and beautifully colored mass of vertical Devonian limestone is here viewed from the summit of Mt. Joli on the mainland. It is approximately 300 feet high, 1200 feet long, and 80 feet wide. Toward the sea end the rock is pierced by an archway which frames the waters of the Gulf beyond

Photograph by F. M. Chapman

Great Bird Rock is the only known rookery of the gannets outside of Bonaventure Island, on this side of the Atlantic It has no human population except the lighthouse keeper and his assistants. When the Bird Islands were discovered by Jacques Cartier in 1534, the "Isles aux Margaulx" as he named them, housed an enormous colony of water fowl. When Audubon visited the place, however, in 1833, he found that the attacks of eggers here and elsewhere, particularly on the Labrador coast, were resulting in the sale in the Boston and New York markets of hundreds of thousands of dozens of eggs annually. These attacks have undoubtedly been the cause of the extinction of the gannet roosts on the islands and coasts of Labrador but an association of most ancient date.

The romance and tragedy of the bird life of this colony have been depicted both by camera and pen. Few more effective pictures of birds have been made than the photographs taken here by Herbert K. Job and Frank M. Chapman who risked limb and life in the acrobatic performances necessary to catch their effective views. And these were pictures taken when such photography was a new and perilous adventure without the help of telephoto lenses or long distance electric connection. It was here that Louis A. Fuertes went for subjects for his paintings of the "Birds of New York," and these ledges furnished the setting for the Bird Rock Group in the American Museum of Natural History.

Photograph by L. D. Bostock

Fledgling gannets on the Bonaventnre Island ledges.—The yonng when hatched are naked and helpless. A white down soon appears; at a year old the plumage is a smoky brown with white V-shaped spots, which finally gives way to the pure white of the adult

A still larger colony of these waterfowl is that on the cliffs which bound the eastern face of Bonaventure Island, lying two miles out in the gulf from the point of Percé, the easternmost projection of the Gaspé coast. Bonaventure Island is nearly circular and about a mile and a half across. It is another insulated remnant of tableland, like the top of a round center table tipped down to low shores at the west but with high and vertical edges rising four hundred feet at the east. It is on these steepest, most elevated, and most inaccessible ledges of the island that the greatest of all the bird colonies left in the gulf makes its breeding home. Until late years these birds have never been subject to the assaults which have so gravely impaired the census of the Bird Rock colony.

Bonaventure is a continental island and strictly within the control of the mainland, so that the eggers of the Gloucester fleet who in the old days made their regular inroads upon the colonies farther out in the gulf and carried back to the Boston market hundreds of thousands of dozens of eggs every spring, were not sufficiently venturesome to invade these mainland limits. On Bonaventure the damage done has been partly through the egging carried on by the local fishermen, but of late years, as the beautiful Percé country becomes annually a more favorite resort for tourists, there have been increasing and ruthless attacks upon the nesting birds by the "fool with a gun," who has slaughtered for the sake of slaughtering and shown his sporting blood by enfilading from a distance squads of harmless waterfowl nesting upon their young.

The bird colony at Bonaventure

Island is of quite the same composition as that of the Great Bird Rock, and it is perhaps nothing more than an interesting coincidence that these two great colonies, constituted of the same aggregation of bird species, have chosen to bring forth their young upon the same kind of conglomerate and sandstone rocks of the same gray and red color, all of the same geological age and formation and having the same horizontal position. Mr. P. A. Taverner, of the Geological Survey of Canada, has estimated, from a series of photographs, that the population of the gannets alone in the Bonaventure colony is between 7000 and 8000, a very much larger number than that assigned to the gannets of the Bird Rock colony.

The third of these notable Gaspé bird colonies is that on the top of the Percé Rock. This celebrated and dramatic rock island lies close upon the coast line of Percé village and is in itself the most extraordinary scenic feature on all the Atlantic Coast—a mass of vertical limestone tinted with red, yellow, and purple, with undulating verdure-capped summit, and it is the wavy top that is the abode of a colony composed of two species of birds,—the herring gull and the crested cormorant. Ever since the days in the late years of the sixteenth century, when the fishermen from Brittany and the Bay of Biscay

Photograph by F. M. Chapman
Courtesy of D. Appleton and Company

The nesting mother gannet (*Sula bassana*) on the conglomerate ledges of the Great Bird Rock, overlooking the Gulf of St. Lawrence. This bird, often called the solan goose and taking its Latin name from its best known home on the Bass Rock near Edinburgh, is the largest and most beautiful of our salt-water fowl. The body of the adult bird is almost entirely white, the wing tips being black, the neck and head washed with buff, and the bill bluish gray

A group of razor-billed auks on the ledges of the Great Bird Rock of the Magdalen Islands.—This bird is the nearest relative of the extinct great auk which at one time also inhabited Great Bird Rock

The coming of the gulls and their departure mean to the people the promise and the farewell of the summer.

All of these territories are in the Province of Quebec and the County of Gaspé. On the seventeenth of last March a bill which had been introduced in the Quebec Parliament for the purpose of establishing these colonies as protected bird sanctuaries became a law. In many respects the law is a very extraordinary enactment, for it is frankly based upon recognition of the "rapid and alarming decrease in the number" of these birds by which there has resulted a "threatened extinction"; and because these are "almost the last resorts of certain vanishing species . . . interesting to all lovers of nature and science and valuable as scavengers," the law has been framed and passed with sentiment paramount and human economy taking a secondary place.

The birds are protected to prevent them from vanishing, because they are interesting and wondrous creations of great beauty, and incidentally because they are valuable as scavengers. Perhaps in the entire history of bird legislation in the western continent no other regulative measure, so essentially based upon the higher sentiment of the community, has been enacted, and for

began their operations at this celebrated fishing port, the cries of the sea birds have been the familiar accompaniment of the life of the coast and the gulls of Percé Rock an historic part of the living scenery of the coast. No one kills a herring gull except a hungry fisherman whose palate does not yet resent the fishy flavor of the fluffy young bird stumbling about the beaches. The Percé Rock is unscalable and thus the birds have had a fair natural protection, but their greatest protection has, I think, lain in the fact that here close upon the shore they have always been kindly regarded by the people of the place as their natural neighbors and helpful scavengers for dirty beaches.

Photograph by P. A. Taverner

GANNET COLONIES OF BONAVENTURE

The great gannet colony of Bonaventure Island is separated into two companies. The observer approaching the island from the north first comes upon the lesser colony; then a hiatus follows of barren rock cliff before the second and larger colony begins. It seems possible that this uninhabited interval owes its existence to a great rock fall in the remote past, which blotted out for its bird inhabitants all memory of their former nesting places

Photograph by F. M. Chapman
Courtesy of D. Appleton and Company

Gannets, murres, and puffins on the horizontal rock ledges of the Great Bird Rock, Magdalen Islands. In view of the years of persecution to which these birds have been subjected, they are still remarkably tame

this reason the law stands tremendously to the credit of the parliament and the people of Quebec. It is a stringent law; it takes under its cover all the migratory game birds and migratory insectivorous birds as well as the migratory nongame birds, in pursuance of the migratory bird law, this being an important but actually an incidental part of the legislation.

To the sanctuaries thus created we have been referring: the Bird Rocks and a one-mile zone surrounding them; a strip of land on the north and east sides of Bonaventure Island, ten feet in depth along the cliffs with the face of the cliffs itself, this provision protecting all of the nesting places with but slight encroachment upon the woodlands there under private ownership; and the Percé Rock with a one-mile zone about it. Severe penalties are imposed for offenses against this law.

After the perfection of this enactment, an order was issued by the Governor General in Council (March 29) to the same effect so far as the Bird Sanctuaries are concerned, thus giving to the reservations a national recognition.

The history of the movement which has led up to this result is not without its interest. About six years ago the anglers of the Gaspé district made joint allegation to the Ottawa government, regarding the depredations by the crested cormorant upon the salmon and trout pools. The indicted bird was accused of being the greatest enemy of the young of the fresh-water game fishes, and as the cormorant colony on the summit of Percé Rock is the only large nesting ledge of its kind on the coast, the game inspector, the late Commander William Wakeham, was officially ordered to destroy these birds. He made arrangements to carry out this order by having the Percé Rock scaled, the young birds killed, and the nests destroyed, although it is within my personal knowledge that he did this with utmost reluctance. It seemed then a proper time in which to enter a demurrer so far as could properly be done until the indictment against the cormorant could be tried out.

Ornithologists were not at all disposed to unanimity in regard to the natural food of the crested cormorant, nor were they willing to grant that the indicted bird was guilty of the crimes laid at its door. In order to determine this matter and in view of a more official protest against the procedure referred to, the Ottawa order was rescinded until such time as the ornithologists of the Natural History Survey of Canada could enter upon and conclude an investigation of the habits of the cormorant. Mr. P. A. Taverner, with his assistants, was detailed to make a special study of this problem on the ground, and as a result of the inspection of the ingested food of these birds, he rendered judgment that the cormorant was not guilty. Mr. Taverner's examinations, however, extended much further than to a solution of this problem; he gave close attention to the other birds of the Percé colonies, and he, too, perceived and emphasized the adverse conditions under which the birds were maintaining their existence.

The long campaign which has at last come to so fine fruition had for its effective conclusion the initiative of the Honorable Honoré Mercier, the Minister of Colonization, Mines and Fisheries for the Province of Quebec, and the provisions of the law were drawn by Mr. E. T. D. Chambers, of Quebec, whose sympathy in this undertaking was of prime moment.

I think it safe to say that the crested cormorant is the sacred bird which has saved the day for these St. Lawrence nesting places and, like many another martyr in a good cause, is itself alone left outside the pale of the protecting aegis. A black bird seems to have plenty of trouble under any of the protective laws.

The Province of Quebec now has a great bird reserve of the most attractive sort. The Percé Rock and the Bonaventure Island cliffs are of themselves objects of great natural beauty. The Percé Rock is ever startlingly under the eye. Bonaventure Island lies in the offing like a great green whale revealing nothing of its bird wonders to the man ashore. The boat trip around it beneath its sheer rock walls is the lifting of the veil to its most impressive feathered community. To the Bird Rocks of the Magdalens it is about 124 miles, into the heart of the gulf, a pleasant two-days' journey by boat from Percé with agreeable weather. Such a trip is not possible under present arrangement but it may be within the power of the Province which has gone thus far so well, to arrange such voyages over its great Marine Park.

Photograph by F. M. Chapman
Courtesy of D. Appleton and Company

"Bird Rock" is about seven acres in area, with grassy top and weathered, precipitous sides. The lighthouse keeper and the birds together keep watch here at the entrance to the Gulf of St. Lawrence

MAN-O'-WAR BIRDS OF LAYSAN

The frigate or man-o'-war bird (*Frigata aquila*) has a bright red gular pouch, an inflated air sac only indirectly connected with the lungs, so that it can be filled or emptied but slowly. When the bird is on the wing the red pouch bobs from side to side, giving a most bizarre appearance. These birds are adroit fliers. It is while on the wing that they gather twigs for the nest, catch surface-swimming fish, and even drink water, catching it up as they dart downward in long parabolic curves. The frigate birds are numerous on Laysan, and maintain a piratical warfare on their neighbors, the blue-faced boobies, who are skillful and industrious fishermen. The boobies are set upon when coming in from the sea laden with flying fish, and are rudely overturned in mid-air, a procedure which invariably causes them to drop the fish—which the man-o'-war birds scoop up as they fall. Afterward, the members of the expedition turned the tables and collected good specimens of flying fish for scientific study from the man-o'-war birds by rapping them lightly on the head with a cane, thus causing the birds to disgorge the fish.

Laysan is the largest of the chain of islets running to the northwest of the main Hawaiian group, set aside by President Roosevelt in 1909 as a bird reservation. The islands are formed by the summits of a great submarine volcanic mountain range. Like most of these islands Laysan is probably an old atoll with a surrounding reef and central lagoon. Nowhere does it rise more than fifty feet above sea level. Tall, bushy grass and shrubs cover its inner slopes, supported by a soil formed through the disintegration of coral and phosphate rock. At one time it was reported that there were several palm trees on the island but our expedition found only dead stumps of palm trees

Laysan's fringing reef over which the long Pacific rollers break.—The reef is open only on the western shore, where landing can be easily effected in favorable weather

Notes on Our Hawaiian Reservation[1]

By ALFRED M. BAILEY

Curator of Mammals and Birds, Louisiana State Museum

OUT in the mid-Pacific, extending from the main Hawaiian group in a northwesterly direction for fifteen hundred miles, are a series of small islands famed the world over for their vast number of long-winged sea birds. These islands are reached by boat from Honolulu and as one proceeds on the way to the famous bird paradises and sails past the green slopes of Kauai and Maui without seeing a feathered creature except possibly a man-o'-war bird dark against the sky, one wonders why these other favorable places in the beautiful Hawaiians are not occupied by a greater bird population.

We left Honolulu December 16, steaming close to verdure-covered Kauai as we circled off toward Bird Island. This we reached the morning of the second day out. It is a precipitous little mountain, a mass of rock towering sheer for nine hundred feet, one portion crumbling to the water's edge, and the gentle interior slope like the bowl of a timeworn volcano. Thousands of birds, flashes of white against the dark blue of the Pacific and dark against the light of the sky, drifted out to meet the on-coming boat. A few albatrosses were seen skimming the waves, and wide-stretching man-o'-war birds drifted lazily above the mast tops, circling rings about the boat with no apparent wing movement. We found that landing on Bird Island was impossible, owing to the tremendous surf

[1] The Hawaiian Islands Reservation was established in 1909 by Executive Order as a sanctuary for the millions of sea birds and waders which return there annually to raise their young or to rest while migrating.

An earlier article by Mr. Bailey, describing the discovery on Pearl and Hermes reefs of the main rookery of the rare monk seal, was published in the May, 1918, AMERICAN MUSEUM JOURNAL.

Illustrations from Photographs by the Author

The Hawaiian terns (*Micranous hawaiiensis*) are confiding birds and dart about the head of the visitor to their island in a fearless manner. They nest in large colonies among the matted bushes, making long excursions offshore for the fish on which they almost entirely subsist. These terns do not dive for their prey but snap up, with a quick jerk of the head, the minnows that come near the surface

Sharks glide stealthily from one cut to another in the outer coral reef, seeking such finny residents as they may devour. As we rowed in to the island, they nipped at our oar blades, noseing curiously the strange disturber of their unfrequented waters

During the winter months Laysan suffers from violent storms. The waves pile across the reefs with thunderous roars, rushing in and breaking over the south sea wall in clouds of spray, often sixty feet high. The greens and dark blues of the deep water meet sharply the light blue of the water over the reefs, and these, together with the prismatic colors of the spray, contrast with the dark and forbidding shadows of the broken bowlders of the reef

The sea wall is cut up with innumerable potholes in which live queer goby fish which leap from one hole to another to make their escape from pursuing enemies. Spined sea urchins line the most exposed places where they receive the full force of the breaking waves. The reefs have, however, other stories to tell for on them may be found many a bolt and hasp from wrecked ships, reminders of tragedies of days long past which crashed against the bowlder-strewn wall, so we turned westward.

At sun-up next morning we sighted Necker Island, a distant, ghostly mass showing vaguely against the sky line. This wall of igneous rock, picturesque and forbidding with its red veins showing against the dark, is a little more than half a mile in length and three hundred feet in height. The walls are precipitous and only in the calmest weather is it possible to land a boat among the broken pinnacles. We pulled close to the island in a skiff, with sailors and a lieutenant to man the boat, but, although we rounded the northernmost point searching for a landing, the crashing waves kept us from a near approach. Sharks nipped at the oar blades and as we entered the deep shadow of the high wall, a great skate rose off our bow—an indistinct mass of glowing phosphorescence, and then sank slowly from view.

It is majestic in the lee of that island. Thousands of birds shriek above one's head, and the sight and sound of the waves, with their high-thrown spray, are bewildering. One of our party landed by swimming—a hazardous feat—and obtained a footing on the slippery rocks only after he had three times disappeared under water, sucked down by the undertow. This rocky islet, far from the main Hawaiian group, is noted for the old stone monuments built upon its crest. Numerous little idols have been found and it is supposed that the ancient Hawaiians used Necker as a place of worship—a long voyage for their small outrigger canoes, with no compass to guide them!

Pearl and Hermes reefs with the rare warm-water seal, Midway Island, the farthermost of the chain, and Lisiansky were visited, all of interest for their wealth of birds. But it was on Laysan that we spent three months, studying the conditions of this Pacific reservation.

Laysan is apart from the world. It is 850 miles from Honolulu, and so far off the general line of boat travel that during our entire stay we saw not even the smoke of a distant vessel. The island is oval in shape, two miles in length by one in width, a dazzling strip of sand lost in the sparkling Pacific—just a dot of white upon the broad expanse. It is supposed to be a raised atoll, and the interior area slopes gently to a little salt lagoon, bordered with a thick carpet of *Portulaca*.

This island is the largest of the Leeward reservation and the best known to bird lovers the world over. Here on this little place are found five species of indigenous birds, one the Laysan teal so restricted in numbers that only seven individuals existed at the time of our visit; a wingless rail skulks among the grasses, the red honey-eaters, quiet-colored miller birds, and joyous-voiced finches dart among the *Chenopodium*. But to the casual observer the vast throngs of sea birds that crowd this sanctuary make it a delight. A great colony of Laysan albatrosses occupies the flat surrounding the lagoon, where they assemble each year to raise their young. A great flock of these large white birds of immaculate plumage resembles the whitest of cotton fields, and hundreds of these darting albatrosses in the sunlight give a picture beyond the power of camera or artist to portray. On the exposed beaches, where the winds sweep viciously, are reared the young of the black-footed albatrosses. These old pirates have a rugged disposition and are inclined to make a stand for their rights, fighting off intruders with beak and wing.

Five species of agile terns make Laysan their nesting ground, and when large numbers of graybacks and sooties are assembled, it is necessary for a man to shout if he cares to be heard above the calls of the birds. The large noddy and its smaller brother, the Hawaiian tern, choose the matted bushes as nesting sites, and often ten nests may be

THE LITTLE WHITE TERN OF THE PACIFIC

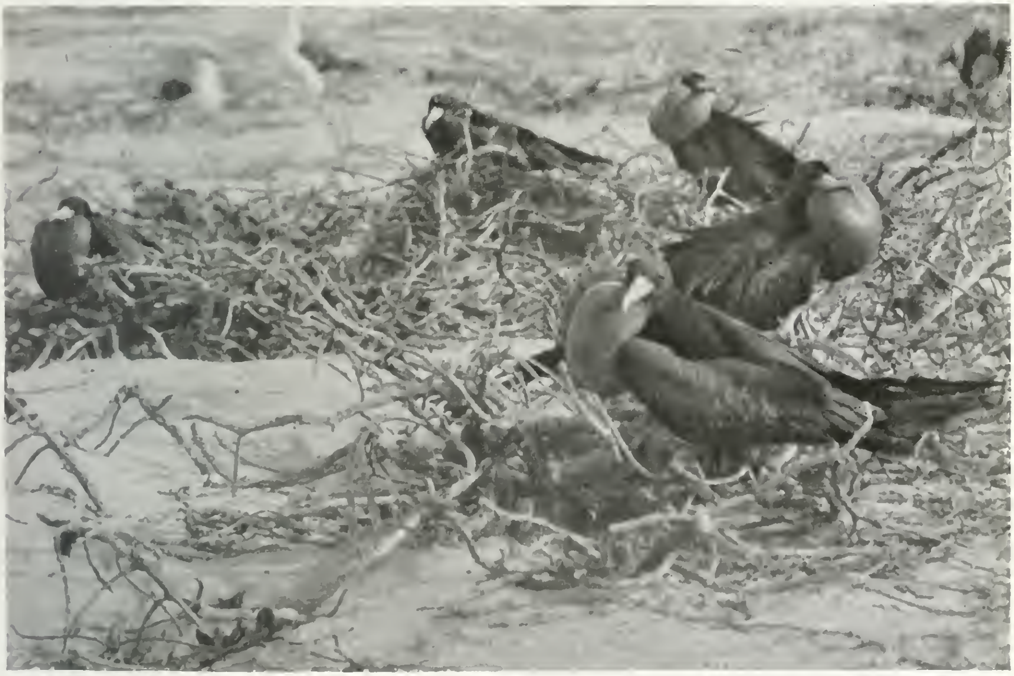
The little white tern (*Gygis alba kittlitzi*), or the "love bird" of the Pacific, is not common on Laysan, for it has been mercilessly slaughtered by poachers. Only three pairs of the terns were nesting on Laysan at the time of our arrival and one little brown chick hatched out the first day. Two months later he was flying about in company with his parents. This species lays only one egg, usually on an exposed rock with no nest whatever, but occasionally the egg may be found balanced precariously on a bare branch. Whenever an intruder wanders near the brooding birds they flutter about examining him curiously. As the birds hover overhead their dark eyes seem all out of proportion in size, and their rather harsh monotonous voice inappropriate for such delicate creatures. The young cling tenaciously to the nest, and the parent feeds them with small silvery fishes which she carries crosswise in her beak, two or more at a time.

The safety of this species seems assured, notwithstanding the persecution on Laysan, for the birds are found by thousands on Necker, French Frigate Rock, and Bird Island, where they nest among the inaccessible cliffs.

Successful experiments have been conducted on sandy wastes in the Pacific in the transplantation of a species of salt grass from California. The time has now come to reclaim the slopes of Laysan Island because of the ravages of a rapidly multiplying rabbit horde. The rabbits, which were introduced about 1903, are destroying the vegetation and will turn the already inhospitable island into a desert unless they can soon be reduced. It will be difficult, however, to exterminate the pests owing to the presence of thousands of petrel and shearwater burrows which afford safe hiding

found to the square yard. But the little white tern, the "Love Bird of the Pacific," is the most beautiful of all, white of plumage with an indescribable flush given by the salmon color which veins the tail and wing feathers, and with deep-set black eyes and glossy beak. As they poise a few feet overhead, white against the light sky, they are the most interesting studies in light and shade imaginable. They lay a single egg on an exposed rock, although I saw one egg deposited on the limb of a bush in a depression scarcely larger around than

The man-o'-war bird rises from the nest awkwardly, sprawling over the bushes, but once on the wing he is a powerful flier, soaring to great heights in an almost total calm. The immature birds (recognized in the photograph by the white feathers of the head) are playful and dart at the visitor with open mouth, but although very formidable-looking they can inflict no injury



On Laysan the man-o'-war birds build their nests among the bushes, using a miscellaneous heap of sticks and vines. They build several weeks before the time to lay the eggs, and spend the intervening days holding down their claims, for such is the competition in the matter of space and nesting materials that if they leave the nest unguarded it is soon appropriated, as a whole or piecemeal, by neighbors. (See appearance of the inflated gular pouch when the bird is in flight, page 382)

the egg itself. The tiny brown chicks are protectively colored and cling tenaciously to the rocks.

Petrels and shearwaters crowd the island, nesting in deep burrows dug in the loose coral sand. The white-breasted petrel is a dove-like bird which seems literally to swarm over the island in the evening. The air was so filled with flying birds that we always had to protect our faces when near their nesting colonies, and they were continually coming into the house at night, attracted by the light. ChristmasIsland shearwaters nest under the bushes, while the quarrelsome wedge-tails go far underground. Great colonies of the long-winged man-o'-war birds nest on the heights of the southern end of the island. Flocks of these birds will sail forhours; higher and higher they go, as we watch, until they gradually disappear from view. The solemn-looking blue-faced booby and the smaller, more graceful red-footed booby nest in near proximity to these man-o'-war birds and make a welcome addition to the old frigate's domain. It is common to see one of these beautiful white birds go squawking through the air, closely pursued by several old man-o'-war birds. If the booby is heavily laden with fish, he is soon overtaken, and if he does not disgorge gracefully, the man-o'-war usually grabs him by the tail and turns him completely over, thus persuading him. His resource is to alight as quickly as possible, for his long-winged enemy is helpless on the ground.

The black-footed albatross (*Diomedea nigripes*) is especially a bird of grace and power, a wanderer on the high seas for most of the year, but in season a careful attendant upon domestic duties. In the presence of a human visitor the parent takes great pride in her offspring, but stands ready to resent any undue familiarity. With the offspring of her neighbors, however, the parent albatross shows impatience, and not infrequently trounces all undefended nestlings in the vicinity. The young birds when approached by the visitor become excited, snap their bills, and may even attempt to charge

Laysan, on our visit, was still a bird paradise, and this in spite of the fact that a few years previous it had been raided by poachers who killed, it is estimated, at least 180,000 birds. We judged that during our stay there were present about 50,000 albatrosses, 50,000 pairs of petrels, half as many terns, and a few odd thousands of other species. There were not many more birds on Laysan at that time than the poachers had killed. At the Waikiki dumping grounds in Honolulu we destroyed eleven wagonloads of the feathers and wings which had been collected by the poachers, besides a whole shedful left on Laysan when the revenue cutter "Thetis" took off the poachers with their plunder. I will not go into detail about the barbarous methods used in the slaughter, cutting off the wings and allowing the birds to die of hemorrhage, and other equally savage practices.

When we were on the island, even though the birds had been so terribly persecuted such a short time before, they were responding to the renewed favorable conditions; and now they will soon replenish their devastated colonies if adequate precaution is taken to prevent another raid. Before the war the island was protected by the revenue cutter which made several trips a year into those waters, which proved often enough to prevent a well-established raid. The poachers were on Laysan at the time the island was made into a reservation, and their plundering was well along before the officers had the authority to interrupt the ravages. Because of late the war has interfered with our work of protection, advantage may be taken of our unpreparedness, and another raid, more serious than the first, is perhaps to be feared.

But Laysan's worst enemy is within her own borders, and if relief is not offered soon, the island will become a waste of drifting sand. Rabbits were introduced a good many years ago and have increased to such an extent that they now overrun the island. The vegetation is being depleted so rapidly by them that there is danger the little indigenous birds will perish. The bushes, which once offered favorable nesting sites, are girdled, the bunch grass undermined and destroyed. Even the trailing vines are disappearing, and the loose coral sand, no longer anchored by a network of roots, shifts in great clouds at every turn of the wind. The sea birds could go elsewhere, of course, but their inherited tendency to return year after year is strong, and their young perish in uncountable numbers. The winds start the sands drifting, and the young birds are smothered under the forming dunes. Young albatrosses start toddling with the swift-moving sea of sand, become exhausted, and are soon covered over. The little petrels, nesting underground, are the most terribly punished. I have found them where they had worked their way to the surface of their filled burrows and, unable to go farther, had died with their heads just above ground, buried alive,—and not one or two, but thousands.

We killed more than five thousand rabbits by actual count, and that should be a help, but by now the pests will be as numerous as ever, and it is strongly recommended that something systematic be done to lessen their numbers, and something also to increase the vegetation. There is a tobacco which has in some way been introduced on the island; this seems to be increasing in abundance. But the tussock grasses, so necessary to hold the soil to the inner slope, the *Chenopodium*, and various bushes are fast disappearing. Rapid-growing forms which will hold the sand should be introduced,—the good work of reclaiming the waste land of Midway is proof that the work can be done, but it should not be delayed.

The late Theodore Roosevelt established that great Hawaiian reservation in 1909, along with many others in this country. Roosevelt is gone now, and his many friends and admirers are seeking to establish monuments to perpetuate his memory. A Roosevelt Foundation for the Protection of Wild Life would be a fitting memorial and would meet many such emergencies as that of Laysan.

BLACK-FOOTED ALBATROSSES NEST ON THE SAND OF THE SEA BEACH

The black-footed albatross (*Diomedea nigripes*) is the species most commonly seen at sea in the north Pacific. These birds are more graceful than the Laysan albatross and have natures much more irascible. They scoop out their nests on the exposed beaches where the winds sweep violently. It is a common thing to see them sitting on their nests all facing into the wind. Both parents help in the work of incubation, while one is on the nest the other is out at sea catching squids, and they seem to take joy in their housekeeping

THE ALBATROSSES BUILD DIKES AGAINST THE FLOODS

The white albatross does scarcely any nest building, but as the bird incubates the single egg she gradually scoops a levee about her, using mud and grass and scattered fish bones in the masonry. These levees often stand the Laysan albatross in good stead for it chooses the gentle slopes and the flats bordering the salt lagoon in the center of the island as the place to rear its young. As the island is saucer-shaped with a high ridge around the edge, the excessive rains often cause floods over large areas. The birds obstinately continue incubating, even when the water is so deep that they are nearly floated away, and it is surprising how much dampness the eggs will stand without becoming spoiled. Thousands of eggs are necessarily abandoned each year, much to the enjoyment of the bristle-thighed curlew who grows fat on the plunder

ON THE MARGIN OF THE CENTRAL LAGOON

Of the two species of albatrosses on the island the Laysan (*Diomedea immutabilis*) is by far more numerous. Probably twenty-five thousand of the long-winged wanderers were busily attending to home duties during our visit, and thousands of young were raised, thus helping to fill the void caused by the ravages of poachers. The albatrosses spend the greater part of the year on the high seas, seldom frequenting land, but they assemble from the sea in the late fall for the nesting season, the first eggs being deposited the latter part of November

THE ALBATROSS REQUIRES A RUNNING START

Albatrosses are great fliers and remain on the wing for hours at a time but they find difficulty in taking-off from either land or water, and run into the wind for some distance before rising. Their flying consists for the most part of soaring or sailing with or against the wind and they are able to quarter a breeze only with great difficulty. These birds while away long hours on the island dancing, each bird striving to out-do the others in making noise as well as in assuming grotesque postures (see photographs of dancing albatrosses, AMERICAN MUSEUM JOURNAL for April, 1913, "The Albatrosses of Laysan")

Frontispiece engraved for Sir William Jardine's London edition of "American Ornithology," 1832

ALEXANDER WILSON, ONE OF AMERICA'S GREAT HUNTER-NATURALISTS (1766-1813)

Inspired by the story of the life of Alexander Wilson, a Kentucky boy of today has searched until weary alone through the woods to find the Kentucky warbler, a bird discovered and named by Wilson which James Lane Allen makes typify the boy's self. The boy dreams:

. . . Then there stepped forth into the open the figure of a hunter, lean, vigorous, tall, athletic. . . . He discovered Webster and with a look of relief stood still and smiled. There could be no mistake. Webster held imprinted on memory from a picture those features, those all-seeing eyes; it was Wilson—weaver lad of Paisley, wandering peddler youth of the grey Scotch mountains, violinist, flutist, the poet who had burned his poem standing in the public cross, the exile, the school teacher for whom the boy caught the mouse, the failure who sent the drawing to Thomas Jefferson, the bold figure in the skiff drifting down the Ohio—the naturalist plunging into the Kentucky wilderness and walking to Lexington and shivering in White's garret—the great American ornithologist, the immortal man.

. . . He came and stood before Webster and looked down at him with a smile:

"Have you found him, Webster?"

Webster strangely heard his own voice:

"I have not found him."

"You have looked long?"

"I have looked everywhere and I cannot find him." . . .

"Why do you look for the Kentucky Warbler?"

Webster hesitated long:

"I do not know," he faltered.

"Something in you makes you seek him, but you do not know what that something is?"

"No, I do not know what it is: I know I wish to find him."

"Not him alone but many other things?"

"Yes, many other things."

"The whole wild life of the forest?"

"Yes, all the wild things in the forest—and the wild forest itself."

There was silence. The forest was becoming more wonderful. The singing of the unseen birds more silvery sweet. It was beyond all reality.

. . . The hunter hurled questions now with no pity:

"Would you be afraid to stay here all night alone?"

"I would not."

"If, during the night, a storm should pass over the forest with thunder deafening you and lightning flashing close to your eyes and trees falling everywhere, you would fear for your life and that would be natural and wise; but would you come again?"

"I would."

"If it were winter and the forest were bowed deep with ice and snow and you were alone in it, having lost your way, would you cry enough! Would you hunt for a fireside and never return?"

"I would not."

"You can stand cold and hunger and danger and fatigue; can you be patient and can you be persevering?"

"I can."

"Look long and not find what you look for and still not give up?"

"I can."

There was silence for a little while: the mood of the hunter seemed to soften:

. . . "*Come,*" he said, as with high trust, "*I will show you the Kentucky warbler.*"

Quoted from James Lane Allen's *The Kentucky Warbler*, pp. 164–70

Alexander Wilson

A LIFE THAT LED, THROUGH MANY YEARS OF DEFEAT, TO THE HIGH ADVENTURE OF PERSONAL SACRIFICE, PROFOUND ENDEAVOR, AND SUCCESS

Quoted through the courtesy of the Author and of Doubleday, Page & Company, publishers, from "The School," the second chapter of James Lane Allen's *The Kentucky Warbler*

FOREWORD.—The scene is a classroom in one of the high schools of Kentucky in 1916; an exchange professor is standing before the pupils ready to address them; the sunshine of an April morning enters at the windows, slanting across the faces of the pupils, and there is a sound in the air of distant bird song. Webster, the Kentucky boy whose vision of Wilson and the Kentucky warbler is told on the preceding page, is among the pupils, far back near a window, as though with a wish to jump out and be free.

The lecturer's subject is the life of Alexander Wilson, but first he tells of George Eliot's Silas Marner and his life as a weaver in Raveloe, England, for two reasons, to enforce the picture of Wilson as a poor Scotch weaver and to put emphasis on the great power of seeing which Wilson possessed in contrast with Silas Marner who saw only his thread and shuttle and loom. The following quotation is the story of Alexander Wilson, as the lecturer told it, and it is a great pleasure to be allowed to present it in the very beautiful prose of James Lane Allen, the author, carrying his keenness of understanding, his appreciation of both human nature and nature, and his sympathy.

"I AM going to speak to you boys about a boy who never reached high school. I want you to watch how that boy's life first seen in the distance through mist and snow and storm as a faint glimmering spark, rudely blown upon by the winds of misfortune, endangered and all but ready to go out—I want you to watch how that endangered spark of a boy's life slowly begins to brighten in the distance, to grow stronger, and finally to draw nearer and nearer until at last it shines as a great light about you here in this very place. Watch, I say, how a troubled ray, low on life's horizon, at last becomes a star in the world of men, high fixed and resplendent—to be seen by human eyes as long as there shall be human eyes to see anything. . . .

"Now, about the period that George Eliot paints the life of her poor English weaver there lived, not in merry England but in Bonnie Scotland—and to be bonnie is not to be merry—there lived in the little town of Paisley, in the west of Scotland, a man by the name of Alexander Wilson, a poor illiterate distiller. He had a son—the boy I am to tell you about.

". . . The boy's father and mother opened before him the two main honoured roads of Scottish life [that of a physician and that of a minister] and bade him choose. He chose neither, for he was self-willed and wavering, and did not know his own mind or his own wish. He did know that he would not take the roads his parents pointed out; as to them he was a roadless boy.

"His mother died when he was quite young, a stepmother stepped into a stepmother's place, and she quickly decided with Scotch thrift. A third Scottish road should be opened to the boy and into that he should be pushed and made to go: he must be put to trade. Accordingly, when he was about eleven years old, he was taken from school and bound as an apprentice to a weaver; we lament child labour now: it is an old lament.

"The boy hated weaving as, perhaps, he never hated anything else in his life and in time he hated much and he hated many things. He seems soon to have become known as the lazy weaver. Years afterward he put into bitter words a description of the weaver: 'A weaver is a poor, emaciated, helpless being, shivering over rotten yarn and groaning over his empty flour barrel.' Elsewhere he called the weaver a scare-crow in rags. He wrote a poem entitled *Groans from the Loom.*

"Five interminable years of those groans and all his eager, wild, headstrong, liberty-loving boyhood was ended: gone from him as he sat like a boy-spider with a thread passing endlessly into a web. During these interminable years, whenever he lifted his eyes from his loom and looked ahead, he could see nothing but penury and dependence and loneliness—his loom to the end of his life.

"Five years of this imprisonment and then he was eighteen and his own master; and the first thing he did was to descend from the loom, take a pack of cloth upon his shoulders and go wandering away among the hills and valleys and lakes of Scotland—free at last like a young deer in the heather. He said of himself that from that hour when his eyes had first opened on the light of grey Scotch mountains, the world of nature had called him. He did not yet know what the forest and the life of the forest meant or would ever mean; he only knew that there he was happy and at home.

"Thus, like Silas Marner, he became a poor weaver and peddler but not with Silas Marner's eyes. Seldom in any human head has the mechanism of vision been driven by a mind with such power and eagerness to observe. And he had the special memory of the eye. There are those of us who have the special memory of the ear or of taste or of touch. He had the long, faithful recollection of things seen. With this pair of eyes during the next several years he traversed on foot three-fourths of Scotland. . . .

"But though he followed one after another well nigh all the roads of Scotland, he could find in all Scotland no road of life for him. It is true that certain misleading paths beckoned to him, as is apt to be true in every life. Thus he had conceived a great desire to weave poetry instead of cloth, to weave music instead of listening to the noise of the loom: he had his flute and his violin. But what he accomplished with poetry and flute and violin were obstacles to his necessary work and rendered this harder. The time he gave to them made his work less: the less his work, the less his living; the less his living, the more his troubles and hardships.

"Robert Burns was just then the idolised poet of Scotland, a new sun shining with vital splendour into all Scottish hearts. Friends of the young weaver and apparently the young weaver himself thought there was room in Scotland for another Burns. Some of his poems were published anonymously and the authorship was attributed to Burns. That was bad for him, it made bad worse. Wilson greatly desired to know the rustic poet-king of Scotland. The two poets met in Edinburgh and were to become friends. Then Burns published *Tam O'Shanter.*

"The Paisley weaver by this time had such conceit of himself as a poet that he wrote Burns a caustic letter, telling him the kind of poem *Tam O'Shanter* should and should not be. Burns replied, closing the correspondence, ending the brief friendship and leaving the weaver to go back to his loom. It was a terrible rebuff, and left its mark on an already discouraged man.

"Next Wilson wrote an anonymous poem, so violently attacking a wealthy manufacturer on behalf of his poor brother weavers, that the enraged merchant demanded the name of the writer and had him put in prison and compelled him to stand in the public cross of Paisley and burn his poem.

"Darker, bitterer days followed. He shrank away to a little village even more obscure than his birthplace. There, lifting his eyes, again he looked all over Scotland: he saw the wrongs and sufferings of the poor, the luxury and oppression of the rich: he blamed the British government for evils inherent in human nature and for the imperfections of all human society: turned against his native country and at heart found himself without a fatherland.

"Then that glorious vision which has opened before so many men in their despair, disclosed itself: his eyes turned to America. . . . In America he thought all roads were open, new roads were being made for human lives; that should become his country. One autumn he saw in a newspaper an advertisement that an American merchantman would sail from Belfast the following spring and he turned to weaving and wove as never before to earn his passage money. At this time he lived on one shilling a week! . . . When spring came, with the earnings of his loom he walked across Scotland to the nearest port. When he reached Belfast every berth on the vessel had been taken: he asked to be allowed to sleep on the deck and was accepted as a passenger.

". . . The port was to be Philadelphia but he seems to have been so impatient to set foot on the soil of the New World that he left the ship at New Castle, Delaware. He had borrowed from a fellow-passenger sufficient money to pay his expenses while walking to Philadelphia thirty-four miles away: and with this in his pocket and his fowling-piece on his shoulder he disappeared in the July forests of New Jersey. The first thing he did was to kill a red-headed wood-pecker which he declared to be the most beautiful bird he had ever seen.

"I do not find any word of his that he had ever killed a bird in Scotland during all his years of wandering. Now the first event that befell him in the New World was to go straight to the American woods and kill what he declared to be the most beautiful bird he had ever seen. This might naturally have been to him a sign of his life-road. But he still stood blinded in his path, with not a plan, not an idea, of what he should be or could be: he had not yet read the handwriting on the wall within himself.

"His first years in the New World were more disastrous than any in Scotland, for always now he had the loneliness and dejection of a man who has rejected his own country and does not know that any other country will accept him. A fellow Scot, in Philadelphia, tried him at copper-plate printing. He quickly dropped this and went back to the old dreadful work of weaving—he became an American weaver and went wandering through the forests of New Jersey as a peddler: at least peddling left him free to roam the forests. Next he tried teaching but he himself had been taken from school at the age of eleven and must prepare himself as one of his own beginners. He did not like this teaching experiment in New Jersey and migrated to Virginia. Virginia did not please him and he remigrated to Pennsylvania. There he tried one school after another in various places and finally settled on the outskirts of Philadelphia: here was his last school, for here was the turning point of his life.

"I wish I had time to describe for you the school-house with its surroundings, for the place is to us now a picture in the early American life of a great man—all such historic pictures are invaluable. Catch one glimpse of it: a neat stone school-house on a sloping green: with grey old white oaks growing around and rows of stripling poplars and scattered cedar trees. A road ran near and not far away was a little yellow-faced cottage where he lived. The yard was walled off from the road and there were seats within and rose-bushes and plum trees and hop-vines. On one side hung a sign-board waving before a little roadside inn; on the other a blacksmith shop with its hammering. Not far off stood the edge of the great forest 'resounding with the songs of warblers.' In the depths of it was a favourite spot—a secret retreat for him in Nature.

"There then you see him: no longer a youth but still young; every road he had tried closed to him in America as in Scotland: not a doctor, not a minister, not a good poet, not a good flutist, not a good violinist, not a copper-plate engraver, not a willing weaver, not a willing peddler, not a willing school-teacher—none of these. No idea yet in him that he could ever be anything. A homeless self-exile, playing at lonely twilights on flute and violin the loved airs of rejected Scotland.

"Now it happened that near his school was a botanical garden owned by an American naturalist. The American, seeing the stranger cast down by his aimless life, offered him his portfolio of drawings and suggested that he try to draw a landscape, draw the human figure. The Scotch weaver, the American school-teacher, tried and disastrously failed. As a final chance the American suggested that he try to draw a bird. He did try: he drew a bird. He drew again. He drew again and again. He kept on drawing. Nothing could keep him from drawing. And there at last the miracle of power and genius, so long restless in him and driving him aimlessly from one wrong thing to another wrong thing, disclosed itself as dwelling within his eyes and hands. His drawings were so true to life, that there could be no doubt: the road lay straight before him and ran clear through coming time toward eternal fame.[1]

"All the experience which he had been unconsciously storing as a peddler in Scotland now came back to him as guiding knowledge. The marvelous memory of his eye furnished its discipline: from early boyhood through sheer love he had unconsciously been studying birds in nature, and thus during all these wretched years had been laying up as a youth the foundation of his lifework as a man.

"Genius builds with lavish magnificence and inconceivable swiftness; and hardly had he succeeded with his first drawings before he had wrought out a monumental plan: to turn himself free as soon as possible into the vast, untravelled forest of the North American continent and draw and paint its birds. Other men, he said, would have to found the cities of the New World and open up its country. His study was to be the lineaments of the owl and the plumage of the lark: he had cast in his lot with Nature's green magnificence untouched by man. . . .

"For a while he must keep on teaching in order to live: he taught all day, often after night, barely had time to swallow his meals, at the end of one term tells us he had as large a sum as fifteen dollars. Often he coloured his first drawings by candle light, drew and painted birds without knowing what they were. Drawing and painting by candle light!—but now he had within himself the risen sun of a splendid enthusiasm. That sun kindled his school-boys. They found out what he wanted and helped. One boy brought him a large basketful of crows. Another caught a mouse in school and contributed that—the incident is worth quoting by showing that the boy preferred a mouse to a school-book.

"Take one instance of the energy with which he was now working and worked for the rest of his life: he wished to see Niagara Falls, and to lose no time while doing it he started out one autumn through the forest to walk to the Falls and back, a short trip for him of over twelve hundred miles. He reached home 'mid the deep snows of winter with no soles to his boots. What of that? On his way back he had shot two strange birds in the valley of the Hudson! For ten days—ten days, mind you!—he worked on a drawing of these and sent it with a letter to Thomas Jefferson. You may as yet have thought of Jefferson only as

[1] The naturalist was William Bartram. Wilson wrote to him in 1805, "They [his bird drawings] may yet tell posterity that I was honored with your friendship, and that to your inspiration they owe their existence."

one of America's earliest statesmen: begin now to think of him as one of the first American naturalists. And if you wish to read a courteous letter[1] from an American President to a young stranger, go back to Jefferson's letter to the Scotch weaver who sent him the drawing of a jaybird.

"Pass rapidly over the next few years. He has made one trip from Maine down the Atlantic Seaboard to the South. He has returned and is starting out again to cover the vast interior basin of the Mississippi Valley: he is to begin at Pittsburgh and end at New Orleans.

"Now you see that he is coming nearer—nearer to you here.

". . . It is the twenty-fourth of February: the river, swollen with the spring flood, is full of white masses of moving ice. . . . They warned him of his danger, urged him to take a rower, urged him not to go at all. Those who risked the passage of the river floated down on barges called Kentucky arks or in canoes hollowed each out of a single tree, usually the tulip tree, which you know is very common in our Kentucky woods. But to mention danger was to make him go to meet it. He would have no rower, had no money to hire one, had he wished one. He tells us what he had on board: in one end of the boat some biscuit and cheese, a bottle of cordial given him by a gentleman in Pittsburgh, his gun and trunk and overcoat: at the other end himself and his oars and a tin with which to bail out the skiff, if necessary, to keep it from sinking and also to use as his drinking-cup to dip from the river.

"That February day—the swollen, rushing river, the masses of white ice—the solitary young boatman borne away to a new world on his great work: his heart expanding with excitement and joy as he headed toward the unexplored wilderness of the Mississippi Valley.

"Wondrous experiences were his: from the densely wooded shores there would reach him as he drifted down, the whistle of the red bird—those first spring notes so familiar and so welcome to us on mild days toward the last of February. Away off in dim forest valleys, between bold headlands, he saw the rising smoke of sugar camps. At other openings on the landscape grotesque log cabins looked like doghouses under impending mighty mountains. His rapidly steered skiff passed flotillas of Kentucky arks heavily making their way southward, transporting men and women and children—the moving pioneers of the young nation: the first river merchant-marine of the new world; carrying horses and plows to clearings yet to be made for homesteads in the wilderness; transporting mill-stones for mills not yet built on any wilderness stream. . . .

"He records what to us now sounds incredible, that on March fifth he saw a flock of parrakeets. Think of parrakeets on the Ohio River in March! . . . Once he encountered a storm of wind and hail and snow and rain, during which the river foamed and rolled like the sea and he had to make good use of his tin to keep the skiff bailed out till he could put in to shore. The call of wild turkeys enticed him now toward the shore of Indiana, now toward the shore of Kentucky, but before he reached either they had disappeared. His first night on the Kentucky shore he spent in the cabin of a squatter and heard him tell tales of bear-treeing and wildcat-hunting and wolf-baiting. All night wolves howled in the forests near by and kept the dogs in an uproar; the region swarmed with wolves and wildcats 'black and brown.'

"On and on, until at last the skiff reached the rapids of the Ohio at Louisville and he stepped ashore and sold his frail saviour craft which, at start-

[1] This letter is given in full in Vol. I, pp. lii–liii, 1828 edition of *American Ornithology; or Natural History of the Birds of the United States* By Alexander Wilson

ing, he had named the Ornithologist. The Kentuckian who bought it as the Ornithologist accepted the droll name as that of some Indian chief. He soon left Louisville, having sent his baggage on by wagon, and plunged into the Kentucky forest on his way to Lexington.

"And now, indeed, you see he is coming nearer.

"It was the twenty-fourth of March when he began his first trip southward through the woods of Kentucky. Spring was on the way but had not yet passed northward. Nine-tenths of the Kentucky soil, he states, was then unbroken wilderness. . . .

"It was on March twenty-ninth that, emerging from the thick forest, he saw before him the little Western metropolis of the pioneers, the city of the forefathers of many of us here today—Lexington. I wish I could stop to describe to you the picture as he painted it: the town stretching along its low valley: a stream running through the valley and turning several mills—water mills in Lexington a hundred years ago! In the market-place which you now call Cheapside he saw the pillory and the stocks and he noted that the stocks were so arranged as to be serviceable for gallows: our Kentucky forefathers arranged that they should be conveniently hanged, if they deserved it, as a public spectacle of warning.

"On a country court day he saw a thousand horses hitched around the courthouse square and in churchyards and in graveyards. He states that even then Kentucky horses were the most remarkable in the world. . . .

"He slept while in Lexington—this great unknown man—in a garret called Salter White's, wherever that was: and he shivered with cold, for you know we can have chill nights in April. He says that he had no firewood, it being scarce, the universal forest of firewood being half a mile away: this was like going hungry in a loft over a full baker-shop.

"And I must not omit one note of his on the Kentuckians themselves, which flashes a vivid historic light on their character. By this time he rightly considered that he had had adventures worth relating: but he declares that if he attempted to relate them to any Kentuckian, the Kentuckian at once interrupted him and insisted upon relating his own adventures as better worth while. Western civilization was of itself the one absorbing adventure to every man who had had his share in it.

"On the fourteenth day of April he departed from Lexington, moving southward through the forest to New Orleans. Scarcely yet had the woods begun to turn green. . . .

"And now we begin to take leave of him: he passes from our picture. We catch a glimpse of him at the Kentucky River, standing on the perpendicular cliffs of solid limestone, green with a great number of uncommon plants and flowers—we catch a glimpse of him standing there, watching bank swallows and listening to the faint music of the boat horns in the deep romantic valley below, where the Kentucky arks, passing on their way southward, turned the corners of the verdurous cliffs as the musical gondolas turn the corners of vine-hung Venice in the waters of the Adriatic.

"On and on southward: visiting a roosting-place of the passenger pigeon which was reported to him as forty miles long: he counted ninety nests in one beech tree. We see him emerging upon the Kentucky barrens which were covered with vegetation and open for the sweep of the eye.

Now, at last, he begins to meet the approach of spring in full tide: all Nature is bursting into leaf and blossom. No longer are the redbud and the dogwood and the sassafras conspicuous as its heralds. And now, overflowing the forest, advances the full-crested wave of bird-life up from the south, from the tropics. New and unknown species are everywhere before his eyes: their new melodies are in his ears: he is busy drawing, colouring, naming them for his work.

"So he passes out of our picture: southward bound, encountering a cloud of parrakeets and pigeons, emerging from a cave with a handkerchief full of bats, swimming creeks, sleeping at night alone in the wilderness, his gun and pistol in his bosom. He vanishes from the forest scene, never from the memory of mankind.

"Let me tell you that he did not live to complete his work. Death overtook him, not a youth but still young. . . .

"I told you I was going to speak to you of a boy's life. I asked you to fix your eyes upon it as a far-off human spark, barely glimmering through mist and fog but slowly, as the years passed, getting stronger, growing brighter, always drawing nearer until it shone about you here as a great light and then passed on, leaving an eternal glory.

"I have done that.

"You saw a little fellow taken from school at about the age of eleven and put to hard work at weaving; now you see one of the world's great ornithologists, who had traversed some ten thousand miles of comparative wilderness—an imperishable figure, doing an imperishable deed. I love to think of him as being in the end what he most hated to be in the beginning—a weaver: he wove a vast, original tapestry of the bird-life of the American forest.

"As he passed southward from Lexington that distant April of 1810, encountering his first spring in the Ohio valley with its myriads of birds, somewhere he discovered a new and beautiful species of American wood warbler and gave it a local habitation and a name.

"He called it the Kentucky Warbler.

"And now, would you not like to see a picture of that mighty hunter who lived in the great days of the young American republic and crossed Kentucky in the great days of the pioneers? And would you not also like to see a picture of the exquisite and only bird that bears the name of our State—the Kentucky Warbler?"

He passed over to them a portrait engraving of Alexander Wilson in the dress of a gentleman of his time, his fowling-piece on his forearm.[1] And along with this he delivered to them a life-like, a singing portrait, of the warbler, painted by a great American animal painter and bird painter—Fuertes.

[1] See page 396.

It was not until the lecturer had progressed in his story to the point where Wilson came to America that Webster, back by the window of the classroom, was noticeably interested. Finally, however, his attention became so breathless that it filled the room and the other listeners were merely grouped around it as accessories; and the lecturer recognized that he was witnessing "that particular miracle in nature—the contexture of the generations—the living taking the meaning of their lives from the dead.[2] You stand before some all but forgotten mound of human ashes; before you is arrayed a band of youths unconsciously holding in their hands the unlighted torches of the future. You utter some word about the cold ashes and silently one of them walks forward to the ashes, lights his torch and goes his radiant way."

Webster, the Kentucky boy of the present, filled with all that Wilson had been made to mean to him, spent a whole day wandering in pasture and forest, and returned home at night with the fragrances and bird songs still about him and the heat of the sun still in his blood. Then he lived in the reality of his great dream and wandered through the woods with Alexander Wilson. When finally the Kentucky warbler was revealed to him, he turned to his guide gratefully to thank him, but—

"No one was near him. Webster saw the hunter on the edge of the thicket yards away: he stood looking back, his figure dim, fading. Webster, forgetful of the bird, cried out with quick pain:

" 'Are you going away? Am I never to see you again?'

"The voice that reached him seemed scarcely a voice; it was more like an echo, close to his ear, of a voice lost forever:

" '*If you ever wish to see me, enter the forest of your own heart.*' "

[2] The grave of Alexander Wilson is in the churchyard of Gloria Dieu (Old Swede's) Church, of Philadelphia.

THEIR FIRST VIEW OF THE PACIFIC, 1806

Memorial in Bronze to Lewis and Clark by Charles Keck, Sculptor, New York

Soon to be unveiled in Charlottesville, Virginia, the early home of Meriwether Lewis. They stand at gaze, with Sacajawea, the squaw guide, bending forward, intent on the vast expanse of the ocean revealed before them

Thomas Jefferson's Contributions to Natural History

HIS EFFORT SENT OUT THE LEWIS AND CLARK EXPLORING PARTY INTO THE UNKNOWN WEST—RECOGNITION AND HONOR ARE GIVEN TODAY TO THE EXPEDITION'S LEADER, MERIWETHER LEWIS

By JOHN S. PATTON

Librarian of the University of Virginia

THE fact that Thomas Jefferson's best service to mankind was political has limited the world's estimate of his greatness to one contribution of his useful life. That he was the preëminent statesman of his day as today he is the dominating influence surviving from the first years of the republic, was not owing to a predilection for politics but to his answering the need for a great constructive and safely guiding genius at the beginning of our independent national life. He rejoiced, instead, at the prospect of the studious life. His letters abound in expressions of his desire to retire from the arena in which he was the most notable figure. The one to Dupont de Nemours is often quoted: "Within a few days I retire to my family, my books and farms. . . . Nature intended me for the tranquil pursuits of science, by rendering them my supreme delight."

And by science he meant more than men do now. It included more than observed facts systematically classified and brought under general laws—he meant by it all that was connoted by the word *scientia* in the days of its widest acceptation. He was an eager student—going into every field open to him. It would not do to claim profound scholarship for him in all instances; his interests were too catholic, and limitations of time and opportunity so restrained him that the thoroughness of the specialist, often meticulous, was not within his reach. But he had a more or less scholarly acquaintance with mechanics, astronomy, meteorology, physics, civil engineering (mensuration, strength of materials), surgical anatomy, geology, zoölogy, botany, economic entomology, aëronautics, and palæontology.

While this list transcends in some instances the limits to which "science" is confined by present day definition and intrudes upon the domain of the industrial arts, it is far from embracing all that Jefferson would have included in the meaning of science, *scientia*, the derivative of all information and skill. *His* science enabled him to invent a plow, indeed *the* plow, to construct a barometer, a thermometer, a wind gage, a duplicating writing machine, and what not; to realize West Point for the nation and the National Observatory, to build the University of Virginia and inform it with a spirit and purpose hitherto disregarded.

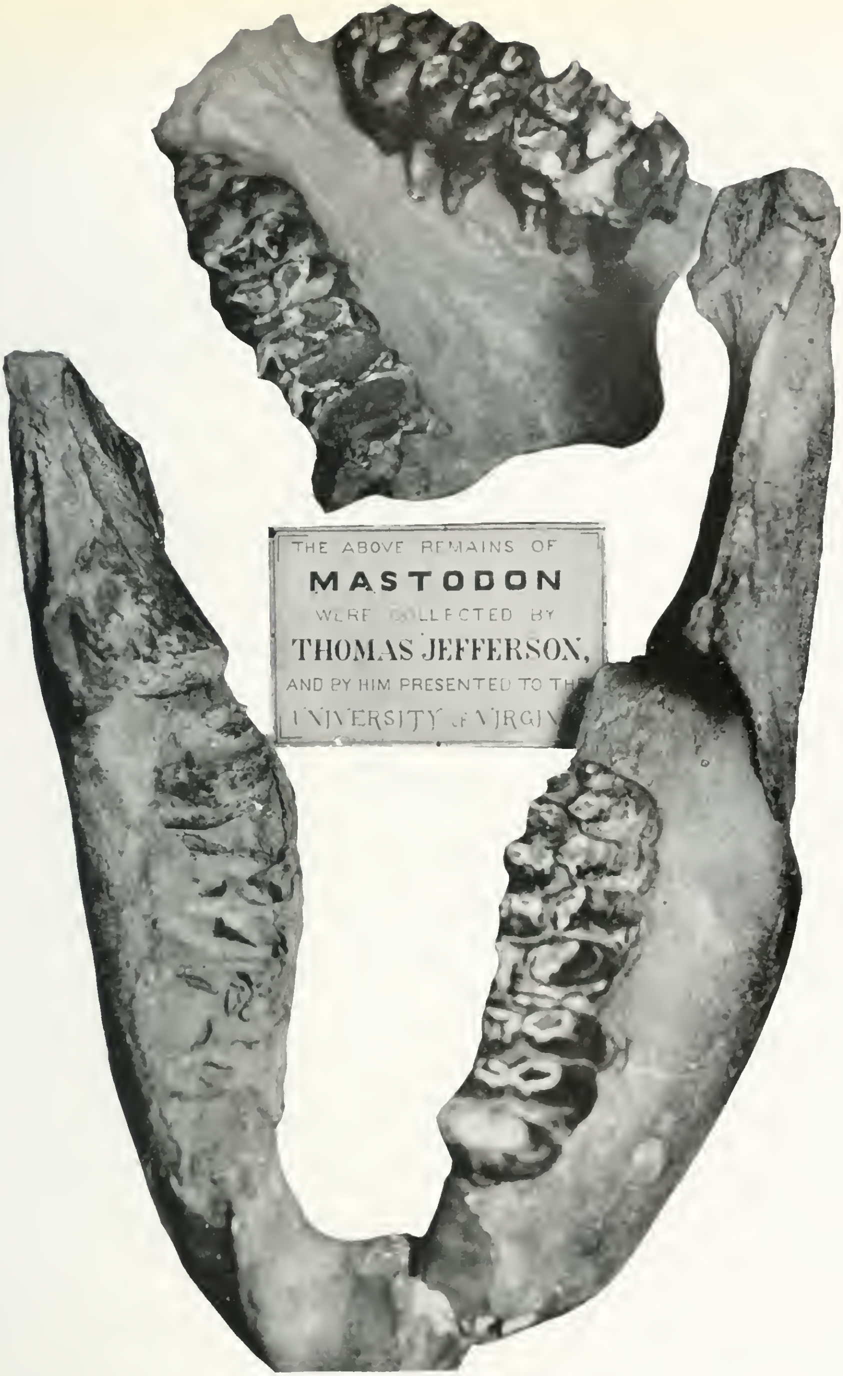
The student who takes to the highways and byways of knowledge is sure to find wherever he penetrates that Mr. Jefferson has passed along before him with more or less careful observation. After twelve years of faithful, scholarly work in rediscovering and determining the truth of Latin and Celtic accent and rhythm and showing that our traditional rule of Latin pronunciation is at variance with the obvious usage of Latin verse, Professor Thomas Fitz-Hugh, of the University of Virginia, turned in pursuit of another object—for he had published the results of his own discovery—to Jefferson's essay, *Thoughts on English Prosody*, and found that he had been anticipated by Jefferson by more than a century, and that nobody had seemed to know it! While Jefferson was the first to assert and use the principle that the pronunciation of an ancient speech cannot contradict the known rhythm of its poetry, Fitz-Hugh has used the principle to reveal a new world of accent and rhythm in Latin and Celtic and to expose the error of the current theory in both fields. "It is well worth while," Professor Fitz-Hugh warns, "for the scholar and technical scientist of today to examine Jefferson's reflections upon any field of investigation in which he allows himself to make excursions."

And so Buffon thought long ago. He had announced his conviction that animals common to the Old and the New worlds are smaller in the latter, that those peculiar to America are smaller, that those domesticated in both have degenerated in the New world, and that the western world has fewer species. Mr. Jefferson collected data and upon ascertained facts based three tables in which he contrasted aboriginals (1) of both the Old and the New worlds, (2) of only one, and (3) of those domesticated in both. The first table showed that of twenty-six quadrupeds common to both America and Europe, seven are larger in America, seven of equal size, and as to twelve the facts were not decisive; the second showed that eighteen quadrupeds are peculiar to Europe and seventy-four to America, while one of the American quadrupeds—the tapir—weighs more than all the eighteen of Europe together; and the third failed to sustain Buffon's theory of animal degeneration in the New world. He did not stop here, but had the bones and skin of the largest moose obtainable, the horns of the caribou, elk, deer, spike-horned buck, and some other large animals sent to Paris. Buffon was convinced, and said to the Virginian: "I should have consulted you, Sir, before publishing my *Natural History*, and then I should have been sure of my facts." It is scarcely worth while to inquire whether the great Frenchman was pleased by the revelation of the truth or irritated by defeat.

In 1797 Jefferson was made president of the American Philosophical Society, and took his place officially at the head of the scientific world of his country. Elected Vice President of the United States, he went to Philadelphia to be inaugurated—and took with him the *os femoris*, a radius, an ulna, three claws, and some other bones of an animal then unknown to science, the giant edentate, allied to the recent sloth. These bones, which he had collected in Greenbrier County, Virginia, he presented to the Philosophical Society, with a statement of the results of his studies in connection with them. His discovery bears the name *Megalonyx jeffersonii*.

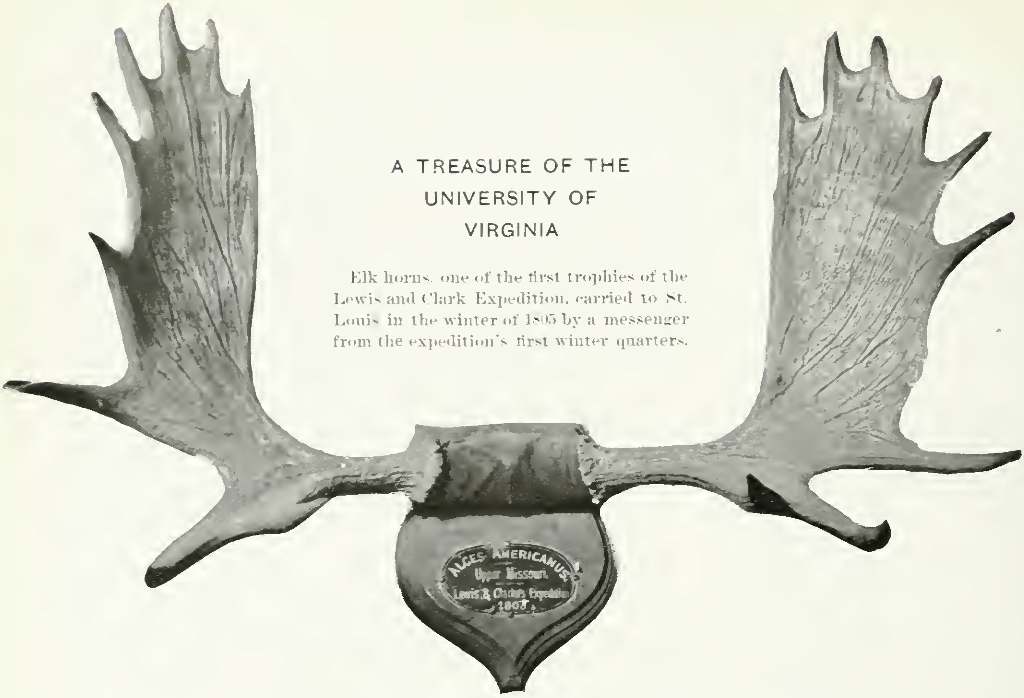
"The spectacle of an American statesman coming to take part as a central figure in the greatest political ceremony of our country and bringing with him an original contribution to the scientific knowledge of the world, is certainly one we shall not soon see repeated," said Frederic N. Luther, writing of Jefferson as a naturalist.[1] ". . . During those exciting weeks," Mr. Luther continued, "in February, 1801, when Congress was vainly trying to untangle the difficulties arising from the tie vote between Jefferson and Burr, when every politician at the capital was busy with schemes and counter-schemes, this man, whose political fate was balanced on a razor's edge, was corresponding with Dr. Wistar in regard to some bones of the mastodon which he had just procured from Shawangunk, Ulster County. Again in 1808, when the excitement

[1] *Magazine of American History* for April, 1885 (volume 13).



MASTODON JAWBONES COLLECTED BY JEFFERSON AT SHAWANGUNK, ULSTER COUNTY, NEW YORK

We have had two men in the presidential chair in the United States who were naturalists and who used their influence for the advance of scientific affairs—Thomas Jefferson and latterly Theodore Roosevelt. Of both these men the words by Jefferson, so often quoted, were true, "Nature intended me for the tranquil pursuits of science, by rendering them my supreme delight." That Jefferson received more blame than praise for his scientific work and that he is known in history only as a great statesman, but convinces us of the pioneer status of science a century ago and our greater enlightenment as to its value today. (Regarding mastodon discoveries at Shawangunk, see note, page 496)



A TREASURE OF THE UNIVERSITY OF VIRGINIA

Elk horns, one of the first trophies of the Lewis and Clark Expedition, carried to St. Louis in the winter of 1805 by a messenger from the expedition's first winter quarters.

These elk horns were highly valued by Jefferson and were long at Monticello. The members of the Lewis and Clark Expedition, sent out as a direct result of Jefferson's interest in natural history and exploration, were the first white men to traverse the region now mapped as the states of Nebraska, North and South Dakota, Montana, Idaho, Washington, and Oregon. A memorial to Meriwether Lewis, leader of the expedition, is about to be inaugurated at Charlottesville, Virginia, his early home

over the embargo was highest, when every day brought fresh denunciations of him and his policy, he was carrying on his palæontological studies in the rooms of the White House itself. . . . Never for a moment, however apparently absorbed in other work, did he lose his warm sympathy with Nature." This devotion at that early time won for him less praise than ridicule and blame in his own country. The feeling it evoked was expressed by Bryant, then a boy of thirteen:

Go, wretch, resign the Presidential chair,
Disclose thy secret measures, foul or fair.
Go, search with curious eyes for horned frogs,
'Mid the wild wastes of Louisianian bogs;
Or, where the Ohio rolls his turbid stream,
Dig for huge bones, thy glory and thy theme.

The man thus lampooned was the author of *Notes on Virginia* which a historian of science, the late G. Brown Goode, of the Smithsonian Institution, declared "is the most important scientific work as yet published in America," if "measured by its influence." It was the first comprehensive account of the topography, natural history, and resources of any North American commonwealth, and Goode pronounced it "the precursor of the great library of scientific reports which have since been issued by the state and federal governments."

He was deeply interested in what was concealed from the world a century and a quarter ago in the great unexplored region between the United States and the western ocean. The mammoth, he believed, might be found roving the great interior plains; indeed, nothing was too much for his credulity. The exploration of the Northwest was one of his fixed purposes, to be carried out at the first opportunity. When John Ledyard reached Paris in 1786, Jefferson, who was there as minister of the United States, believed the hour of the great adventure had arrived. Ledyard had been with Cook on his voyage to the Pacific and had engaged in other adventurous undertakings. He was appraised by Jefferson as "a man of genius" and "of some science," and the great American soon had him on the way to explore the western part of the North American continent. His itinerary was to take him through St. Petersburg to Kamchatka and thence to Nootka Sound. Ledyard's arrest by the Prussian government, which regarded the undertaking as impracticable, ended the enterprise, but not Jefferson's interest in it.

Six years later, in association with the American Philosophical Society, Mr. Jefferson, now Dr. Jefferson by the decrees of Yale and Harvard universities, promoted a subscription for the exploration of the West, and personally became responsible for a thousand guineas of the amount to be raised. André Michaux, the noted French botanist and traveler, and Meriwether Lewis, a youth of nineteen, who lived within ten miles of Jefferson's home in Albemarle County, Virginia, were chosen to make the westward journey. The letter of instructions, which was drawn with Jeffersonian care of details, discloses his interest in natural history. "Under the head of animal history," Michaux is told, "that of the mammoth is particularly recommended to your inquiries, as it is also to learn whether the Lama or Paca of Peru, is found in those parts of this continent." Whatever its motive, the French government interfered with the undertaking by charging Michaux with a mission relative to the occupation of Louisiana. Later the French minister canceled the appointment.

Ten years afterward Jefferson, then President of the United States, decided that the exploration ought not to be delayed longer. In 1803 the continuance of the act for establishing trading houses with the Indian tribes was under consideration and the President seized upon the opportunity it afforded to propose to Congress, in a confidential message, a party to explore the Missouri to its source and thence to make its way to the Pacific. ". . . other civilized nations have encountered great expense to enlarge the boundaries of knowledge by undertaking voyages of discovery, *and for other literary purposes*," Mr. Jefferson contended. "The nation claiming the territory, regarding this as a literary pursuit,"—thus he advanced in his plan to persuade Congress—"would not be disposed to view it with jealousy." The necessary appropriation for the enterprise could be charged to "the purpose of extending the external commerce of the United States," which the President would understand as legislative sanction. The bill was passed.

Meriwether Lewis, who was to accompany Michaux, had now been for two years private secretary of President Jefferson, by whom he had been appointed captain of the first regiment of infantry, and was eager to undertake the adventurous journey. "Of courage undaunted," Mr. Jefferson wrote of him, "possessing a firmness and perseverance of purpose which nothing but impossibilities could divert from its direction, careful as a father of those committed to his charge, yet steady in the maintenance of order and discipline, intimate with the Indian character, customs, and principles; habituated to the hunting life, guarded by exact observation of the vegetables and animals of his own country against losing time in the description of objects already possessed; honest, disinterested, liberal, of sound understanding, and a fidelity to truth so scrupulous that whatever he should report would be as certain as if seen by ourselves—with all these qualifications as if selected and implanted by nature in one body for this express purpose, I could have no hesitation in confiding the enterprise to him. To fill up the measure desired, he wanted nothing but a greater familiarity with the technical language of the natural sciences, and readiness in the astronomical observations necessary for the geography of his route. To acquire these he repaired immediately to Philadelphia, and placed himself under the tutorage of the distinguished professors of that place."

With Lewis Mr. Jefferson associated William Clark, a brother of George Rogers Clark, the Hannibal of the West,[1] and, like him, a born leader of men, a soldier and an expert in woodcraft and in knowledge of Indian character. The other members of the party were fourteen United States soldiers, nine volunteers, Clark's colored valet (York), and an interpreter and his Indian wife.

The Lewis and Clark Expedition was a high adventure with vast results, whose characterization transcends the scope of a sketch. An abundant and thrilling literature has resulted, and will be increased. The first installment of the story was written—as was appropriate—by Mr. Jefferson in his message "communicating discoveries made in exploring the Missouri, Red river, and Washita by Captains Lewis and Clark."

[1] George Rogers Clark, born in Virginia in 1752, won fame as soldier, surveyor, and Indian fighter. He was known as the conqueror of the large area northwest of the Ohio River, which was practically reclaimed from the warlike Indian tribes by him. He died in Kentucky February 18, 1818, and lies buried in an unmarked grave in Louisville.

While the record in books is ample, in marble and bronze it has been singularly scant, as in the case of Clark's elder brother, George Rogers Clark.

The members of the exploring party were the first white men to traverse the region now mapped as the states of Nebraska, North and South Dakota, Montana, Idaho, Washington and Oregon. Meriwether Lewis, the leader, who contributed to our knowledge of the customs, manners, and languages of the American Indians, has had until recently, so far as my information goes, a single visible memorial. In Lewis County, Tennessee, "in the midst of wild and romantic scenery, surrounded only by the native growth of the forest and where but few travelers pass, there stands a gray stone monument composed of native rock, with a shaft of limestone in imitation of a giant of the forest untimely broken," the tribute of the General Assembly of Tennessee rendered to Meriwether Lewis in 1848.[2]

Another memorial is now on the eve of inauguration in Charlottesville, Virginia, the home town of Lewis until he enlisted in the army at the time of the Pennsylvania whiskey insurrection. This monument, the work of Charles Keck, of New York, is a group in bronze, and commemorates the moment when Lewis and Clark had their first view of the Pacific. They stand at gaze, with Sacajawea, the squaw guide and only woman of the party, bending forward, intent on the scene. The group is the gift of Paul Goodloe McIntire, of Charlottesville.

[2] Since writing this I have been informed of a monument to Lewis and Clark in Portland, Oregon, but I have not been able to obtain facts relative to the artist or to the details of its erection.

War Impressions of French Bird Life

By LUDLOW GRISCOM

Member of the American Ornithologists' Union

APART from very obvious reasons for wanting to be in France during the war, the writer had long been interested in French bird life, owing to former extended travel in that country, so that there was the additional desire to renew acquaintance with old friends in the bird world, the hope of acquiring new ones, and the possibility of observing the effects of war upon them.

Conditions for Bird Life in France

The first fact about the birds of France that impresses the traveler is the small number of species in any given area, coupled with the extraordinary abundance of individuals of some species and the equally marked scarcity of others. This is easily accounted for. In a country settled as long as France has been, the adaptive power of any given species to a changing environment has been tested with merciless severity. It is obvious, therefore, that any species successfully passing this test has flourished in proportion, while the species that has failed must be sought for in game preserves, government forest lands, and such more remote sections of country as have remained comparatively unaltered through the centuries.

Another factor has served only to accentuate this process of elimination. In France, whether legally or otherwise, almost every bird is a game bird, or at least has been game during a very long past and up to very recently. It follows, therefore, that birds, although abundant, are remarkably shy in a great many cases. An interesting comparison can here be made with conditions in England, where the song thrush, blackbird, and robin redbreast are familiar garden birds dear to the hearts of the people. In France they are typical woodland birds, the two thrushes especially, so shy at times that they are about as easy to observe as a field mouse.

England has frequently been likened to a vast park. In the same spirit France could be likened to a huge wheat field or a vegetable garden neatly divided into little squares, hedges doing duty for fences. All western, northern, and central France is under a nearly maximum amount of cultivation, and the peasants cling each to his little patch of land with a passionate devotion which is a salient characteristic of the people. The bird lover, starting out from any given town in an effort to reach really good country, never gets there. All tempting patches of woodland in the distance turn out to be private parks with a high fence around them, or government *forêts*, at best second or third growth, all the trees planted at the same time, of equal height, and so close together as to be almost impenetrable, through which the peasants are constantly wandering, plucking the dead twigs from the shrubs and picking up windfalls in a pathetic effort to reduce their fuel expenses. So it is not surprising that hawks and woodpeckers, and the brightly colored birds are scarce, as well as all woodland species of retiring habits.

The scarcity of large rivers and the canalization of nearly all the smaller ones have made all water birds normally occurring inland very local. To make a broad statement, water birds are relatively much more abundant along the coasts than in the United States, and are scarcer inland. As regards land birds, they are most numerous specifically in southern France.

most abundant individually in western France, and scarcest in eastern France. The migration phenomenon is most marked along the coasts, and especially in the delta of the Rhone. Eastern France is much more broken in character, with a large proportion of woodland, and a much colder winter. As a result, many of the rarer local species occur here, so that a very fair list of summer residents can be obtained, without, however, any great number of individuals. Water birds are uniformly scarce even in migration. The winter bird life is relatively very poor.

The Birds of France and of America

While most of the families of birds in France are the same as in the United States, naturally enough the species are different. In fact, the little bank swallow has the unique distinction of being the only small land bird which is absolutely identical in the two continents. Even where the families are quite distinct, as the flycatchers and the oriole, there is often a surprising superficial resemblance in appearance and habits. One group, at least, of the European warblers, reminds one of our own puzzling *Vermivoras;* indeed, the chiffchaff could do duty very well as an orange-crowned warbler. In migration time mixed flocks of birds roam over the countryside just as in this country: kinglets, warblers, and titmice in the woods; buntings replacing sparrows in the fields, and swallows overhead. The wealth of species is, however, entirely lacking.

But the greatest outstanding impression is the difference in the relative representation of the same families of birds. The crow family is the best illustration. One can count on blue jays in the woods and crows in the fields almost anywhere in New York or New England. The European jay and the rook may appropriately be regarded as homologues. But magpies are absolutely everywhere, even in salt marshes and dunes along the seashore. In the fields the carrion crow occurs with the rook, while in winter the northern hooded crow with a gray mantle joins its cousins. Even so, I feel quite convinced that rooks alone are more numerous than crows in this country. An old castle, a cliff, or a cathedral spire is pretty sure to provide a home for a colony of jackdaws. Should the given locality include some high mountains, such as the Alps, it would be possible to add the raven, a chough and a nutcracker.

To those accustomed to our somber little chickadee, the European titmice furnish another surprise. Five species cannot be missed by the observer almost anywhere in France, while two others are possibilities. Among the five common ones some are by no means content with a staid and Quaker-like garb, and a blue, green, and yellow titmouse seems quite remarkable to American eyes, until extreme familiarity breeds contempt.

A third notable feature of the landscape is the abundance of the wood pigeon, a large blue-gray bird with conspicuous white wing patches—a true pigeon (*Columba*) with a short, square tail. Considering its conspicuousness and the fact that it must be good to eat, it is certainly amazing how it manages to exist in such numbers in so settled a country. Its wariness is one good reason at least, for out in the open country I have never been able to get within gunshot range of it. Where the chances for persecution are absolutely eliminated, however, it is quick to seize the opportunity: and today it is a common bird even in the smaller gardens of Paris, such as the Tuileries and the Parc Monceaux. In the late fall and early winter, especially in places where food is abundant, it gathers in large flocks, and a flight of several hundred birds streaming across the fields in the crispness of dawn is a very fine sight in the bird world.

A War Study of Birds in Eastern France

Circumstances prevented any indulgence of my hobby until I arrived at Chaumont, the American Great Headquarters, about September 1. The country here is a succession of steep hills, clad with evergreen and deciduous woods with open valleys between. The town is on the top of one of these long hills. To the south is open farm land, while, in the valley below, the infant Marne flows peacefully through green meadows. The buildings occupied by the Americans were at the end of a long boulevard bordered with trees, a few small gardens, and a park. Swallows and house martins flew up and down the streets. Chaffinches sang their simple trill in the park, and titmice of four kinds wandered through the gardens. In the pine woods on the slope of the hills were mixed flocks of titmice and kinglets. Creepers plodded patiently up the trunks, and tiny wrens for all the world like our winter wren, bobbed and scolded among the windfalls.

Down in the river valley itself, jays squawked and magpies chuckled. Rooks and carrion crows fed in the meadows; wood pigeons or stockdoves occasionally crossed high overhead, and over the hilltops soared the buzzard, screaming very much like our own red-shouldered hawk. The fishing rights of the river were amicably divided between a pair of dippers and some kingfishers, the latter a tiny feathered beauty, turquoise blue and chestnut, which darted up and down stream like nothing so much as a gigantic bumblebee, and gave sharp squeaks by way of relieving its feelings. The gray and the white wagtails, with long tails constantly going up and down, were permitted, however, to search for humbler food on the banks, while the sedge warbler nested peacefully in the rushes. In the shade trees along the canal the green woodpecker made the American rub his eyes not only because of its general color, but also its notes, which strikingly resemble those of our yellowlegs. In the fields skylarks were restlessly flying about, with an occasional phrase of their matchless song. Goldfinches wandered about looking for thistles, and linnets, tree pipits and yellow buntings were constantly rising from the ground and dashing off in all directions. The latter is one of the few common birds of Europe with a dash of bright color. It is, however, an alarmist, constantly annoying the ornithologist by its strident chirp of alarm from the nearest bush or telegraph wire, continued long after the imaginary danger is past, and acting as a signal to less common species to make off. Its song is a slow monotonous trill, which incessant practice fails to improve. English country folk claim that the bird says, "A little bit of bread and no ch-e-e-s-e." Occasionally with the common yellow-hammer was found the rarer cirl bunting, with a black, green and yellow striped head stuck incongruously enough on a dingy body, and with an apparently colorless personality. In all about fifty species of birds were seen around Chaumont.

On October 2, the writer was sent in a truck to the Vosges sector to deliver some dispatches to divisional headquarters. The autumn migration was in full swing at this time, and birds of various kinds roamed over the country in flocks. Jays, magpies, rooks, and carrion crows were everywhere, and the first hooded crow of the season was noted. Larks, starlings, buntings, chaffinches, and goldfinches were observed every few minutes. Very few swallows were left, however, and only one house martin was seen, the very last of the dying year as it proved. As we proceeded east the hills became higher and higher until we plunged fairly into the Vosges Mountains, rising and twisting through the spruce forests to Saint-Dié, the headquarters of one of the divisions. The town is in an open plain with the German lines on the tops of the hills a little more than a kilometer away. The valley road which was in plain sight was carefully camouflaged, but, even so, one felt quite conspicuous in a truck. The country had been heavily shelled; every house was in ruins, so I was not particularly surprised when I did not note a single bird. Saint-Dié itself was partly in ruins, and was considered an unhealthful spot due to constant bombing, shelling, and gassing—the last apparently the favorite method of annoyance. Everybody carried a gas mask at all times, and had picked a cellar into which to retire rapidly when a yearning for seclusion seized him. It was astonishing, therefore, to see the full quota of house sparrows quarreling on the roof tops, the swallows flying up and down the main street. They had no gas masks, and it is hardly likely that they descended to cellars. Just what they did was a mystery. As dusk gathered, the guns began to thunder and rumble a scant mile away. In the garden of the old château which did duty as Headquarters, was a mountain ash tree laden with fruit. Here by the light of the setting sun, with the air pulsating with sound, three beautiful bullfinches were peacefully feeding on the crimson berries, heedless of three Fokkers which droned directly overhead. Unperturbed and unhurried they finished their meal, and then disappeared in the gathering gloom, leaving behind an impression so strong by its sharp contrast that it is graven deeply on my memory.

The end of October I was ordered to the First Army Sector. The hills northwest of Verdun had been selected as an excellent sending station for a certain type of balloon, and I was sent there on November 2 to start a station. As we approached Verdun the country appeared more and more wrecked until it could be described as totally ruined in the hills to the northwest. There, where the flower of young French manhood had died by the tens of thousands, there was nothing but a succession of shell holes. The trenches were partly fallen in, the barbed wire entanglements were just as they had been left at the last triumphant advance, and here and there a few blasted tree trunks did duty for a wood. Vegetation even was scant. A kestrel hovered over the dreary waste, a flock of goldfinches twittered around a thistle, and a great gray shrike had taken up his quarters in a barbed wire entanglement.

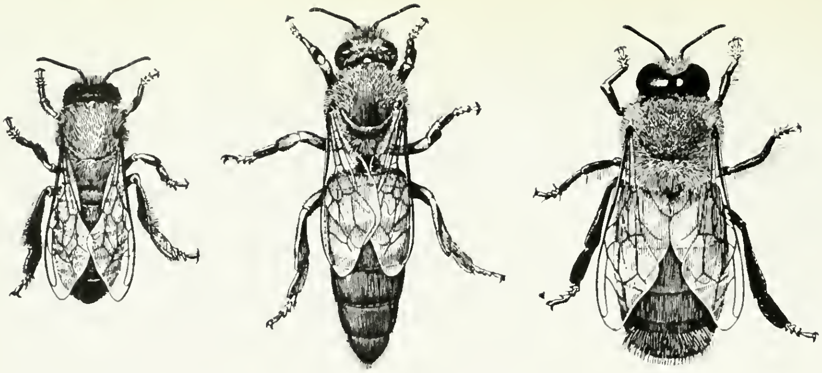
As dusk fell we descended into a steep little valley to the ruined village of Frémonéville, and elected to spend the night in one of the few houses which still boasted of a roof. That night the artillery fire at the front rose to the intensity of drum fire. The Allied heavy guns were concealed in the hills along a line lying a mile or two south of us. These joined merrily in the chorus, so that in the early morning the ground fairly shook. The approach of dawn brought quiet, permitting a brief cat nap, and I was astonished to hear a wren singing in the rafters near by, as I woke up. A bird hunt in this ruined village and its outskirts started immediately. Wrens were common, the smashed roofs and torn rafters furnishing them an abundance of hiding places among which they ducked and bobbed. Robin redbreasts were also common, singing sweetly in every bush that remained. Along the little brook flowing through the village was a solitary white wagtail, and a great tit kept it some sort of company in a willow bush near by. House sparrows were chattering around the church, and a flock of tree sparrows were feeding around the horse pond. Add a flock of rooks flying past overhead and a pair of yellow buntings in a field just outside the village, and we have quite a list for such a locality. Later on a few scattered shells burst on a hillside about a quarter of a mile away, to which the birds in the village paid not the slightest attention.

Somewhat later the bird hunt was rudely interrupted by the scream of a shell which fell near a field hospital on the outskirts of the village. A second shell, 11-inch high explosive, plumped through the roof of the church. This was the last straw for the sparrows of both species, which flew away in a mixed flock protesting harshly, their example being followed by the wagtail which departed in a different direction. The wrens and the redbreasts had all disappeared, and my men and I sought the seclusion of the nearest dugout. The shells kept falling for about an hour, but after a short while it became apparent that they were coming with clocklike regularity every four or five minutes. So after each burst I would go to the door of the dugout to look around and see what new damage had been done.

Right opposite me was a bush on each side of which masonry was piled in such a way that down among the roots there was quite a little pit, an excellent retreat from a bird's point of view. A robin redbreast had been singing in this bush all morning, and I was pleased to discover it among the roots, apparently alive and well, in spite of the fact that a high-powered shell had burst only a hundred feet away. One might think that the concussion alone would have killed so small a bird,—it is a bad enough jar to the human frame. Knowing possibly more about shells than the bird, I would appear immediately after the last piece of masonry had fallen down. The bird would be down among the roots, still as a mouse, and would not show any signs of life for about a minute, when it would begin to work up very cautiously toward the top of the bush. The scream of the next shell was the signal for both of us to dive hastily back into our respective retreats. Five minutes after the last shell had fallen this particular redbreast was singing sweetly from the top branches of its bush, joined by several others in various parts of the village, in marked contrast with the solemn-faced and quiet men who emerged somewhat later from scattered dugouts all over the hillside to take stock of the damage done, the lives lost, and the wounded who needed immediate attention.

It is, of course, obvious that a small bird has an infinitely better chance of not being hit by a shell fragment than a man. If, therefore, its resistance to shell-shock and concussion were about equal to that of man we would have a partial explanation of the existence of bird life in the war zone. Although it is highly improbable that a bird is equally resistant, nevertheless we must not overlook that best of preventives, a barrier. And here it is again obvious that a tree trunk, a brick, or a rafter, would serve as an excellent deflector of concussion and sound waves for a bird crouched behind it, whereas the objects mentioned would totally fail to help a man.

After all, the accounts, chiefly by English observers, of the existence of bird life in the war zone are too well substantiated to be questioned. Some explanation must be forthcoming, and is probably along the lines indicated above. Perhaps, too, the extraordinary powers of adaptability which account for the existence of common birds in France, a country so totally altered from its original condition, are again an aid in helping any given individual to endure so utterly abnormal an experience as shell-fire.



Conserving Our Natural Resources of Sugar

By E. F. PHILLIPS

Apiculturist, United States Department of Agriculture

THE people of the United States consume enormous quantities of sugar made from cane and sugar beets, the average individual consumption during times of plenty being more than eighty pounds annually. There are produced within the boundaries of the United States several thousand tons of cane sugar and about twice as much from the sugar beet. From our outlying islands we get more than the total sugar produced on the mainland and we also import great quantities from other countries. We go to much trouble and expense to get this sugar supply and if the quantity is reduced, as it was during the war, we feel that it is a great hardship.

There is another source of sugar supply which the people of the United States have sadly neglected. The amount of nectar secreted by the multitude of flowers is large beyond our comprehension. This is secreted that insects and other pollinizing agents may be attracted to bring about the cross pollination of the flowers, and to this end this sweet liquid is poured out freely. The per cent of sugar in this nectar varies in the different species of flowers and is also influenced by environmental factors. Whether or not it is a thick solution, the amount of sugar in each individual flower at any one moment of time is exceedingly small, but the number of secreting flowers is stupendous, and they continue to secrete nectar for some time, so that it is quite conservative to state that the total sugar secreted by these flowers in a year exceeds the amount of all sugars annually consumed by the American people. If only we could get it all, war and rumors of war would not affect our sugar markets!

Unless collected, however, this nectar, from its very nature, soon disappears as the flowers wither, and is lost to human use. Any method for conserving a portion of this abundant resource must be through some agency that is ever on the alert for each fresh supply. Some of the flowers which secrete nectar are of such size and shape that only birds or moths can reach this nectar, and what they get is lost to human use. Then there are thousands of species of insects which seek out the nectar for their immediate use, and while many of these species are economically valuable, man does not get the sugar.

Of all these nectar-seeking species, the honeybee alone is capable of being used by man as an instrument for collecting some of this vast sugar supply in such form that it can be used as human food. In spite of all that we can do, most of this sugar will be lost, but far more of it might be saved if this insect could be put more widely into the service for which its instincts and colony organization so well fit it. Even these useful insects cannot be considered as examples of brilliant efficiency when viewed solely from man's selfish point of view, for they use for their own purpose far more than the beekeeper can take away. There are produced, however, about 250,000,000 pounds of honey annually as the beekeeping industry is now developed.

The worker bees gather the nectar, take it to the hive, remove the excess moisture, change the sugar chemically, and finally store it for future use. They use honey, as we call the finished product, for their own food, to feed the developing brood, and to provide stores for periods of the year when not enough nectar is available to keep them in food. Nectar is not secreted throughout the summer season in most places, but comes periodically with the blooming of the various species of flowers, these periods being called the honey-flows. Then in winter, after the first killing frost, there is the long period during which the adult bees must be fed, for the honeybee is unique among insects of the temperate zone in that it passes the winter as an adult and still does not hibernate.

The amount of honey used by an average colony of bees to maintain its existence during the year is large. The strength of the colony varies from about 15,000 individuals at the close of winter to perhaps 100,000 at the peak of prosperity and then the number again decreases as winter approaches. These bees must be fed, not only as adults but as larvæ, and they use great quantities of food during the period of development. When we realize that a bee larva may increase in weight several hundred per cent in 24 hours, and that there may be 25,000 of these hungry larvæ in the hive at one time, it will be clear that the colony must maintain a plentiful larder to care for the family needs. It will, perhaps, not be far from the truth to assume that the total amount of ripened honey used by a good colony of bees is four hundred pounds during the entire year. This will vary enormously, for in lean years the bees do not rear so many young and thus their consumption more nearly fits their income, while in the fat years of nectar, if given the proper room and care, they carry on brood-rearing to the capacity of the queen, the colonies become stronger, and they gather still more nectar.

Assuming, then, for the sake of a definite figure, that every colony must have its four hundred pounds, it is clear that this must be gathered before there is any honey which the beekeeper may take away. The honey removed for human use is usually called "surplus" by beekeepers and this is literally its correct name. In years of plenty the task of finding so much nectar is an easy one and under such circumstances there is surplus for every beekeeper. Unfortunately in most seasons nature does not supply this sugar so freely, and only the beekeepers who manage their bees properly get a surplus. It is not the purpose of this article to tell what the beekeeper may do to increase the amount of honey gathered by the colonies, for this has been so well covered in bee literature and it is so long a story that we must pass on to the broader problem of planning to get more nectar by the promotion of the industry. Perhaps, in the average season and with the fairly good beekeeper the amount of surplus honey for each colony will scarcely exceed fifty pounds.

The honey removed for human use represents, according to our figures, only one ninth of the nectar gathered by the bees. In such an average season an apiary of one hundred colonies may gather nectar equivalent to 22½ tons of honey, whereas the honey crop, or that taken off by the beekeeper, will be only 2½ tons. That the worker bees from one hundred colonies can find nectar sufficient to produce $22\frac{1}{2}$ tons of honey within a radius of two miles will give some idea of the stupendous amount of sugar at hand in a region where the unsuspecting individual would see no sugar production. Of course the bees are not able to get all the nectar during rapid secretion, and in most places there are not enough bees to get one tenth of it. There are many locations where more than one hundred colonies may be kept with profit or where more than a fifty pound surplus is obtained. It really would appear from a study of these figures that the chief end of nature is to pour out sugar syrup.

In the face of these facts it is regrettable that so many beekeepers in the United States fail to get even the small percentage which belongs to them. There are parts of the United States where nearly 90 per cent of all colonies of bees are kept in hollow logs or plain boxes, in which the combs cannot be handled. There are few places where the box hive is not found and probably one third of the bees of the country are so housed. Such beekeeping is almost as bad as no beekeeping at all, for bees in such hives cannot be handled and, without the contribution made by an intelligent beekeeper, the surplus honey of a colony is usually exceedingly small. In this case both the equipment and the management are poor.

It is not enough to buy good hives, however, for the greater number of those beekeepers who have their bees in such hives fail to get their full share of the crop. By failing to give the bees proper attention during the winter, by providing insufficient room for storage of honey (a mistake which is well-nigh impossible to understand and yet one which is most common), and by failure to control swarming, the crop is often reduced one half or more. The equipment is good but the management is poor. It is a common saying that the beekeeper invests one part of money and nine parts of brains in his business. If he leaves out the major investment, failure is sure to follow, and this most necessary article is not on sale by the dealers in hives.

The bright side of the picture is seen in the commercial apiaries throughout the country—even though their number be relatively small—where the bees are properly housed in good hives, where swarming is controlled, where the bees are given just the right amount of room for storage at just the right time, and where they receive adequate protection and care in winter. The number of such apiaries is increasing in an encouraging manner throughout the country, but there is still room for more. Beekeepers who take the proper care of their bees receive an adequate return for their labor and, as it is only the good beekeeper who gets all the available crop, it may safely be stated that the honey crop is chiefly traceable to study and care. Many beekeepers in almost all parts of the country receive a good living from their bees and have incomes equal to those of the good farmers in other lines of agriculture, resulting from the proper directing of the energy of the bees.

As it is only the good beekeeper who helps the bees to conserve much of the vast sugar supply of which mention was made earlier, it will be clear that from the standpoint of national economy it is most desirable to encourage more such beekeepers to go into the business. It will be equally clear that it is a detriment to have those take up the business who will not or cannot make the major investment—that of brains. We do not want in the bee business those who have no brains, but there is little danger from that class. The class which may do actual harm, and which is perhaps the greatest handicap to beekeeping as an industry, consists of those who have the necessary brains but who do not intend to make the investment.

Obviously, I refer to those owning a few colonies of bees, who take it for granted that "bees work for nothing and board themselves," who occupy territory which might better be occupied by commercial beekeepers, who, through lack of care, often allow their bees to be a menace to all the bees about them through the dissemination of disease—in short, who desire to be merely amateur beekeepers. The amateur beekeeper, usually the suburbanite with a few colonies, is rarely of benefit to the beekeeping of the country. He may get a little honey at times for his own use and, if he has a little more than he needs, he may sell it in such a way that he spoils the market in his community for the sale of honey produced by a beekeeper who makes his living through the bees. If the beekeeper with a few colonies would study the problems of beekeeping, would study his bees, and really retain throughout the work that enthusiasm with which he began, he would be a help and not a hindrance to the development of beekeeping.

The only class of beekeepers who do more harm than the amateurs is that group usually spoken of in beekeeping circles as the "farmer-beekeepers." There is no reason why a good farmer cannot be a good beekeeper, for he is able to make the investment of both money and brains. The great difficulty is that just at the time when the bees demand attention, the general farmer is exceedingly busy with other work. Usually the bees back in the orchard are neglected from one year to the next, an easy prey to disease, never properly packed for winter, and of no profit to the owner. Whenever you see a few colonies of bees back in the orchard in unpainted hives or behind the barn in all sorts and conditions of boxes, you may be sure that there is no profit here, and probably when the apiary inspector comes along for bee diseases he will "lose his religion" in trying to induce the owner to clean up the wreckage.

I have tried to indicate why it is that all the agencies which are honestly trying to build up the beekeeping industry in the United States are making an effort to induce more people to take up beekeeping as their vocation, and are more or less openly discouraging the amateur. We all realize that everyone who goes in for beekeeping must one day make the start, and usually this start is a small one. Out of the great group of amateurs—there are now about 750,000 of them—must come the professional beekeepers of tomorrow. There is, however, an adequate supply of material on which to work in trying to make better beekeepers of those who now have bees, and it is unnecessary to try to make more beekeepers. As time goes on, some of those who now make a business of beekeeping may be driven out by the inroads of bee disease, unless they are able to invest enough brains to make the fight. Some of our present beekeepers engaged commercially cannot make this investment for, as before stated, they cannot get brains from the hive dealer. We will want some improvement in the personnel of beekeeping, and it may well be that there are persons who now know nothing about bees who might make our very best beekeepers. The risk of making an average amateur is too great to run and, as a result, almost every person engaged in helping beekeeping in this country shudders a bit when anyone suggests taking up bees.

Beekeeping offers opportunity as a commercial enterprise for thousands of alert people. The work of the beekeeper, while not at all a sinecure, is not so hard as that of many other lines of activity; there are abundant periods for recreation and study especially during the winter, and the returns are good. As has been stated, the investment is one part money and nine parts brains. There is no branch of agriculture in which the return is so large in proportion to the financial investment as in beekeeping, but if the money is invested without putting in the larger investment, there is no hope of success. The prospective beekeeper may be sure that he will be associated with good people in a work which demands such care and study and he will be well repaid for his work and study.

To the person who fondly hopes to have a few colonies of bees just back of the two apple trees to the rear of the suburban home, the best advice is to buy any honey needed at the top of the market, put money into W. S. S. instead of into bees and hives, and read Maeterlinck for the beekeeping experience. It will be found more profitable than the plan which he has had in mind. He may, if he wishes, still look forward to the time when he buys his farm and can keep bees on that, but most suburbanites do not buy the farms to which they look forward. The best way to conserve the vast nectar resources of the United States is to leave the production of honey to professional beekeepers, for they and they alone can save it for us.

For those who do not engage in beekeeping or who may feel that this discussion has barred them from a pursuit to which they have looked forward, there still remains one of the great joys which have their origin in beekeeping; there is the honey to eat. Comb-honey is of course a pure product just as made by the bees and it is not glucose in paraffin cells, as the sensational press periodically asserts in an effort to portray the ingenuity of the Connecticut Yankee. Extracted honey, that is, honey in liquid form, separated from the comb, is also pure for, since the passage of the Pure Food Act of 1906, honey adulteration is indeed rare. There is probably no food product on the market more free from contamination than either comb or extracted honey.

It is quite possible to put in words an assurance of dietetic fitness and chemical purity. It is not possible to string together a group of English words which describe adequately the taste of fine honey. Its beneficial properties and its value as a food for children and invalids are quite explainable, but the attractiveness of honey, the reason we eat it, lies in its flavor, which is quite beyond words. Each species of nectar-secreting flower gives forth a supply of characteristic flavor so there is abundant variety and a flavor for each taste. It is the nectar of the gods and the very name is sweet.

It is a conservative estimate that the sugar secreted by the flowers of this country each year exceeds the total amount of sugar consumed annually by the American people. Of all the nectar feeding insects, however, the honeybee alone can be used by man for saving nature's vast output of sugar. Each colony requires about 400 pounds for its own living, this leaves the fairly good beekeeper a surplus of about 15 pounds. Hope for the industry lies in commercial apiaries, but only the thoroughly informed, experienced, "good beekeeper," should be encouraged to enter the work

The Evolution of the Human Face[1]

Especially the story of the evolution, from fish to man, of the lacrymal bone as one of the bones around the eye socket

By WILLIAM K. GREGORY

EARLY in the nineteenth century Cuvier, the famous French comparative anatomist, and his colleague, the elder Geoffroy Saint-Hilaire, observed that in the skulls of crocodiles and alligators there are four bones around the orbits or eye sockets, and that two of them respectively correspond in position to the lacrymal or tear bone of the human skull, and the other two to the jugal (malar) or cheek bone.

About the same time it was noted that in fishes also there is a ring of bones around the orbits, and in 1818 Julius Victor Carus sought to identify the human lacrymal with the first suborbital bone of fishes. These identifications by Cuvier and Carus were further studied and accepted by Sir Richard Owen and later anatomists down to our own time; in 1910, however, E. Gaupp, of Freiburg, cast serious doubt upon them, holding that it was the so-called "prefrontal" or front upper element of the circumorbital series of lower vertebrates, which was the real homologue of the human and mammalian lacrymal.

As the problems thus raised ramify in many directions, I have closely examined the evidence cited by Gaupp, and during the last few years I have studied the bones around the orbits in all classes of recent and extinct vertebrates from fishes to mammals. I conclude, however, that Gaupp was mistaken, and that Cuvier and Carus were right. This is one of the conclusions in a report on the evolution of the lacrymal bone of vertebrates, comprising about two hundred figures, which will shortly be published in the *Bulletin* of the American Museum of Natural History, and upon which the present article is largely based.

In an earlier article in this magazine I endeavored to summarize the main stages in the evolution of the eyes, nose, and mouth. In the present article attention is centered chiefly upon the evolution, from fish to man, of the bony elements around the orbits or eye sockets.

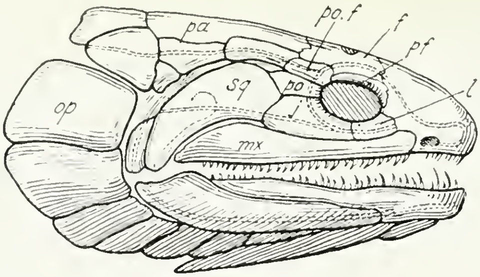
In the earliest fishlike vertebrates the whole head was covered with a tough skin surrounding the eyes, the nose and the jaws and covering the roof of the skull and the region of the gills. In the stage represented by Fig. 1 of our series this tough skin had already acquired a bony base which is preserved in many ancient fishes of Devonian and later ages and is still retained by the gar pike and other lowly forms of living fishes. At that time the eyes were surrounded by a ring of about five flat skin-bones named respectively the prefrontal (*pf*), the postfrontal (*po.f*), the postorbital (*po*), the jugal (*j*) and the lacrymal (*l*). These were grooved on the surface by a branch of the "lateral line" canal encircling the orbit.

Between this and the next stage of evolution there is a great gap in the palæontological record. But the cumulative evidence of comparative anatomy and embryology indicates that the oldest known four-footed animals, known only from certain footprints in the Upper Devonian and Lower Carbon-

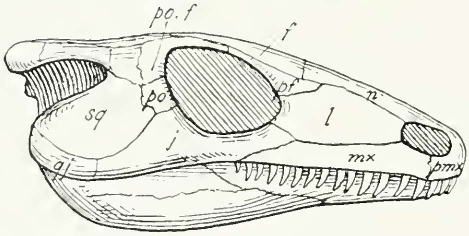
[1] Continued from the AMERICAN MUSEUM JOURNAL, October, 1917.

EIGHT STAGES IN THE EVOLUTION OF THE HUMAN HEAD

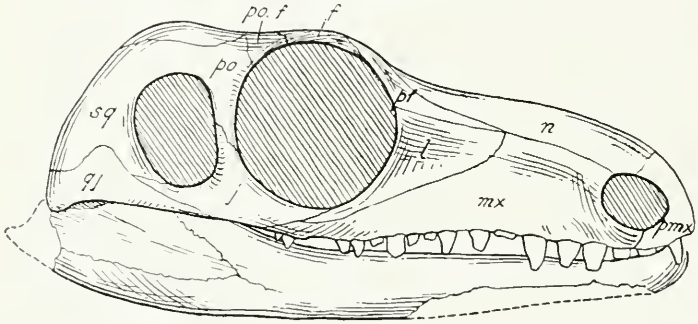
To show especially the evolution of the lacrymal or "tear" bone as one of the bones around the eye socket



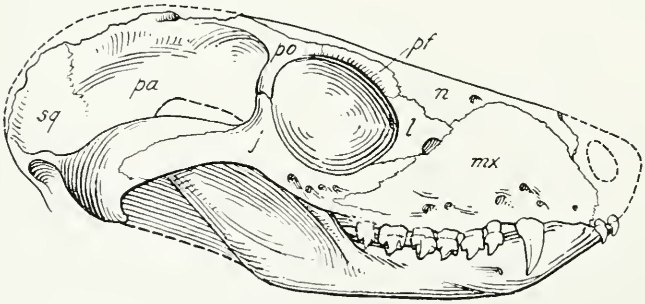
Stage 1—Head of a primitive fish, *Osteolepis*, of Devonian age, showing the five bones of the primitive circumorbital series[1] (After E. S. Goodrich)



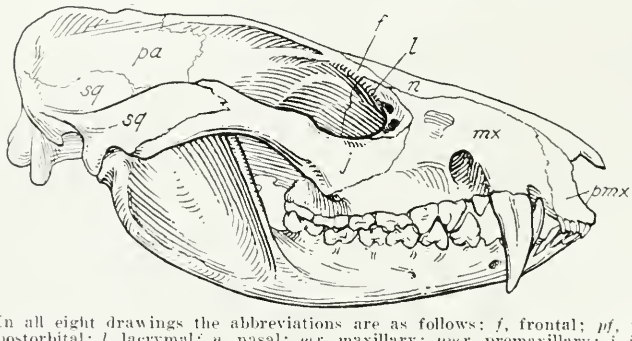
Stage 2—Head of the most primitive known reptile, *Seymouria*, from the Permian of Texas. The primitive upper jawbone (*mx*) is comparatively slender and lies entirely below the lacrymal, which extends from the orbit to the nostril (After S. W. Williston)



Stage 3—Head of a later primitive reptile, *Mycterosaurus*, from the Permian of Texas. The upper jawbone (*mx*) has grown up over the lacrymal (*l*) and is in wide contact with the nasal (*n*)

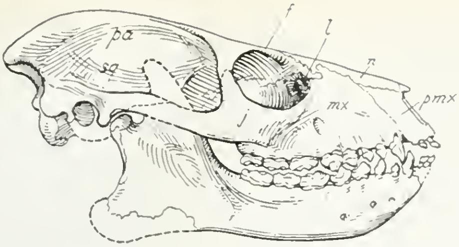


Stage 4—Head of a still higher reptile, the mammal-like *Ictidopsis* of Triassic age, South Africa. The upper jawbone (*mx*) is still larger and the whole head is very mammal-like, except that the reptilian prefrontal (*pf*) and postorbital (*po*) bones are still present

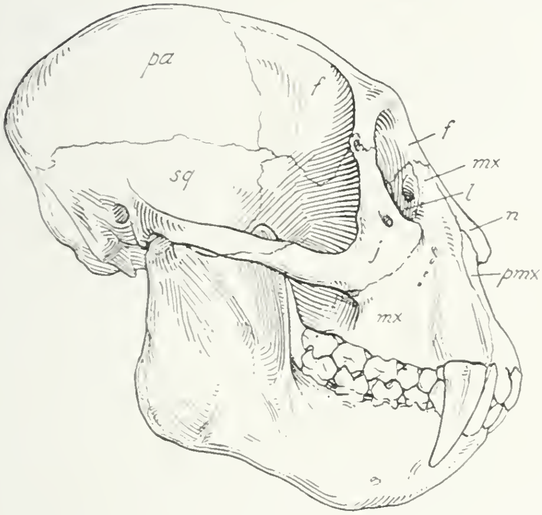


Stage 5—Head of a Virginia opossum representing the primitive mammals. The upper jawbone (*mx*) has now grown upward around the lacrymal (*l*) thus reaching the frontal (*f*). The prefrontal and postorbital bones are no longer present

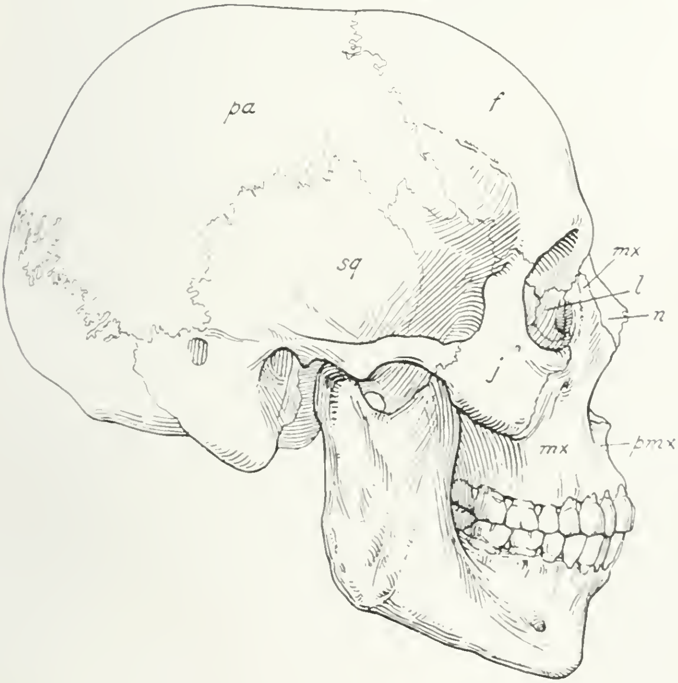
[1] In all eight drawings the abbreviations are as follows: *f*, frontal; *pf*, prefontal; *po.f*, postfrontal; *po*, postorbital; *l*, lacrymal; *n*, nasal; *mx*, maxillary; *pmx*, premaxillary; *j*, jugal (cheek); *pa*, parietal; *sq*, squamosal.



Stage 6—Head of a primitive Primate *Notharctus* of Eocene age, Wyoming. The lacrymal (*l*) is pushed to the inner wall of the orbit. A new rim behind the orbit is formed by outgrowths from the frontal (*f*) and cheekbone (jugal, *j*)



Stage 7—Head of an Old World monkey (macaque), showing the forward direction of the orbits, the retreat of the lacrymal bone to the inner wall of the orbit, the formation of a bony partition behind the orbit, the beginning of the expansion of the brain case and of the shortening of the face



Stage 8—Head of a man, showing the final stage of evolution. The lacrymal bone remains much as it was in the preceding stage, but the eyes are now directed wholly forward, the brain case is greatly expanded and the face extremely shortened and deepened

iferous rocks, were the descendants of certain very progressive "lobe-finned" or rhipidistian fishes, which had begun to use their fore and hind paddles as limbs, crawling about the margins of pools and swamps, and developing such incipient lungs as are found in the lungfishes of the present day. In these transitional creatures the gills were probably used only in the larval aquatic stage and gradually disappeared in the adults. Consequently the numerous skin-bones covering the gill-chamber in fishes and called the opercular series (*op*, Stage 1) disappeared, along with the gills themselves, so that in the oldest known four-footed animals (Stage 2) there is a great notch at the back of the skull on each side, representing the outer part of the primitive gill-chamber.

Thus, after an interval of millions of years during the emergence of the four-footed vertebrates from fishes, the rocks reveal to us the second great stage of this line of evolution, represented by the reptiles and amphibians of the Coal Measures and succeeding ages. In these animals (Stage 2) we find the same ring of five bones around the orbit which was first developed in the fishes, but now the several elements of this series are more differentiated one from the other. The lacrymal bone (*l*), at the lower front corner of the orbit, is pierced by a duct corresponding to our tear duct, which it is believed is a modified remnant of the lateral line canal. The jugal (*j*) or bone beneath the orbit now suggests the beginning of the zygomatic arch or cheek bone of higher types. At this stage the lacrymal extends from the orbit to the nostril, and the maxilla (*mx*) or upper jaw bone is a slender element which is widely separated from the nasal (*n*) by the lacrymal.

In the third stage (Stage 3), represented in certain reptiles from the Permian of Texas, the lacrymal is restricted through the upgrowth of the maxilla, which acquires a wide contact with the nasal. Here, also, we have the beginning of the temporal fossa or opening for the jaw muscles behind the orbit.

The fourth stage (Stage 4) is represented by the mammal-like reptiles of the Triassic age found in South Africa. In these wonderful saurians there is a surprising mixture of mammalian and reptilian characteristics. The region around the eye is very mammal-like. The upper jaw bone is much larger than in earlier stages and the lacrymal is still more restricted. The zygomatic arch is extremely mammal-like in form and so is the temporal fossa.

The fifth stage, which was attained in the latter half of the Mesozoic era or Age of Reptiles, is preserved even at the present time in the opossum (Stage 5), one of the most primitive of existing mammals. In this stage the upper jaw bone (maxilla) has grown upward around the lacrymal, which is now further restricted. As compared with the ancestral reptiles the greatest changes in this region in primitive mammals are the loss of the prefrontal, which exposes the frontal, and of the postorbital, which makes the orbit widely continuous with the temporal fossa. The stout zygomatic arch is now fully mammalian in form.

The sixth stage is found in the very ancient Primates from the Eocene of Wyoming, here represented by *Notharctus osborni* (Stage 6). The lacrymal has now greatly dwindled and withdrawn to the inner wall of the orbit as in many existing Primates, this reduction and retreat within the orbit being probably associated with the reduction of the parts of the nasal cavity which the lacrymal covers. The orbit is now guarded in the rear by a bony rim, which is, however, by no means the same as that in reptiles (Stages 2–5), since it is now formed, not by the original postorbital bone (*po*), which has been lost, but by a new bony outgrowth or postorbital process from the frontal bone, which meets a similar new extension from the jugal. At this stage the face is somewhat shorter than it was in primitive mammals and reptiles, but the eyes still look outward.

The seventh stage (Stage 7) is preserved in the monkeys, especially those of the Old World, such as the macaque. These have advanced widely beyond the primitive Primates in the fact that the orbit is now shut off from the temporal fossa by a new partition growing out from the above-mentioned postorbital process of the frontal and jugal bones. This great change is associated partly with the forward pointing of the orbits, which also causes the lacrymal bone to be pressed tightly against the inner wall of the eye. The large opening of the lacrymal canal or tear duct is now between the lacrymal and the upper jawbone or maxilla. The bony face is shortened and deepened and the whole brain case is expanded.

The final or human stage (Stage 8) presents only an emphasis of the features already noted (Stage 7) in the monkeys, and is already attained in the higher anthropoid apes (see drawing on this page). The eyes now look directly forward, the brain case is enormously expanded and the face greatly shortened and deepened. The position and characters of the lacrymal are essentially the same as in the preceding stage except that the tear duct is still larger.

The series as a whole shows the dominating parts played in this evolution at first by the loss of the opercular bones following the loss of the gills; secondly, by the development of a temporal fossa and of a zygomatic arch in connection with the more efficient functioning of the jaws; thirdly, by the forward shifting of the orbits to obtain better vision; fourthly, by the final expansion of the brain case; and fifthly, by the retraction of the jaws beneath the brain case.

Thus in the course of many millions of years the lowly head of the Devonian fish has been refashioned into the voluminous brain case and forward-looking face of man.

Forepart of the skull of a young chimpanzee showing subhuman character of the bones around the orbit, especially the lacrymal (*as*, alisphenoid; *pl*, palatine; other abbreviations as on page 422). Thus in the higher anthropoid apes, as in man, the lowly head of the Devonian fish has been refashioned, during the course of many millions of years, into the large brain case and the very different forward looking face

WEATHERED OUTPOSTS OF THE FOREST

Glassy spicules of ice and sharp unworn sand grains grind at the windward side of the trunks, sometimes eating almost to the heart. On the leeward side the trees put forth their toughened branches and needles. The limber pines stand alone and take the punishment of the winds in unprotected spots where their neighbors, the spruces, cannot live

A snowstorm at timber-line.—The snowfall along the continental divide in Colorado is one of the heaviest of the country. In the immediate vicinity of Longs Peak it feeds the Grand River on the west and tributaries of the Platte on the east. "Eternal snow" lies all along the Front Range and from its border there flows a sheet of icy water during the summer days

The Wars of the Wind at Timber-line

THE FOREST RANKS IN THE DRY WIND-SWEPT HIGH ALTITUDES OF THE ROCKY MOUNTAINS ARE BEING DRIVEN DOWN THE SLOPES

By ENOS A. MILLS

Illustrations from photographs by the Author

FOR ages the high, dry, winter wind had blown out of the west across the Continental Divide. Down the eastern slope these winds swept roaring against the ragged, battered upper ranks of the forest at timber-line. At one place in the Rocky Mountain National Park they came down across a wide treeless moorland between two lateral moraines of huge size. They dashed so fiercely against the forest front that the aggressive trees had never been allowed to do more than peep over the edge of the inclined moor. Again and again an adventurous seedling had dared the treeless space only to be blown to pieces before it could get a good roothold.

One day far up a mountain-side a cliff crashed and fell. The ice had at last wedged it off. It plunged and rolled down a steep slope with great leaps, and went to pieces. A few of the pieces tumbled far out on this moor. The largest stone formed a small windbreak a few hundred feet in advance of the forest's wind-battered edge.

In due time a few daring seeds sought to start a tree outpost in this shelter. They succeeded. In a close cluster they grew up. When they rose above the upper surface of the rock the terrific winter wind cut them off with sand blasts and the cutting edges of glassy sleet. New trees from time to time found a foothold to the leeward of the stone's pioneer tree cluster. Thus a line of trees gradually extended in a long wind-battered row, thick as a hedge, to the front ranks of the forest. The wind did not allow a tree to start or a limb to extend beyond the sheltered edges of the stone.

The timber-line of which this windrow was a part stretches along the eastern or Atlantic slope of the high Continental Divide for hundreds of miles. The Engelmann spruce and the Arctic willow represent the tree growth in the moister places, while it falls to the lot of some variety of the limber pine to maintain the forest front on the dry wind slopes and rock ridges.

Timber-line, like the shore line of the sea, bends and curves. Here a mountain-side cañon causes it to sweep back like a bay of the sea, and there it thrusts itself out around a peninsula-like headland. In places the topography causes it to extend for a mile or more in a straight line. Next it comes to an end upon an out-cropping of barren rock which offers it no soil; and in places a drift of "eternal snow" holds it at bay; while on slopes and ridges the dry and devitalizing winds say, "Thus far and no farther."

The winds and gales that strike and beat and break against the front ranks of the forest, roar as intensely as a storming sea upon the shore, and with all its terrible eloquence.

Wind is the strongest factor in the life of these timber-line trees. This is shown in their attitudes and shapes. Standing trees are tilted toward the east, the vinelike, crawling trees are headed east, and those standing with banners and pennants of long, tattered limbs and foliage, extend their arms only toward the east. All proclaim, "Out of the west come the forces that direct us." At timber-line, wind, the sculptor, has carved for himself a thousand graphic tree statues that proclaim his presence and his power.

The stone on the moor continued to shelter the windrow at timber-line. Each winter around the stone the violent winds raged, and pounded it almost incessantly. During the summer months the wind rarely blew. Then brilliant flowers stood thickly in a green and snowdrift-dotted Alpine scene. But with the coming of autumn the wind again came pouring out of the west across the peak-broken heights. Through the long winter it commonly blew from the same quarter.

As it poured around the stormward corners of the stone, the wind gradually blew the earth away. Then along the stormward front of the stone it connected these corner erosions with a channel. Finally it began to undermine this immovable wind-defying piece of granite. Each spring and summer the water from the winter snows and from the rains carried forward the eroding, undermining work of the wind.

Occasionally an accident came to a tree or two in the windrow and a slight opening was left, between the grizzled edges of which a man might squeeze through. One day a bowlder rolled down and smashed a larger opening. But most of the trees in this long, narrow hedge interlaced still more closely with new limbs. The wind did not allow them to extend their tops upward or their arms outward beyond the line determined and sheltered by the stone. Each winter the hundreds of tiny adventurous twigs that had during summer grown beyond the side or the top lines were clipped off by the wind.

A long, long time the stone remained. Upon it many a white ptarmigan alighted; upon it, too, the crested noisy jay, the quiet camp-bird, and the curious magpie often sat to look upon the scene. Around it lived the bighorn sheep. Beside it a grizzly once dug for a chipmunk.

On the wide moor here and there a partly embedded rock fragment sheltered a tiny persistent tree. Here and there a bowlder that had rolled down from one of the moraines sheltered

ON LONGS PEAK, COLORADO, AT AN ALTITUDE OF 11,500 FEET

The timber line, which is one of the most marked boundaries of plant zonation, sweeps in a sinuous course along the higher ranges of the Rockies, now ascending a protected gully, now driven down the mountain's side from a wind-swept lane or rocky prominence. After this manner the Arctic-Alpine and Hudsonian, or forest, zones lap past each other for vertical distances as great as a thousand feet. In the upper mountain forest of northern Colorado the Engelmann spruce and limber pine chiefly abound, while above the tree limit lies a rocky tundra with its lichens, low willows, and herbs. Here the ptarmigan, pipits, and finches find their breeding grounds in spring, building their homes among the rock débris. Lichens are the most important element in breaking up the rocks to form the minimum of soil in which mosses, grasses and shrubs may gain a foothold somewhat larger growing trees. A pile of débris that a landslide had brought down sheltered a grove almost twelve feet high.

Immovable the great stone lay on the moor. Dust and trash accumulated beneath the trees in its shelter, as under any hedge, and formed a barrier which blocked the water coming down the slope of the moraine. This cut a small channel alongside the tree row. This water joined the wearing, undermining forces of the wind that ever worked beneath the stormward foundation of the protecting stone.

Immovable the stone continued to lie through the wonder summers amid Alpine flowers, and through the roaring windy winters, while invisible chemistry tinted it with many hues and the lichens came to color it. But at last the wash of water and the sweep of winds dug a great hole in front and beneath the stone. Early one summer as the frost was vanishing from the soggy earth the stone settled forward and rolled over into the hole on its side, leaving the windrow of trees to the winds. This was only a few years ago, but today those trees are only a memory.

Most of the forest front is without a windbreak. While ridges, landslide débris, and bowlders here and there afford protection, the main timber-line breasts the wind unsheltered. If one follows along this strange boundary line, the timber-line, he will see in some places trees which have been struck by lightning, others mowed by snowslides and in places crushed, and in still other places trees protected by bowlders or landslides that have come down from the treeless heights above. Trees that have grown up to the leeward of a shelter are quickly trimmed and markedly changed shortly after the sheltering barrier is removed.

A tree may be forced out of plumb by prevailing winds and then be caught by heavy snow and crushed down and held so long that it never regains its upright position. There are acres of trees prostrate, chiefly from the effect of high winds, but perhaps incidentally from the weight of winter snow. A combination of wind and snow causes many a tree, at a foot or less above the earth, to abandon the growth of its top and give all of its energy in sending out and maintaining long limbs which radiate in all directions. Many of the long, storm-tempered limbs are nearly as tough as steel. The smaller limbs may be knotted without breaking.

In other places trees grow along the ground to the leeward with a few flattened limbs streaming out parallel to the top. The few scattered erect ones possess limbs on only the leeward quarter. Limbs on the stormward side have never been allowed to grow. Many trees thus are standing, worn away to the heart on the stormward side, the naked bones showing, while on the leeward there is the green bark and long out-streaming limbs.

Many of these dwarfed ancient looking little trees are not two feet high. Yet they are two and three centuries old and look as old as the mountains. Some are two or three feet in diameter and less than eight feet high. Numbers of trees, although at least a century old, are but small grizzled shrubs. In places a number of these may be growing together in a beautiful wild-flower garden composed chiefly of dwarfed flowers,—flowers with stalk and bloom perfectly formed but less than one inch in height. Like the trees themselves, many of these dwarfed plants have a strange and extensive root system, while others, like many of the trees, are growing on only the leeward quarter.

Areas of a "block" or more are covered with low matted growths as smooth and unbroken as the trimmed surface of a hedge. They are clipped off almost as level as a lawn, with the

SHELTERED FOOTHOLDS AGAINST THE WINDS

Dwarfed, ancient looking little trees, matted together behind a sheltering rock, maintain themselves far beyond the tree limit. Their tops are clipped off as in a trimmed hedge, for any adventurous twig that reaches too far upward during the summer is certain to be dried out and killed by the winter winds. The work of the wind is not altogether destructive, however, for it carries dust from the upper plateau to the nooks and corners of the glacier valleys to serve as soil where the meadow and, later, the forest can gain a foothold for advance in the never-ending struggle up the granite slopes

Limber pines grow in exposed spots among the forests of Engelmann spruce. The spruces stand straight and true wherever they are found, but the pine develops a stunted, gnarled, and weathered appearance as a result of its rigorous warfare with the winds. As is the case with all plant forms at the limits of vegetation, the pines increase very little in size in a single season so that a veteran of many decades may have developed but a small stature. (Photograph taken at an altitude of 11,200 feet, on the Front Range of the Colorado Rockies)

numerous twigs interlacing. Here and there in these growths a single tree trunk, badly battered, may stand like a tattered flag or banner. Even in the worst wind-swept groves one may see, waved far aloft, the plume of one or more pines.

On a moraine nearly 12,000 feet above sea level I once saw in the distance a tree of striking appearance. Its substantial trunk was three feet six inches in diameter. The total height of the tree was seven feet nine inches. For two feet it was limbless, then came a great whorl of limbs. A few of these at the base were nearly a foot in diameter. Apparently the tree had been shielded and its form and height determined by the presence of a few large bowlders thirty or forty feet up the

The spruces form the regular heavy growth of the upper forests where they are associated with balsam fir. On the higher and more exposed localities the fir is replaced by foxtail and limber pines. Flowers in profusion, full of color although not highly varied, blossom on the mossy floor of the forest and in the Alpine meadows above. The spruce-fir forests are chiefly important as conservers of the water supply on which the surrounding country relies for irrigation; their value as lumber is slight, although the spruces may be employed for mine timbers

This squatty giant of the timber-line, although not eight feet high, has a trunk three and one half feet in diameter. Such tabular forms are frequently assumed at both the mountain and polar tree limits. The height of the tree beyond which upward growth ceases is determined by the average depth of the snow, for twigs that project above the drifts throughout the winter are usually cropped by the dry Alpine blasts. Beyond the tree limit the same conditions reduce the tree growth to mere ground mats of shrubs. (Compare with page 431)

slope. The annual rings in this tree are exceedingly thin and the probable age is about two thousand years. It was killed by a forest fire in 1900. Its wood is so dense, fine-grained, and tough, that the preservative treatment given it by the fire should enable it to endure for a century or longer.

Dry winds are the deadly ones. Trees on wind-swept beaches, the very front ranks of the forest at the seashore, are also greatly exposed, but the air here is damp. Sometimes in winter in the Rockies extremely dry winds blow for days in succession. If their coming has been preceded by a drought they have a most devitalizing effect on the trees. Apparently they absorb much of the moisture—the very life—from the trees, and as a result the fol-

The prevailing winter winds which bring the heavy snowstorms blow from the west so that the trees are bent eastward and tend, after years of pressure, to put out their branches and point their heads permanently in this direction. The winds, sweeping the high ranges, sometimes blow more than a hundred miles an hour with great regularity in direction. Only where the direction and strength are continuous and persistent, as on high mountains and along some stretches of seacoast, is such direct contortion of trees to be seen lowing summer the needles of the trees turn brown. They are dead.

It is in the arid climate of the eastern front of the Rockies that high winds are most destructive. Dead trees in exposed places are literally eroded away. The lack of grass and other vegetation on the surface of the ground enables the wind to obtain tools of sand and gravel. These cut like sandpaper or powdered glass.

Timber-line as seen in the life of the individual man is a fixed, permanent line, but in reality, in the general view of time, timber-line is not fixed. Despite the aggressive work of the hardy trees which time has developed, the forest ranks in the dry wind-swept heights are being driven down the slopes. In moist places timber-line is slowly creeping up the heights, while in the drier regions, especially in the Rocky Mountains, it is losing ground. The surface of the earth is becoming drier. This condition in a few regions is favorable to trees, but over many wide and wind-swept stretches it is most unfavorable. One may travel for miles along the forest frontier without seeing a single young tree in advance of the old front rank of the forest.

Numbers of small pine trees, although at least a century old, are but short grizzled shrubs, contorted out of all resemblance to their kind in the forest. Down among the spruces the limber pines grow taller than at timber-line, sometimes as high as thirty feet in northern Colorado and fifty feet in southern Colorado. Owing to the compact annual growth of the Alpine form, it is very difficult to tell the tree's age without the assistance of a lens. The most potent factor in this stunting of tree growth is not the cold but rather the desiccation caused by persistent icy winds. The winds in winter rob the tissues of their stored-up water which they are unable to replace from the frozen soil

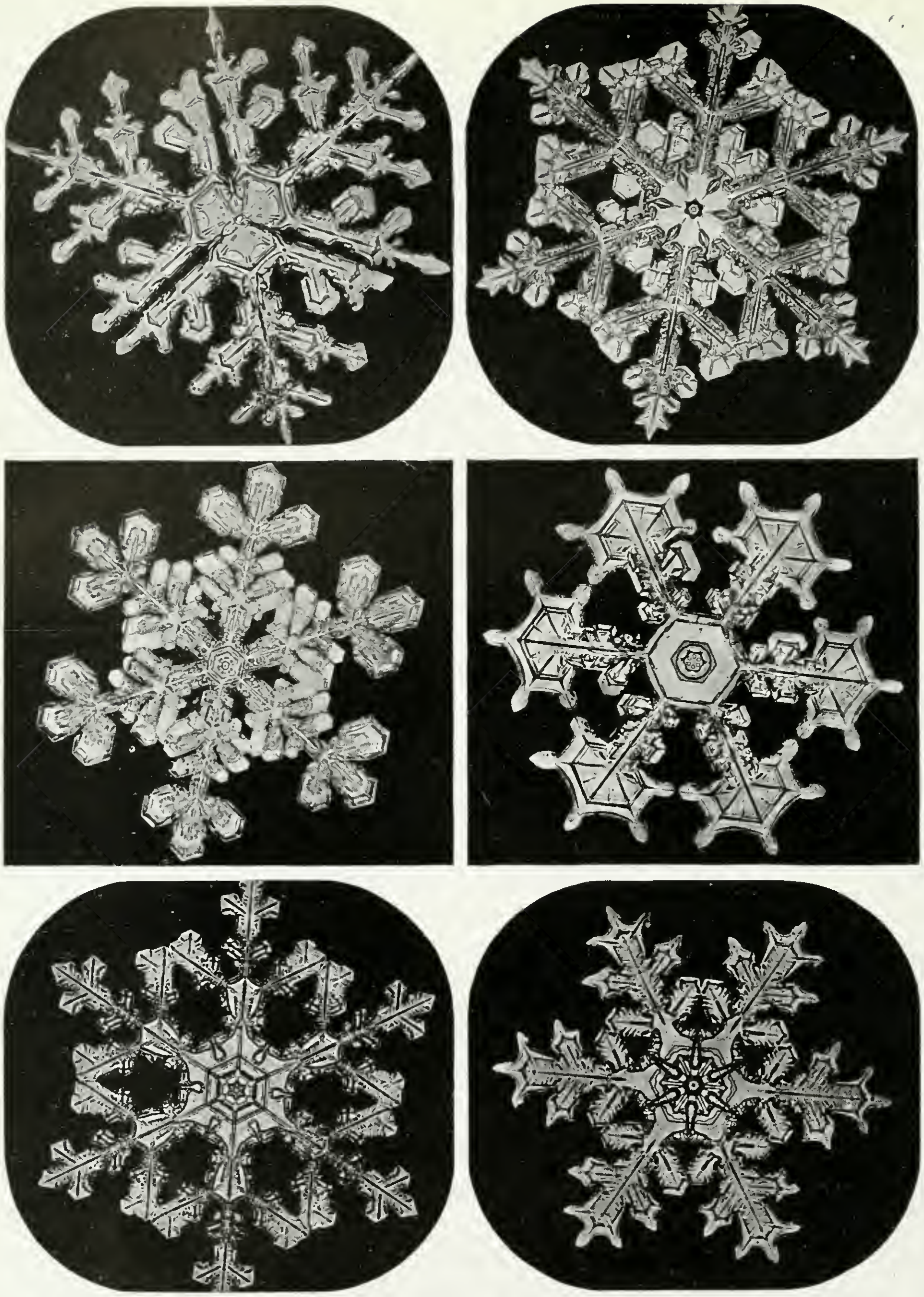
Here and there along the timber-line in the Rockies is a bleaching log or a sand-eroded snag—all that remains of a former tree colony. Its nearest living representatives are several hundred feet down the slope, where there is more moisture and more shelter.

The front ranks of the forest—the forest frontier—are fighting the winds on all of the high mountains of the world: in the forest's farthest north near the Arctic Circle, the timber-line lies low, only a few feet above the level of the iceberg-dotted sea: in the Alps it is more than a mile above the sea: under the warm equator its ranks climb high into the mountainous sky: and in the Rocky Mountains they are dwarfed and broken by battles with the winds on the dry heights more than two miles above the shore line of the sea.

The lot of a tree may be cast in a tropical jungle, on the ocean's shore, alone out in the plains, or in a favored clime as where the unrivaled Sequoias grow. Every tree tastes adventures and looks upon many stirring pageants, but none lives a more intense life than that tree whose shadows fall upon mountain snows—the tree which faces the winds of the high plateaus, bravely struggles for existence, and lives its vigilant and exacting life among high peaks and passes.

In places the trees grow along the ground to the leeward with a few flattened limbs streaming out parallel to the trunk. This condition is undoubtedly caused by the combined action of wind and snow, for the trees, while bent over in a blizzard, are buried under the great weight of snow, which bears down their branches and permanently alters their growth. Snow falls to a great depth on the high ranges and lies late into the summer season, drifts of "perpetual snow" being found down to the tree limit in protected spots

Protected from the winds among the bowlders and with roots crowded into cracks among the rocks, a solitary tree will start and persist in its lonely growth on the very fringe of tree vegetation. Seldom does its head rise above the protection, however, as it creeps eastward away from the blasting winds. The most astonishing feature in such growth is frequently the minimum amount of soil which the tree requires for its roots



COMPOUND STELLATE SNOW CRYSTALS FOR THE JEWELRY DESIGNER

The intricate and branching forms of this group suggest jewelry designs in gold or enamel and patterns for lace or machine embroidery. These most complex snow crystals are probably formed in intense cold such as is found in the high altitudes from which the snow falls during general storms or during local storms in zero weather. The central usually hexagonal ice crystals act as nucleus for the intricate branches whose ribs are for the most part hollow tubes. The upper left-hand crystal shows imperfect or asymmetrical growth from an imperfect nucleus

Art Motives in Snow Crystals

BOREAL STUDIOS CONTINUALLY MAKING NEW DESIGNS

By HERBERT P. WHITLOCK

WITH the resumption of manufacture upon a peace basis, a growing demand is being felt throughout the United States for American products which will express a distinctly American spirit in new designs. Manufacturers have voiced the opinion that an added impulse to applied art in this period of reconstruction of trade will come with the introduction of art motives which are not only striking but novel.

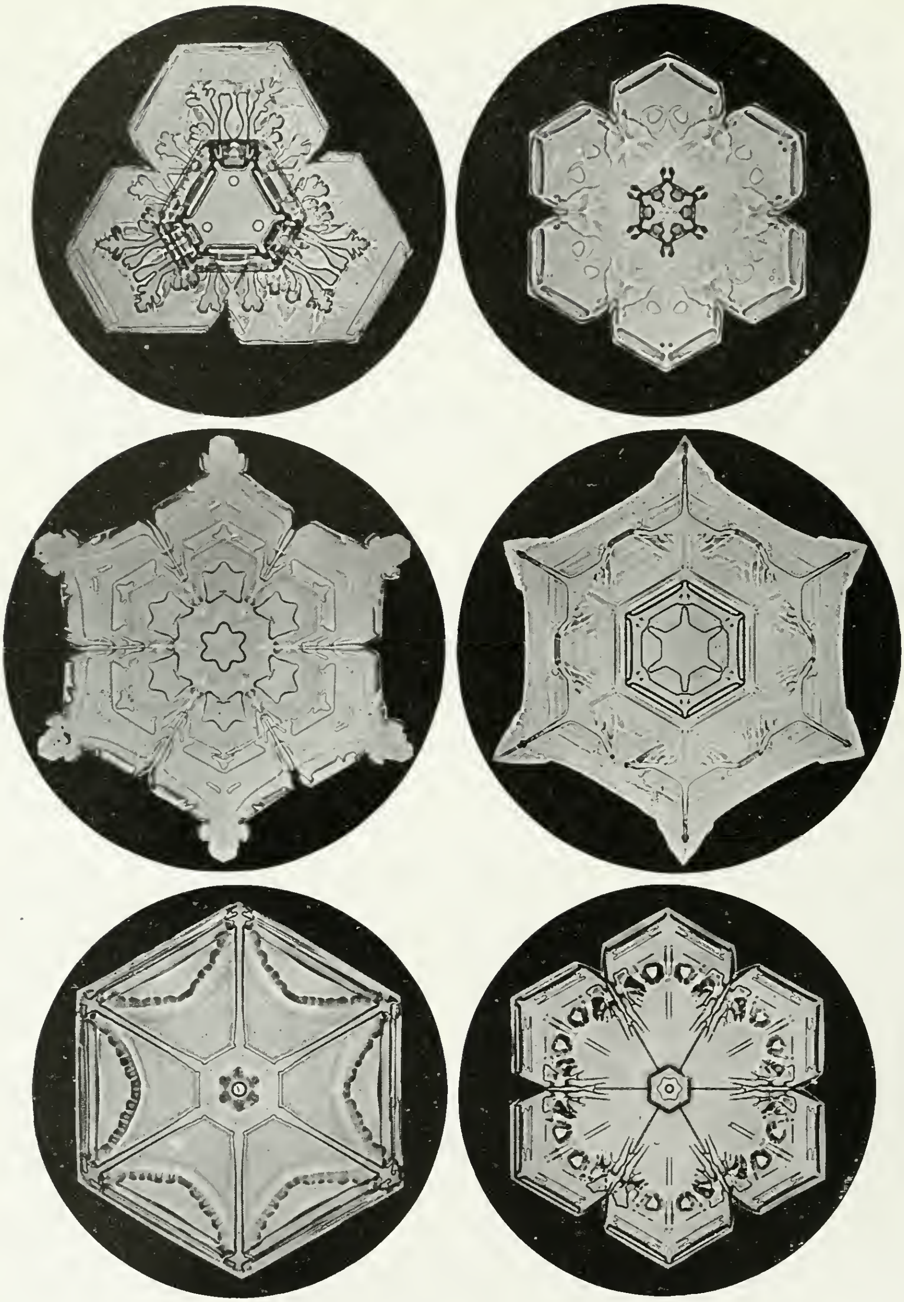
The forms of the inorganic kingdom have as yet played little part in the development of art motives which have, up to now, been dependent mainly upon geometric patterns and upon more or less conventionally treated plant or animal forms. And yet it would seem that at least some of the mineral forms could be successfully substituted for those more stiffly geometric patterns which have been handed down through the centuries as part of our art heritage.

Snow crystals, combining, as they do, a wonderful symmetry of form with a practically inexhaustible variety of six-symmetric outlines, offer a fertile field for the designer. The snow crystals illustrated in these four pages are only a few examples—chosen from many hundreds—of the intricacy and beauty of nature's geometrical designs as expressed in these tiny jewels of the air. The magnified photographs, enlarged about fifteen or twenty diameters, were obtained by the simple method of catching the falling snowflakes on a black screen, which could be immediately introduced on the stage of a low power microscope fitted with a photographic apparatus. In order to secure the best results the photographing of the snow crystals should be conducted in the open air while the snow is falling. Snow crystals have, for many years past, been successfully photographed and studied by Mr. W. A. Bentley, of Jericho, Vermont, and the photographs here reproduced have been selected from his extensive collection.

As a basis for art motives, it would seem that the range of uses to which these natural geometric forms could be applied is fairly comprehensive. Many of them suggest designs for cut and engraved glass in a great variety of applications. The stellate types, repeated with their extremities in contact, or nearly in contact, develop into allover patterns applicable to book covers, oilcloth, wall paper, or textile designs. Some of the more delicately branching forms are strongly suggestive of jewelry designs, as applied to brooches and pendants, either as settings for stones or enameled. The designer of stained glass rose windows may find in some of the compound tabular forms inspiration for unique patterns.

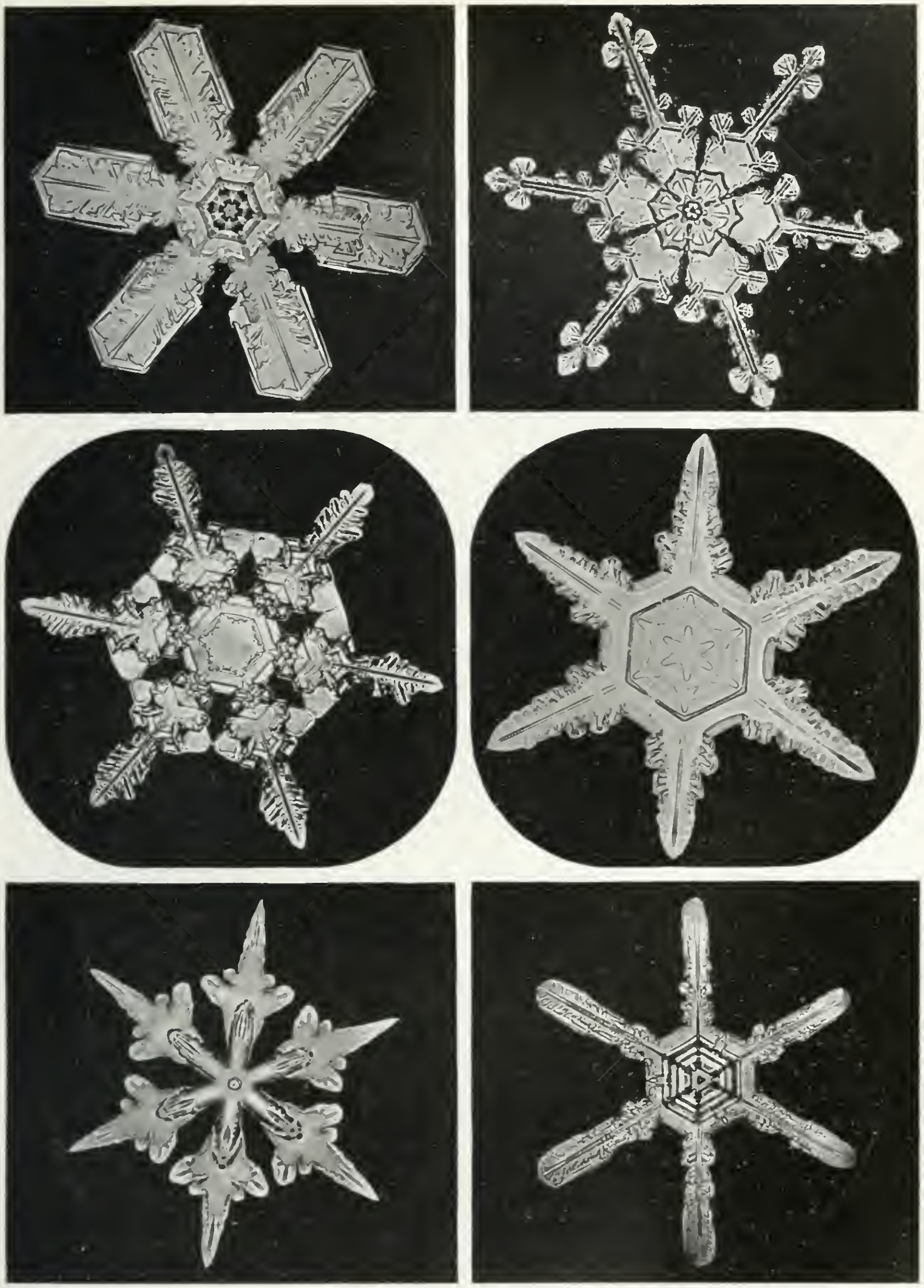
Lace and drawn work, rosettes in fresco, tailpieces for books and magazines, and medallions for the centers of china plates, are some of the suggested uses which might be made of snow crystal motives. In fact the user of geometric designs in any of the decorative arts could well profit by the consideration of these varied and beautiful combinations of six-sided symmetry turned out of nature's studio.

Nor is there any limit to the supply of new motives, derivable from this source. With every fall of snow, in temperate and boreal regions, under the right conditions, more combinations are being added to the thousands already photographed, constituting an ever growing portfolio of designs, and presenting every degree of complexity from a simple hexagonal outline to intricate, branching forms of the compound stellate type.



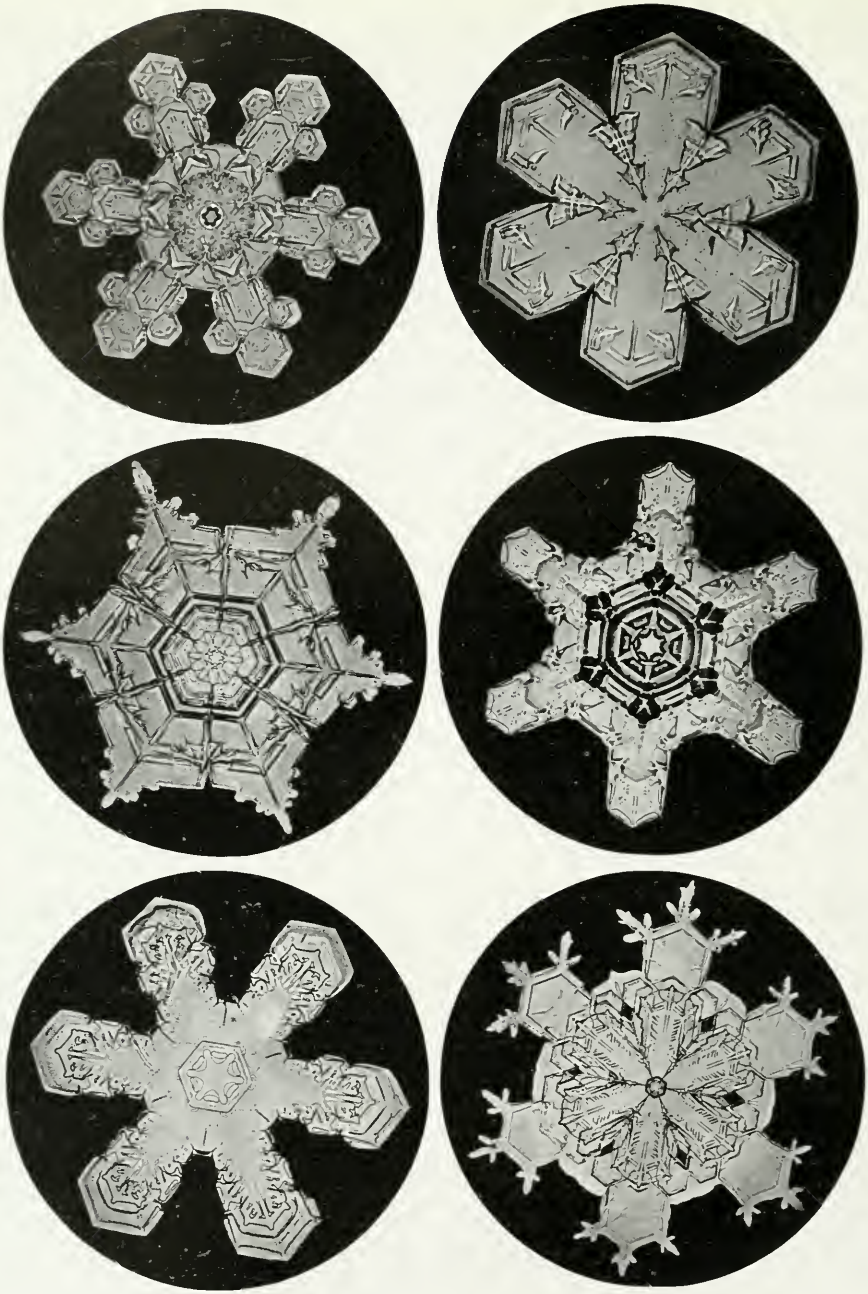
TABULAR DESIGNS FOR CUT AND ETCHED GLASS

The simple variations of the hexagon shown in this group of snow crystals suggest designs which could be used for cut and etched glass as applied to electroliers, bowls, and table glass. They could also be used as the centers of designs for china decoration in raised gold or color. These types of crystals are probably formed in relatively high temperatures and are found especially in local storms



STELLATE SNOW CRYSTALS SUGGESTIVE TO THE TEXTILE DESIGNER

This type suggests close repeated designs in oilcloth or the conventional wall paper as well as in textiles, such as print fabrics and heavy curtains. These six-pointed stars are apparently a combination of the tabular and stellate types. The small tabular hexagons acquire branches in their journey through the clouds and become otherwise modified by the varying temperature and atmospheric pressure strata through which they fall. The lower right hand crystal is interesting as an illustration of the not infrequent change from a triangular to a hexagonal form or vice versa. The more elaborate forms of this group merge into such complete stellate designs as are shown on page 436, and are susceptible of similar gold and enamel applications



COMPOUND TABULAR SNOW CRYSTALS SUGGESTIVE OF WORK IN FRESCO AND STAINED GLASS

This group of very modified crystals would furnish admirable designs for isolated rosettes in fresco. They even suggest rose windows in stained glass and Saracenic lattice work. All of the above forms are but illustrative examples of the many thousands of microphotographs which Mr. W. A. Bentley has taken during the last thirty-five years in Jericho, Vermont, and from which an infinite number of artistic designs adapted to different purposes might be selected

Cinema-microscopy an Essential to Modern Science and Education

By CHARLES F. HERM

(Department of Physiology, American Museum of Natural History)

MANY subjects in the various branches of biology which are discussed in the modern textbook belong to a region of observation inaccessible to the general reader or student. They can be approached only by means of refined techniques applied to special objects not ordinarily available for practical study or demonstration. A knowledge of these subjects must, therefore, in most cases be acquired from textbooks in which illustrations take the place of the living object. Drawings or still pictures, however excellent, cannot always convey an accurate mental picture of the living object. It is extremely difficult for the most skillful technician to represent even in a carefully preserved specimen the exact appearance of the real object. The fixative and stain render the subjects in some measure more or less schematic and embody a considerable subjective element of interpretation.

The Cinematograph Faithful to Nature

The cinematograph, whatever its shortcomings, gives an absolutely faithful representation of what appears under the microscope or before its lens; it contains no subjective element save that involved in the focusing of the instrument, and hence conveys a true mental picture—a picture nearest to nature itself.

There is no field of endeavor in which the cinematograph has not been tried, proved, and accepted, with the result that it has become an essential aid. The biologist, particularly, has an immeasurable opportunity for the production of films to show biologic phenomena such as function in health and disease, the action of parasites, and the many activities relating to personal and public hygiene, especially as hardly anything has been done in cinematographic representation along these lines.

Cinematographs of this sort would undoubtedly be a most important adjunct to real educational effort. The arduous and wearisome method of study by memorizing textbooks can be materially moderated by the adaptation of the motion picture. These pictures can be arranged so logically, so clearly, and so free from puzzling questions that students can immediately absorb the most complicated subjects.

Cinema-microscopy is a great need of the future; many colleges and schools are eager to introduce its results in their class rooms because they realize that no other device equals it for conveying a lecture or experiment. But at present where and how are schools to get films of such a character—films on microscopical subjects, strictly educational, having technical qualities, and produced by specialists just as textbooks are written and edited by specialists?

Cinema-microscopy a Problem for Educational Institutions

The production of a film textbook of zoölogy, physiology, or botany which contains hundreds of short reels or subjects, scientifically correct, up to the highest standard of learning, correlating with the approved textbooks, has so far not been a commercial success, due perhaps to the lack of specialists, the large expense involved, and certain limitations of the subject. The public undoubtedly is interested; the secondary schools and colleges would welcome aid of this kind and it remains for some large educational institutions to establish a micro-cinema laboratory for the production of such negatives.

The producer of such films, if he be well acquainted with the various branches of science, can devise interesting and original experiments to suit any stage of knowledge. He can vary the experiments so as to bring the pupil face to face with something which can never be illustrated by diagrams in a textbook. He can lead the pupil step by step, and the more deeply he plunges into the particular branch of science, the wider will be his scope in the portrayal of scientific phenomena by fascinating experiments.

Cinema-biology a Demonstrator of Vital Life Factors

Above all, the cinematograph gives the scientist an opportunity to illustrate at will and repeatedly the results of the laboratory experiments. In many colleges, in medical schools, and even in certain classes of high schools, it is important to demonstrate the living phenomena as closely as possible; sketches, wall charts, or still photographs do not show the different movements and the results of experiments: they do not show the technique of the experimenter or the accompanying reactions of the organism such as the beating of the heart, the circulation of the blood, and the acceleration of respiration.

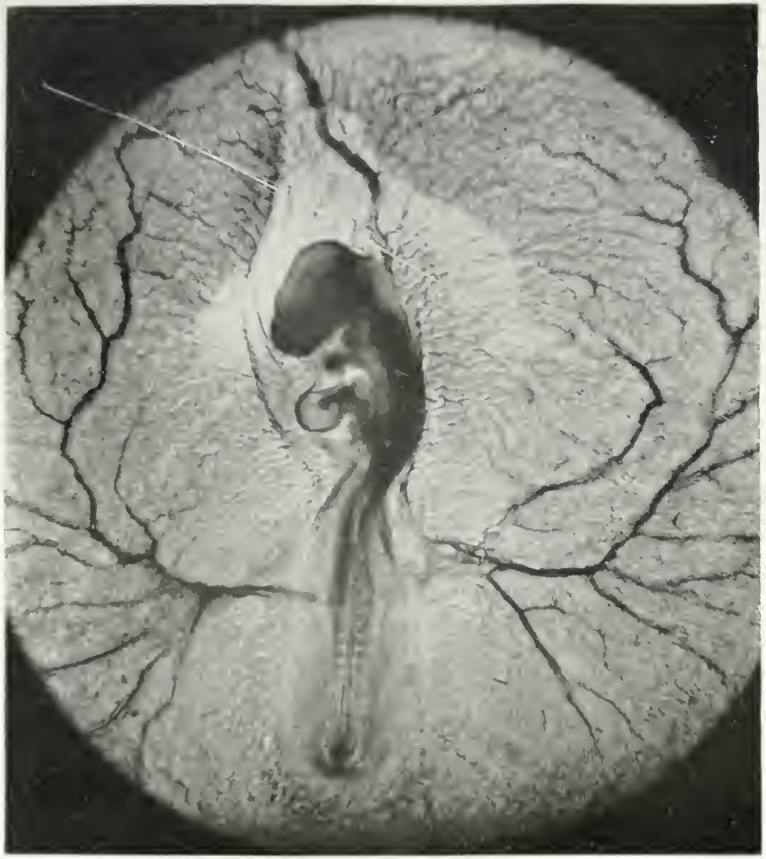
But by means of the cinematograph the most delicate operation can be recorded and all its details reproduced with the utmost precision. At the same time this wonderful instrument will save many hours of tedious laboratory routine which could be used to far greater advantage in original research. On the other hand, cinematography will widen the teaching power of any single experiment or demonstration, and become the greatest of all teachers.

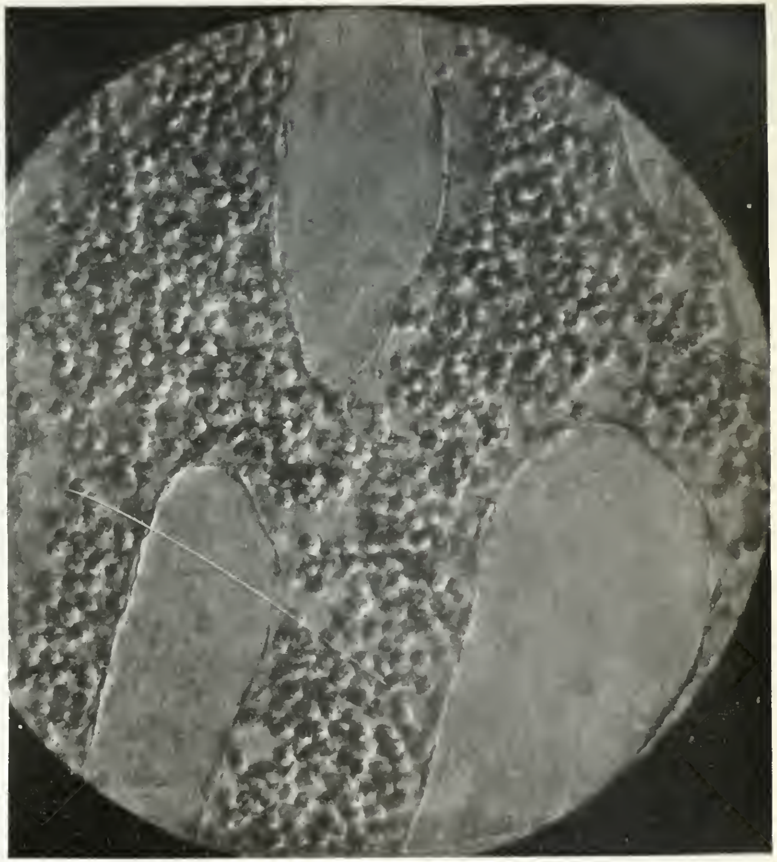
When an experiment is well executed and recorded on the film, and then shown to a large audience of students, each individual can follow it precisely and in all its details. By varying the rapidity of the exposure the cinematograph can quicken or retard the movements. As is easily understood, this possibility offers great advantage for demonstration.

Each film becomes a document representing a scientific truth, and from this record any number of copies can be reproduced for the different schools and colleges of the country. The demonstration by cinematograph possesses certain marked advantages over the laboratory experiment: it reaches simultaneously and equally a greater number of spectators; it enables the teacher to demonstrate an important fact leisurely and repeatedly; it permits the student to interrogate and thus accurately crystallize his deductions from the experiment.

A cinematographic apparatus for taking and exhibiting scientific motion pictures has been installed by the Faculties of Medicine in Paris, Lyons, Bordeaux, at the Pasteur Institute in Paris and Lille, and even in certain museums. Records of the many surgical techniques and biological processes necessitated by the great war have in this way not only been visually preserved but have also been actually used for disseminating the knowledge gained.

But the auditorium and the class room should not be the only places in which to exhibit scientific motion pictures: a corporation should be established through whose agency certain scientific subjects could be exhibited to the public. Every day there are hap-





CINEMAPHOTOGRAPHS OF THE LIVING CHICK EMBRYO AND OF ANASTOMOSING BLOOD VESSELS IN ITS CIRCULATION

Microcinematograph of a forty-eight-hour-old chick embryo, together with its vascular area dissected from the egg yolk. The embryo has been placed in a culture medium where it is kept alive for many hours while the rhythmical action of the heart and the circulation of the blood are photographed. This illustrates the possibilities of the motion-picture machine in reproducing physiological processes for educational purposes. The heart is seen in the embryo as an external bulblike organ near the center of the animal. The dark vessels are the vitelline arteries and their branches, while the lighter are the various branches of the venous system. Magnification 120 diameters

Connecting or anastomosed capillaries of the vascular area of the chick embryo magnified 500 diameters. The blood corpuscles are seen as disks which by means of the cinematograph can be shown floating in the blood serum through the system of microscopic capillaries. In this way experiments too complicated or difficult to be performed by the individual student and unsuited for demonstration from the lecture table can be presented to elementary classes in biology, whereas at present verbal description or still photographs and drawings are relied upon. From the cinematograph the student will get not only the facts but he will also have many of the advantages of the laboratory work penings of interest and importance in the scientific world of which the people at large have only a hazy understanding. Scientists make discoveries which illumine the dark phenomena of ordinary life; inventors create new wonders for the benefit of mankind—but about all these things the people for whose benefit the creative mind of the scientist really works, know little or nothing. Many of these subjects could be rearranged so that they would be entertaining and at the same time would give the public the kind of picture which is instructive, which demonstrates vital factors in life.

Films Showing Circulation of Blood in the Chick Embryo

My interest in this work has arisen through laboratory researches on living tissue in the department of physiology at the American Museum of Natural History. In collaboration with Mr. Alessandro Fabbri, research associate in physiology in the American Museum, who is much interested in biological cinematography, there has been prepared a microscopical film 1200 feet long, on the physiology of the heart and the circulation of the blood in the chick embryo. This work was done in the private laboratory of Mr. Fabbri,—a laboratory completely equipped with all facilities for the highest grade of cinematography.

The physiology of the heart and the circulation of the blood have attracted the attention of investigators from very early times. Far back in 1616 scientists studied them. William Harvey was the first to grasp the fact that the heart acted as a force pump to drive the blood in a circle through the blood vessels and back. Since the time of Harvey, however, physiological technique has been remarkably improved. Many methods have been discovered to demonstrate the general function of the heart and vascular system. But not until cinema-microscopy attracted the attention of modern physiologists, has it been possible publicly to demonstrate the finer details of this phenomenon.

In the film which has been made, the first scene demonstrates the necessity of carefully marking on the shell of the egg the date and hour when it is placed in the laboratory incubator, in order to obtain an embryo of known age. A constant temperature of 103 degrees Fahrenheit is maintained.

The second illustrates how, after forty-eight hours, the egg is removed from the incubator and, after being carefully opened, is placed in a glass dish, embryo and vascular area uppermost. The vascular area, with its embryo, is now dissected from the yolk and transferred to a large culture chamber, which is sealed with a cover glass by means of hot paraffin and placed under the micro-cinematographic apparatus.

We see the entire living embryo, forty-eight hours old, demonstrating the circulation in the vascular area. The circulatory system of the young chick consists of branching tubes, the arteries coming from the heart, which is now outside of the body. Dividing into a fine network of capillaries in the vascular area, these vessels reunite into a large vein which carries the blood back to the heart at the opposite side.

The picture shows the heart as a muscular organ which rhythmically contracts, decreasing its volume, and thereby driving out the blood which has flowed into it during the period of relaxation. In mammals and birds there are two separate circulations; the two pumps are combined side by side, the right auricle and ventricle form one pump, while the left auricle and ventricle form the other.

The subject of the fourth scene is the heart of a living embryo thirty-three hours old, showing its first rhythmical activity and the course of the blood in the transparent heart cavity during contraction.

CINEMAPHOTOGRAPHS OF BLOOD VESSELS WHICH CARRY THE FOOD SUPPLY FROM THE YOLK TO THE DEVELOPING CHICK EMBRYO

The capillary network of the yolk sac is here shown in detail, demonstrating the ultimate connection between the arterial and venous systems as well as the free endings of many of the capillary tubes. With the cinematograph this fundamental aspect in the circulation of the blood can be presented not only to the student of embryology with his incubators and expensive laboratory equipment, but also to the elementary classes in physiology and zoölogy. It requires, however, production of films by specialists and not merely by professional photographers with no particular knowledge of the science they are to demonstrate

Capillary tubes from the yolk sac of the chick, magnified 200 diameters, showing the free endings of some of the branches. It is by these fine tubes that the food material stored in the egg is absorbed by the growing embryo. Physiological actions such as the above can be recorded and indefinitely repeated in the class room, together with the technique of the experimenter or the surgeon. In this way the teaching power of any particular specialist is widened, and the audience to which scientific knowledge may be brought is enlarged

The next picture shows us a heart of a living embryo thirty-six hours old, with body still transparent enough to demonstrate the action of the heart valves. In the following picture we see an embryo magnified 150 times, and we observe the circulation of the blood in the right and left mesenteric artery and the contraction of its walls. Next the vascular area is seen in detail where the blood vessels, as they become farther removed from the embryo, divide into smaller branches, and there is evidence that an increased internal friction results which causes considerable resistance to the flow of the blood. A high pressure is therefore required in the main arteries to drive the blood through the small vessels. Next we see the mesenteric artery demonstrating the arterial flow of blood; we follow the blood vessel until it divides into several branches, which in turn are often connected by anastomosis; then the arterioles in fore- and mid-brain and the capillaries in the hind-brain; then we see the capillaries of the posterior vitelline area, the posterior cardinal vein, the capillaries of the anterior vitelline vein, all leading back to the mesenteric venous system and reaching the embryo again at the right mesenteric vein, where the even flow of venous blood is nicely demonstrated.

Another film has also been constructed in collaboration with Mr. Fabbri, emphasizing the behavior of transplanted heart muscle. Many experiments have been made in transplanting heart muscles into a tissue culture to determine the conditions which will prolong their life and function. The heart of a chick embryo will beat rhythmically from six to ten days after having been removed from the animal and transplanted in blood plasma. But if tissues are retransplanted from time to time into a fresh culture, it is known that the muscles will live for more than sixty days.

In order to obtain such cultures for the motion picture the heart of an embryo is dissected into small pieces about the size of the head of a pin, and each piece transferred to a cover glass and quickly imbedded in a drop of blood plasma. The cover glass is then inverted over a hollow ground slide and sealed with hot paraffin to prevent drying; the prepared slide is then reincubated.

In the picture we see the transplanted heart of an embryo eight days old, which is still beating rhythmically after six days of transplantation; also a section of heart muscle fifty times magnified showing its rhythmical activity ten days after transplantation.

Scientific authorities agree that one of the most valuable possibilities of such films lies in the fact that they bring within the comprehension of the student mind a wide range of information, thereby encouraging reflection, original thought, and research.

The cinematographic apparatus used for the production of these films is a special and rigid table, and a Debri camera. The source of light should be automatic, as it otherwise would be difficult to keep a subject properly illuminated for a certain length of time. The condenser and cooling trough are attached in front of the arc, between the microscope and the light. The vertically arranged camera has attached to it a handle by which it can also be swung in a horizontal position when detached from the microscope. This camera is provided with a direct focus tube through which the image on the film can be watched during exposure. This arrangement is of extraordinary importance, because it is absolutely necessary to watch the living subject while under the camera in order to obtain the best pictures. The mechanism for moving the film is worked by a small electric motor which is connected by pulleys and a leather belt to the shaft of the camera. The microscope used is a Zeiss No. 1. This instrument is of excellent construction and is supplied with an Abbé condenser, a dark-field illuminator, and a special rotating and centering mechanical stage with very slow movements for micro-cinematography; but the ordinary stage is preferable for most of the work. Here the vertical movement is built into the stage and the bar carrying the lateral movement is removable. The substage is focused by rack and pinion, but does not carry centering screw. The Berger fine adjustment is a very practical arrangement fitted with lateral milled heads. The body tube is 50 mm. wide. The diameter of the body tube is quite important for cinematographic purposes, for in working without eyepiece it governs the area of the projected disk and, within the covering power of the objective, the size of the specimen that is to be photographed. The ordinary microscopes generally carry a tube 37 mm. in diameter, but for the reasons just mentioned, a 50 mm. tube is much to be preferred. To utilize the wide tube to full advantage arrangements must be made for the removal of the draw tube. The interior of the tubes must be dead black, so as not to cause reflections.

The most difficult problem in cinema-microscopy is the illumination. Sunlight would be ideal for the purpose, but because of the uncertainties of its availability recourse must be had to artificial lights, of which the electric arc lamp is the most useful.

Arc lamps are made to work with almost any current, direct or alternating, from 4 to 60 amperes or upward, giving a light that varies correspondingly from 300 to 10,000 candle power. The most useful lamps for the purpose under consideration are the smaller types taking 10 amperes or less.

The Bausch and Lomb 10-ampere lamp is very well adapted for cinema-microscopy. It is a hand-fed arc rendering about 1500 candle power; the carbons are regulated by milled heads which work very smoothly, and despite constant attention necessary to keep the arc in reliable working condition, this lamp has proved perfectly satisfactory. The arc is adjustable to different heights on a suitable pillar, and can be tilted if required.

Microphotograph of a hydroid, *Gonothyraea* (enlargement about 100 diameters), showing growth in branching colonies, also two kinds of members of the colony, feeding polyps (flower-like in appearance) and reproduction polyps

A MASTERPIECE OF ASSYRIAN LOW RELIEF

This and the examples of Assyrian sculpture following, from copyrighted photographs of the originals in the British Museum, are reproduced through the courtesy of W. A. Mansell & Co., of London

The foundation for low relief was laid from twenty to thirty thousand years or more ago, before historic times, in southern France, by the Crô-Magnon race. Their sculptures on the walls of caves, in low or in high relief, or in drawings incised or painted, challenge our admiration today by firmness of touch and sureness of line, and by what some of us in this twentieth century A.D. should take to heart—the restraint which cautions against unnecessary detail.

Low relief in relation to architecture had its foundation in early historic times as a development in Egyptian art. Egyptians discovered that conventionalism and simplicity even to the extent of stiffness of the lines and figures brought harmony of the sculpture with the building. They, however, did not use animal sculpture to a great extent, whereas the Assyrians did; therefore, the direct line of tradition of architectonic principles in animal sculpture comes to us by way of the Assyrians—for instance, through the beautiful sculptured friezes of Nineveh. The above low relief of the head of a horse is a masterpiece in which accuracy of drawing is combined with simplicity of modeling

A group of wild asses from the Palace of Nineveh

Zoölogical Sculpture in Relation to Architecture

With especial reference to development from the Crô-Magnons through Egypt, Assyria, Greece, Rome, and France.—Whether in high or low relief or in the round, the pasture as well as the planes, the lights and the shades, should carry the lines of the architecture.—A vast future for modern architecture lies in the lessons of the past on animal sculpture

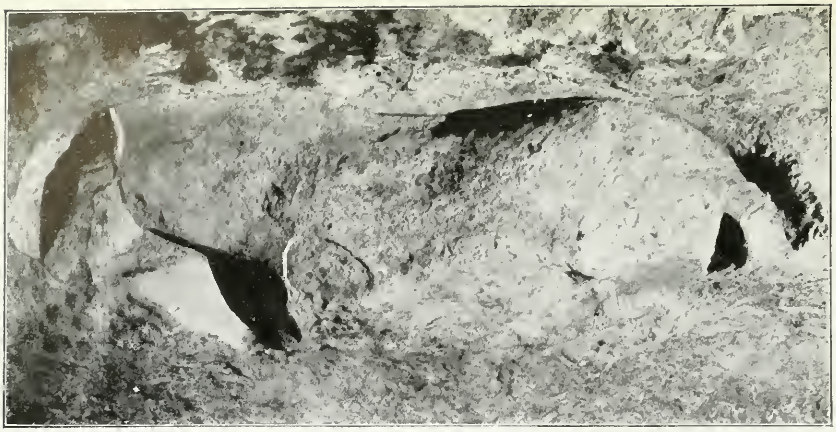
By S. BRECK PARKMAN TROWBRIDGE[1]

THE recent discovery of animal paintings and sculptures on the walls of the caverns in southwestern France and the Pyrenees writes the prologue of the history of art and at the same time makes an important contribution to the science of zoölogy.

These works of art, executed in the Aurignacian and Magdalenian periods, that is, about twenty or thirty thousand years ago, give striking evidence of the high state of intellectual development of the Crô-Magnon race to whom their creation is attributed. Their value to science consists in the truthful and accurate representation of a great number of animals, some of them long since extinct in Europe, such as the mammoth, the horse, the cave bear, the wolf, the reindeer, the rhinoceros, and especially the bison, whose majestic and imposing form seems particularly to have appealed to the fancy of the artists. Their artistic qualities challenge unqualified admiration. Paintings, incised drawings, sculptures in low or in high relief abound, and all are characterized by firmness of touch, sureness of line, and by admirable restraint in the omission of unnecessary detail.

Prehistoric sculpture had for its background the bold and rugged rock walls of the caverns and shelters, and never erred in too great refinement of

[1]Appointed by Roosevelt when he was President, as chairman of the National Council of Fine Arts; incorporator, vice-president, and trustee American Academy in Rome; member Trowbridge and Livingston, Architects, New York City.

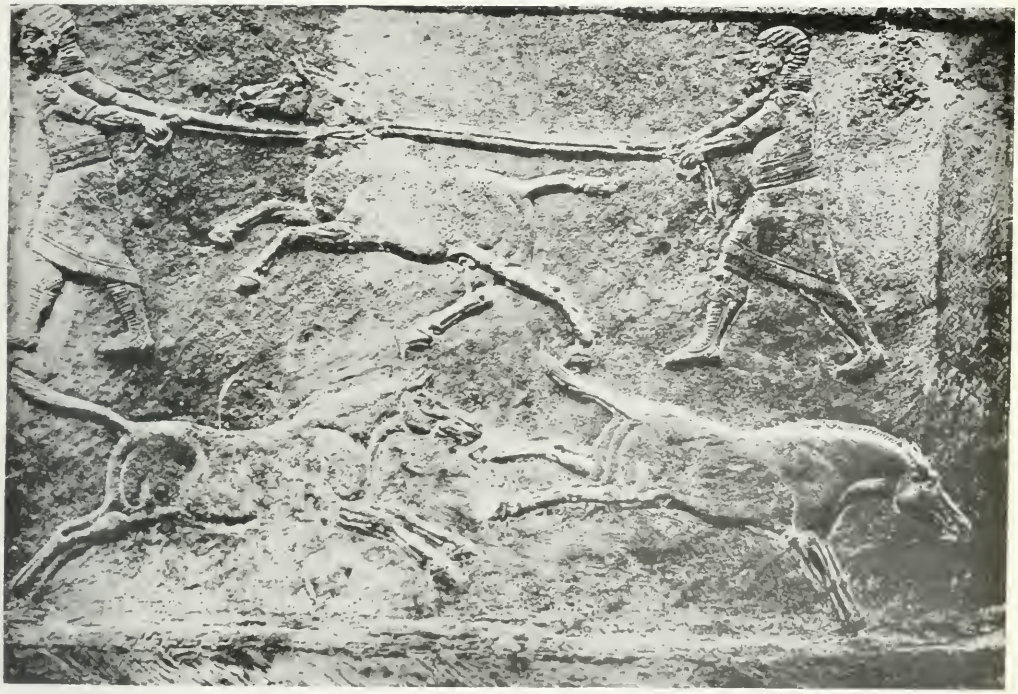


From "Men of the Old Stone Age" through courtesy of the Author and Charles Scribner's Sons

Part of a frieze of six horses, each horse relief seven feet long, found sculptured in the limestone under the sheltering cliff at Cap-Blanc (in Dordogne, France). Crô-Magnon artists invented low relief—a conventional method of representation of the round in a series of very flat planes by a proportionate reduction of thickness. Their subjects were many European animals now extinct, especial predilection being shown for mammoth, bison, reindeer, and wild horse. To view their work today, in comparison with modern sculpture, is to recognize the "unity of purpose, the sincerity, the restraint, the appreciation of plane and shadow combined with truthful and accurate delineation," which place it not as an effort of savages but as a work of true art by a highly developed human race

From "Men of the Old Stone Age" through courtesy of the Author and Charles Scribner's Sons

From the Crô-Magnon painting of the Celtic horse from the ceiling of Altamira, in northern Spain. This ceiling of ancient paintings, now so famous throughout the world, was discovered in 1879 by the little daughter of the Spanish archæologist, Sautuola, who was hunting flints on the cavern floor. The paintings are polychromes, ochreous brown in color, the outlines etched in the stone, given strong contour lines in black, and often a second series in red. On the Altamira ceiling the paintings are placed in groups, often on bosses of the limestone, the Crô-Magnon artist having had sufficient creative genius thus to adapt his work to the surface of the rock. (This painting of the Celtic horse may be seen in color as a mural in the American Museum and is reproduced in color in the *American Museum Journal* for December, 1912, in connection with articles by Professor H. F. Osborn and Dr. Clark Wissler)



(Above) The Wounded Lioness from Nineveh This Assyrian relief is remarkable not only for truthful drawing and modeling but for the suppression of every unnecessary detail and the emphasis of every part necessary to the impression of unbeaten courage which the artist wished to convey

(Below) A beautifully composed group of wild asses from the frieze of Nineveh. Compare the drawing of the heads of these animals with the sculptured Crô-Magnon horse on the opposite page

Part of a frieze in the Palace of Nineveh, the groups of which are conspicuous for their excellence in composition. Among the Assyrians we find first in historic times animal sculpture as such. Their work proves that they had love and knowledge of animal life and that they sought to express the characters of the wild beasts. Assyrian sculptures followed rather closely in artistic quality the cave sculptures of Crô-Magnon man, notwithstanding 15,000 or more years' separation in time and the entire lack of knowledge of the early artists among the Assyrians

Another group from the frieze in the Palace of Nineveh. Here at least six planes of surface are expressed in the slight projection. No country has ever equaled Assyria in the amount of animal sculpture used as a decorative feature in building, although to the Greeks belongs the credit of bringing such work to its highest expression

Lions from the same Nineveh frieze. The conventional treatment of the mane recalls the cuneiform inscriptions. The spirit of conventionalism in Assyrian sculpture connected with architecture passed on as a heritage to mediaeval architecture, but the development there entered the field of human figure representation

All the figures of this frieze, in their treatment of detail, show very distinct architectonic qualities in that they harmonize perfectly with their architectural setting

A BEAUTIFULLY COMPOSED GROUP OF WILD GOATS FROM NINEVEH

A GROUP OF WILD ASSES FROM NINEVEH

The figure of the ass looking back over his shoulder is one of the most extraordinary reliefs in existence, not only on account of its drawing and modeling, but because the full depth necessary for the turning of the head is expressed without violating the plane of the picture detail. Whether in flat or low relief or whether in bold relief, as in the case of a frieze of six horses, each seven feet long, carved on the wall of the rock shelter at Cap-Blanc, on the River Beune in Dordogne, these sculptures always show the unity of purpose, the sincerity, the restraint, the appreciation of plane and shadow combined with truthful and accurate delineation, which characterize all the work of the Crô-Magnon artists and place them not among the primitive efforts of savages but in the realm of true art.

It is a far cry from the Magdalenian art to that of the present day, but one cannot look upon the former without feeling that both are inspired by the same impulse and that underlying both are the same basic principles, so that we may justly attribute to the Crô-Magnon race the inauguration of the great traditions of art which have come down to us through the ages.

After a long gap of approximately fifteen thousand years, sterile in art as far as our knowledge goes, we come into the more familiar ground of historic times. As the architecture of Egypt developed and finally crystallized into a definite style, sculptural decoration necessarily followed the general trend and became highly conventionalized.

In order to produce unity, harmony of line, of surface, and of light and shadow in their architecture, Egyptian artists discovered that in their sculpture simplicity of modeling, firmness of outline and restfulness, even stiffness of pose, were essential, and to them we owe the tradition of those architectonic qualities which are so necessary to make of sculpture an integral part of a building.

Although there are many very beautiful examples of animal sculpture in Egypt, they are generally found grouped with human figures, and are more or less subordinate or incidental to the scenes presented. In Assyria, however, we find once again after many thousand years a return to the use of animals as the principal motive of wall decoration. Like their forerunners of Magdalenian times, love and knowledge of nature led the Assyrian artists to express the emotions and characters of the wild beasts. With no possibility of any knowledge of even the existence of the earlier art and with a separation of about fifteen thousand years between them, it is interesting to note how closely in artistic quality, in the essence of characterization, the Assyrian sculptures resemble the Crô-Magnon.

The lion hunt from the palace in Nineveh is but one of many groups adorning the palace walls which display not only great artistic quality in the individual figures but also a very marked ability in composition as well; and "the wounded lioness," one of these individual sculptures, is one of the most exquisite sculptures in existence, in which sincerity and simplicity are the salient characteristics and which, as an expression of unbroken courage and unconquered spirit, is unrivaled. All these animal figures are necessarily stylized, or conventionalized to the degree necessary to conform to the architectural setting, but in artistic feeling and in technique, as well as in truthful interpretation, they are unsurpassed.

As in Egypt conventionalism made possible the depiction of mythological forms such as the gryphon and the sphinx, so in Assyrian caryatid figures, where required for the portals of the palace, conventionalism permitted the use of the great bulls with human heads. In the use of animal sculpture as a decorative feature of architecture, no country has equaled Assyria.

Another recent discovery has added one more chapter to the history of art and illustrates again the principles laid down by our Crô-Magnon forerunners. No enumeration of the great animal sculptures of the past would be complete without at least a mention of the sculptured bulls of Crete.

To find, however, the highest expression of architectural animal sculpture we must, of course, turn to Greece. As the Parthenon has no equal in its architectural perfection, so the sculpture which adorns it is unparalleled in its beauty. As we should expect, there is a perfect blending of architectural and sculptural detail. The frieze depicting the Procession from Eleusis at the Panathenaic Festival, with its long line of horsemen, is a perfect illustration of the application of the principle of architectonic sculpture. The horses and men are rendered in low relief, vigorous and clean in line and contour, simple in modeling, restrained in detail, conventional to just the right point, and the proportionate relief of the different parts is preserved without confusion or the loss of a necessary shadow.

The posture of each figure, particularly the horses, though all are supposed to be in motion, is at that point of momentary rest which indicates the completion of one movement and the beginning of the next, giving

Detail from the Panathenaic Procession of the Parthenon Frieze. Among the Greeks, architectonic sculpture reached its highest development. The frieze of which this is a small part is perfect in composition, posture, drawing, and modeling, and eight distinct planes are shown without confusion the impression of progress to the whole procession without violating the canon that the medium of sculpture precludes the translation of actual movement.

The later Greek sculpture fell gradually into a realism which marked its decadence. Rome, however, revived to some extent the early Greek spirit and produced some notable animal sculpture. The very beautiful relief which adorns the rostra in the Roman Forum, as a single example, is sufficient to show that the Roman artists were still influenced by the early Greek spirit, and understood the necessity of conventionalism in architectural sculpture.

Mediæval architecture, although abounding in sculpture, has little to offer in the representation of animals if we except the grotesques, but in the use of the human figure it is unsurpassed and teaches a wonderful lesson in architectonic ornament.

Quite different in character but equal to the Greek sculpture in its adaptation to the lines of its architectural setting, Gothic figure sculpture, aided by the use of lines of draperies, not only melts into and blends with the mass and the detail of the building, but in the cathedrals and churches is also the means of proclaiming the spiritual and religious feeling of the architecture. The very rigidity of the figures, carried sometimes even to the point of awkwardness, typifies the mysticism and religious fervor of the age. Nothing could better illustrate the meaning of the "architectonic quality" than the portals of the great French cathedrals. The pose of the figures, the lines of the draperies, the quality of the modeling, the introduction of the crocket-like figures in the arches, all harmonize with and are a part of the architecture.

The saints of the portal of the Cathedral of Notre Dame in Paris (see Frontispiece) when seen apart appear grotesque, stiff, and uncouth, but in their proper setting, with the straight lines carrying up the vertical lines of the

Rostra, in the Forum of Rome.—The treatment differs materially from that in the Parthenon frieze. Harmony with the architecture has been preserved, but a decline in the art of relief is noticeable in that there is an attempt to produce the actual roundness of the figures, violating the essential principle of low relief architecture, and with the wonderful adaptation of planes and angles, they are the very acme of architectonic art. It is impossible to imagine these figures in a Greek temple or the frieze of the Parthenon on a Gothic church, yet each in its proper place is as near perfection as the art of man has been able to attain. In later Gothic times the tendency to realism again marked a decline and a decadence; as sculpture became more perfect in the imitation of nature it lost in architectonic quality and, as a result, in power of expression.

The Renaissance, in which one may include our own times, has given few great examples of animal sculpture as applied to architecture. For three hundred years sculpture has shown a tendency to fall more and more into realism with a resultant loss of architectural value. The history of art has been marked both in painting and sculpture by a succession of alternate waves of simplicity and complicated realism. We seem now to be coming to the end of a phase of the latter and there are unmistakable signs of a reaction.

A number of schools of various degrees of extravagance have appeared, the cubists and the modernists, but in passing they have rendered an undoubted service. They have at least notified the world that art is not photographic imitation, and they have broken the spell which seems to have bound us for nearly three centuries—but they, like children groping in the dark, have not found the way. Whether through deficient education or through lack of reasoning power, they have tried to persuade the world that artistic expression can be reached without work, that accuracy and skill in delineation are unnecessary or harmful; whereas the exact contrary is true.

The whole experience of mankind, the whole history of art from the Crô-Magnons to this day, teaches that there is no short cut, that there is no easiest way. Work, hard work, through years of incessant effort, is necessary to produce the qualities which enable men to express great and noble thoughts through the medium of dead immutable materials.

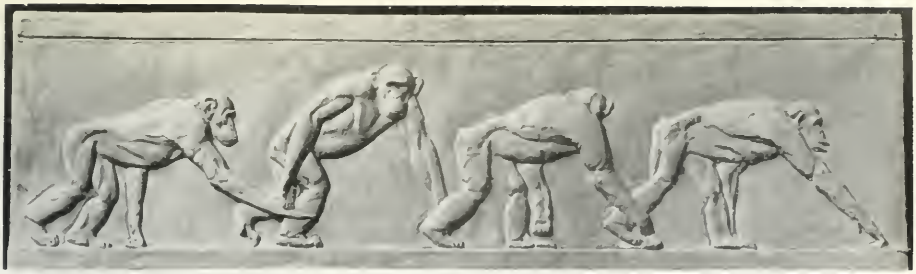
The error into which we have fallen and that into which the modern schools would lead us are the same. In both cases it is due to the neglect of the great tradition which has come down to us in an unbroken line from the Crô-Magnons, through Egypt, Assyria, Greece, Rome, and France, that, in the art of sculpture, as in all art, there must be sincerity and truth, accuracy in delineation and fidelity in modeling, and the suppression of every detail unnecessary to expression. The quality of beauty, which is the very essence of art, implies that the subject should always appeal to the higher and not to the baser emotions.

Where sculpture, whether of men or animals, is used in architecture, the treatment should be architectonic in order that it may be an integral part of the building. Whether in high or low relief or in the round, the posture as well as the planes, the lights and the shades, should carry the lines of the architecture. These are the lessons of the past. The ability to carry them out depends upon great technical skill, which can be reached only by infinite pains and a lifetime of labor and study.

Advocates of new styles in architecture who are constantly crying for new motives might do well to consider the possibilities of animal sculpture. There is a peculiar charm, an appealing pathos, in the expression of human emotions through the medium of the dumb animals, and by an endless variety of forms nature has provided a fertile field for the imagination. As far back as the Old Stone Age art sought its inspiration in the forests and plains and left traditions of interpretation which experience has shown cannot be neglected with impunity.

ON VIEW AT THE FIRST EXHIBITION OF ANIMAL PAINTING AND SCULPTURE IN THIS COUNTRY

This bronze, the black rhinoceros with tick birds on its back, was modeled by James L. Clark in 1914 shortly after his return from a trip with A. Radclyffe Dugmore to Africa, where they followed the big game over the African plains and obtained a famous collection of photographs. Mr. Clark has studied his animals in the field at close range and is interested in them as individuals. He shows in the arrangement of his subjects a familiarity with their inner psychology as well as with their external anatomy. The love of the animal for its own sake marks the true animal painter or sculptor. This rhinoceros bronze (which stands about two feet high) takes on additional interest because it is a duplicate of one which formed the centerpiece on the library table of the late Colonel Roosevelt's trophy room at Oyster Bay



By Grace Mott Johnson

Wild Life in Art

WORK OF CONTEMPORARY AMERICAN ARTISTS IN SCULPTURE, PAINTING, AND BLACK AND WHITE, DEALING WITH ANIMAL LIFE

By CHARLES R. KNIGHT

Illustrations from the work of Carl Rungius, James L. Clark, Charles Livingston Bull, Carl E. Akeley, and others[1]

TO the Brooklyn Museum belongs the credit of holding what is probably the first exhibition of animal painting and sculpture in this country. By this I mean an exhibit shown in a picture gallery and therefore regarded by artists and laymen as a true art expression along the lines selected by the sculptors and painters who took part in it. The purpose of those who had the exhibition in charge was to include

NOTE.—That our country is young and has, to date, been developing commercially rather than in the arts is evidenced in the lack of local encouragement of art. We have great centers like New York City where the painter or sculptor is recognized, finds some small chance for study, inspiration from the attitude of the people to do the best that is in him, and also the very necessary commercial market for his canvases or bronzes. But there is an emphatically disadvantageous situation in this country as a whole for the artist—perhaps particularly for the animal artist.

A young artist in America has to go to a great art center like New York to sell his work. His townspeople in the West, or the South, or the North, would seldom think of buying it, or even of holding him in the high esteem his work deserves. As a people we are not yet educated to it. The only art seen in many places is by means of the circuit system of sending pictures from city to city, and these of course do not reach the small towns.

Even in New York an artist must hire a place himself if he wishes his work exhibited. The American

[1] For examples of the animal sculptures of A. Phimister Proctor the reader is referred to pp. 470–476 of this magazine; for further illustrations of the work of Carl E. Akeley, to the AMERICAN MUSEUM JOURNAL for April, 1913, pp. 172–178, and May, 1914, pp. 175–187; for that of Louis Agassiz Fuertes to the JOURNAL for May, 1915, pp. 220–224; and the work of Charles R. Knight is illustrated in the JOURNAL for March, 1914, pp. 82–98. We regret that we have not been able to give a reproduction of Bruce Horsfall's "California Condor" or other of his notable canvases.

Miss Grace Mott Johnson approaches the study of large game animals purely as a sculptor. Her elephants are studio models rather than wild life, but modeled with a suggestion of movement and force. She follows an interesting insistence on the planes of the muscular surfaces.

works having both decorative and realistic character, with the result that many different styles of design were presented at the same time. This seems to me a very excellent idea, my only regret being that the necessarily limited space forbade the assembling of a still larger and more comprehensive exhibit. It was with much pleasure, therefore, that I was privileged to spend several hours wandering about the alcoves set apart for the purpose.

On first entering the main hall a bronze statuette of a rhinoceros caught my eye. This is the work of James L. Clark, at one time connected with the American Museum of Natural History. Mr. Clark made this model, which represents a black rhinoceros with several small tick birds on its back, shortly after his return from a collecting trip in Africa in 1913. The character of the great beast is very well expressed and one is impressed by the fact that Mr. Clark loves animals for their own sake and strives to depict not merely their outer form, but their inner psychology as well. This is a most important point and always marks the true animal painter or sculptor as the case may be. Miss Grace Johnson, on the other hand, to judge by her models such as those of elephants and lions has evidently studied modeling in the schools, as her work shows an insistence on the planes of the muscular

art museum seldom holds an exhibition of the work of American artists, except perhaps of such men as Whistler and Sargent. It buys mostly foreign pictures or bronzes, yet—and here is the crux of the whole matter of comparison of conditions in America and Europe—not many European paintings or bronzes and never any European wild life art is seen for sale in America, because if there is any cleverness in that kind of work in Europe, it is kept in the particular home town of the artist as a special possession. In Europe artists do not have to flock to the great centers to find encouragement or market for their work. In France and various other European countries there are many art galleries scattered in many towns, and there is a well developed general appreciation of art by the people.

It will take time to educate ourselves to a similar spirit in America, but this is what we must accomplish if art in America is to become at all comparable with art in Europe. Can we doubt that obligation —responsibility for the result—rests upon the great centers, especially upon New York?—C. R. Knight.

The famous bronze, "The Wounded Comrade," represents two elephants assisting a wounded bull to a place of safety. It is perhaps Mr. Carl E. Akeley's best known group. The subject of the bronze and its sympathetic treatment make a strong emotional appeal. Mr. Akeley, noted as a hunter of African elephants, has studied intimately the animals he portrays, and he gives to his sculptures the true form and character of wilderness life, which animals living in captivity do not possess. (An illustrated description of the clay model of "The Wounded Comrade" appeared in the Journal for April, 1913)

"Children of the Sage," a canvas showing the pronghorn antelopes in their wilderness home, by Carl Rungius. The artist is a hunter and traveler who has lived much among the western game, painting the animals as he found them in their natural surroundings. This picture sets forth well the life of the pronghorn antelope, one of our most graceful ruminants and once the commonest large animal of the Plains. Mr. Rungius has been making a large series of paintings of western big game for the New York Zoölogical Society. All of these are from sketches and observations in the field and are valuable records of our disappearing North American wild life

surfaces,—a good point, but one which may easily be carried too far. She is vastly more interested in this study than in the real character of the animal and I therefore mention her work in this connection as diametrically opposite that of Mr. Clark. She has an excellent eye for general proportion and a certain suggestion of movement in her work, yet I feel that she approaches the subject purely as a sculptor and not as a lover of animal life.

Two points of view apparently prevail in any collection of paintings or sculpture connected with this subject: one which deals with the animal as a living creature and gives a portrayal of its exact character as is done in a portrait, the other merely regarding the animal as a piece of color or pattern and treating it accordingly. Both seem logical and I suppose are really correlated, as in most other fields of artistic endeavor.

Mr. Moorepark's interesting compositions in pastel, for example, show a love of color and decorative line, but the birds themselves are often quite lacking in construction and the finer drawing which should accompany every serious attempt in art. The condor in one of these panels is absolutely grotesque in its proportions, with its huge head and puny body. I fear that work of this sort rather takes for granted the general public's lack of knowledge on the subject and for this reason, if for no other, the practice is a bad one. Mr. Moorepark evidently has very little interest in his subjects as living entities, which is to be deplored, as no one who regards them merely as spots of color can grasp the full beauty of the living creatures. They are so fine, so graceful, and withal so vigorous in line and construction that it seems a pity not to do them full justice.

Mr. Benson's studies of wild ducks and geese represent the work of an artist who, if I am not mistaken, began life as a figure painter. They show what one would expect, a knowledge of composition and values essential in the work of a serious painter. I understand that Mr. Benson has had great success with these pictures, yet they are sometimes trivial in handling and not well enough drawn to be convincing. One panel, for example, presents a flight of swans or geese, but the individuals in the group are so carelessly drawn that their real identity

Copyright by Carl Rungius

"The Mountaineers," an oil painting of bighorn sheep, by Carl Rungius, portrays magnificent specimens of an animal in many ways the most picturesque of the Rocky Mountain fauna. Mountain sheep are now so nearly extinct that to attain his sketch Mr. Rungius must have spent many difficult weeks or months among the wilds of the Rockies. *This canvas is one of the series belonging to the New York Zoölogical Society*

is rather a mystery. This seems unnecessary and in no way adds to the artistic effect. In other pictures the character of the birds is most accurately indicated and one gets an impression of life and atmosphere which is very charming. Taken as a whole, the work is interesting and a departure from the more hackneyed paintings of game birds. As a complete contrast with the above, one may mention a drawing of a partridge done by Gerald G. Thayer. This is an elaborately painted work illustrating the value of protective coloration in birds of this species. The picture is unique in its way, as the values of the bird against its background have been most painstakingly indicated, with the result that the creature is almost invisible at first sight, so closely does it merge into its surroundings. It was painted under the personal guidance of the artist's father, Abbott H. Thayer, and exemplifies many of the points so carefully brought out by the celebrated painter in regard to what we now call "camouflage," or the science of concealing an object by means of masses of color artfully distributed over its surface. The picture was loaned by the Metropolitan Museum of Art, and will repay careful study on the part of the observer.

Carl Rungius, rather meagerly represented in this exhibit by his bighorn picture and studies of pronghorn antelope, is a hunter of big game—a man who has lived for months in the mountains of the great West, shooting and painting during a considerable part of each year. All his studies are made in the field, and the animals he depicts are rarely seen in our zoölogical parks where they are represented at best by a few sickly individuals not at all comparable with the magnificent creatures so ably portrayed by the artist. Mr. Rungius has endured hunger and privation in his search for the various species of big game, and he has been working for some years on a series of pictures for the New York Zoölogical Society. These pictures, which include the moose, elk, caribou, antelope, and musk ox, have all been painted in the true environment from sketches made on the spot, and should prove a valuable record of our rapidly vanishing big game animals.

In the work of the artists already referred to, a more or less serious attempt has been made to portray some definite and withal beautiful phase of animal life either decoratively or realistically, but I can detect no such intention on the part of Mr. Nadelman. Rather do I see in the examples of his work a trifling with all that makes for good art

A VALUABLE PERMANENT RECORD OF ONE OF THE MOST DANGEROUS OF AFRICAN BIG GAME

This study in bronze (about two feet high) of the African buffalo, by James L. Clark, is an excellent example not only of fine modeling but also of natural pose and expression. It is a duplicate of the bronze presented by the members of the African Big Game Club of America to the Nairobi Club, in memory of the late Frederick Courtenay Selous, the "Great Hunter, True Sportsman, and Gallant Soldier" who was killed in action in German East Africa, January 3, 1917. One of the most adventuresome of Selous' experiences and the story he liked best to tell, was the occasion when he nearly lost his life before a charging African buffalo and a generally misdirected energy. The irritating part of it all is that Mr. Nadelman knows better and he presumes upon our good nature when he presents to us as works of art the distorted lumps of bronze which he is pleased to call animal sculpture. When work of this sort is excavated from some prehistoric grave we are lenient in our judgment of it, but there can be no excuse for such monstrosities in our day and time.

As a relief from work of this character, let us turn to that of a sincere student and lover of animals, Mr. Carl E. Akeley. As a hunter, taxidermist, and inventor, Mr. Akeley is well known. He has collected for many years in Africa and his groups of mounted animals in the Field Museum of Natural History, Chicago, and elsewhere deserve all the praise accorded to them. As a sculptor Mr. Akeley is best known by his group "The Wounded Comrade," which shows a wounded bull elephant being assisted to a place of safety by two companions. The work makes a strong human appeal and the sentiment is excellent. "The Elephant Herd Charging" while less dramatic gives one a good idea of a herd of swiftly moving pachyderms. Mr. Akeley is a close student, a keen observer, and above all a serious-minded man who believes in trying to present (as does Mr. Rungius) the actual form and character of animals seldom seen at their best in captivity.

Mr. Charles L. Bull, whose numerous illustrations are well known to readers of our current magazines, is a firm believer in the decorative qualities of animal form and color. His work while based primarily upon that of the Japanese is nevertheless original in conception and treatment. Composition is perhaps Mr. Bull's strongest point, although he shows a fine feeling for color in many of his pictures. His work includes a wide range of subjects but the treatment is substantially the same in all. He affects a flat delineation of surfaces which grows rather monotonous at times, although the lack of roundness in his animal forms is not evident to most people. He shows excellent taste in his arrangements of light and dark surfaces and altogether his work occupies a rather unique place in the field of animal art. If one might criticise work of this sort, I should say that the constant reiteration of a certain scheme of treatment grows rather tiresome no matter how pleasing it may be, and makes one long for some totally different conception of the subject at hand.

In the work of Bruce Horsfall we find a decided contrast to the flat decorative panels so characteristic of Mr. Bull's method, and a return to the strictly realistic point of view. Mr. Horsfall is a trained and competent painter who, while not primarily a lover of animal life, is nevertheless capable of conveying to our minds some very pleasing impressions of animal nature. His "California Condor" is a scholarly piece of work, well painted, well drawn, and withal excellent in character. It depicts the great ungainly bird standing on a rocky ledge, with outstretched wings poised for flight. The sunlight strikes sharply on the grotesquely wrinkled head and neck, and casts a strong shadow upon the glaring yellow cliff in the background. The picture is interesting and convincing, and illustrates what can be done in the portrayal of a wild creature by a skillful and observing man.

It was with great regret that I learned of the untimely death of Mr. Rembrandt Bugatti, shortly after the completion of the "Giraffe," a bronze model loaned to the Brooklyn exhibition by Mrs. H. P. Whitney. Just how much this talented young man knew or cared about animals I cannot say, but the bronze is certainly the work of a clever sculptor and one who, had he lived, might have made a name for himself along these lines. The ungainly body and long awkward legs of the giraffe are nicely indicated, and the modeling itself is thoroughly well done.

Miss Anna Hyatt is represented by several minor pieces which show, nevertheless, her ability to catch and preserve a difficult pose. Her "Jaguar Tearing a Piece of Meat" is well composed and the main action good, but the muscular anatomy of the shoulders is not well understood and the statuette loses something thereby. It is difficult in such a small exhibit to represent adequately the work of any one artist and I very much regret that Miss Hyatt could not have shown at least a small study of her "Joan of Arc," the bronze original of which now occupies a splendid site on Riverside Drive, New York City. This is most certainly Miss Hyatt's supreme effort thus far, and to my mind the best equestrian statue in this country. The sculptor's love of horses has stood her in good stead in this

"PEACOCK AND PANTHER"—STUDY IN ANIMAL FORM AND COLOR

The work of Charles Livingston Bull, well known to the public, always shows originality of conception although often related in treatment to Japanese art. His work covers a very wide range of subjects and is the exponent of his profound belief in the decorative qualities of animal form and color. His canvases are recommended to those who wish to analyze fine composition in animal painting and to develop appreciation of fine feeling for color

Miss Eugénie F. Shonnard at work on the excellent model of Dinah, a young gorilla lately on view at Bronx Park

instance and the figure of the Maid of Orleans is both graceful and statuesque in pose.

Z. H. Pritchard strikes a new note in his paintings of fishes made on the Tahiti reefs. The artist took no end of trouble to obtain these pictures, actually going below the surface of the water to observe his effects. The results are interesting, yet one feels that Mr. Pritchard could have done much more from the art standpoint with his subjects had he been so inclined. The color is interesting but not very convincing as a suggestion of a watery medium.

A. P. Proctor, long and favorably known as an animal sculptor, shows several small works which are mostly studies for his large bronzes. His "Buffalo Bull" is the scale model for the heroic statue recently set up on one of the new bridges in Washington, D. C., while his "Princeton Tiger" is also a carefully wrought statuette, later enlarged for one of the buildings at Princeton, New Jersey. Like all of Mr. Proctor's work, great care has been taken with the superficial finish of the pieces but as a work of art I much prefer the buffalo to the great feline, the former being much better understood in every way. Few men are able to grasp the salient characters of all types of animals with equal facility, and I feel that Mr. Proctor's feline types are rather lacking in this regard. His standing "Puma" for example (made some years ago) is decidedly off anatomically, and certainly does not give one the impression of a great cat standing in an attitude of attention. He is, however, much more happy in his delineation of the horse, and his "Indian and Horse," unfortunately not shown here, is a most excellent piece of work. A number of the animals and birds decorating the buildings in the New York Zoölogical Park are the work of Mr. Proctor, and he has executed many other large and successful commissions throughout the country.

Mr. Julius Rolshoven contributes a large and ambitious panel in pastel and tempera—"Sun Arrow," and several smaller studies. The subject of the panel is an Indian chief mounted on a most extraordinary looking horse, which at first sight seems to have stepped from the canvas of some old Dutch painter. The anachronism leaves a bad impression on the mind of the spectator and discloses a lack of close study on the part of the artist. Surely no Indian brave ever rode such a horse as this, and where Mr. Rolshoven found him, I can't imagine. With all its brilliant color and flashy technique the picture leaves one cold and unimpressed. The smaller studies of Indians, however, are very charming in color and decidedly interesting.

The small models of birds by Miss Shonnard are very well done and have a certain style and statuesque quality about them most pleasant to see. An excellent bust of Dinah (the young gorilla lately on view in Bronx Park) is unfortunately not shown in this exhibit.

Eli Harvey has one large and several small pieces on exhibition. They are all characterized by this serious sculptor's usual attention to detail and his "Lioness and Cubs" shows very good character indeed. The large roaring lion "Menelik" is excellent as to attitude but the hind quarters seem small and weak for the general physique of the great beast.

Paul Herzel also shows a number of small models of feline types. A lioness and cubs by this young artist strikes me as being particularly good in composition and attitude, but I cannot say as much for the tiger and python model, even though the latter did get a prize in a school exhibition. The action in this group while very violent is decidedly false and unpleasant in conception, and the work is a good example of what not to do in an effort to obtain a dramatic effect. No tiger, I am convinced, would or could assume the attitude shown in this group and the pose of the snake is equally poor. It seems to the writer that all such attempts at super-action are distinctly bad art and should be condemned as such. Barye, the celebrated French sculptor, loved action for its own sake, but he never made the mistake of overdoing the movement of his animals, and therefore the results are always interesting and artistic. Mr. Herzel will, we trust, in the future stick more closely to actualities in his work and direct his undoubted ability into more realistic and beautiful channels.

The very charming little models by Mr. Roth are full of life and action. Mr. Rockwell's fountain and rhino group give evidence of thoughtful care and study, while Miss Crittenden's little pastels are charming in color. Unfortunately, Mr. Chandler's screens had been removed before my visit, but I feel sure that their brilliant color schemes and fanciful arrangements of fishes and birds are very interesting.

The exhibition as a whole is a convincing illustration of the fact that at last the hidebound prejudices in regard to the depiction of wild animal life as opposed to the domestic forms have been cast aside and henceforth we may hope to see similar exhibitions held in the various art centers throughout the country. Surely there is no good reason why the magnificent wild animal life in the world about us should be relegated to the good graces of men who paint only what are known as "sporting" pictures. We trust that the exhibition just over will direct the eyes of both artist and layman alike to the vast untrodden fields which are open to them in this direction, and that all the magnificent types of wild things may be fully utilized in the reproduction of beautiful and interesting works of art. Let us learn to appreciate as well the great opportunities offered to us by the numerous museums and zoölogical gardens in our great cities, from which the serious student in this branch of art may derive so much pleasure and profit.

A Paradise crane in plaster by Miss Shonnard. Miss Shonnard's small models of birds have a certain style and statuesque quality which are very pleasing. The advantage of art is that it allows emphasis of general form, or line, or color, by keeping the detail subdued in directions which would confuse

MAJESTY OF THE POWER OF BRAIN AND BRAWN EVOLVED IN WILD ANIMALS

'he United States shows its youthfulness in the lack of art works in the cities and towns, and is likely in the coming decade to reveal the advancing years of its civilization by a great development in communal art and architecture. Much of this is certain to be carried out in a record of wild animal life. No nation more than the American people has shown fine sentiment toward the preservation of wild birds and animals, but with all this the big game is rapidly becoming extinct. Zoölogical statuary of the highest order will not only set up before us the greatest beauty and power, outside of man, that the earth has evolved, but also will preserve in imperishable stone and metal great races which are vanishing from the ranks of life. The giant Bengal tigers by the sculptor, A. Phimister Proctor, which mark the termination of the Sixteenth Street Bridge, crossing Piney Branch, Washington, are examples of the best animal sculpture to be found in our national capital. Washington was laid out on a predetermined plan and therefore possesses generous opportunities for the use of municipal statuary. Such statues as have been erected, however, are largely war memorials, with few zoölogical subjects, although a number of lions and more or less conventionalized eagles embellish or disfigure certain public monuments. We value highly as subjects for our statues the Old World species—tigers, lions, elephants—for are not these the forms we know from our ancestry, from our literature and traditions? But notwithstanding this cosmopolitan interest, as Americans we should like to see immortalized our native American fauna, in connection with which the pioneer history of the United States has developed

Zoölogical Statuary at the National Capital

By R. W. SHUFELDT

Fellow American Ornithologists' Union, honorary member Royal Australasian Ornithologists' Union, member Zoological Society of London, Academy of Natural Sciences of Philadelphia, and many other scientific societies of Europe and America

IN all modern cities of the civilized nations of the world we find in parks, public places, and buildings, statues which, in the main, are devoted to distinguished personages of one nation or another, to allegorical subjects, and to general designs, usually exemplifying the stage of development attained in that branch of the fine arts at the time of their erection; or else the statues are the materialization of the conceptions of some of the noted sculptors of the period. Often these statues are of great merit, lending a peculiar dignity to the city and to a degree tending to exert, through their presence, an elevating and refining influence upon the minds of the members of the community.

I have turned my attention recently to a special department of this particular activity, with the view of making a study of the merits of such statues in Washington as are purely of a zoölogical type in design, and of those in which animals have been employed in allegorical pieces or groups.[1]

It is surprising how very few animal statues we find in the city of Washington. It is the more to be wondered at because no other city in the world today lends itself better to the exhibition of this branch of art. Washington's streets and avenues are, in the main, generously laid out, with great width between the broad sidewalks; they are abundantly lit at night by electricity and are ever tidy in appearance; their numerous intersections at common points are often the chosen sites for "circles" or parks of various dimensions. These are admirable locations for statues, pieces, or groups, and are usually available for such purposes. Many of them have already been utilized in this manner, and we find, in not a few instances, bronze statues of heroes of our Civil War, commanders of the Federal troops in that conflict. With these the present article has nothing to do; nor is it my purpose to take into consideration those groups in which horses form a part. Although they are, in a way, zoölogical, they are not of the ferine class which I have in mind for treatment.

Taking animals in natural sequence, it may be pointed out that fish and reptiles but rarely enter into sculpture of the class under consideration; still, some nondescript animals of the latter group are to be seen in the great fountain in the Botanical Gardens, and a more elaborate representation of a similar form is found in the famous Hinton Perry fountain of the Congressional Library, where we see on the primal base at the foot of Neptune, certain frogs, hawksbill turtles, and an eel-like creature which seems to have been modeled after the famous Japanese shark, *Chlamydoselachus anguineus*—the oldest existing type of vertebrate, named and described by the late Samuel Garman. The fore-flippers of the turtles (*Caretta imbricata*) are too long and too narrow for adult examples, and it would appear that the distinguished sculptor of this group selected rather young specimens for his models. As we know, the limbs—especially the forepair—are proportionately much narrower and longer in the subadult animal than in the matured specimen.

Among birds, the eagle is the only species that has been selected for representation, so far as I have observed; and that this has been used is doubtless due to the fact that the eagle happens to be the emblem of the United States of America. In no instance known to me is the eagle represented naturally in any piece of sculpture, or in any metal reproduction, in the city of Washington,—that is, so far as groups in public places are concerned. Scores of these birds are to be found, either as single pieces or in groups; but they are all more or less idealized, and performing some feat that makes them appear ridiculous, from whatever viewpoint we may select. The arrangement and number of the feathers in the wings and tail

[1] In pursuing this study I have been assisted in the matter of obtaining data by Col. William W. Harts, Corps of Engineers, United States Army, in charge of public buildings and grounds at the national capital, and by Daniel J. Donovan, secretary to the Commissioners of the District of Columbia, to both of whom it affords me pleasure to extend my thanks.

Illustrations from photographs by the Author

One of the four concrete lions, modeled by a New York sculptor in 1909, for the Connecticut Avenue Bridge, Washington. This figure is on the southwest end of the bridge and measures nine feet in height and twelve feet long. Here was an opportunity to model the great "King of Beasts" so that the majesty of his creation would appeal to all observers through generations to come. Instead we have what appear to be "sick lions unwillingly pulled from some passing menagerie, to pose just as death was overtaking them"

One of a pair of lions on the Columbus Memorial, Washington, modeled by a Chicago sculptor. This also is an instance where the sculptured marble brings little pride to American art of the twentieth century are invariably incorrect; other parts are not in due proportion, much less natural. The eagles at the base of the McClellan statue, opposite "The Highlands," are supporting a heavy wreath in the most unnatural way imaginable, and the sight is sufficient to send chills down the spine of any well-informed ornithologist. There could not have been a more fitting opportunity to have placed at every angle of the base of this handsome production a fine, adult eagle, in bronze or other suitable metal, of natural size, normal proportions, and perfect in all other respects. There are plenty of live birds in the big, out-door eagle cage at the National Zoölogical Park, not fifteen minutes' walk from this McClellan statue, that the sculptor might have selected as models for this work. Indeed, in my opinion, this is one of the purposes for which we keep wild animals confined in zoölogical gardens; at least, it is just as important a purpose as any other to serve as an excuse for our making life prisoners of these creatures.

Speaking of the National Zoölogical Park, here is certainly an opportunity of the first order to introduce some work of the class I am considering. Especially is this true of mammalian sculpture, which at present is not represented there. All of the entrances to this great reservation for the public exhibition of captive animals from all parts of the world, are singularly unattractive and primitive in character, and to no little degree a disgrace to such a country as ours: this applies particularly to the main entrance on the Connecticut Avenue side. Apart from a few simple signboards placed there, nothing indicates to the visitor that he is about to enter the confines of the National Zoölogical Park of the United States of America. For example, we find nothing to correspond to the fine lion group at the Girard Avenue entrance to the Zoölogical Gardens of Philadelphia, or to simi-

Lion statue on one of the marble pedestals of the unfinished Grant Memorial in the Botanical Gardens, Washington—Our native big game fauna is large antelope, elk, moose, buffalo, musk ox, mountain goat and sheep, several species of deer, and all the bears. Any of these would appear with strength and beauty and dignity in our municipal or national statuary; and so fast are they becoming exterminated it will be as if only tomorrow in the story of the earth's history that all have disappeared lar groups in other parts of the world. Surely it is time that a suitable sum be appropriated for this purpose. Let us trust that, when it does come about, when the proposed enterprise can be properly financed, animal statues worthy of the name will be selected by the authorities having this important matter in charge.

Personally, I am distinctly opposed to the choosing of non-indigenous animals for projects of this kind. In Washington, foreign animals have been employed altogether too often as subjects for statues of this class. There are lions here, lions there, lions everywhere, and several of them very impossible lions at that. We have an unusual number of large mammals in this country, all of which are upon the highroad to extinction; among these I may mention the antelope, the elk, the buffalo, the musk ox, the mountain goat and sheep, several species of deer, and all of the bears. Comparatively speaking, the time is not far off when the greater number of these animals will be exterminated; we shall know them only through preserved skins, mounted museum specimens, and pictures of various kinds—all of which are more or less perishable in their nature.

What would form at this time a desirable addition to the National Zoölogical Park would be two life-size statues of famous American mammals in bronze, placed upon suitable pedestals at the main entrance on Connecticut Avenue. Perhaps none better could be selected for this particular purpose than an adult, antlered, bull elk, in a characteristic pose, upon the one hand, and, on the other, an old, male moose, modeled after as fine a specimen as the northern wilds can furnish. The work should be placed in the hands of a sculptor familiar with the superficial or topographical anatomy of these animals, as well as with their characteristic poses in nature. In time, similar statues could be placed at the remaining entrances to this Park, in keeping with their importance and in harmony with their surroundings. Finally, at suitable points within the Park, another piece or two—perhaps three—could be placed to good advantage. One of these might be an extinct animal form, for example, the ponderous *Stegosaurus stenops*, the ancient herbivore so successfully modeled recently by Mr. Charles W. Gilmore, of the United States National Museum.

Personally, I am much averse to sculptural license in the modeling of the animal pieces that are to occupy various salient points throughout the city. There is no excuse for such unscientific and often ghastly work. It is a miserable, misdirected expenditure of funds, and publicly perpetuates a bunch of errors in comparative anatomy and practical zoölogy that can have only an undesirable effect upon the mind of the populace, old and young, as it passes down the ages to come. Take for example the four concrete lions that occupy the terminating pedestals of the Connecticut Avenue bridge, one upon either hand at the entrances.

Here was an unusual opportunity to place a couple of pieces that would have been not only a credit to the nation but also a source of inspiration and education to the people for generations to come. But what have we? The sculptures present the appearance of sick lions, unwillingly pulled from some passing menagerie, to pose just as death was overtaking them. No lion living ever possessed such a form as has been given to any one of these by the sculptor. Their musculature is absolutely incorrect in every particular, and idealism has been carried to the point of the ridiculous; they appear like starved, dead lions, with impossible muscles, manes, and morphology, bolstered up in cadaveric poses.

Even more impossible leonine pieces are those on the Columbus Memorial, in front of the Union Station. These lions are hideous in their facial expressions, terrible in their unnatural proportions, and passing strange in their superficial anatomy. Muscles are shown that have no existence in nature and are absurd from any point from which we may study or view them. They are pitiable examples of the cheap, American sculptural work of the twentieth century, and they will, in the years to come, furnish food for laughter and ridicule for students of correct lines in animal contours and normal poses of the big carnivores of the present time. No lion ever looked the least bit like the two that confront one on this celebrated Columbus Memorial in Washington.

Better lions are those upon the marble pedestals which form a part of the Grant Memorial in the Botanical Gardens, opposite the Capitol. This elaborate and long unfinished piece of work was intended to commemorate the deeds of a great American military hero; but it stands now as

THE SPIRIT OF GRANDEUR OF THE WESTERN PLAINS BROUGHT TO THE SPACIOUS AVENUES OF THE NATIONAL CAPITAL

Four American bison of heroic size were modeled and cast in bronze by A. Phimister Proctor in 1915 for the terminals of the Q Street Bridge, Washington. In these Mr. Proctor does not let what is natural in form and pose be overruled by the principles of conventionalism in art. It is easy to understand that in the case of animal forms used as a motive in architecture even the lines of nature may be drawn away from their realistic course for the sake of harmony with the whole, but such deviation from the naturalistic could never be valid in an isolated statue

Bengal tiger on the Sixteenth Street Bridge, Washington (see front view of the same figure, page 470).—This great cat, ten feet long in the bronze, by Proctor, 1911, has been given a pose characteristically feline, and the anatomical detail, where indicated, is perfect, giving a result altogether pleasing both to the zoölogist and the artist

The Sixteenth Street Bridge is an object of admiration in the eyes of all visitors to Washington, and the bronze tigers of heroic size lend an appreciable dignity and elegance to the highway. It is suggested that at the entrances of the National Zoölogical Park the addition of life-size statues of American big game, especially of elk and moose, would fill a great present need though evidence of an ease in forgetting our country's great among the warriors she has produced in her history and civilization.

Apart from their glorifying representatives of the mammalian fauna of certain parts of India, the four bronze Bengal tigers on the Sixteenth Street Bridge, crossing Piney Branch, are superb pieces of work. The pose, which is the same in each animal, is full of dignity, natural, and with a certain subtle meaning that is not only characteristically feline, but especially appropriate for pieces of this character, occupying, as they do, a prominent position in one of the best known avenues of a modern city. Washington is to be congratulated upon this achievement; and Proctor's great, tigerine cats will be objects of admiration for all who view them in the ages to come.

Proctor was also given the opportunity to model and erect four bronze American bisons at the terminals of the Q Street Bridge (crossing Rock Creek in line of Q Street, between Twenty-third and Twenty-fifth streets)—a work which was finished July 22, 1915, or four years after his bronze tigers were completed.

It will be at once observed that in his idealization of animal poses, Mr. Proctor does not allow the just principles of conventionalism in sculpture and modeling to overrule what we recognize to be natural. His conception of how the American buffalo should be represented for the purpose for which he employed it, most emphatically stands for this. These four splendid bisons are sculptured or cast so close to nature that their grandeur and naturalness impress all beholders favorably. Their very presence at the entrances to the above-named bridge at once stamps the latter as one of a series of famous spans in the history of American enterprises of that character. And it is to be fervently hoped when Washington comes to repeat such work in other parts of the city, that each achievement will bear the stamp of a similar knowledge of requirements; that it will prove to be an exposition of all that constitutes a correct conception of zoölogical and anatomical facts as we know them, and that this knowledge will be employed, in any particular instance, to perpetuate the normal and the real in such of our big mammals as we may select for the purpose, especially as these creatures are being as rapidly exterminated upon this continent as they are in the wilds of other parts of the world.

Few instances of fish or reptiles in statuary can be found. There are hawksbill turtles and frogs on the base, at the feet of Neptune, in the famous Hinton Perry fountain of the Congressional Library, Washington. As shown in the photograph a very young specimen of the hawksbill must have been used as model, indicated by the great length and slenderness of the foreflippers

ANIMAL POPULATION FOUND ON MUD BOTTOM OF ONEIDA LAKE

A biological survey of Oneida Lake, New York, illustrates the relation of physical environment to plant and animal life. Six general types of lake bottom could be definitely distinguished: bowlder, gravel, sand, sandy clay, clay, and mud. These different soils support varied types of vegetation, which in turn serve as food for different animal groups, which in their turn serve as food for various species of fish. Although the invertebrates and plants of the lake are not directly of economic interest to man, they are, in their capacity of food supply for the edible fish, of great and hitherto largely unrecognized importance.

In the above photograph are assembled the invertebrate animals collected on 768 square inches of mud bottom under eleven feet of water. The animal life here is principally molluscan, snails and finger-nail clams. Caddis fly cases, mostly empty, a few midge larvæ (*Chironomus*) and a dragon fly larva (*Tetragoneuria*) are also present. [The last-named, unfortunately for the attractiveness of its portrait, has lost four of its legs]

Studies in Aquiculture or Fresh-water Farming

By FRANK COLLINS BAKER

Curator, Museum of Natural History, University of Illinois

THE great war that has but recently come to a close has shown in a most forceful manner the intimate relationship between the food supply and the well-being of the human race. Food shortage has caused our people more or less willingly to economize food supplies and to increase food production, and to submit almost without a murmur to restrictions that in peace times would not have been tolerated. Perhaps nothing other than this world tragedy could have turned the attention of the nation so intensively to the study of increased crops. Yields of wheat and of corn have risen to unthought-of proportions and the vast number of home gardens attest the magnificent spirit of the American people in meeting the problems of decreased food supply.

And while the land is being made to give up an ever increasing share of its products, the waters are being studied and experiments carried on to demonstrate the possibilities of water culture. But the water has received no such careful study as the land; yet there are immense, almost unknown possibilities in the way of food crop productions in our inland lakes and rivers. These possibilities are being realized in some places and extensive and far-reaching studies have been made, principally in the states of Illinois, New York, and Wisconsin. From these studies, and from others carried on by the Federal Bureau of Fisheries, it has been shown that crops of fish and aquatic food animals can be raised in ponds and streams, artificial and natural, that rival or surpass in value the land crops produced from the same area. Much has been done for agriculture through the various agencies organized for the solution of its problems. Aquiculture, or the study of the conditions governing the production of animals and plants living in fresh water, has received no such extended investigation and we are still ignorant of many important facts which are necessary before aquiculture is on the same sound basis as agriculture.

Professor S. A. Forbes, whose early studies of the food of fishes in Illinois waters have been epoch-making, likens a pond or lake to a microcosm or miniature world. In it all of the processes of life go on almost independently of the land around it. But within this microcosm all are interdependent, the large fish feeding upon the smaller organisms, and these in turn upon those still smaller, and agencies that affect any one group of animals or plants influence in a more or less marked degree the whole life of the pond. Furthermore, in studying any one organism in this microcosm it is necessary to include all organisms, as well as all physical agencies, that are related to it or that come in contact with it. For example, if we wish to understand the life history of our black bass, one of our most valued food and game fishes, we must not only learn what we can concerning this fish, but also what it feeds upon, what the food supply feeds upon, and finally the general character of the environment, whether favorable or unfavorable. In other words, a complete natural history survey of the pond life is necessary to understand fully the history and value of this beautiful fish, or of any fish.

Realizing the poverty of our knowledge on the subject of fish life as it relates to the food supply and to general ecological conditions, the New York State College of Forestry at Syracuse University sought to remedy this defect, in a measure, by carrying on studies in Oneida Lake, New York's largest inland lake. Accordingly, Dr. C. C. Adams, of the Department of Forest Zoölogy, College of Forestry, established laboratories on the lake, and the writer was privileged to conduct studies bearing on these problems during 1915, 1916, and 1917. These studies included examinations of the stomach contents of fish to ascertain the kind and quantity of food eaten; an intensive study of the animal and plant life of the lake to ascertain the relation of the biota to the fish fauna; and quantitative studies to find out, if possible, the size of the fish fauna that the lake was able to

Sand bottom in Oneida Lake is usually found in lagoons and other spots protected from the direct action of the waves. In such places the bulrushes flourish and here are found the best conditions for the growth of the small clams, snails, and insects which form an important element of the food of fish. This photograph of the sand bottom area of the lagoon east of the steamboat landing, Lower South Bay, was taken from a mud bottom habitat in the foreground where the vegetation is more dense but less favorable for mollusks, and illustrates the close relation between the lake fauna and flora and the type of lake bottom. The lagoon is one of the best habitats for the filamentous algæ known as *Cladophora*

The invertebrate population of a sixteen-inch square of sand bottom under four feet of water. The bivalve mollusk (*Sphærium*) at the left, the pond snails (*Lymnæa*) below the center, and small snails (*Amnicola*) in the lower right-hand corner are in notable predominance. Only five animals other than mollusks were found here, although over the sand bottom as a whole the latter make up only about 50 per cent of the invertebrate life. The mollusks of this lake serve as food especially for the pumpkin seed and the common sucker and indirectly for the bass and pike which eat mollusk-eating fish support with the amount of the biota present. The investigations, in a way, paralleled those carried on in the study of agricultural problems, the environments of the objects studied being quite different.

Fully realizing the significance of the fact that the lake is a microcosm, the problem resolved itself into a study of the relation of the fish fauna to the general physical characteristics of the environment, to the biota as a whole, and to the other members of the fish fauna present in the lake. The data for solving such a problem can be obtained only by making an intensive and exhaustive survey of the body of water. To accomplish this result it was decided to select a limited area of known extent and to study this from several angles. Oneida Lake is 21 miles long and more than five miles wide and has a maximum depth of 55 feet which occurs near the east end of the lake. There are several large bays or indentations which provide admirable localities for habitat studies. One of these, Lower South Bay, situated near the southwest end of the lake, was selected for carrying on the intensive studies planned. This bay is one and five eighths miles long and about a mile wide and contains 881 acres of surface water. It is a comparatively shallow body of water, ranging from a foot or two in depth at the west end to nineteen feet at the east end where it enters the larger lake. It is protected on the west and south sides by the land which rises more or less abruptly from the shore; on the north a long point and several shallows protect it from the rough water. At the east end, however, it is open to the storms from this direction which have a more or less marked influence upon the bay.

In this investigation one of our aims, and perhaps the chief aim, was to ascertain as definitely as possible the actual amount, numerically, of animal life that lived on the bottom or on the vegetation at this time of the year (July). To accomplish this result dredges were constructed to take up a portion of the bottom measuring approximately four inches square or sixteen square inches. On a rocky shore a number of bowlders were carefully removed from the water and all of the life, both animal and vegetal, was removed to vials to be sorted and counted later. Vegetation was carefully taken from the water and the attached animals removed. To minimize the liability of error a large number of samples were collected (upward of 800). When sorted and identified this material gave a clear idea of the relation of animals to the different kinds of bottom, to the vegetation, and to each other. A feature of the investigation worthy of mention is the fact that more than twenty-five specialists, many of them in the front rank of America's biologists, coöperated in the identification of the different groups of animals and plants. In this way only can results of a dependable character be obtained.

To support a large plant and animal population a body of water must provide varied and suitable conditions, and these are found in Oneida Lake in abundance. Detailed studies indicate that there are three primary types or kinds of these habitats which are more or less distinct. The first includes the headlands or points and some portions of the shore which are shallow and have been swept clean of fine sand and clay, leaving the stones and small bowlders as a rocky pavement, the stones ranging in size from large gravel to huge bowlders several feet in diameter. This type of habitat affords lodgment for many mussels which live in the sand or gravel between the stones, for a multitude of snails which live on the rocks, and for crawfish, insect larvæ, and leeches which live on, under, and between the rocks. The vegetation of such habitats consists of water willow and bulrush.

The second kind of habitat is found in sheltered bays and in other partly protected spots where the force of the waves is somewhat arrested. The bottom is composed of fine sand; the vegetation is abundant, consisting of pickerel weed, bulrush, swamp loosestrife, bur reed, the water lilies, and a few pondweeds (*Potamogeton*). Many mussels live here, but the most important life is made up of small clams, snails, insects, and other small animals which form such a large proportion of the food of fish.

The third kind of habitat is found in the well protected bays, where there is a mass of vegetation consisting of submerged plants such as pondweeds, hornworts, milfoils, water lilies, and the emergent plants such as pickerel weeds, cat-tails, and bur reeds. The bottom is usually of fine clay or mud. Many fragile snails as well as insect larvæ inhabit this kind of habitat which provides excellent food for fish and other aquatic animals.

The striking feature of the plant life in many habitats, which was constantly forced upon our attention, was the presence of large quantities of the water plants known as filamentous algæ, which covered the bottom as well as the higher plants like a thick blanket, and greatly modified the natural character of the bottom. It seems probable that the great wealth of animal life in parts of this lake is largely due to the presence of this lowly plant, which provides a rich food supply for the invertebrate animals.

In the bays and the shallow areas bordering the shores of this beautiful lake, the floor is carpeted with a great variety of plants, many of which, like the feathery water milfoil (*Myriophyllum*), form miniature aquatic forests. The rocks, the plants, and the whole bottom in many places are covered with masses of the delicate green water plants, the filamentous algæ.

Among this wealth of plant growth many kinds of animals live in great abundance. The algæ are inhabited by the young or larvæ of flies, and small jointed worms related to the earthworms (Oligochæta), whose bodies are as green as the color of the algæ which they have eaten. Myriads of little crustaceans, called scuds or water fleas (amphipods and Cladocera), dart about and thousands of fresh-water sow bugs (isopods) crawl over the filmy masses of algæ. The little spider-like mites (hydrachnids) actively search the algæ and weeds to prey upon the smaller animals. The young or nymphs of dragon flies (Odonata) lie in ambush among the algæ or bury themselves in the muddy bottom; the young of May flies, with their feathery gills attached to the outside of the body, and the caddis fly larvæ, with their curious houses or cases made of grains of sand, snail shells, bits of sticks, and plants, crawl over the bottom, dragging after them the houses that protect their soft bodies. Water bugs, water boatmen, beetles, both adult and young, and many kinds of snails complete the variety of this wealth of animal life on the bottom.

The rocky shores afford good foraging ground for many snails, with which are associated the young of May flies (*Hexagenia*), the flat, disklike larvæ of a beetle (*Psephenus*), the spiral caddis fly (*Helicopsyche*), that resembles a snail, and other small animals, such as worms and leeches. The stones on many points are covered with sponges which look like patches of green velvet through the water. The higher plants afford resting places as well as foraging grounds for many snails, aphids or plant lice, some beetles, and numerous hydras.

The study of this rich storehouse of animal life by the unit area method brought out many facts of interest and importance concerning the distribution of life in this body of water. There are several diverse habitats and the animal and plant life show a corresponding variation. Dividing the bay into three areas, each separated by a contour line at 6, 12, and 18 feet, we find that the greatest development of invertebrate life occurs within the six foot contour. Of the 1164 acres of bottom examined in Lower South Bay and vicinity, 205 acres occur between the shore and the six-foot contour and 959 acres lie beyond this line in deeper water. Careful computations indicate that 88 per cent of the total individual animal life lives in water six feet or less in depth, and that but 12 per cent lives in the deeper water of the area surveyed. When reduced to actual figures, which in a measure are difficult to comprehend, the result shows that upward of 6786 million individuals live in 205 acres in water six feet or less in depth, while but one million individuals live in 959 acres in water deeper than six feet.

When we consider this animal life in relation to acres the results are clearer and can better be compared with acreage productions of land crops. To the acre, the invertebrate animals within the six-foot contour number 33 million individuals, while beyond this line in deeper water the life per acre is but one million individuals, the shallower water being 33 times as productive of life as the deeper acres of the bay. These figures, of course, do not include the plankton, or floating population, only those animals that cling to some support, the bottom or the vegetation. The addition of this population would greatly increase the numerical results, but it was only with the bottom fauna that these studies were concerned.

The population of the 6–12 and 12–18-foot contours does not show such a marked drop in individuals, the water deeper than 12 feet containing 59 per cent of the population of the deeper areas. When we remember that fish life, as well as other aquatic vertebrate life, is more abundant in water six feet or less in depth, and that here the greater number

On the clay and sandy-bottomed portion of Lower South Bay of Oneida Lake the shore is bordered with the typical growth of cat-tails, surrounded on the lake side by American bulrushes. The lake here is only about one foot and a half to four feet deep and well protected from waves, which have a marked effect on vegetation. In all parts of the bay large quantities of vegetable débris are found floating in the water and covering the bottom. Even the "dust-fine detritus" is probably a valuable source of food for many of the mollusks and crustaceans, as well as for the bottom mud-eating fish. The bay, with its abundance of vegetation, affords excellent breeding grounds for the fish of the lake, particularly those species which build nests, such as black bass and rock bass

Animals collected on sixteen square inches of clay bottom from the southwest shore of the bay. Caddis fly larvæ, *Agraylea* and *Phryganeidæ* (upper right-hand corner), the snails, *Amnicola*, the fresh-water sow bugs, *Asellus* (lower right hand corner) and scuds (*Hyalella*) are the more conspicuous forms These are food for crawfish and frogs which are in turn eaten by pickerel and yellow perch. Bivalve mollusks are notably absent from clay bottoms and altogether in this area there are only half as many mollusks as other animals. When the sand becomes intermixed with the clay, however, the mollusks increase in frequency

The south side of Lower South Bay illustrates the vegetation on sandy clay bottoms, particularly the cat-tails along the shore. These are not found on sand. Bordering the cat-tails on the lake side grow the ever present bulrushes. From the point of view of animal population the most important vegetation in this area is composed of submerged plants and especially the algæ which coat the bottom and other plants, and which float in filamentous masses. The algæ supply the most valuable vegetable food of the invertebrates of the lake

Invertebrates supplied by one hundred square feet of surface on a log five feet under water. The principal forms are the snails (*Bythinia* and *Amnicola*) and the scuds (*Hyalella knickerbockeri*). The latter crustaceans are eaten by fishes and frogs, and are also useful scavengers. It was notable that the sunken log which served as a home for these animals was covered with a thick coating of filamentous algæ and this undoubtedly supplied their chief source of food

Lower South Bay of Oneida Lake looking west from Short Point.—This shows a transition from the shallow bowldery point in the foreground, with its scanty vegetation of water willow, to the protected bay in the background with its sandy or clay bottom and its abundant vegetation ot cattail, willow, lake bulrush, water lilies, pickerel weed, and a number of pond weeds. In general, bowlders and gravel cover the floor of exposed points, while shallow bays have sandy bottoms and those of the deeper bays and the main floor of the pond are composed of clay and mud. By far the greater part of plant and animal life of the lake is found where the water is less than six feet deep; below a depth of twelve feet there is little or no vegetation

Invertebrates yielded by approximately 768 square inches of mud bottom under ten feet of water, illustrating the marked falling off in numbers with increased depth, especially of mollusks. Finger-nail clams (*Pisidium*), snail shells (*Amnicola*), the larvae of midges (*Chironomus*), and the nymphs of May flies (*Hexagenia*) are the principal animals; the caddis fly cases (on the left) are practically all empty. The larvae are of great importance in the food supply of most of the larger species in the lake including other nymphs and larvae; the May flies are eaten especially by pickerel. The mussels which were taken in this area are not shown in the photograph

A rocky wind-swept shore devoid of vegetation.—From Long Point, north side of Lower South Bay, an exposed gravel bowlder bottom extends into the lake on all sides. Mollusks easily obtain a foothold on the bowlders and among the gravel. Crawfish, insect larvæ, and leeches also live on, under, and between the rocks, and many small fishes feed hereabouts

This group of invertebrates, taken from a small bowlder in water 20 inches deep, consists mostly of insect larvæ (beetle, caddis fly and May fly) and of snails (*Goniobasis*). Bowlder bottoms have the smallest percentage of the plant life of shallow water areas, although they afford good feeding grounds for minnows and young fish, even in water only a few inches deep. Most fish vary their food with age, at first taking only the smallest insects and larvæ

of young fish live and adult fish breed, the significance of this rich store of animal and plant life in shallow water is at once apparent and the importance of studies in such areas bordering the shores is at once recognized. It is in such situations that fish culture can be carried on most successfully.

The kind of bottom was also found to play a large part in the abundance or scarcity of animal life. In Oneida Lake six kinds of bottom are found, depending upon the physical condition of the shore: bowlder, gravel, sand, sandy clay, clay, and mud. Of these different kinds of bottom, sand supported the greatest number of individuals. If the sand bottom be valued at 100 per cent, the relative values of the other kinds of bottom, as related to number of individual animals, stand as follows: sandy clay, 87 per cent; clay, 66 per cent; gravel, 57 per cent; mud, 42 per cent; bowlder, 36 per cent. It will be noted, therefore, that not only depth acts as a controlling factor in the density of the fauna, but also the character of the bottom material.

One of the chief factors in providing a favorable environment for the development of animal life is the presence of an abundant and varied flora. In Oneida Lake the vegetation fully measures up to the maximum requirements in this respect as has already been indicated. The value of this abundance of vegetation is perhaps not fully realized by many fish culturists. It may be said without fear of successful contradiction that when the flora is insufficient or wanting the animal life will be correspondingly rare or absent. There is also another source of food supply which has received little attention by American students of fish culture. This is the fine covering of the bottom which Dr. C. G. Joh. Petersen, the Danish biologist and fish culturist, has called dust-fine detritus. This material is composed of the finely comminuted fragments of vegetation, together with diatoms, desmids, and other biotic material, and is largely used by many of the invertebrate animals and by some fish as food. It is believed by Petersen and other Danish workers on fish food problems that this is of greater value than the plankton organisms which are so abundant in most of our fresh-water lakes. It is known that marine animals use it to a large extent but its proportionate use by the inhabitants of fresh-water ponds and streams is not definitely known. That it is of some, if not great value, is highly probable.

When we consider the sources of food of the invertebrate population of this bay, as well as other bodies of fresh water, we find that the herbivorous animals, those that live on plants and detritus, greatly predominate over the animals that have carnivorous habits and prey upon the other animals present. Dividing the population of the area of Lower South Bay into herbivorous and carnivorous animals we find the astounding result of 7743 million individuals that feed on plants and detritus against 23 million individuals that are carnivorous. In per cents this means that the carnivorous animals make up but $^3/_{10}$ of 1 per cent of the entire population. This fact is of great importance, for the herbivorous animals are producers of fish food and the carnivorous animals are consumers of fish food. While the carnivorous animals are of some food value to fish, it is the great mass of herbivorous animals that is transforming plants and débris into animal flesh, that forms the principal food supply of our food and game fishes.

One of the most interesting features of the Oneida Lake investigation was the variety of animal life found on the bottom of Lower South Bay. Seven of the ten phyla of invertebrate animals (the Protozoa are not considered for obvious reasons) are represented by twenty-five classes or higher groups, forming a microcosm of large size and great variety.

The mollusks, snails and clams, and the insects are about equal in number of species, the mollusks forming 35 per cent of the entire number of species represented. When the number of individuals of the two groups, mollusks and the other associated animals, are compared, it is found that the former are 30 per cent greater in number. This preponderance of mollusks over associated animals has also been noted by students conducting marine investigations. Of the 7766 million individuals of invertebrate animals calculated to be present on the bottom of Lower South Bay and vicinity, 4704 million are mollusks and 3062 million are associated animals. The mollusks or shellfish form a large part of the food of such valuable fish as the sturgeon, sheepshead, suckers, red horse, whitefish, pumpkin seed, and bullheads. Of the 225 different species of fish inhabiting the waters of Illinois and New York, 46 or about one fifth are eaters of shellfish to a greater or less degree. Of all the classes of food, insects are by far the most valuable, about 40 per cent of the food of all fishes being of this group of animals.

One of the results hoped for in the Oneida Lake investigations was a knowledge of the size of the fish fauna that the natural food of the lake could support. To find this it was necessary to know the amount of food eaten in a period of time, as in twenty-four hours. Studies on marine fish (notably the plaice) indicated that the digestive canal was emptied once in twenty-four hours. These marine fish, however, are not strictly comparable with the fresh-water fish in this respect. In 1917, a study of fish caught in trap nets and allowed to remain in these nets for a period of 24, 48, and 72 hours, indicated that the digestive tract might be emptied in about 24 hours. Of the fish caught, 50 per cent had full stomachs in the 24-hour interval, 13 per cent in the 48-hour interval, and all were empty in the 72-hour interval.

It is known that the digestive powers of a fish become slower in cold weather, and it is probable that between November and March fish eat about two thirds or less of the amount of food eaten during warmer months in spring, summer, and fall. In the examination of the stomach and intestines of Oneida Lake fish it was found that on the average a fish with a full stomach contained about 115 invertebrate animals. If we assume that this amount is a daily average, and that fish eat this amount for nine months of the year, then the invertebrate animal life on the bottom of the 1164 acres examined in Lower South Bay and vicinity is calculated to furnish food for 337,500 bottom-feeding fish. Predatory fish like the pike perch consume a large number of fish. By using data from Illinois and New York it was estimated that a single fish of this species will eat 250 to 600 small fish in a year. When we remember that there are hundreds of individuals of the pike perch, as well as other predatory fish, in Oneida Lake, it is at once realized that the number of small fish in this lake must be very great to supply these fish with food. It also follows that a large number of invertebrate animals as well as an abundance of vegetation for the smaller animals to feed upon is necessary to provide food for these small fish. It has been shown by these investigations that Oneida Lake meets, in full measure, all of the conditions and requirements favorable to fish and these provide the essentials for a large and varied population of food and game fish.

The studies carried on at Oneida Lake and elsewhere have shown that there are great possibilities in the production of animal life of a useful character to man from the fresh-water streams and bodies of water in our country. The recognition of the value of shellfish and other associated animals which form the food of fish, will lead in the not distant future to the artificial introduction of these animals, as well as needed plants, into waters where they were previously wanting or insufficient in number. If the environment and other factors are favorable there will be no insurmountable difficulties to hinder this procedure. The fresh waters will be cultivated to the extent that the land areas are now worked, as has been the case in parts of Europe, where ponds have been made artificially and stocked with fishes and their food. Food in the form of plants, shellfish, insects, crustaceans, and the like, will be introduced where needed before the fish are planted, paralleling in a way the preparation of the land before the crop is sown. Given a species of fish whose life history and natural history are known, it is comparatively easy to prepare the right kind of habitat and the natural and suitable food. Thus in the course of time we may hope to have a flourishing water culture or aquiculture, so that our streams and lakes may be made productive to the same relative degree that the fields and forests now are. Water culture has the additional advantage of affording healthful recreation to a degree not shared by any branch of agriculture.[1]

[1] Those who may be interested in the details of the studies carried out on Oneida Lake are referred to the following technical papers, published by the New York State College of Forestry at Syracuse University, N. Y.: Publication No. 4. The Relation of Mollusks to Fish in Oneida Lake. 1916; Publication No. 9. The Productivity of Invertebrate Fish Food on the Bottom of Oneida Lake, with Special Reference to Mollusks. 1918; Circular No. 21. The Relation of Shellfish to Fish in Oneida Lake. 1918.

Between Dunham and Frenchman islands in the distance lies a sandy shoal where the water is for the most part less than five feet deep. On this hard, smooth bottom a greater average number of animals was found than in any other part of the lake. This photograph of Oneida Lake is taken from Norcross Point looking northwest

Quest of the Ancestry of Man

TWO institutions have recently been founded to investigate the problems of man's antiquity, human ancestry, and cultural development—the Institut de Paléontologie Humaine, founded in Paris in 1910, and the Galton Society, recently established in the United States with rooms at the American Museum of Natural History.

In founding the Institut de Paléontologie Humaine in 1910, the Prince of Monaco addressed the Minister of Public Instruction as follows: [1]

"In the course of my laborious life I have often regretted that in the intellectual activities of our epoch a more important place has not been given to the study of the mystery that shrouds the origin of man. The more my mind has been stimulated by scientific study, the more ardently I have desired to see established on methodic foundations the investigations necessary to uncover the fugitive traces left by our ancestors in the bosom of the earth during an incalculable succession of centuries. And I thought that the philosophy and ethics of human society would be less uncertain in view of the history of past generations, written in their own remains.

"Therefore, when I had finished establishing the pursuit of Oceanography in the institutions of Monaco and of Paris, I devoted a part of my effort to the search for means which would further the development of Human Palæontology. And, after the foundation of the Museum of Anthropology of Monaco (Musée anthropologique), which was soon enriched with veritable treasures; after the publication of the marvels found in the caverns of Spain; I resolved to establish near some university center a strong foundation for studies based on methodic excavation. Immediately I made choice of the capital of France, where my earlier foundation, the Oceanographic Institute, had already been so largely developed.

"I have selected a site for the building of the Institute of Human Palæontology, and I have selected the first scientists who will direct its scientific undertakings; I have also named an Administrative Council who will control its financial resources.

"I must add that I do not limit the patrimony of the new institute to the building to be erected at Paris: the collections which I have installed at Monaco, although destined to remain there so long as my wishes for their conservation are followed, will become a conditional donation on my part to the Institute of Human Palæontology, to which I have given, for a working endowment, the sum of sixteen hundred thousand francs.

"Being anxious that this foundation should survive me under the most favorable conditions for the advancement of Science, I make request to the French Government to recognize it as a public utility and to approve its statutes."

The Institute is directed, from the technical and scientific side, by a "Comité de Perfectionnement" (Committee of Development), composed of twelve members, either French or foreigners. The members are chosen without distinction of nationality and without observing any especial proportion in the representation of different countries, from among those scientists best qualified to serve. It is to this body that Henry Fairfield Osborn of the American Museum has recently been elected.

The Founder, and, after his decease, the Comité de Perfectionnement, designates—either among its members or outside them—a French scientist to whom it delegates a portion of its powers, and who has the title of Technical Director of the Institute. He receives compensation on account of his responsibilities. The Director is appointed for three years at most and with the possibility of reappointment. The Administrative Council may call upon the Director to attend any of their meetings in an advisory capacity. This office has been held since the beginning by Marcellin Boule, who is also head of the palæontology of the Museum of the Jardin des Plantes, Paris.

The Comité de Perfectionnement fixes the program of work to be undertaken upon the recommendations of the Technical Director, presents to the Administrative Council those scientists who may be attached to the Institute and who will form its scientific person-

[1] Institut de Paléontologie Humaine, Fondation Albert 1er Prince de Monaco. Statuts, p. 5. Letter of His Serene Highness the Prince of Monaco to the Minister of Public Instruction.

nel, assigns to these their undertakings, and decides upon the proper distribution of the results of excavations among those scientific establishments best qualified to receive them. After consultation with the Administrative Council in regard to ways and means, it decides upon the various publications of the Institute and determines the regulations for the laboratories and libraries.

Under the original organization the Institute selected a number of the most distinguished scientists in France to conduct its explorations and carry on its researches. With a personnel including such experts as Marcellin Boule in palæontology, Verneau in anatomy, and Cartailhac and Breuil in archæology, no surprise can be felt at the brilliant results which are already the fruit of their labors during the few years that have passed since the inception of the Institut de Paléontologie Humaine through the scientific ardor and wise judgment of the Prince of Monaco. NATURAL HISTORY will from time to time publish abstracts and reports of the latest work of the Institute.

It is not an exaggeration to say that the researches and publications of the eight years elapsing since its foundation mark a new epoch in anthropology. On the anatomical side, Boule in a masterly manner has described the Neanderthaloid characteristics in his monograph on *La Chapelle-aux-Saints;* Verneau has studied the skeletal remains of the Crô-Magnon artists in a very complete way, although there is still much to be done on this race; Breuil has covered the marvelous field of palæolithic art of France and Spain and has firmly established the connection between the stages of its development and the respective stages of the flint industry; the relatively unknown period of the Aurignacian flint culture has been fully studied, and Breuil and Obermaier have connected the art of Spain with that of France, and the Aurignacian and "Capsian" culture of Spain with that of Africa.

The Galton Society for the Study of the Origin and Evolution of Man held its first meeting in New York on April 17, 1918, when the object of the Society was outlined and especial emphasis laid on the importance of coöperative effort on the part of specialists, so that the problems to be considered might be studied from widely diverse lines of approach. In addition to the original charter members, comprising Madison Grant, Henry Fairfield Osborn, John C. Merriam, Edward L. Thorndike, William K. Gregory, Charles B. Davenport, George S. Huntington, J. Howard McGregor, and Edwin G. Conklin, there have been added at subsequent meetings the following fellows: Ernest A. Hooton, Peabody Museum; Gerrit Smith Miller, United States National Museum; Raymond Pearl, United States Food Administration; L. R. Sullivan, American Museum of Natural History; Frederick Tilney, Columbia University; Harris H. Wilder, Smith College; Clark Wissler, American Museum of Natural History; and Nels C. Nelson, American Museum of Natural History. Two patrons were elected: Mrs. E. H. Harriman and Mr. M. Taylor Pyne, New York.

At the five meetings so far held significant addresses have been contributed by Professor McGregor, Dr. Wissler, Dr. Sullivan, Professor Davenport, Professor Merriam, and Professor Huntington; and the opportunity afforded for informal mutual discussion of the problems presented already justifies the hopes of its founders that the Galton Society might constitute a symposium of specialists qualified to consider the origin and evolution of man from widely different points of view. The Society has resolved to establish a laboratory to be known as the Galton Laboratory, in furtherance of its objects, and a committee is now considering plans for this project. Many of the members are at present engaged in special investigations within the field of the Society's interests and it is planned that a suitable medium of publication for the scientific and educational documents of the Society shall be secured. A special object of the Society is to encourage the establishment of courses in anthropology in universities, colleges, and other centers of education.

A Letter from John Burroughs

With a question for the palæontologist on evolution

To the Editor of Natural History: Dr. W. D. Matthew in his admirable little pamphlet on the Dinosaurs[1] thinks their progenitors in late Palæozoic time were small animals like the modern lizards in size, appearance, and habitat; he adds in a footnote that if "some vast catastrophe should today blot out all the mammalian races including man, and the birds, but leave the lizards and other reptiles still surviving, with the lower animals and plants, we might well expect the lizards in the course of geologic periods to evolve into a great and varied land fauna like the Dinosaurs of the Mesozoic Era."

Is not this an astonishing statement? If Mesozoic times could be brought back and the earth, air, and waters be in every way as they were in that era, this might happen but, in my opinion, not otherwise. Does not the evolutionary impulse run its course? Can or will it repeat itself? It is another world today, from surface to center. Each geologic era had its typical life-forms. The dinosaurs appeared in different parts of the world in the same era, as Doctor Matthew says, and "the cutting off of the Dinosaur dynasty was nearly, if not quite simultaneous the world over." These monsters of the primeval world were highly specialized to meet special conditions, and these conditions can never again return to the earth. We still have reptiles but they are insignificant and cut no figure in the life of the globe. That the huge *Brontosaurus*, for instance, could ever reappear in the Age of Mammals is unthinkable. The Age of the dinosaurs covered about nine million years and its end is now at least three million years behind us. Can we believe that the life of the different periods was as accidental and unrelated as Doctor Matthew's statement would seem to imply?

[1] *Dinosaurs*. By W. D. Matthew, Ph.D. December, 1915.

Might not one as well declare that were our deciduous trees and plants and all exogens swept away, the mosses and ferns and horsetails and ground pines would again produce the tremendous growth of cryptogamous plants that gave us the main part of our coal measures, producing calamites thirty or forty feet high, lycopods sixty to ninety feet high, giant sigillarias, lepidodendrons, and others?

"Amelioration is one of the earth's words," says our poet of the cosmos, Whitman, and it is as true in science as it is in poetry. The earth has developed and ripened, hanging like fruit on the great sidereal tree, and can no more repeat the stages it has passed through, than can any other fruit or growing thing.

[Signed] John Burroughs.

Riverby, West Park, New York.

Reply to Mr. Burroughs by Dr. W. D. Matthew

The footnote to which Mr. Burroughs refers came very near being cut out of the manuscript before it was printed, as a speculative and fanciful supposition that had no place in a brief summary of what is known about dinosaurs. It was left in chiefly because such speculations have for me a certain fascination, and I thought it might be the same way with others. That Mr. Burroughs has picked it out from its lowly position for comment and criticism shows that he, too, finds it of interest.

From the standpoint of the older concepts of cosmic and geologic history his objections are undoubtedly valid. If we believe that the earth has been gradually cooling off during geologic time, the atmosphere becoming less warm, humid, and loaded with carbonic acid gas, the seas cooler, the climate changing from a moist, tropical uniform condition to the cooler, drier, zonal climates that prevail today, then undoubtedly one would conclude that whatever were the ultimate result of the supposititious case I raised, it would not be the evolution of lizards into a fauna paralleling the dinosaurs.

But these geologic concepts cannot be reconciled with the evidence of glacial periods in the Permian, in the pre-Cambrian, and even farther back in geologic time, nor with various other lines of evidence. The geologic theory, which I outlined briefly in the introductory pages of the Dinosaur handbook, conceives of the physical condition of the earth's surface as passing through a series of cyclic changes in climate, topography, and other factors that constitute the physical environment to which life is adapted, but without any very fundamental permanent change during geologic time. The recurring cycles bring about a recurrence of the physical environment sufficiently identical to condition substantially similar adaptations.

It is of course different with the biotic environment, the fauna and flora, which equally condition the trend and scope of evolution of any one group. This has changed in a generally progressive way, since there are certain factors in adaptation and specialization which operate independently of changing physical environment, certain upward steps that, once attained under its stimulus, are retained as advantageous under all circumstances. The physical environment is cyclic, but the biotic evolution moves in a spiral, reaching corresponding but higher points with each recurrent cycle of climatic change.

The physical conditions at the beginning of the Mesozoic when the dinosaurs arose, were much like those of the present day. The earth had just passed through a glacial period, believed to be quite as intense and widespread as that from which we have just emerged. The continents were extended to or even beyond their present limits, arid climates prevailed widely through their interior as they do now, and probably cold climates at the poles. The atmospheric and climatic conditions cannot have been very different from what they now are; whether the outlines of the continents were substantially the same or not, makes no difference to the problem in hand. The physical environment does substantially correspond at the present time to that under which the dinosaurs arose.

The animals and plants are widely different. The presence of higher types of vertebrates prevents the lizards or any lower vertebrates from expanding into a varied fauna of large land animals as were the dinosaurs. They are unable to compete with the higher types save in certain special fields to which these last are not well adapted. My supposition involved the removal of this competition by extinction of all higher vertebrates, leaving a free field for the lizards such as was open to the lizard-like ancestors of the dinosaurs.

It may well be objected that the evolution of the dinosaurs was conditioned by the nature of the vegetation quite as much as by the competing animal types. The higher types of plant life now prevalent would bring about a different trend and scope of evolutionary progress among lizards in our supposititious case than occurred with the dinosaurs. Probably this objection is valid to some extent, and certainly as to any detailed correspondence. But I do not think it would prevent a marked general correspondence. For the dinosaurs in fact passed through two distinct periods of evolution and expansion, the first in the early Mesozoic, which culminated in the late Jurassic dinosaurian fauna, and the second in the late Mesozoic culminating in the upper Cretaceous dinosaurs.

The first evolution was correlated with a flora lacking the higher plants (angiosperms) now dominant, but the second with a flora very like that of the present day, the herbaceous perennials being the most significant element lacking. These two dinosaur faunas correspond in a broad way; they include armored and unarmored dinosaurs, bipedal and quadrupedal types, great and small carnivorous forms, terrestrial and amphibious adaptations; but similar or equivalent adaptations occur in many cases of different races. There is little correspondence in detail; yet the place they occupied in nature was substantially the same, and there is a great deal of parallelism in their adaptations. We do not find any of the gigantic Sauropoda, *Brontosaurus* and its allies, in this later fauna. But their place as an amphibious adaptation was taken by the wading and swimming trachodonts. The armored dinosaurs of the Cretaceous are like those of the Jurassic only in the fact that they were gigantic and heavily armor-clad. The unarmored herbivorous dry-land dwellers were even more contrasted in detail. Only in the carnivorous dinosaurs is there any near correspondence and relationship.

It would seem therefore that the evolution of dinosaurian types of specialization is not tied to the more ancient flora, and that so far as this objection is concerned it would not prevent the lizards from evolving in the absence of higher animal types into a varied fauna of large land animals paralleling the Cretaceous dinosaurs in a broad way, although doubtless as different from them in detail as they are from the Jurassic dinosaurs. That they or some other group of lower vertebrates might in the course of further geologic periods give rise to higher types corresponding as to their place in nature to birds, mammals and man is conceivable, but too speculative for discussion. Their limitations in brain, in circulation of the blood, etc., would first have to be overcome, and so far as palæontology can teach us this is a vastly slower progress than the expansive evolution into large specialized and varied faunal adaptations.

Certainly such an expansive evolution of the lizards with their higher competitors removed would not cause the huge *Brontosaurus* to reappear on earth. But it might —if we accept the modern theory of geologic history—bring about the appearance of gigantic wading or amphibious reptiles equally huge and equally innocuous, although probably not at all like a Brontosaur in appearance.

It would seem equally true that under our modern tenets we must be prepared to believe that were all the higher plants swept out of existence the lower plants would proceed under physical environment corresponding to that of the late Palæozoic to evolve into specializations with a broad general resemblance to the Carboniferous flora. They would not reproduce calamites and sigillarias, but they would produce something to take their place, probably no less gigantic and impressive.

This aspect of adaptive evolution receives many illustrations from the fauna and flora of oceanic islands and isolated continents, where, in the absence of certain higher types of animals or plants, certain lower types are evolved and specialized to take their place. The adaptive evolution of marsupials in Australia or of the Tertiary mammals of South America, affords notable instances. Such adaptive parallelism sometimes results in a curiously close imitation or correspondence of particular types; more often the correspondence in habits and in position in the economy of nature leads to a resemblance only in certain parts and a wide difference in other parts of the animal.

[Signed] W. D. Matthew.
American Museum of Natural History,
New York City.

Notes

It is with profound regret that the American Museum records the death, on April 25, of one of its Trustees, Augustus D. Juilliard. Mr. Juilliard, who was senior member of A. D. Juilliard and Company, has been before the public for many years as a patron of art and science. He left several bequests to carry on the work in which he has been personally interested, including a gift to the American Museum of one hundred thousand dollars.

Owing to the lateness in publication and especially to the very greatly increased cost of engraving and printing still effective from war times, the American Museum is combining its last two spring issues of Natural History in this number. Also, because of the prohibitive expense of preparation, it will reduce somewhat the number of pages in the three fall issues, and will omit statements of the institution's work and membership, and advertisement of its publications—except in so far as such matter can be carried on the inside cover pages.

An account of the library of the University of Louvain and of the sack of the city and the wanton destruction of this ancient collection of manuscripts and books was written and partly printed during the early days of the German occupation, by Ed. de Moreau, S.J., but it has only recently seen publication after lying hidden from the German police four and a half years. The library, with its treasures of manuscripts, incunabula, and literary, historical, and scientific collections which were burned in the incendiary fire of March 25, 1914, had a long and glorious history. The university itself was founded in 1425 and in the next century ranked as one of the foremost scientific institutions of Europe until suppressed during the French Revolution. In 1913, 2855 students attended the university and it was reported that the library at that time contained 250 incunabula and between 120,000 and 230,000 volumes (M. Moreau quotes the latter figure as too low) in addition to a larger number of manuscripts of ancient and mediæval authors. A movement is under way among the world's universities to rehabilitate the library, but, as M. Moreau says, "The library of Louvain cannot be restored, for the library was formed day by day in intimate association with the history of the University, and this history cannot be restored to it."

The Life of Frederick Courtenay Selous, D.S.O., Capt., 25th Royal Fusiliers, who, according to Roosevelt, was "the greatest of the world's big-game hunters," has recently been written by J. G. Millais. Mr. Millais is himself a noted author, artist, and naturalist, and brings to his task a personal appreciation of the work of Selous. The volume is enriched with a beautiful set of illustrative drawings.

Selous went to Africa at the early age of nineteen, where he resided for the most part until 1897, hunting big game and fighting in the Matebele Wars. His later years he spent lecturing, writing, collecting in Europe and America, and elephant hunting in Africa. In 1915 Selous took part with the Royal Fusiliers in the invasion of German East Africa where he lost his life while leading an attack against the German fort at Behobeho on January 4, 1917. Roosevelt said of him: "No other hunter alive has had the experience of Selous, and, so far as I now recall, no hunter of anything like his experience has ever also possessed his gift of penetrating observation joined to his power of vivid and accurate narration." The biographer has faithfully scanned the public and private writings of the great hunter, especially his correspondence with Roosevelt, for notes on African natural history.

"The Old Humanities and the New Science" was the subject of the presidential address before the Classical Association (England) delivered by Sir William Osler, regius professor of medicine at Oxford. Sir William, according to *Nature*, pointed out the necessity of a well-rounded education in which would be found a union of science and the humanities. There is, however, he pointed out, a marked need of revision of the present classical instruction at the English universities which should aim to inspire in the student some of the spirit of the classics rather than to raise up a race of philologists.

Sir William also opened at Oxford a loan exhibition of ancient manuscripts and instruments illustrating the scientific history of Oxford. The earliest were two Persian and Moorish astrolabes dated A.D. 977 and 1067. There are exhibited a microscope of 1693, and a slide rule dated 1635 which is probably the oldest in existence.

Dr. Patton in his article in this number of Natural History (page 405) on Thomas Jefferson, the great statesman, who was also the advocate of science and friend of naturalists, makes us admire the force of Meriwether Lewis, the young leader of an expedition across the western plains and mountains to the Pacific. James Lane Allen (page 397) brings to our understanding and sympathy young Alexander Wilson of the same period of pioneer life in America—but we gain no hint of the interlocking of the interests and lives of the two young men. If we follow the young naturalist and the young explorer only a few years further, with just a matter-of-fact statement of events, our interest is not decreased: Wilson desired keenly to go as ornithologist on the expedition with Lewis through the unknown West, but his letter to Jefferson and that of his naturalist friend, William Bartram, for some unknown reason did not bring response. The expedition proceeded (1805) and Wilson remained in Philadelphia. Wilson quoted Lewis in his first volume of *American Ornithology* (1808) regarding the distribution of the blue jay on the Missouri. Lewis returned in honor and became governor of Louisiana. Wilson, at his own expense and alone, made his most difficult expedition through the southern country to New Orleans, on which he contracted disease which soon was to cause his death. At the last white man's house, on the border of the Indian country, he came upon the story of the tragic end of Lewis (1810), who had been murdered there but a few days before and buried beside the common path. He left money from his small store to build a fence about the grave where the legislature of Tennessee erected the monument in 1848. He returned North most enthusiastic and successful in his work; he worked harder than ever. By 1812 he had published five volumes; in 1813 he finished the seventh; he worked indefatigably on the eighth and last volume because he eagerly saw ahead a revision and perfecting of the whole, but died with it incomplete, in August, 1813.

RELATIVE to Thomas Jefferson (p. 405) and the all-round man, of which we have even in this day of specialization many remarkable examples, it is well for every specialist to take to heart certain recent letters and editorials in the *New York Times*. For instance, Dr. W. W. Keen, of Philadelphia, under date of July 31, writes apropos Stewart's axiom, "No human letters without natural science and no science without human letters." In this connection he gives a brief history of our American Philosophical Society of which we as Americans are proud:

"The policy of the American Philosophical Society, 'held at Philadelphia, to promote useful knowledge,' is most instructive. Founded by Franklin on the model of the Royal Society, which until a relatively few years ago, embraced both the humanities and science, the American society has adhered to the broad original scope, and still embraces both letters and science. Among our members we include philologists, historians, archaeologists, statesmen, lawyers, etc., as well as astronomers, physicists, chemists, physicians, etc. From the ranks of the society have been chosen eight presidents of the United States, and Thomas Jefferson was our president during all his eight years as President of the United States, and for ten additional years—a unique record as a society."

THE tooth of a mammoth has been presented to the American Museum by Dr. A. K. Kouznetsov, Director of the Museum of the Russian Geographical Society at Tchita, Siberia. Dr. Kouznetsov, who extended this expression of cordiality through Mr. Franklin Clarkin on the occasion of the retirement of American agents from that district, says in his message that he is the oldest political exile in Siberia, having served a fifty-year sentence, and that he hopes if he survives the threatened annihilation of all *intelligentsia* by the Bolsheviki he will see in Russia a democracy patterned after that in America.

Many bones of the mammoth and other extinct animals are found imbedded in the impervious clay in the gold mines of the province (Transbaikalia) of which Tchita is capital. Farther to the north in the province of Yakutsk the famous discoveries were made of mammoths preserved intact by the cold in crevices. One of these mammoths, taken out in 1801, is the well-known skeleton set up in the zoölogical museum in Petrograd. Dr. Kouznetsov is of the opinion that it had stood less than two thousand years in the ice. Its skin and long hair were in fairly good condition and its flesh was eaten by the dogs of the party. Dr. Kouznetsov reports that the natives of Yakutsk Province are selling every year two thousand pounds of mammoth tusks to be used for ivory imitation.

THE report for 1918 of the "Explorations and Field-Work of the Smithsonian Institution"[1] reveals extensive work, in spite of the war, in the fields of anthropology, archaeology, geology, botany, zoölogy, and astrophysics. The institution is rapidly collecting records of the languages, customs, and traditions of the American Indian tribes. The astrophysical observations at Mount Wilson on the accurate measurements of solar radiation have been continued. A station was also established at Calama, Chile, as the most cloudless spot on the earth for simultaneous observations. By this work it is hoped to lay a foundation for the application of such accurate measurements to the forecasting of terrestrial temperature changes. Botanical exploration was carried on in Ecuador and in the southwestern United States; and other expeditions for general collecting were sent to the French Congo, and to Borneo and Celebes.

Two initial volumes have appeared of what will be a most notable series of "Monographs on Experimental Biology,"

[1] *Smithsonian Miscellaneous Collections*, Vol. 70, No. 2.

edited by Jacques Loeb, head of the department of experimental biology in the Rockefeller Institute, T. H. Morgan, professor of experimental zoölogy in Columbia University, and W. J. V. Osterhout, professor of botany in Harvard University. The two volumes which have so far appeared are *Forced Movements, Tropisms, and Animal Conduct*, by Dr. Loeb, and *The Elementary Nervous System*, by G. H. Parker, professor of zoölogy in Harvard.

In connection with the illustration of mastodon bones collected by Thomas Jefferson at Shawangunk, Ulster County, New York (see page 407), it is interesting to recall that both Ulster and Orange counties have been prolific in mastodon remains. After the recession of the transcontinental glacier, large marshes were left in this region where these huge animals frequently became mired. The most perfect skeleton so far unearthed, the "Warren mastodon" now in the American Museum, was taken out near Newburg, in 1845. This skeleton together with the "Shawangunk skull" was purchased and described by Professor John Collins Warren, of Harvard, in his famous memoir, *The Mastodon Giganteus of North America* (1852). Farmers in these counties are frequently turning up bones in a greater or less state of decay, which they not infrequently take for pieces of tree stump. Remains of mastodon hair also have been reported from Ulster County, "of dark, golden brown color, long, dense and shaggy."

Recently preliminary reports on the scientific work of Rasmussen's Second Thule Expedition have been printed by the Danish Geographical Society. An ancient folded range (probably palæozoic) was discovered extending from Robeson Channel along the whole north coast of Greenland into Peary Land, probably continuous southward with the range in Grinnell Land. It was found that the great ice-free highlands of the inland ice belt, which the expedition crossed on its return journey, are entirely devoid of higher forms of vegetation. With reference to the evidences of Eskimo occupation, especially at Independence Bay, Mr. Rasmussen is of the opinion that it would never have been possible for Eskimo to migrate from the west along the northern coast to the point where the expedition found tent rings, and that accordingly these remains indicate migration northward along the eastern coast.

The Fisheries of the North Sea[1] has been written to inspire a greater appreciation of "our magnificent heritage of the sea." It gives a sketch of the history of the fishing industry of these northern waters from the time of primitive bone hooks to the modern steam trawler. The book contains much useful information on the industry in Scandinavia, Holland, Germany, France, Russia, and America. We are all fully awake after the late war to the economic and naval importance of the subject.

The total eclipse of the sun which occurred on May 29 was notable for its duration—5 minutes in Brazil, and 6 minutes 51 seconds on the Atlantic Ocean. The eclipse was visible in Bolivia and Brazil, South America, and in the French and Belgian Congo, and Mozambique, Africa.

More than one thousand contributions for the Roosevelt Memorial Bird Fountain to be erected by the National Association of Audubon Societies of the United States, had aggregated $11,684.19 on May 1. It is estimated that $100,000 will be needed to make the memorial a fitting monument to the memory of the great naturalist president.

The summer course of the Marine Biological Laboratory, Woods Hole, Massachusetts, enters on its thirty-second year. A new department, Protozoölogy, is added, and Professor Gary N. Calkins, of Columbia University, offers a formal course in this subject for advanced students. The faculty of the investigation branch of the botany department has also been expanded by the addition of Edward M. East, professor of experimental plant morphology in Harvard, Robert M. Harper, professor of botany in Columbia University, E. Newton Harvey, assistant professor of physiology in Princeton University, and Winthrop J. V. Osterhout, professor of botany in Harvard.

The summer courses at the Cold Spring Harbor Biological Laboratory are adapted to both elementary and advanced students, and facilities are granted as usual to stu-

[1] *The Fisheries of the North Sea*, by Neal Green. London, Methuen & Co., 1918.

dents wishing to undertake original investigations. Associated with Dr. Charles B. Davenport, director of the laboratory, is a large staff, including Professors Herbert E. Walter, field zoölogy, Henry S. Pratt, comparative anatomy, John W. Harshberger, plant geography and ecology, and Harris Hawthorne Wilder, physical anthropology.

The Carnegie Institution of Washington reports for the year 1918 a transference of many of its activities into war channels for both the Institution as an organization and for the individual members of the staff, many of whom were temporarily drawn from their regular duties for special government service. Most of the big war tasks the Institution had in hand were still confidential at the time President Woodward submitted his yearly report and so are not included, with the exception of the organization of an optical glass industry by the Geophysical Laboratory. Most of the high grade optical glass used in this country before the war had been imported from Europe. Not only was this supply cut off, but the entrance of the United States into active military participation entailed an increased demand for all sorts of optical instruments. The Geophysical Laboratory at the request of the government undertook to investigate the processes underlying this industry and then assumed the direction of establishments built for manufacturing the glass. As a result of their work the output of uncut optical glass in the country was increased from one to one hundred tons a month.

The continuation of the regular scientific work of the Institution, however, was not entirely interrupted. Even the menace of German raiders did not keep the nonmagnetic ship "Carnegie" in port throughout the year. The magnetic surveys of the "Carnegie" have carried her over 189,176 nautical miles, more than eight times the circumference of the earth. The service of this survey to navigators cannot be overestimated, for even slight errors in compass bearing may prove disastrous to a ship relying on an erroneous chart. In places in the South Pacific, the errors in magnetic variations of the best charts were discovered to be as much as 16 degrees.

At the beginning of 1918 there was incorporated into the Carnegie Institution the Eugenics Record Office at Cold Spring Harbor, Long Island, founded by Mrs. E. H. Harriman. This office has been serving as a clearing house and repository for eugenical records and as a training school for field workers in connection with the summer course given at the Harbor by the Brooklyn Institute of Arts and Sciences. A large number of bulletins and several memoirs on subjects of heredity and eugenics had been published and the office had accumulated nearly 52,000 pages of first-hand manuscript data before coming under the control of the Carnegie Institution.

It is interesting to note that 372 volumes of scientific researches have so far been published by the Carnegie Institution, not to mention the many articles and books printed elsewhere by its investigators.

Color patterns of fishes with reference to the habits and environment of the species have been the subject of intensive studies conducted during the past year in the Hawaiian Islands by Professor William H. Longley under the auspices of the department of marine biology of the Carnegie Institution. Professor Longley made most of his observations under water by means of an equipment of diving-hood and submarine cameras, remaining at considerable depths for as long as four or five hours at a time. Also he has been carrying on experiments in submarine color photography, and reports that he is convinced of its possibility, although a special color screen is required to stop more of the shorter light waves than does the customary screen.

One of the first results of the war, in England and America at least, is exaltation of what is national, and one of the earliest reactions is a turning to peaceful out-of-door sports and quiet country living and travel. It is safe to prophesy that Americans will now know America far better than ever before, and will understand and appreciate as never before the fundamental facts of the natural history of America, especially of physiography, geology, archaeology, and of course of plant and animal life. There promises to be available a most remarkable abundance of authentic literature on natural history subjects.

Probably the greatest movement on foot in America along this line results from the organization of the "National Parks Asso-

GRAND CAÑON, THE WORLD'S GREATEST EXAMPLE OF STREAM EROSION

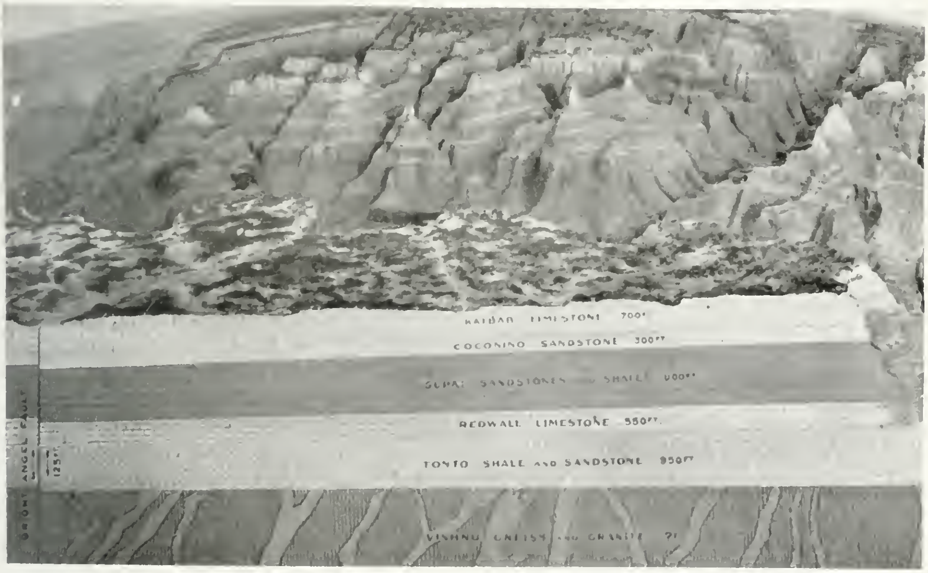
Model of part of the Bright Angel section prepared at the American Museum. Horizontal scale, 1000 feet to the inch; vertical, 500 feet to the inch. (This exaggeration counteracts the flattening effect which results from having the eye of the visitor (standing before the low model) at a comparatively great altitude, as if looking from an aëroplane about 24,000 feet above the famous El Tovar Hotel.)

Method of Preparation.—The primary object was to show topography and geology, purely artistic results were secondary in importance. The topographical map of the United States Geological Survey was enlarged by photography four diameters. The chosen contour lines of the map were then transferred by means of impression paper to boards of the proper thickness to give vertical distances of 100 feet between contours. These boards were then sawed along the contour lines, and the resulting pieces glued and nailed one on top of another in the proper order, forming a reproduction of the map in relief. The core thus built up was coated with a modeling composition which could be moulded and carved into shape to represent the actual surfaces of ground and cliffs as nearly as possible. During the progress of the task the modeler made a special trip to the Grand Cañon to gain first hand data, including color sketches for surface and sky. When the modeling on the core had been completed a plaster cast was made, the surface was retouched, and the whole colored in accordance with the studies from nature. The background was then painted, with "flies" similar to those used in theatrical scenery to heighten the pictorial effect.

The preparation of the model, begun under the direction of Chester A. Reeds and completed under that of E. O. Hovey, was carried out by P. B. Hill, E. J. Foyles, A. Brickner, and A. Latzko. Modeling, coloring, and background are by Morgan Brothers ciation." It is outside of the United States Government, independent of the National Park Service; it will work in coöperation with the Government but "untrammeled by precedents and politics"—the Service to develop the parks, the Association to educate the people for the higher enjoyment of the parks. Space will not permit quotation of the long lists of representatives of travel clubs and scientific societies, of universities, and of influential individuals, but to one interested in the results these lists are encouraging in the national importance of the included authors, journalists, educators, geographers, geologists, explorers, conservationists, publicists, artists, etc. About twenty universities are represented in the Association by their presidents.

America's numerous national parks are to be utilized as a "People's University of Natural Science," where a half million or more in attendance may study the natural history of our country and the formative processes that have given the continent its physical characteristics. Our national parks have been viewed largely as scenic wonders; "National Park" should be a trade-mark for conspicuous grandeur and majestic beauty, but it should also represent a standard of out-of-door living and natural history appreciation. The Association therefore will try to function as interpreter, a medium through which scientific knowledge may be made available to the general public, and it is greatly hoped that the various universities will coöperate by sending classes and instructors to the parks, allowing credits toward a degree as in regular course work.

The National Park Service of the Department of the Interior through its Educational Committee has been carrying on preliminary work of this nature in coöperation with the Commissioner of Education. Publications have been introduced into the schools and one series of pictures sent out for public exhibition. The Director of the Forest Service has emphasized the importance of this work in his annual report, expressing his desire to see its wide extension. "I want to see pictures of American mountains, geysers, glaciers, and cañons in every classroom of geography in the land; I want to see the beautiful pictures of national park scenes placed in the schoolhouses with portraits of national heroes and views of historic places; I want to see textbooks in certain subjects made more truly American by referring to features in our national park system rather than to similar objects in foreign lands."



Detail of the Grand Cañon model in the American Museum, showing the geological section as given on its front. The names appearing on the beds of rock are those which have been applied to the groups of rocks by the geologists who have made special studies of the region. The bed of the Vishnu gneiss and granite at the base is of Archæan age, the oldest in the geological series, and its approximately flat top indicates the elapse of a vast period of exposure and erosion before the Tonto shale and sandstone began the series of sedimentary rocks above—which form the principal features of the cañon

Photograph by Trevor Kincaid

The summer laboratory of the Puget Sound Biological Station, connected with the University of Washington, is situated just above high tide at Friday Harbor. Pipes laid deep in the channel supply fresh and sea water at a constant temperature to all individual research rooms. The tides rise about twelve feet at this point, rushing through the channels of Puget Sound, thus keeping the local water well aërated for marine life. For facts regarding the work in fisheries at the University of Washington, see the article, in this number, by Dr. Hugh M. Smith, United States Commissioner of Fisheries

A NOTABLE out-of-door natural history course is offered this summer of 1919, by the University of California, in the form of the Le Conte Memorial Lectures in the Yosemite Valley. These lectures will be delivered in localities in the valley which illustrate the physiographic subjects under discussion. They include three series covering the botany, geology, and ethnology of the region. A fourth series, on John Muir, will be given by Professor W. F. Bade.

Far Away and Long Ago,[1] by W. H. Hudson, the British and South American naturalist and author, gives us a glimpse into his early life on the pampas of Argentine where he spent his boyhood, keenly observing the wild things of the plains. Mr. Hudson writes in a reminiscent spirit more to express the joy he found in living in the great outdoors than to give an autobiography. "When I hear people say," he writes, "they have not found the world and life so agreeable or interesting as to be in love with it—I am apt to think they have never been properly alive nor seen with clear vision the world they think so meanly of. . . . "

[1] *Far Away and Long Ago: A History of My Early Life.* By W. H. Hudson. London and Toronto, 1918.

THE University of Montana is holding for the nineteenth season its six weeks' outdoor courses in geology, botany, and zoölogy at the Biological Station on Flathead Lake. As in previous years the students camp at the lake in tents provided by the university. Outdoor, laboratory, and lecture courses are offered and opportunity afforded for individual research. Morton J. Elrod, professor of biology, Paul W. Graff, assistant professor of botany, and Roy Wilson, instructor in geology, all from the state university, constitute the scientific staff.

A FIELD course in anthropology is being offered for six weeks during July and August by the University of Arizona. The work will take the students over the Navajo Reservation and the homes of the Pahute and the Hopi Indians, and visits will be made to the Grand Cañon of the Colorado, the Painted Desert, Monument Park, and the Nonnézoshie (Rainbow) natural arch. Students undertaking this work must be able to ride horseback and will have to be prepared to spend most of the time tramping and camping on the desert. As a scenic trip the route cannot be excelled; it is also one of the best localities of the country in which to study both the ruins of the cliff dwellings and contemporary Indian tribes.

A DEPARTMENT of forest recreation has been established at the New York State College of Forestry to undertake investigation and instruction in the proper use of the public forest reserves for recreation. Prof. Henry R. Francis has accepted this chair and will give his attention to the forest and park areas of the state with reference to their playground possibilities. This is the first department of the kind to be established in a school or college in this country.

THE State Ranger School of the New York State College of Forestry undertakes to train men to fill positions in the field of work between that of the lumberman and the professional forester. The school is located at Wanakena in the Adirondacks. Practical forest work is emphasized and a nursery is maintained where many thousands of trees are produced annually.

THE Bureau of the Associated Mountaineering Clubs of North America in its recent bulletin for 1919 proclaims a wide interest in the pleasures of outdoor recreation among America's forests and mountains. Twenty-nine different clubs, societies, and institutions compose the Bureau, comprising most of the organizations of this country and Canada which are actively interested in the protection and development of the scenic treasures of America. They are: American Alpine Club, Philadelphia and New York; American Forestry Association, Washington; American Game Protective Association, New York; American Museum of Natural History, New York; Adirondack Camp and Trail Club, Lake Placid Club, N. Y.; Appalachian Mountain Club, Boston and New York; Boone and Crockett Club, New York; British Columbia Mountaineering Club, Vancouver; Colorado Mountain Club, Denver; Field and Forest Club, Boston; Forest Service, U. S. Dept. Agriculture, Washington; Fresh Air Club, New York; Geographic Society of Chicago; Geographical Society of Philadelphia; Green Mountain Club, Rutland, Vermont; Hawaiian Trail and Mountain Club, Honolulu; Klahhane Club, Port Angeles, Wash.; Mazamas, Portland, Oregon; Mountaineers, Seattle and Tacoma; National Association of Audubon Societies, New York; National Parks Association, Washington; National Park Service, U. S. Dept. Interior, Washington; New York Zoölogical Society, New York; Prairie Club, Chicago; Rocky Mountain Climbers Club, Boulder, Colorado; Sagebrush and Pine Club, Yakima, Washington; Sierra Club, San Francisco and Los Angeles; Tramp and Trail Club, New York; Wild Flower Preservation Society of America, New York.

The current bulletin of the Bureau announces an International Congress of Alpinists, called by Baron F. Gabet, vice president of the French Alpine Club, to meet in Monaco, May 10–16, 1920. The proceedings of this congress, to which the National Park Service will contribute, are to be published.

AT the annual meeting of the American Camp Directors' Association and the Woodcraft League of America, held at Greenkill Camp near Kingston, New York, in May, Prof. George L. Meylan, of Columbia University, gave a vivid account of his work abroad in introducing athletic games in our armies and in those of France. Demonstrations in woodcraft were in charge of Ernest Thompson Seton, and of campcraft in charge of Dillon Wallace, the Labrador explorer. Bird study was conducted by Dr. G. Clyde Fisher, representing the American Museum.

THE "Roosevelt," Admiral Peary's ship which made possible his discovery of the North Pole, is called to mind in connection with the recent death of Eugene D. Hawkins. It was Mr. Hawkins who in 1904 favorably presented Peary's projects to his client, the late George Crocker, with the result of a prompt subscription of $50,000 for the ship and expedition.

ONE New York artist's impression of the recent exhibition at the Brooklyn Museum of relics of the whaling industry on Long Island is as follows: "The little collection contained many instructive things connected with this once flourishing industry. Chief among them from the artist's point of view were the numerous pie-markers artistically wrought from pieces of sperm whale teeth or bone. The ingenuity displayed by the rough whalers who made these little tools for the kitchen is truly remarkable, but the artistic side of the work is even more worthy of notice. One sees here how successfully such homely objects may combine usefulness and beauty: a charming object lesson to students of design in household furnishing."

President Henry Fairfield Osborn has recently been elected to one of the trusteeships of the Institut de Paléontologie Humaine of Paris, as a member of the Conseil de Perfectionnement. In announcing his election, Director Marcellin Boule writes: "Il a voulu reconnaître ainsi, non seulement les éminents services que vous avez rendus à la Science, mais encore la sympathie que vous avez montrée à nos préhistoriens en écrivant votre bel ouvrage sur les Hommes de la pierre. . . . Je suis heureux d'avoir le privilège de vous annoncer cette nomination. Elle ne peut que resserrer les liens d'amitié qui unissent votre pays au nôtre, et qui nous unissent personnellement."

A dinner was given in honor of Dr. N. L. Britton, director of the New York Botanical Garden, by the managers of the Garden on May 7. The organization of the work twenty-three years ago and its subsequent success were reviewed, and Dr. Britton was presented with a loving cup on behalf of the board of managers.

A plan is being carried out for the improvement and development from a scenic standpoint of the forests and open lands along the Du Pont Road in Delaware. This road, which forms a part of the Lincoln Highway, extends throughout the length of Delaware and in its improved form will be a great asset to the state. It is two hundred feet wide, with roadbed of cement. The right of way was presented to the state by Mr. E. C. Du Pont, who also financed the undertaking of its development. The upkeep and control of the road, forty miles of which already have been completed and opened to travel, are in the hands of the State Board of Agriculture. Mr. George B. Sudworth, dendrologist of the United States Forest Service, recommended the plan for making the highway scenically attractive by planting forest trees along the roadway to supplement and improve natural woodland effects. At several places cleared lands are to be planted with fruit trees, and various horticultural and agricultural projects will be undertaken as object lessons in practical farming. Incidentally the excellent roadway makes it possible to carry harvested crops easily and quickly to markets.

The American Society of Mammalogists has been organized in Washington. The Society will be devoted to the general problems involved in the study of mammals, their evolution, behavior, and life histories, as well as to systematic and anatomical studies. More than two hundred and fifty were enrolled as charter members. The following officers were elected: C. Hart Merriam, president; E. W. Nelson, first vice president; Wilfred H. Osgood, second vice president; H. H. Lane, recording secretary; Hartley H. T. Jackson, corresponding secretary; Walter P. Taylor, treasurer; N. Hollister, editor. Glover M. Allen, R. M. Anderson, J. Grinnell, M. W. Lyon, W. D. Matthew, John C. Merriam, Gerrit S. Miller, Jr., T. S. Palmer, Edward A. Preble and Witmer Stone were elected councilors.

Dr. J. A. Allen, curator of the department of mammalogy and ornithology at the American Museum, has been elected the first honorary member of the newly formed American Society of Mammalogists.

The history of science in England and in America has been reviewed in two recent books[1] by notable scientists of the two countries. The work on American science by Professor Dana, and by other members of the Yale faculty, for the most part was published to commemorate the one hundredth anniversary of the founding of the *American Journal of Science*. The general progress of science through the century, especially as illustrated by the *Journal*, is depicted in chapters devoted to special fields. The first chapter, written by Professor Dana, is an account of the *Journal* itself and its various vicissitudes in the hands of Professor Silliman and his successors. In its inception the *American Journal of Science*, as the first American scientific magazine, aimed at a very comprehensive program "to advance the interests of this rising empire by exciting and concentrating original American effort, both in the sciences and in the arts." No

[1] *A Century of Science in America with special reference to the American Journal of Science 1818–1918*. By Edward Salisbury Dana, *et al.*
Britain's Heritage of Science. By Arthur Schuster, F.R.S., and Arthur E. Shipley, F.R.S., London, 1918.

better means of measuring the scientific advance of the century and the country could be found than the pages of this *Journal* which has been the fortunate publisher of some of the most notable scientific discoveries of the time.

The greater part of the volume is devoted to geology, mineralogy, and palæontology to which the *Journal* has been especially devoted, but there are in addition chapters on chemistry, physics, zoölogy, and botany.

The British work by the secretary of the Royal Society and the vice-chancellor of Cambridge undertakes "to give a plain account of Britain's great heritage of science," from Roger Bacon to the present. The authors have treated their subject as a series of biographies presenting the main facts concerning the lives and discoveries of distinguished British scientists. On the whole the work does not aim to include accounts of living scientists, although exceptions have been made in certain cases. Both volumes are illustrated with numerous portraits.

Dr. W. D. Matthew, curator of vertebrate palæontology of the American Museum, has recently been elected a Fellow of the Royal Society of Great Britain. The citation accompanying his election is as follows:

"A Canadian palæontologist distinguished for his valuable contributions to our knowledge of the fossil mammals of North America, and his philosophical discussions of the modern results of vertebrate palæontology. By geological research in the field he has helped largely in the more exact determination of the relative ages of the fossils occurring in the Tertiary rocks of western North America. He has also done much to popularize vertebrate palæontology and to spread a general interest in the subject. Author of numerous memoirs and papers, among which may be enumerated:—*Revision of the Puerco Fauna* (1897); *Fossil Mammals of the Tertiary of N. W. Colorado* (1901); *Hypothetical Outlines of the Continents in Tertiary Times* (1906); *Osteology of Blastomeryx and Phylogeny of the American Cervidæ* (1908); *Carnivora and Insectivora of the Bridger Basin* (1909); *Phylogeny of the Felidæ* (1910); *Revision of the Lower Eocene Wasatch and Wind River Faunas* (1915–16), (*Bull.* and *Memoirs*, Amer. Mus. Nat. Hist.); *On Certain Theoretical Considerations Affecting Phylogeny and Correlation* (1914), (*Bull.* Geol. Soc. Amer.); *Climate and Evolution* (1915), (*Annals*, New York Acad. Sci.)."

This citation is signed by three of the most eminent palæontologists of Great Britain, namely: A. S. Woodward, C. W. Andrews, and H. Woodward, of the British Museum; also by E. S. Goodrich, of Oxford, Oldfield Thomas, of the British Museum, and G. Elliot Smith, the anatomist.

Two handy pocket manuals of common woody plants have been published during the last two years by Professor William Trelease,[1] of the University of Illinois, comprising admirable keys to the trees, shrubs, and woody climbers in eastern United States and northern Europe during both winter and summer. Most of our manuals use fruit and flower characters for the basis of their keys, making it impossible to identify the plants throughout the greater part of the year, but Professor Trelease has based his first book, *Plant Materials*, as he says, "in large part on differences used by the old herbalists,—position and other peculiarities of foliage," and the second volume, *Winter Botany*, in a similar manner on leaf scar and bud differences. For the man who wishes an introduction to some of the delights of out-of-doors, as well as for the entomologist who wishes to determine the habitat of certain larvæ, for the mycologist identifying the host of his fungus specimens, for the gardener in winter, and for the amateur or even professional botanist, these little volumes will always prove valuable guidebooks in the field.

The great change which has come in the literature and art of Chile since the beginning of the twentieth century was emphasized by Sr. Enrique Molina, director of Concepción High School, in a lecture at Columbia University. Chilean literature especially has become both more national and better appreciated throughout the country so that it is now possible for an author to live by his profession. Chile has made notable educational advances during recent years and particular attention to the building of schools is being given by the present government under President Sanfuentes.

A very valuable exhibition in late spring at the Metropolitan Museum of Art, New York, illustrated plant forms historically used in design, and called attention to the

[1] *Plant Materials of Decorative Gardening*, Urbana, 1917, and *Winter Botany*, *ibid.*, 1918.

possibilities in the use of American plant subjects for new ideas in design. A collection of native and exotic objects of art, tapestries, china, wood carving, and architecture was arranged in connection with examples of living plant forms which contributed their dominant motives,—such as acanthus and papyrus, lotus, grape, cypress, and almond.

THE American Museum was represented at the fourteenth annual meeting of the American Association of Museums, held in Philadelphia in May, by Messrs. E. O. Hovey, Herbert J. Spinden, and Roy W. Minor. Dr. Spinden addressed the session with reference to the utilization of museum material in industrial art. He explained the extensive adaptations by textile manufacturers of decorative motives found among North and South American Indians and the more primitive peoples in other parts of the world. Anthropological collections make available many old ideas that can be put to modern use. The commercial success along this line of development has already been great. For the first time American houses have been able to market silks and ribbons in both Paris and London in competition with European designers. The problem before America is to develop an everyday art that properly expresses our nationality. Dr. Spinden's paper aroused a lively discussion.

THE value of the educational work which the American Museum is doing for the public schools of New York City is emphasized by the recent action of the Board of Education in providing a special appropriation which will enable the institution to extend its full-time service to the schools during the current year. This service to the schools is quite outside the terms of the contract between the Museum and the City: consequently, when the Board of Estimate reduced the appropriation for the maintenance of the Museum in 1919, the trustees were compelled to suspend activities which were not provided for in the letter of the contract. Under the limited program provided, the Museum was obliged to discontinue supplying nature-study collections to the schools of the Bronx, Brooklyn, Richmond, and Queens, to reduce the lectures for school children to half the number, and to discontinue entirely the circulating collections for public libraries. President H. F. Osborn, of the American Museum, brought the situation to the attention of members of the Board of Education at a conference held in the Museum on February 18, 1919, at which President Arthur S. Somers, Mrs. Ruth F. Russell, and Dr. Gustave Straubenmüller represented the Board of Education, Professor Stephen P. Duggan, the College of the City of New York, and President Henry Fairfield Osborn, Director Frederic A. Lucas, Mr. George H. Sherwood and Dr. G. Clyde Fisher, the American Museum. As a result of this conference, at which the various phases of the Museum's activities with the schools were presented and discussed, the Board of Education, at the request of President Somers, made a special appropriation of $4,100 to enable the Museum to resume its full-time service to the schools.

DURING the past winter and spring the auditorium and other assembly halls of the American Museum have been in almost daily use for lectures or meetings of scientific societies. At the autumn course for members Mr. Branson M. DeCou lectured on the Colorado, Yellowstone, and Glacier National Parks; Mr. T. Gilbert Pearson on the United States bird reservations; Mr. Charles Crawford Gorst on bird music; and Mr. Graham Lusk on the food supply of the Allies. For the spring course Mr. Carl E. Akeley lectured on Africa; Mr. George D. Pratt on the forests and wild life of New York; Professor Herbert E. Gregory on Australia; and Dr. G. Clyde Fisher on a naturalist's rambles in Florida. The children's course included two series of four lectures each on wild birds and animals, the Eskimo, Indian stories, and the winds. For the children of the public schools four courses of six lectures each were offered by members of the Museum staff on the industries of the United States, natural history, early history of America, and geography respectively.

In addition to these regular courses a number of special lectures have been delivered at the Museum from time to time. Professor S. A. Mitchell spoke in December on "The Result of the Eclipse of 1918"; Dr. Lindley M. Keasbey in January gave three lectures on "Wealth and its Ways"; and Mr. John Kendrick Bangs lectured on "Light and Shade in the Land of Valor." On February 5, Sir Arthur Pearson, the blind

PUBLIC LECTURES ARE ONE OF THE AMERICAN MUSEUM'S IMPORTANT EDUCATIONAL FEATURES

Not only members of the American Museum but also large numbers of primary and high school children and of the general public are reached by the lectures given in the auditorium. This photograph shows Dr. G. Clyde Fisher addressing an audience of school children, with the assistance of stereopticon views of the local birds. The auditorium has a seating capacity of 1400 and is well equipped for presenting stereopticon slides, and especially moving-picture reels, of which the Museum now possesses a valuable and rapidly growing collection founder of St. Dunstan's Hostel, London, addressed seven hundred New York blind and their friends. This spring a special course of travel lectures was arranged for visiting soldiers and sailors who were addressed on three occasions by Messrs. Carl E. Akeley, George H. Sherwood, and James Barnes.

The small assembly rooms of the Museum have served as meeting places and lecture halls for the New York Academy of Sciences and affiliated organizations, which include the Linnaean Society of New York, the New York Mineralogical Club, New York Entomological Society, Torrey Botanical Club, New York Microscopical Society, and the American Ethnological Society. Special lectures were arranged by the educational department of the Museum for several of the city's high schools, the Ethical Culture School, art classes, the School Nature League, and the Boy Scouts.

THE following persons were elected members of the American Museum during the months of April and May:

Patron, MRS. HENRY FAIRFIELD OSBORN.

Fellow, MR. S. N. BOND.

Life Members, MRS. HAROLD F. MCCORMICK, MISSES E. M. KITTREDGE, ISOBEL H. LENMAN, DR. PEARCE BAILEY, MESSRS. JOHN EDWARD ALDRED, JOSEPH C. BALDWIN, JR., EDMUND G. BUCKNER, C. L. CARPENTER, WALTER S. CASE, FRANCIS B. CROWNINSHIELD, J. S. CULLINAN, HEYWARD CUTTING, WILLIAM DU PONT, W. CAMERON FORBES, HENRY S. HALL, JR., REYNOLD JANNEY, FAIRFAX S. LANDSTREET, JOHN M. MOREHEAD, HOWARD PHIPPS, HERBERT L. PRATT, DANIEL G. REID, FRANCIS BEACH WHITE, WILLIAM WHITMAN and GEORGE WOOD.

Sustaining Members, MRS. CARL FERENBACH, MESSRS. R. J. CALDWELL, WALLACE DE WITT, WILLIAM B. GOODWIN, ELON HUNTINGTON HOOKER, G. B. MCCANN and EDWARD MILLIGAN.

Annual Members, MESDAMES HEZEKIAH A. BRAYTON, S. B. BROWNELL, C. N. EDGE, HERBERT SPENCER GREIMS, CLEMENT ACTON GRISCOM, H. HARDINGE, FRANKLIN S. HENRY, ROBERT I. JENKS, WOLCOTT H. JOHNSON, LEO LORENZ, F. MAURICE NEWTON, JAMES F. SHAW, FAYETTE SMITH, MISSES ANNE HAMPTON BARNES, MARY F. BARTLETT, IDA M. HARRIS, BESSIE NATHAN, MARTHA R. WHITE, REAR ADMIRAL C. MCR. WINSLOW, U.S.N., DOCTORS ALICE G. BRYANT, ROBERT GOOD, THOMAS HOWARD GROSVENOR, SAMUEL SWIFT, FRANCIS W. WHITE, J. SHERMAN WIGHT, MESSRS. WILLIAM APPLETON AIKEN, HENRY A. ALKER, B. I. ASHMUN, EDWARD S. AVERY, WOODWARD BABCOCK, CHARLES CHANEY BAKER, HARRY S. BANDLER, C. D. BARNES, ROBT. I. BARR, EDWARD R. BARTON, H. C. BECKMAN, SIDNEY FORBES BECKWITH, E. R. T. BERGGREN, JOHN D. BROWN, HOWARD SUMNER CANDEE, HENRY B. CANNON, THEODORE W. CASE, C. H. B. CHAPIN, GEORGE CHASE, W. H. CLARK, JAMES LIDE COKER, HENRY A. COLGATE, RUSSELL COLGATE, HENRY E. COOPER, R. C. DAVIS, E. DE GOLYER, WYLLYS E. DOWD, JR., ROBERT D. EMMERICH, JACKSON EVANS, S. J. FELDMAN, FRANK B. FOSTER, LEO FREEDMAN, JOHN H. FULTON, GEORGE R. E. GILCHRIST, W. E. GLYN, WM. E. S. GRISWOLD, JOHN HARRIS GUTTERSON, SIDNEY HARRISON, WILLIAM HOLABIRD, CHARLES C. HOMER, JR., FRANK T. HULSWIT, ARTHUR M. HUNTER, C. L. HUTCHESON, WALTER N. KAHN, G. H. KENT, EMIL L. KIEGER, HERBERT T. KING, ALLAN F. KITCHEL, W. M. LADD, ALFRED LE BLANC, PERCIVAL MANCHESTER, SAMUEL G. MCCLURE, CHARLES MCKNIGHT, EDWARD J. NALLY, JAMES C. O'CONNOR, WILLIAM TAFT PITKIN, SHERBURNE PRESCOTT, GEORGE W. RAYNES, WM. S. SCARBOROUGH, E. H. SCOTT, WILLIAM PAINE SHEFFIELD, FRANK R. SHULL, I. SIBBERNSEN, CHAS. H. SIMMONS, B. HERBERT SMITH, ISAAC STERN, FREDERICK PHILIP STIEFF, JR., FREDERICK M. P. TAYLOR, GEORGE F. TITUS, H. O. UNDERWOOD, FRED VOGEL, JR., JUSTUS VON LENGERKE, ROGER B. WILLIAMS, JR., H. LEONARD WILTON, J. WALTER WOOD and T. B. YUILLE.

Associate Members, MESDAMES A. S. PIERCE, FREDERICK SUNDT, MISSES ABIGAIL H. BISHOP, LILIAN GILLETTE COOK, COLONEL CHARLES K. WINNE, U.S.A., MESSRS. W. L. CHAMBERS, P. R. CLUFF, HENRY W. CORNING, WALTER L. DUNHAM, CHARLES W. FARNHAM, RICHARD A. FEISS, ARTHUR L. A. HIMMELSTEIN, EDWIN HOYT, HOWARD F. MARSTON, F. C. MCMATH, BENJAMIN F. MYERS, F. B. RAY, CRAIGE MCCOMB SNADER and SAMUEL F. WADSWORTH.

NATURAL HISTORY

THE JOURNAL OF THE AMERICAN MUSEUM

DEVOTED TO NATURAL HISTORY, EXPLORATION, AND THE DEVELOPMENT OF PUBLIC EDUCATION THROUGH THE MUSEUM

DECEMBER, 1919

VOLUME XIX, NUMBER 6

NATURAL HISTORY

VOLUME XIX

CONTENTS FOR DECEMBER

NUMBER 6

M. C. DICKERSON, *Editor*

Published monthly from October to May, by the American Museum of Natural History, New York, N. Y. Subscription price, $2.00 a year.

Subscriptions should be addressed to the Secretary of the American Museum, 77th St. and Central Park West, New York City.

NATURAL HISTORY *is sent to all members of the American Museum as one of the privileges of membership.*

Entered as second-class matter April 3, 1919, at the Post Office at New York, New York, under the Act of August 24, 1912.

Acceptance for mailing at special rate of postage provided for in Section 1103, Act of October 3, 1917, authorized on July 15, 1918.

CONTENTS (CONTINUED)

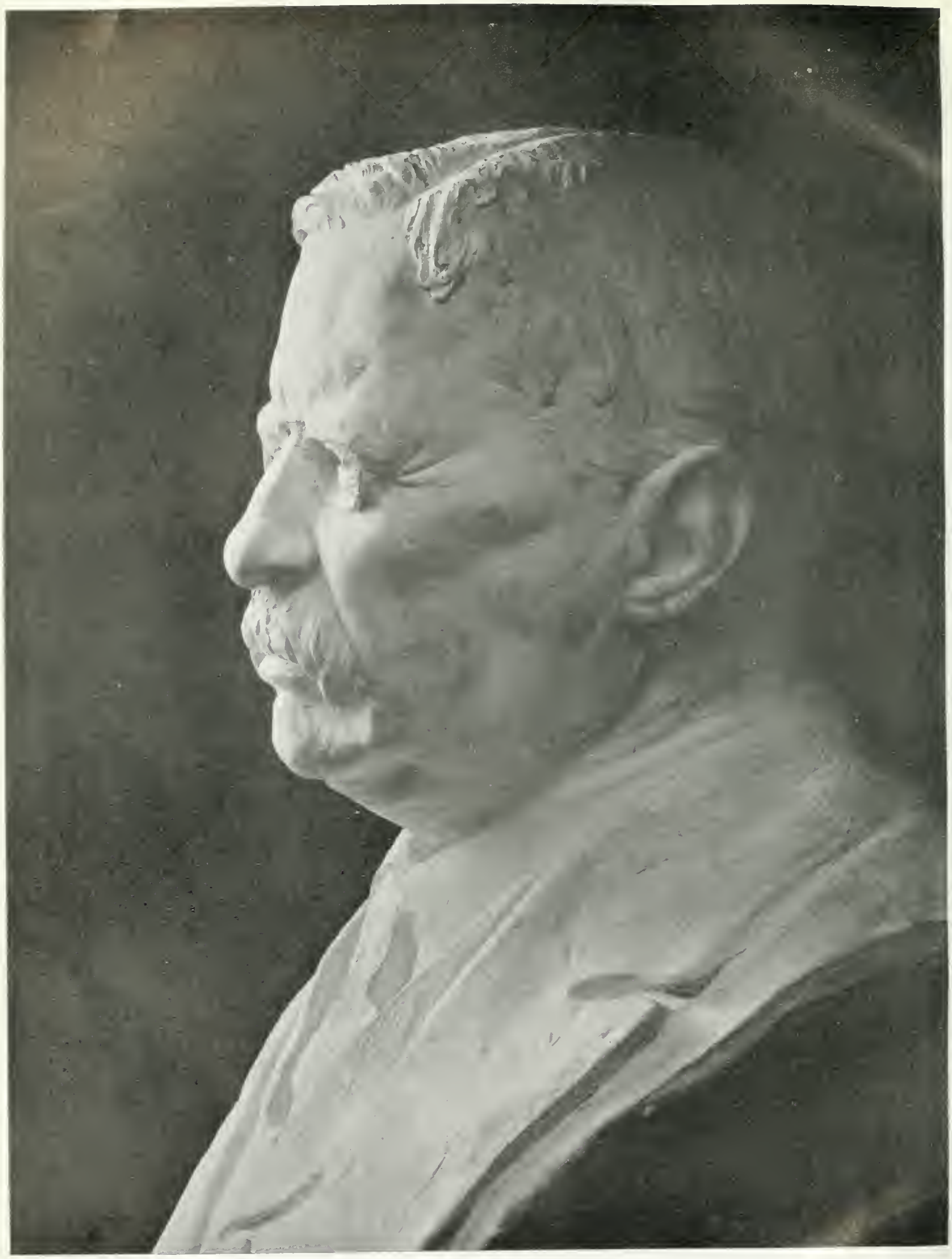
THE AMERICAN MUSEUM OF NATURAL HISTORY

MEMBERSHIP

For the enrichment of its collections, for scientific research and exploration, and for publications, the American Museum of Natural History is dependent wholly upon membership fees and the generosity of friends. More than 4000 friends are now enrolled who are thus supporting the work of the Museum. The various classes of membership are:

Benefactor		$50,000
Associate Founder		25,000
Associate Benefactor		10,000
Patron		1,000
Fellow		500
Life Member		100
Sustaining Member	annually	25
Annual Member	annually	10
Associate Member (nonresident)	annually	3

Full information regarding membership may be obtained from the Secretary of the Museum, 77th Street and Central Park West.



THE LAST BUST OF ROOSEVELT MODELED FROM LIFE

The work of Sigurd Neandross

Mr. Neandross aimed to make a faithful life portrait of the older Roosevelt. The work was executed from studies made at Mr. Roosevelt's New York office and at the American Museum of Natural History just before Roosevelt was taken to the hospital prior to his death, and the bust was never completed.

At the close of a new single-volume edition of Rudyard Kipling's verse, just from the press of Doubleday, Page & Company, are these lines on Roosevelt:

"Concerning brave Captains
Our age hath made known
For all men to honor,
One standeth alone,

Of whom o'er both oceans
Both peoples may say:
'Our realm is diminished
With Great-Heart away.' "

NATURAL HISTORY

VOLUME XIX DECEMBER, 1919 NUMBER 6

A Geographer at the Front and at the Peace Conference

By DOUGLAS W. JOHNSON

Professor of Physiography, Columbia University; lately Major, Military Intelligence Division, United States Army, and Chief of Division of Boundary Geography, American Commission to Negotiate Peace

From stenographic notes of an address delivered on the occasion of the annual dinner of the New York Academy of Sciences, December 15, 1919. Illustrations from photographs by the speaker

I HAD the opportunity, in connection with a coöperative undertaking by the American Geographical Society and the authorities of the United States Army, to visit the battlefronts from Belgium to Saloniki during the military operations, for the purpose of studying on the ground the influence of the terrain upon military strategy and tactics. It will be possible in the few minutes this evening to pick out from my interesting experiences during that trip only a few examples of the very evident influence topography has on strategy, and then to show how we applied geographical knowledge not only of strategic matters, but also of other territorial questions, in solving the problems of the Peace Conference.

In northern France and Belgium we have a region of low plain, above which there are occasional low topographical eminences, which played a striking part in the military operations of the Great War. Farther southeast, in the area east of Paris, the land is made up of a series of plateaus, each having a general slope westward toward the Paris basin, and a somewhat ragged and steep escarpment overlooking a lower plain to the eastward. These steeper slopes face toward Germany, and have been called the natural defenses of Paris. It was no accident that the main German offensive came not from the east, across the low plains dominated by high escarpments, but instead from the north to take the natural defensive lines in the flank.[1]

I am going to describe a few typical areas in the northern plain, beginning at the Belgian coast and the Mt. Kemmel-Vimy Ridge area, where the topography had a very striking influence on the local fighting; then in the Verdun region and the St.-Mihiel salient; and finally in the vicinity of Nancy, where the topography was ably utilized by General de Castelnau in his magnificent defense of that city.

Turning first to the Belgian coast, we find that the battle-front ended literally not only at the sea, but in the sea, the barbed wire entanglements crossing the line of dunes which separates the lowland of Belgium from the sea and extending out into the water in order to prevent local flanking movements. In that lowland the surface over extensive areas is below the level

[1] For full explanation see *Topography and Strategy in the War* (pages 2–10), Henry Holt & Co. By Douglas W. Johnson

of the sea at high tide. By opening the tide gates, it was possible to admit the waters of the sea at high tide and flood large tracts of land. This means of topographic defense was utilized, as you will remember, in the great battle for the Channel ports, and with such success that an inferior number of Allied troops were able to stop the great German drive in one of the big bids which Germany made for success in the war. On every railroad embankment or other slight elevation above the low-lying waste of waters it was possible to construct a series of sandbag protections to serve as lines of resistance against which the Germans always had to advance across submerged areas. The danger of these submerged areas lay not merely in the fact that maneuvers in the water were difficult and the footing very insecure and uncertain, and that concealed beneath the waters were deep ditches and trenches where a man might suddenly drop into depths far over his head, but also in the fact that in such a flooded region every wounded man is a dead man. When he falls from his wound, he falls not on the battlefield to be carried off to a hospital, but into the water to be drowned. Hence it was that the German losses in killed were unusually heavy in the battle for the Channel ports.

Some distance southeast of the Belgian coast and just northwest of Lille is a series of low hills rising only a few score of feet above the general level of the flat plain. Mt. Kemmel forms the easternmost member of these hills. When one of the German communiqués stated that their best mountain troops had been able to scale the heights of Mt. Kemmel, the world may have imagined that the climb was a difficult one. I think, however, that the most corpulent of individuals could easily reach the summit in a ten or fifteen minute walk from the base of the hill. Yet that slight elevation gives a perfect command of every road and of every obstacle capable of concealing a gun, over a broad stretch of country. From Mt. Kemmel it was possible on a clear day to see northwestward clear to the line of dunes at the sea; then to sweep the entire panorama of the battle-front north, east, and south, until it faded away on the horizon south of Vimy Ridge. It is not difficult to understand why there were such bitter struggles for so commanding a point of observation.

Southwest of Lille, and not far from the town of Arras, there rises above the plain a ridge which has a gentle southwestern slope and a steep northeast-facing escarpment. This is the famous Vimy Ridge. In the early days of the war the Germans made a point of seizing this ridge. I may say parenthetically that it was the testimony of officers all along the western front that the Germans showed unusual skill in selecting and seizing topographically favorable points, and that as a result the Allies were, at the beginning of the war, usually at a topographic disadvantage as compared with the enemy.

What was the peculiar value of Vimy Ridge that such a terrible price should be paid for its recapture by the Allied armies? It was a question of observation. So long as the Germans held the southwestern slope of the ridge they could see every movement within the Allied lines for a great distance north and south; whereas, the Allies themselves, facing up hill against the German lines, could see nothing but the obstacle of the rising ridge. The Germans could carry on their maneuvers on the plain behind the ridge unhampered by enemy observation except such as was possible by means of aëroplane and balloon. Continuous and easy observation direct from the ground has great advantages over the more uncertain observation from the air, where the observer is subjected to great annoyance and danger if he flies low, and suffers from restricted vision if he flies high.

The Allies lost many tens of thousands of killed and still larger numbers in wounded, to gain a few hundred yards of this valuable terrain. It was worth the price, for with that gain the rôles of the two armies were reversed. The Germans were on the defensive, their back areas under perfect observation, and the possibility of their planning a surprise attack greatly reduced, while the Allies enjoyed the protection from direct terrestrial observation which the enemy formerly enjoyed. The path to victory was being prepared.[1]

Now let us pass far eastward to the region of Verdun. It is in the topography of this region that we find an explanation for the direction of the German attack, which was from the north down the valley of the Meuse, in spite of the fact that the east-west spurs, projecting into the winding valley, gave a series of positions very difficult to take. The high plateau escarpment facing eastward and overlooking the low plain of the Woëvre, was even more difficult, however, for the French troops on the plateau crest possessed a truly wonderful command of the whole low country to the east over which any German attack from this direction would be compelled to move. The plain of the Woëvre is dotted with marshes and ponds, roads are few, and are in full view of observers on the heights above. Artillery control of the relatively few approaches to the cliffs leading up to the plateau was so perfect that an attack from the east would offer even less chance of success than an advance down the valley.

During the battle of the St.-Mihiel salient, the American troops pressing north across the plain of the Woëvre were aided by troops sweeping down from the plateau on the west, and by observers posted on the plateau crest in order to observe and direct the progress of operations. The American troops occupied, at the beginning of the operations, a line running east and west across the low plain. Facing them were the Germans in a very strong position selected with such skill that, while the Americans on taking over this part of the French line found themselves down in the marshes and mud, the enemy stood high and dry on the projecting spur of the plateau forming Montsec and its adjoining ridge.

In the battle of Nancy the Germans did attempt the difficult task of attacking the face of a plateau scarp from the low plain to the east of it. The scarp in question lies next east of that near Verdun, and is known in part as the Grand Couronne. North of Nancy the scarp is high and forbidding, while to the south it appears less formidable.

The battle of Nancy was divided into three phases. The Germans, realizing the difficulty of scaling the heights north of Nancy, first marched their armies southward and attacked the escarpment where it was lowest. The attack failed because the French, even on the lower escarpment, had a command of the low plain in front which made it impossible for the Germans to attempt any movement of surprise, and which enabled the French artillery to decimate the attacking columns as they moved into position. The second attack was against the city of Nancy itself and that part of the plateau just north; but although the Germans were able to cross the plain toward Nancy

[1] The full significance of Vimy Ridge, and its place in the fighting of several campaigns, cannot be told in a few moments but will be fully described in a large monograph to be published by the American Geographical Society in 1920.

for a considerable distance, on twelve successive days they were beaten back by the artillery fire controlled from advantageous observation points. The final attempt was a drive southward from the direction of Metz, against a projection of the plateau at Ste.-Geneviève, with the hope of passing down the Moselle Valley to reach Nancy. After the attacking forces had succeeded in reaching the crest of the plateau at one point they were pushed back into the plain and held there for the remainder of the war.

These studies were carried on in part for the purpose of making the American Government acquainted with the importance and significance of strategic frontiers. We knew that when the Peace Conference convened certain countries were going to press extensive claims for strategic annexations of territory in order that they might have good, defensible frontiers; and we thought it advisable to know from observation under modern conditions of warfare just what was the value of topography in defensive and offensive warfare. It is interesting to record that the testimony of the officers with whom I talked, including both commanders-in-chief and generals of lesser rank all along the fronts from Belgium to the Balkans, was to the effect that topography not only affects the movements of military forces today as much as it did in the past, but that under modern conditions of warfare the control of topography is even more effective than ever before. As Marshal Haig expressed it, one would not be exaggerating to say that the entire war has been a struggle for topographic position.

It may perhaps interest you if I sketch for a moment the kind of organization we had at the Peace Conference, and tell where the geographic work came in.

The question of language interested many of us, particularly when we first saw the Peace Conference begin its operations. English and French were on an equal footing as the official languages of the conference, and the proceedings of the Supreme Council and of the Big Four were carried on in both. Only in some of the commissions where everyone spoke French, was French alone employed, in order to reduce by half the time required for such commissions to do their work. In the Supreme Council and other more important meetings the translating was done by the wonderful Mantoux, a man of high distinction as an authority on certain English economic problems, possessing perfect command of a number of different languages, and gifted with a most remarkable memory and a power of mimicry which enabled him to reproduce not alone the words but also the thought and spirit of those whose words he translated. Inasmuch as he is probably the one man who was present at most of the important meetings from the days of the Supreme War Council to the close of the Peace Conference, his memoirs, if ever published, should prove a valuable and fascinating document.

I shall never forget the first time I saw this remarkable man at work. It was at a meeting of the Supreme Council, and the representative of a smaller power was presenting his country's claim to certain territory. As the presentation proceeded, Mantoux, sitting to the right of and slightly behind Clémenceau, jotted down hasty notes on large sheets of paper lying on the small table before him. I waited, with growing surprise, the moment when the speaker would cease and allow the translation to begin. But five minutes, ten minutes passed, and still the speaker continued; and still Mantoux calmly jotted down his notes. The door opened, a liveried porter slipped into the room, and laid a letter on Mantoux's table. Note taking ceased, Mantoux read the letter, wrote a reply, and handed it to the porter. All this time the delegate of the power in question continued the earnest argument in favor of his country's demands. What a shame, I thought, that the translator should be missing a vital part of that argument! And I made a mental note of the points which would escape the knowledge of those who did not understand the original presentation in French. Finally, after a lapse of time which seemed to me almost interminable, the speaker paused, and bowing to Mantoux, intimated that the first section of his address might now be rendered into English. A moment's hesitation, during which he glanced hastily over his several pages of notes as if to visualize the whole argument in its entirety, and Mantoux began. In clear tones and a forceful manner, the translator now reproduced with remarkable fidelity the thought, the phraseology, the very emphasis of the original speaker. Nothing was lacking, and while I breathlessly awaited the hiatus which should mark that portion of the address lost during his preoccupation, Mantoux calmly reproduced it all, not a sentence missing. His mind had recorded each word even while it seemed otherwise engaged, and now gave back in another tongue all it had received. Assuredly Mantoux was one of the outstanding figures of the Peace Conference.

With the Supreme Council and its general organization you are already familiar. Later, this Supreme Council (popularly called the Big Ten) broke up into the Big Four and the Big Five—the Big Four being Mr. Wilson, Signor Orlando, Mr. Lloyd George, and M. Clémenceau (the Japanese representative not participating actively where matters of the western world only were concerned), and the Big Five consisting of the Ministers of Foreign Affairs. Next below there came a series of commissions including the territorial commissions composed of two delegates from each of the four great western powers. There were such commissions to consider the territorial demands of Greece, Roumania, the Jugo-Slavs, the Czecho-Slovaks, and so on. The appropriate territorial commission would give a hearing to any small power which desired to present its case, or to two or more powers where there were conflicting claims to territory. After hearing both sides of the case, the members of these commissions and their associated geographical, economic, historical, military, and other experts would debate the issues at length, and decide what was just in each claim and what was unjust, and where the new boundary lines should be drawn, striving to fix the frontiers as nearly as possible along lines of racial division but taking into due account the geographic, the economic, and to some extent, the strategic factors, in order to get the wisest and most permanent settlement of the various complicated territorial problems. I think it is just to say that in most cases a sincere effort was made by the disinterested technical men of the different great powers to lay down the frontiers of Europe in the way which would be fairest to all concerned. And while political considerations sometimes influenced the representatives of this or that nation, and questions of politics or policy sometimes caused the recommendations of the experts to be set aside by the higher authority of the Supreme Council or the Big Four, nevertheless, the frontiers of the new Europe as you will see them on the map were, for the most part, drawn in the territorial commissions by disinterested geographic and other experts.

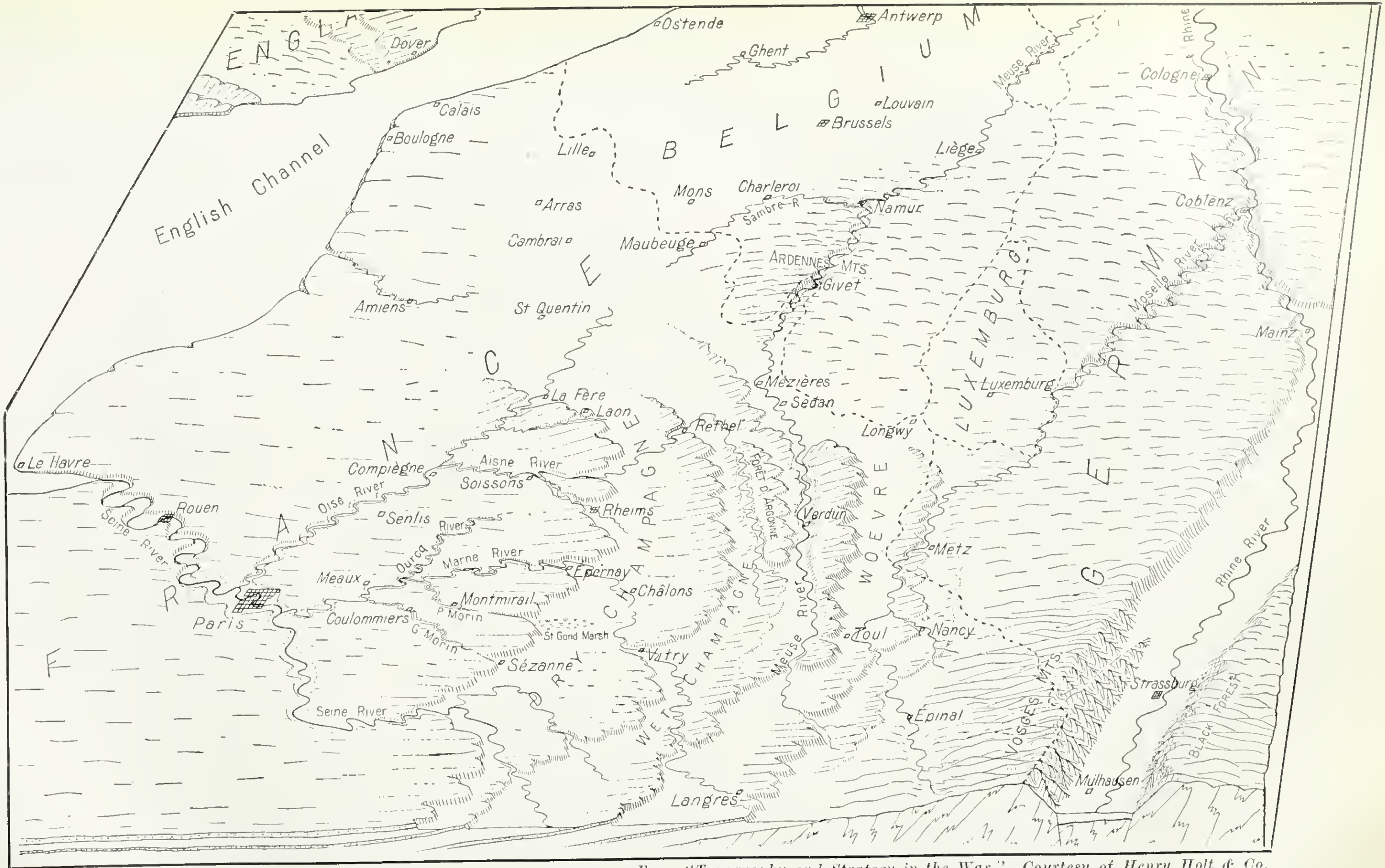
Now, the kind of problems which constantly came before the territorial commissions can best be illustrated by taking one which did not come before such a commission; for then I will reveal no commission secrets by referring to it. I will select a problem in which you are very much interested at the present time; namely, the Adriatic problem. We have here an issue which is fundamentally based on great questions of political, physical, economic, and strategic geography. It was the duty of the different geographic, economic, historical, and other experts to know all phases of this and other territorial problems: to say, for example, that the linguistic and racial boundary between the Jugo-Slavs and the Italians lay far over on the western edge of the Istrian peninsula, and that if a decision were made on the basis of nationality alone, not only Fiume but most of Istria would have to go to Jugoslavia. It was also for them to say that the natural or geographic frontier lay on the high mountain ridge forming the backbone of Istria and located close to its eastern shore; that all economic relations of the people west of that divide may lie most naturally with the Italian side of the mountain; and, hence, that it may be wisest to push the new international boundary away from the racial boundary and on up the western slope of the mountain until its crest is reached, in order to secure not only a good economic and a natural geographic frontier, but also a frontier that is strategically defensible. For all these reasons there may be very just grounds for giving to Italy a part of the territory she desires to annex, despite the fact that in so doing, a solid block of 370,000 Jugo-Slavs must be put under Italian rule against their very strong protests.

On the other hand, the geographer and economist must point out the fact that along the whole eastern coast of the Adriatic runs a high barren mountain belt, very little populated and across which at the present time there is not a single standard gauge railroad south of Fiume; that no commercial intercourse of great importance can ever take place across that barrier; that if one takes a map of the standard gauge railway system of the new Jugo-Slav nation he will find that it is almost entirely concentrated in the northern part of the country, and that its one and only natural outlet is the port of Fiume: and to point out that because of these peculiar conditions, any power which controls Fiume holds in the hollow of its hand the entire economic life of a nation. It is the duty of the higher political authorities to balance the claim of an isolated group of Italians constituting a minority of the total population of Fiume, against this claim to economic life of a whole nation, and against the further fact that if the frontier of Italy is brought far enough eastward to include the few Italians of Fiume, a vastly greater number of Jugo-Slavs must be sacrificed.

In conclusion I can assure you that the work of supplying such a variety of technical information on a large number of vitally important problems taxed to the utmost the capacities of the scientific advisors. If the work was exacting, it is a satisfaction to know that the advice of the territorial experts was frequently sought and extensively used, and that it played no inconsiderable rôle in establishing the new frontiers of Europe.

Mont Kemmel as seen from the plain at its base.—In the foreground is one of the muddy roads typical of the Flanders plain beside which are the ruins of a former village. Mont Kemmel is the easternmost of a number of low hills just northwest of Lille. From its summit could be obtained a panoramic view of the battle-front from the dunes of the Belgian coast on the north to the horizon south of Vimy Ridge near Arras. Accordingly, the army which possessed the hill held command over every road and gun position available to the enemy. It is easy to understand why such small eminences on the northern lowland were the centers for some of the most severe struggles of the war.

The plateau scarp southeast of Verdun.—At the right is seen the plateau upland, its higher, steeper slopes wooded, while at the left is the low plain of the Woëvre, effectively dominated by the escarpment. This illustrates the nature of the scarps presented by the series of semi-circular plateaus which extend eastward from Paris. Artillery fire from these commanding heights could not successfully be faced, therefore the great attacks against Verdun were from the north down the valley of the Meuse. The east and west cross ridges of the Meuse gateway, however, proved equally effective obstacles. It was the natural topographic defenses of Verdun and not its modern fortifications that made possible its stubborn and successful defense.



From "Topography and Strategy in the War." Courtesy of Henry Holt & Co.

PHYSIOGRAPHIC DIAGRAM OF THE WESTERN THEATER OF THE WORLD WAR.—The natural defenses of the Paris basin are a series of semicircular plateaus (with their escarpments facing Germany) and the outlying Vosges and Ardennes mountains. Across the plateaus several rivers run to the west, as the Aisne and the Marne, and provide a series of trenches opposing an attack from the north. There are two main directions of approach to Paris: one directly westward across the successive belts of plateau; the other, more circuitous, by way of the Belgian plain. The first was opposed by topographical obstacles so serious as to render a quick descent upon Paris impossible; hence, the longer but easier route through Belgium was chosen. On the extreme north is another natural defense in the Flanders coastal plain which is overflowed at high tide unless artificially protected and which assisted materially in the defense of the Channel ports. The important part played by these geographical features may be read in the names most frequently mentioned in dispatches: Liège and Mons at the beginning of the war; the Marne where the Germans were checked; and the towns which lie at the gateways in the line of escarpments, as La Fère, Rheims, Rethel, Verdun, Nancy, and Metz

BEYOND LIES GERMANY

Looking east from the plateau scarp south of Nancy, showing the effective observation control of roads over which the enemy had to approach the upland. Here the Germans attempted to attack the escarpment directly, but were successively beaten back by artillery fire which swept the open plain, breaking up their formations before they could move against the face of the plateau

AN OUTLOOK WHICH WAS BOUGHT AT A GREAT PRICE

View of the Flanders plain, looking northeast from the crest of Vimy Ridge.—The conical mounds are "slag heaps" from the coal mines lying under the plain; these played an important rôle in the fighting because of their value as observation points. The ridge commands the plains on both sides so that the army in possession could maneuver to advantage while fully anticipating all movements of the enemy. The Germans seized Vimy Ridge at the beginning of the war and it was recaptured by the Allies at great cost in the famous actions bearing its name

VIEW FROM THE EDGE OF ONE OF THE NATURAL DEFENSES OF PARIS

The flat plain of the Woëvre as seen from the dominating plateau to the west.—Montsec is visible in the left distance and the American line before the battle of St. Mihiel crossed the plain just beyond the wooded areas in the middle distance. In advancing from this position, the Americans were aided by troops moving down from the plateau and by observers on the heights who were able to watch the progress of the attack

COCONUT PALMS, A STRAIGHT ROAD, AND A LEVEL COUNTRY

The first as common a sight in Porto Rico as the other two are uncommon. But this photograph is characteristic of the limestone plateau in the northwestern part of the island. Coconut palms are universal along the coasts of Porto Rico and may be readily distinguished from their upright relative, the royal palm, by a flexible appearance and a thinner trunk. Compare with the royal palms shown on page 531

The port of San Juan is the mooring place for sailing vessels which frequent the coast and ply to islands near by, notably to Saint Thomas. In the distance the even sky line of the upland (upper peneplane), broken by the notches of the Plata and Bayamon rivers, is easily seen. Nearer to the foreground are the fantastic limestone hills which border the coast

Five Land Features of Porto Rico: A Story of Cause and Effect

By A. K. LOBECK

Fellow of the New York Academy of Sciences

FOR the traveler in a new country, the conditions of travel and the comforts which await him in the places where he stops are often more important in molding his impressions than are the charms of the country itself. The traveler who sees Porto Rico from the magnificent automobile route between San Juan and Ponce will return with glowing memory of pictures of idyllic landscapes, rugged mountain grandeur, tumultuous waves on rocky coasts, broad plains of waving sugar cane, and far-away views over the sparkling Caribbean—with its wealth of exploits in the days of Spanish glory.

But the man who steps aside and goes over the native trails or stops in the smaller towns, although he may feel more the romance of his undertaking, will nevertheless, later, probably have his thoughts often tinged with the memory of the inconveniences and hardships to which he was subjected. This is true not only of Porto Rico, it would be the same anywhere. Most of the show places of America, our national parks, our places of scenic interest, are beautiful or otherwise to us according as we have seen them in comfort or misery. Porto Rico deserves to make herself hospitably comfortable for the tourist. She deserves a setting among these other gems of natural beauty. She deserves to be known in all her parts. The charm of her scenery, the variety of her features, and the peculiarities of her people place her in a novel position as a retreat for American nature lovers. She can add a distinctly new set of interests to those already known in our national parks and monuments.

Look at Porto Rico from the tourist's standpoint. What does she have and what does she lack? She has an unexcelled system of automobile roads encircling the island and crossing it in several places. But she has only two cities, San Juan and Ponce, which provide that degree of comfort to which the traveler is accustomed. The ninety-mile ride—a five-hour trip overland from San Juan to Ponce—a comfortable night at the Hotel Melia, and the return next day is the usual itinerary of the tourist. It leaves with him a delightful panorama of things tropical and a good idea of Porto Rican geography. No other towns in the island provide comfortable hotels. At some places like Arecibo, Manati, Mayaguez, and Yauco, the little hotels are reasonably good, but they would never leave a satisfactory impression upon the traveler. Now, what parts of Porto Rico are most worth seeing, what parts will most repay the efforts of visiting, what parts can we look forward to as most likely to have, some day, the facilities to attract and entertain the tourist bent on study or adventure?

First of all there is the Luquillo National Forest with its virgin timber, open and parklike, its quiet trails, its streams and bold cataracts. From Mameyes to Naguabo is a two-days' tramp through the mountains, a journey of supreme interest, but at neither end of it are there any real comforts to be found. So the only visitors to this garden spot are the occasional men of science who come prepared for what they find. Some day it will have its little chalets, not very elaborate but at least provided with American beds and facilities for preparing meals.

A distinctly different type of country is the bold haystack hill region between Lares and the north coast. Deep sink holes without outlets, streams plunging underground to follow their subterranean channels for many miles, sharp and picturesque limestone cliffs and pinnacles, overgrown with a tangled network of vines and tropical plants, are easily seen by trail; but here again the traveler must be willing to accept the hotel accommodations as he finds them and to put up with annoyances which few are willing to endure.

Of even greater interest and still more venturesome is the trip to Mona Island, fifty miles to the west of Porto Rico. The trip is made by sailboat from Mayaguez in less than twenty-four hours, but Mona Island is a wild place with only a lighthouse and occasionally a little colony of workers who come to extract the guano from the caves. On this little plateau, facing the sea in bold cliffs on all sides, one may see how forbidding nature can be and yet subtly lure one on in quest of strange sights. The jagged limestone surface, devoid of water and covered with a thick growth of cactus, is thoroughly inhospitable, but there is no reason why some day a little boulevard trail may not be cut through it and a place constructed to accommodate visitors whose tastes carry them to the unusual and unique places of the earth.

A fourth region of exceptional attractiveness in Porto Rico is the stretch of the northwest coast in the vicinity of Isabela and Camuy. The bold cliffs, the high sand dunes, the peculiar platforms and reefs at the water's edge, and the incessant activity of the waves make this place one of sustained interest and life. The waves that roll in upon the coast are sometimes ten feet or more in height under the impulse of the steady northeast trade winds.

These, then, are some of the attractions of Porto Rico, so different from those of our homeland, and so accessible that we can confidently look forward to the time when they will be made more hospitable to the stranger.

If a certain degree of comfort makes more profitable the time spent in visiting and studying a country, so also does a slight previous knowledge of the meaning of the things seen. Landscape is not unlike music, it is not unlike a written composition, it is not unlike anything else which is organ-

Morro Castle and the entrance to San Juan Harbor.—The reefs in the foreground owe their stepped character to the precipitating action of the sea water

The city of Guayama is one of the largest towns on the south side of the island. Broad alluvial plains covered with sugar cane front the Caribbean in the distance. Here is located the irrigation service of the United States Government. While the northern side of the island is abundantly provided with water, the southern side is deficient in rainfall. It consequently draws a large supply for irrigation by means of deep tunnels from the northern side of the watershed where large collecting reservoirs have been built

The trees show the effect of the incessant heavy trade winds which blow against the north coast of Porto Rico. Along a roadway near San Juan not only have the branches been forced to grow in one direction but the trunks as well show a marked inclination away from the wind

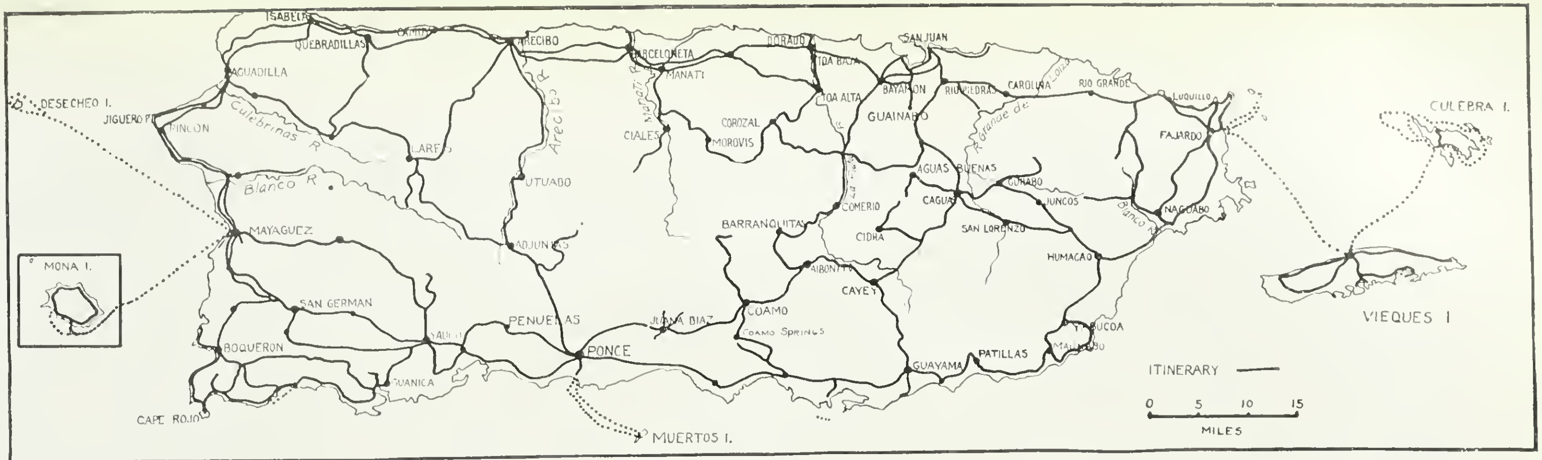
A forest of cactus.—The surface of Mona Island, several square miles in area, is densely covered with vegetation of this character. Herds of wild goats, pigs, and cattle, escaped from domestication, roam over it and eke out a difficult living. The animals have taken on characteristics in keeping with the harsh conditions of life to which they are now subjected. For instance, the pigs have apparently reverted to a type of boar with prominent tusks two or three inches long ized. The various parts may give pleasure in themselves. Indeed, ordinarily, we enjoy hill, valley, stream, cliff, plain, and beach each on its own merits without regard to the fact that they are all only parts of an organized whole and that they are all interrelated. Some people profess to enjoy music better if they do not understand the secret which underlies the composition of its parts. They would rather listen to it in a dreamy and languid way. There may be some people, too, who would rather enjoy scenery in the same way. But observations upon the usual traveler will show him quite eager to know how the features of the earth came to be as they are. Such a knowledge not only awakens in him a much deeper love for the things that he sees, but also this same knowledge helps him to remember these things because it introduces a logical and coherent relationship among them.

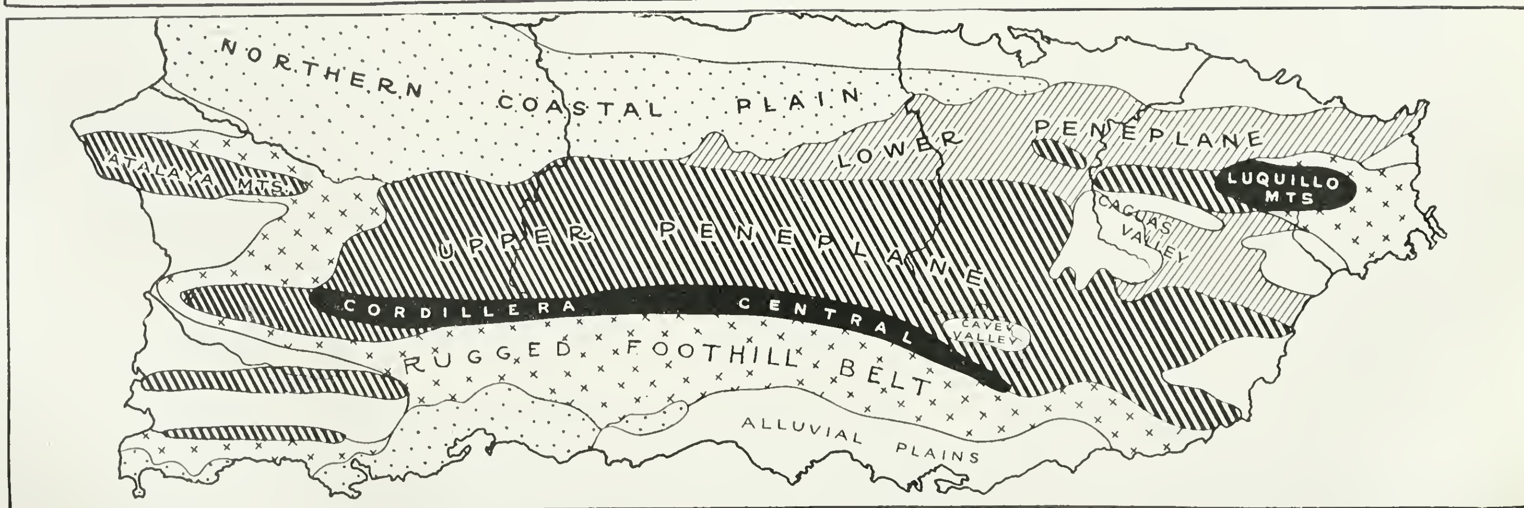
Five different types of land forms make up Porto Rico. Of course, land forms, like everything else in nature, exist in almost infinite variety, but if we confine ourselves to the five most important types, we can obtain a thoroughly satisfactory picture of the island and have a framework upon which to add any other types we may discover.

As we approach Porto Rico by boat from the north we are impressed by the remarkably even sky line over the central part of the island, interrupted only by the notches of the Plata and Bayamon rivers. When we travel into the interior, as on the route between San Juan and Ponce, we find that part of the course lies upon this rolling upland surface. The streams flow in deep gorges below this upland level and when the road runs along the bottom of the valley or along the side of the gorge the aspect of the country on all sides is rugged and mountainous, and not until we have climbed out of the valley on to the upland, about two thousand feet above sea level, do we realize how level-topped it is. And if investigation is made as to the attitude of the rocks in the road cuts, it is found that this level surface is so not because the rocks lie in level beds, for they are intensely folded and the upland surface apparently "planes" across the beds indiscriminately. Geologists have come to the conclusion that a surface like this which planes across the structure represents an old worn-down land surface, a surface worn down during many ages of time to sea level and then later bodily uplifted to its present height. It is because of this later uplift that the rivers have had their activity much renewed, and in consequence have cut deep gorges or cañons below the upland surface.

Examples like this are rather common, too, one of the best known being the upland of southern New England, standing in Massachusetts about one thousand feet above sea level and, like Porto Rico, having deep gorges cut below its surface. The name "peneplane" has been assigned to such a land surface, a term which means "almost a plane," although it must be noted that most uplifted peneplanes are very rugged regions for they have been much dissected by streams and only the even sky line beveling their complex structure reveals their true identity. This, then, is the explanation of the upland of Porto Rico, the central rugged portion, mountainous in aspect when viewed from below but even-topped when viewed from a distance or from a knoll upon its surface. This is the first of the five important types of land forms in Porto Rico.

A second type is exemplified in the two mountain masses, the Luquillo Mountains and the Cordillera Central. They stand as groups of peaks above the upland surface. Their present height is ascribed to the fact that they are made up of harder or more resis-





Maps by A. K. Lobeck

Above—Sketch map of Porto Rico showing the chief routes of travel and most of the towns

Below—Chart to show the five physiographic regions of Porto Rico:

1—The upper peneplane or upland which covers all the central part of the island. 2—The two mountain masses, the Luquillo Mountains and the Cordillera Central, which rise above the upland surface; with these may be included the rugged foothill belt which is simply the more dissected parts of the upland. 3—The lower peneplane forming a rolling platform along the north side of the island about a thousand feet below the level of the upland. 4—The limestone plateaus and hills forming the extensive northern coastal plain and the irregular patches on the south coast. 5—The alluvial plains, extensive flat areas along the coasts

Photograph by A. K. Lobeck

A GORGE THROUGH THE LIMESTONE PLATEAU OF THE NORTH COAST

The Manati River is not only cutting down into the limestone but is also widening out its valley by eroding the walls. In many parts of its course tributary streams which have been flowing underground beneath the plateau emerge from the sides of the little cañon and cascade into the main stream

A COFFEE "HACIENDA"

On this coffee plantation near the top of the upland the owner lives surrounded on all sides by the huts of his peons or laborers. The royal palm is a common tree in the vegetation of the upland, as the coconut palm is of the coastal regions. The intricate character of the stream dissection and the almost infinite number of small steep-sided valleys necessitate very winding and roundabout trails, almost precluding the building of satisfactory roads except at great expense

ROYAL PALMS WITH TRUNKS LIKE CLASSICAL COLUMNS

These stately trees are common in the interior of the island. Their heavy trunks bow outward in the middle and taper upward (compare with page 522). In the distance appear the haystack hills at the edge of the limestone country. The smaller trees and shrubs in the foreground are wild oranges which are very common throughout the western part of the upland and in much of the limestone country. Millions of oranges go to waste because of the difficulty of transporting them to the railroad or to towns for shipment. Going by trail through the country, one depends upon these as quenchers of thirst and it is no unusual thing to stop and "drink" twenty-five

Photograph by A. K. Lobeck

In the background rugged haystack hills form the margin of the limestone country. In the foreground the underlying formations, mainly volcanic tuffs and shales, give rise to a more flowing topography, often thickly covered with trees. The forests, however, are not a virgin stand, but are planted to serve as a screen to the coffee plants beneath. Thus, throughout the central upland much of the region that is apparently wild forest is actually planted in coffee and does not at first give to the visitor a true conception of the thorough use that is actually made of it

tant rocks which were not worn all the way down to the level of the upland when the peneplane was formed. These mountains are "residuals" or "monadnocks," a name derived from Mount Monadnock in southern New England, the type example of such a form.

The third distinctive land feature occurs as a rolling lowland belt ten miles or so in width along the north side of the island, and separated from the upland level on the south by an abrupt and rugged escarpment a thousand feet or more in height. In origin it is similar to the higher upland—that is, it represents a land surface worn down during long ages of time so as ultimately to form a rolling country. It also is a "peneplane." and may be called the lower peneplane. It was formed during the period following the uplift of the higher peneplane. Presumably much of the rock was worn away by streams, but it is also conceivable that the pounding of the waves against the north side of the island eventually cut this platform to sea level and that its present elevation is due to a later uplift.

A fourth land feature of Porto Rico introduces a new idea—and new rocks. Whereas the rocks underlying all the upland peneplane and the lower peneplane as well as the two mountain masses are of a complex nature, sometimes very much folded, oftentimes quite resistant and apparently of great age, the rocks making up the limestone plateaus and hills on the north and south sides of the island are in reality quite soft, and they lie in almost horizontal beds. And moreover, they are abundantly filled with the remains of marine organisms, corals especially, oyster shells a foot long, sharks' teeth, and parts of crabs and sea urchins. These beds represent accumulations of limestone and chalk, deposited under the sea upon the flanks of the much older land region, and later the uplift of the old land has brought these newer deposits far above sea level. As a result of this exposure to the rain and to streams the original smooth surface has been worn down irregularly in many places to form fantastic hills known as "haystacks." Elsewhere, because of the solvent nature of the limestone, these streams have dissolved out underground courses, a condition which is true of parts of Camuy and Tanama rivers where they flow beneath the limestone plateau between Lares and Arecibo.

Finally, there are extensive flat tracts of bottom land, or "playas," which fringe much of the coast and extend inland along the rivers sometimes for many miles. These alluvial plains represent deposits of fine material carried down by the streams and spread out along the coast either as deltas or alluvial fans as on the south side of the island where the water is quiet, or as a filling of the shallow bays which deeply indent the coast on the east and west ends. The seaward margin of these plains is formed by beautiful curving beaches of white sand which swing like arcs between the promontories on each side, sometimes for a stretch of two or three miles. With their groves of waving coconut palms silhouetted against the ocean and the sky, they add just that touch of picturesqueness which gives so much charm to the coasts of Porto Rico.

With these five types of relief features in mind, the central upland, the mountains rising above it, the lower rolling platform on the north side, the limestone plateaus, and hills, and the flat playa lands, it is comparatively easy to see the different parts of Porto Rico, even in their diversity, as elements of a larger unit. It is possible also to add many new and smaller features, placing them in some definite relation to these five important ones already known. Similarly other obser-

Photograph by A. K. Lobeck

These miniature erosion forms show characteristics which are found in the larger features of Porto Rico, intricate systems of branching valleys, sharp *cuchillo* or knife-edge ridges, and very steep slopes, sometimes almost vertical. The barefoot boy with his brace of fish provides scale for the picture

DIPPING BEDS IN THE LIMESTONE COUNTRY (UPPER PHOTOGRAPH)

The limestone region on the north side of the island of Porto Rico, known technically as the coastal plain, is made up of beds of limestone altogether several hundred feet in thickness, sloping gently northward toward the sea. This view provides a transverse or cross section of the beds in the valley of the Manati River and shows small sloping terraces in the valley sides formed by differential erosion or the wearing away of the less resistant layers

Photographs by A. K. Lobeck

CAYEY VALLEY, PORTO RICO A LOCAL LOWLAND IN THE UPLAND (LOWER PICTURE)

The even sky line of the upland forms the entire horizon of the picture. Around the town of Cayey, which lies in the center of the lowland, are numerous plantations of tobacco, this being the most important tobacco district of Porto Rico. The white patches are not snow, or water, but tobacco fields covered with cheesecloth

Photograph by A. K. Lobeck

So-called tidal deltas are formed when the ocean waves break upon the beach to such a height that they pour over the narrow bar into the adjoining lagoon. The sand that is carried over is deposited in the fan-shaped mass which is a miniature delta, but oddly enough it is formed not by a stream entering the ocean but by the ocean entering the stream

Photograph by A. K. Lobeck

Sand dunes along the beach west of Arecibo.—Where the sand is kept moist by the spray from the waves it has become quite compact and solid through the deposition of lime in its interstices. All stages may be noted from loose sand on the landward side of the dunes to a hard coating over the seaward side, and finally to consolidated rock at the water's edge where the waves are continually breaking. Even the flat beach is hard and firm like a pavement, except where loose sand has just drifted upon it vations such as those upon the location of towns, the agricultural pursuits of the people, the character of the vegetation, may best be made with the topography as a background. For instance, we may note certain geographical facts with regard to each one of these topographical areas.

On the rolling lower peneplane, because of the greater ease of movement and because of the proximity to shipping ports, fruit raising and the growing of some sugar cane are practised.

The limestone regions of the north and south sides of the island, both the

Photograph by A. K. Lobeck

Rugged cliffs mark the limit of the limestone plateau against which the waves of the Atlantic pound incessantly. After each rush of the waves the retreating water pours out of the hollows and irregularities of the rock and, by depositing a thin film of lime around the edge, gradually develops a series of terraces like those of the Mammoth Hot Springs, and for a similar reason. At first they suggest a wave cut platform uplifted a few feet, but the random disposition of the small terraces and the presence of a thick pinkish deposit of lime around the margin of the pockets indicate their true origin

Because of its elevation and its rugged character the central upland is not densely populated and has practically no large towns. Coffee growing is the chief industry there because it requires almost no culture, and because the crop is of small bulk and is easily transported over the rough trails.

In the higher mountains the extreme ruggedness and the numerous rock exposures preclude practically all agricultural pursuits.

flat plateaus and the dissected haystack hill areas, are usually too dry and barren, because of the subterranean drainage, to permit the raising of large crops. Locally among the haystack hills there are flat spaces developed upon the more clayey beds of the limestone. The soil is excellent for fruit raising and is easily cultivated. For this reason not a little of the north coast region between San Juan and Manati is given over to the cultivation of citrus fruits and pineapples. Many of the Americans who have made Porto Rico their home are engaged in this work.

By far the most valuable lands of Porto Rico are the great alluvial plains or playas. The word "playa" really means "shore," but in Porto Rico it is used to designate the whole expanse of flat land bordering the rivers along their lower courses. Here are the sugar cane lands. Extremely rich, extensive in area, easily cultivated, well watered, readily served with roads and small railroads, close to the shipping centers along the coast, they have the ideal combination of desirable attributes which have caused the sugar crop of Porto Rico to be worth each year three times the total of all her other exports—made up chiefly of coffee, fruits, and tobacco. Each of the great playa lands is a unit in itself. Separated more or less from its neighbors by the hilly promontories which extend down from the uplands to the sea, it seems like a little world of its own. The chief town lies in its center. Here is located the sugar mill or "central," to which all of the cane of the neighborhood is brought for grinding. The towns of Humacao, Maunabo, Yabucoa, Fajardo, and Naguabo near the east coast, are especially representative in this respect.

Intimately related with the topography, too, is the interesting climate of the country. In a small area Porto Rico offers some striking contrasts. Lying as it does within the tropics

The native huts in Lares are typical of the whole island. They are usually roofed with the flat pliable bark of the banana tree of which a grove is seen in the right of the picture. It is becoming common, however, especially among the more pretentious individuals, to use corrugated zinc or sheet iron, which, however, is not so picturesque, but is more durable and somewhat more satisfactory during the moments of a torrential downpour. The general use of the automobile in Porto Rico with the introduction of the common square five-gallon tin containers for gasoline has solved many a native's problem for weatherboarding, but unfortunately a building sheathed in this convenient material does not appear in this view

Growing tobacco under cheesecloth produces leaves of finer and thinner texture more suitable for cigar wrappers than those grown in the open, and the leaves are also much freer from holes, as the cheesecloth keeps out many biting insects. The cloth is stretched over poles and wire about ten feet above the ground. Such plantings are extensive and are followed mostly by large companies, the small planter being unable to invest in the enormous supply of cloth necessary

A pineapple field in the limestone country of the north coast. The haystack hills resulting from the wearing down of the original limestone plateau are characteristic of the region. Between the "haystacks" there are occasionally sink holes or depressions without outlets. Elsewhere there are broad flat areas opened out upon a more clayey layer in the horizontally bedded limestone. These flat areas provide the principal fruit-raising lands of Porto Rico and directly under the belt of trade winds which blow from the northeast, it is subject to their influence which is expressed in opposite ways. Trade winds are recognized as producers of desert conditions. Most of the deserts of the world lie in trade-wind zones. Around Porto Rico the islands which are not of sufficient size or height to induce precipitation are very dry and support abundant growths of cactus. This is especially true of the small islands Culebra, Desecheo, and Mona. Even on Porto Rico, the northeast tip of the island has a similar aspect because of the drying influence of the trade winds. But when these winds, with the great quantity of moisture which they have accumulated, are forced to rise over the mountainous interior of Porto Rico, their capacity for retaining moisture is diminished and excessively heavy downpours result. From out of the brilliant sky dense cloud masses form with great rapidity over the uplands and throughout most of the year several downpours may be expected every day. But when the winds reach the lower lands of the southern coast they not only have lost a large part of their moisture, but also in their downward journey they have been transformed into drying winds again, with the result that this whole coastal area is almost barren and parts of it experience months and even years without rainfall. Therefore irrigation is essential for the cultivation of large crops, and in the southwestern corner of the island where there occur the longest periods of drought, considerable areas are densely covered with cactus.

The torrential character of the rainfall over the uplands is a significant factor in the development of the sharp *cuchillo,* or knife-edge divides, common in the interior. Because of their very steep slopes, often of twenty-five to thirty degrees, and even of forty to forty-five degrees, the valley walls are pronounced barriers to progress. The average annual rainfall over the uplands is between 80 and 90 inches, or more than twice that of the vicinity of New York. Unlike the precipitation of middle latitudes, where the duration is to be measured in hours and even days and the amount in hundredths or tenths of an inch, the average duration of a shower in Porto Rico is ten or twelve minutes. There are numerous instances of successive showers which totaled 10 inches rainfall in twelve hours, while amounts of from 4 to 5 inches in twenty-four hours are of frequent occurrence. A record of 23 inches for twenty-four hours, as an example of an extended period of heavy precipitation, and of 1 inch in nine minutes for a short period, may suggest that important consequences must result from the accumulation and run-off of so great a volume of water in so brief a period of time.

An interesting phase of the situation is the impervious character of the soil throughout the "oldland portion" of Porto Rico—that is, the region made up of the volcanic rocks. The soil which develops from the decay of these rocks is a red clay or mud, excessively unctuous and tenacious, and exasperatingly slippery. It acts as an impervious mantle which prevents the penetration of water into the ground, thus causing it either to accumulate in all of the little pockets and irregularities of the surface, or immediately to run off and flood the streams. The exceedingly rapid run-off may be appreciated from the fact that many streams immediately rise 15 to 20 feet after heavy showers. In one case, the Plata River, twenty-five minutes after it began to rise, poured over the dam near Comerio in a sheet 15 feet or more in thickness throughout the entire length of the dam, about 575 feet, the flood continuing all day at 10 feet above the dam.

"Theodore Roosevelt's Letters to His Children"[1]

By HERMANN HAGEDORN

Poet and Playwright; Author of *Boys' Life of Theodore Roosevelt;* Secretary of the Roosevelt Memorial Association

TO those who were privileged to know Theodore Roosevelt in his intimate relationships, the cries of mingled delight and astonishment that have greeted the volume of letters which he wrote to his children, have themselves brought a shock of surprise.

"How perfectly extraordinary," exclaims Tom to Dick and Harry, "these letters are tender!"

"Amazing," cries Dick, "he was a real father, a wonderful father! In the midst of that noisy, busy life of his, he actually had time every day for his children."

And Harry gasps helplessly, "Who would ever have imagined it!"

All of which goes to show that the most discussed man of his time, the man who filled more newspaper columns and more magazine pages and more books than any dozen of his contemporaries put together was actually unknown to the millions whose hero and idol he was. They thought of him in terms of the Big Stick of the swashbuckler of the cartoons, the Apostle of Strenuosity, the Man-eating Lion, the Thunder-god before whose word parties died and parties came to birth—that was Roosevelt to them. One wonders in bewilderment what these millions imagined concerning him in his capacity of husband and father. A tyrant unquestionably they thought him, domineering over his family, thundering laws from Sinai, stamping through the house like an elephant trumpeting down the slopes of Kenia. One wonders what these folks with their established notion of what "T. R." ought to be, would have said if they could have seen him on a certain summer's day during the last year of his life.

It was at Sagamore. The day was warm and the youngest grandchild was lying in her crib in a shaded corner of the porch, dreamily content. Around the corner from the *porte-cochère* came the Colonel, espied the baby, and with a chuckle of delight lifted her out of the crib and hugged her, making absurd, joyous noises.

Suddenly at his back he heard a soft, familiar voice. "Now, Theodore," protested Mrs. Roosevelt, "do you know what you've done? That baby was perfectly happy there. Now someone will have to hold her the rest of the afternoon."

"All *right*," cried the Colonel. "I'll hold her!"

And hold her he did, rocking back and forth in his favorite rocking-chair all afternoon, as he carried on his political conferences.

To those who knew Theodore Roosevelt in the intimate and friendly atmosphere of Sagamore Hill, this book of his letters to his children is no revelation: but it furnishes perhaps an even keener delight to them than it furnishes to those startled others, since it gives as possibly no other written record could, a reflection of that wise, warm-hearted human being, so gay, so boyish, so full of tenderness and humor, who was the master, and the pervasive spirit, of Sagamore. In these letters, the man of the cartoons gives way to the sympathetic father, the playmate without peer, the boy who never grew up.

The collection begins with the period of the Spanish War, although hidden in some drawer somewhere, there must be similar letters written during his ranching days, for he began sending illustrated communications to his children from the time the oldest of them was scarcely more than a year old. The great affairs of this world

[1] *Theodore Roosevelt's Letters to His Children*, edited by Joseph Bucklin Bishop. Charles Scribner's Sons, New York, 1919.

are touched on here and there, but only touched on.

"Tomorrow the National Convention meets," he writes to Kermit on June 21, 1904, "and barring a cataclysm I shall be nominated." But he seems less interested in the surge of great human currents at Chicago than he does in the little matters of daily life which make the world of his children. On that same day—the day preceding also the transmission of the famous ultimatum, "We want Perdicaris alive or Raisuli dead"—he wrote from the White House to each of his four younger children.

"The garden here is lovely," he tells Ethel. "A pair of warbling vireos have built in a linden and sing all the time. The magnolias are in bloom, too, and the jasmine on the porch."

"Blessed Archikins" receives word the same day concerning Bill the Lizard. "The other day when Mother and I were walking down the steps of the big south porch," writes his father, "we saw a movement among the honeysuckles and there was Bill the Lizard—your lizard that you brought home from Mount Vernon. We have seen him several times since and he is evidently entirely at home here. The White House seems big and empty without any of you children puttering around it, and I think the ushers miss you very much."

But it is "Dear Quentyquee" who receives that day the most weighty communication of all. "The other day when out riding what should I see in the road ahead of me but a real B'rer Terrapin and B'rer Rabbit. They were sitting solemnly beside one another and looked just as if they had come out of a book; but as my horse walked along B'rer Rabbit went lippity lippity lippity off into the bushes and B'rer Terrapin drew in his head and legs till I passed."

On the day following (while the Convention was opening its deliberations and the chancelleries of Europe were beginning to mutter and flutter and hold up their metaphorical hands at the implications of the Moroccan ultimatum), the President was writing and elaborately illustrating a letter to Ethel, including among other works of art a picture of a policeman and a squirrel which bore this caption: "A nice policeman feeding a squirrel with bread; I fed two with bread this afternoon." What after all were presidential nominations and ultimatums in comparison with matters of such import?

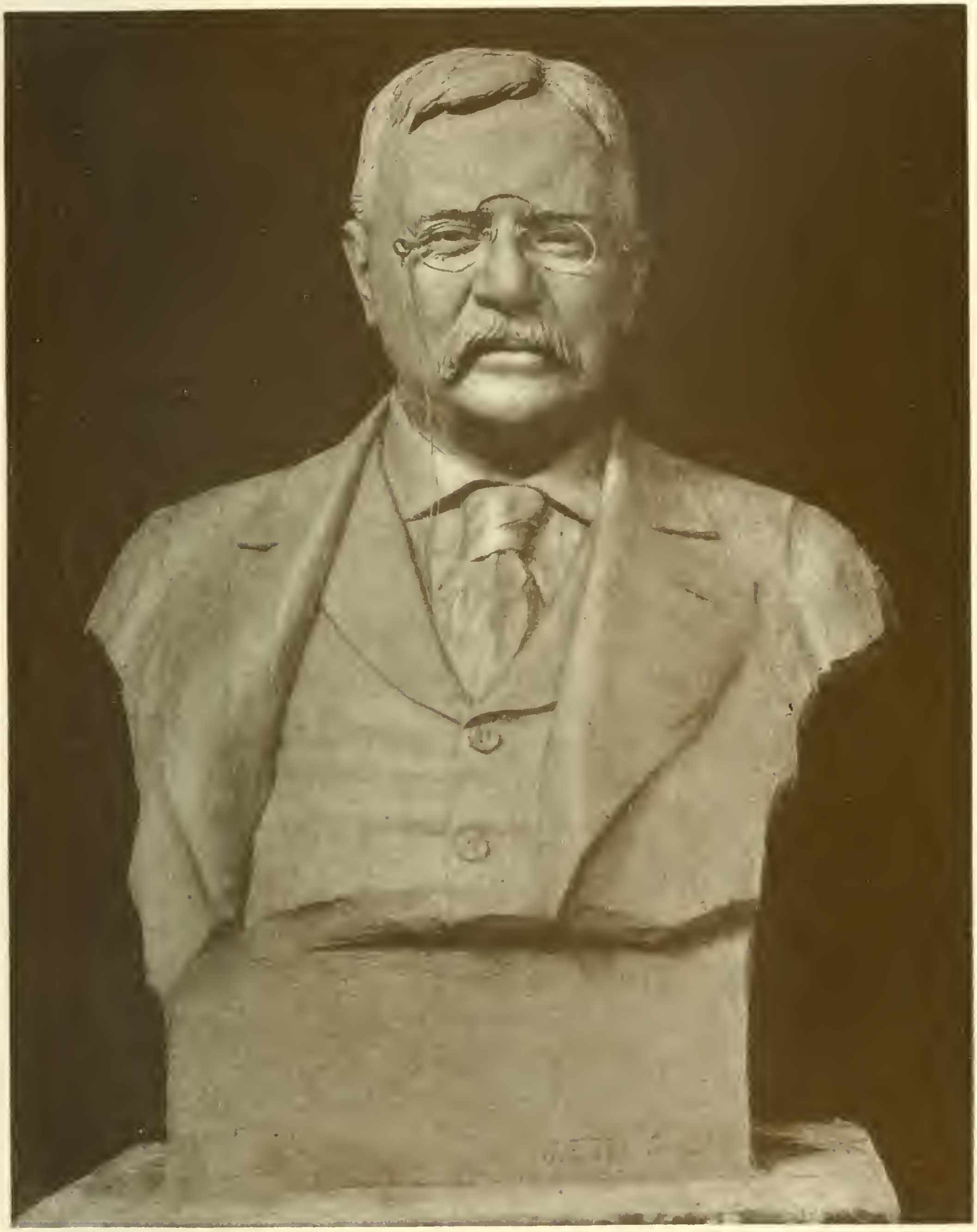
Roosevelt was and remained, among his children's companions, the best beloved and most eagerly sought after. His sympathetic understanding enabled him to meet them always on the level of development on which they stood. As they grew he seemed to grow with them. Imperceptibly almost, as the years go on, the letters deepen, and in place of the stories of lizards and rabbits, come analyses of the relative merits of Japanese and American methods of wrestling and bits of sage advice given almost apologetically concerning studies or athletics or the choice of a career.

Theodore Jr's arrival in college drew from the President a series of indignant and sympathetic letters concerning "the newspaper men, camera creatures and idiots generally" who beset the path of one whose home address happened to be the White House. To Kermit he wrote largely of books. Through all the letters runs the delight of living, the joy in beauty of color and sound and fragrance, the quiet contentment of a happy home.

Books will be written without number in the years to come concerning Theodore Roosevelt, and many will tell of the things he did and many will paint or attempt to paint the man that he was. But this book of his own letters to his children will always stand alone, for in it lives and breathes forever the very man himself.

SCULPTURES OF THE LATE THEODORE ROOSEVELT

BY FRANK OWEN PAYNE[1]



THE MAN OF LETTERS

Roosevelt Bust, recently executed by John Ettl

This portrait bust is intended to depict Theodore Roosevelt as he appeared in later life—as the lover of books, the contributing editor, the creative man of letters. It is based on the death mask and on one of his best known photographs of recent years

[1]Contributor on sculptural subjects to *Art and Archæology, International Studio, Architectural Record*, etc.

THEY GLADLY FOLLOWED WHERE HE LED

Bronze statuette by James E. Kelly

A sculptor's portrayal of Theodore Roosevelt as a military leader of his regiment of Roughriders. Roosevelt refused a sitting for this, when urged by the sculptor, after returning from Cuba; but granted it later on learning that the sculptor was the author of "Sheridan's Ride." For that inspiring bronze was then in his own study: he had seen it one day in Tiffany's window, when he was just out of Harvard, and had been so impressed by its spirit that he sacrificed other things to buy it. Replicas of this portrait of Roosevelt, sent to grammar schools, for the boys of America to see daily, would be well worth the monetary cost

2?5

A PORTRAIT THAT WILL ALWAYS LIVE

"The Senate Bust," by James E. Fraser

A sculptor's portrayal of Roosevelt as President of the United States. Roosevelt would not "waste time" in sittings, so Mr. Fraser did the work at the regular Cabinet meetings. His subject was not easy to model, for Roosevelt was absorbed in business of state, his pose never constant, and his expression continually changing. The bust which was executed in marble for the United States Senate Chamber is represented with the conventional vesture of the Chief Executive, rather than with the Roughrider garb of the sculptor's original work. (John Burroughs, after touring and camping through the West with Roosevelt when he was President in 1903, reports that he said all he cared about being President was just "the big work." Our California redwoods need the big work of just such a man as he today)

THE DEATH MASK

By James E. Fraser

Immediately after death came, the sculptor who had modeled the living Senate Bust was called to make the last record of the head and features of Theodore Roosevelt. This record, in the white plaster, gives the authoritative form for all sculptures of the future, and without the fire and the spirit, still carries the nobility and heroic sincerity and strength which molded the face of the Roosevelt we knew

THE MAN OF MENTAL GRASP AND PRODIGIOUS MEMORY

Medal, by Saint Gaudens and Weinman

It is a source of gratification that two such eminent medalists as Augustus Saint Gaudens and Adolph Weinman united their efforts in the execution of a medal bearing the head of Theodore Roosevelt. The work carries the combined monogram of the two sculptors. Mr. Weinman says that even he himself cannot tell just what features are the work of his hand and what are the work of Saint Gaudens. This medal must rank with the works of first importance among the Roosevelt [illegible].

IN WAR A FIGURE OF UNRIVALED ARDOR AND DARING

Roosevelt, in the statuette by Frederick MacMonnies

Modeled and executed in MacMonnies' Paris studio soon after the war with Spain and presented by the sculptor to Roosevelt when he was President. The photograph reproduced here is from the original statue, the property of the Roosevelt family, who have always set high value on it because of its truthful portrayal of Roosevelt's enthusiasm. So far as known, this is the only copy in America.

Today, at the close of 1919, when the great personal Roosevelt of our time is passing into the Roosevelt of history and memory, we are beginning to see him in his permanent proportions and are united in desire to do honor to him in great and unique ways. Representative of his "spirit of youth and swift strength and mounting joy of life," an American flag was carried by relays of young American boys from station to station across New York State and through the city of his birth, stars were sewed on by young American girls at each stop, and the completed flag finally brought to his grave at Sagamore Hill

AT THE BEGINNING OF HIS CAREER AS STATESMAN

Bronze Bust, by J. Massey Rhind

Within the imposing memorial structure at Niles, Ohio, which marks the birthplace of the martyred President McKinley, are portrait busts of the Vice President, Theodore Roosevelt, and many important men of McKinley's administration—Elihu Root, Mark Hanna, John Hay, and others. This Roosevelt portrait stands at the right of that of McKinley and in the expression there seems to be foreshadowed the dread moment when the shocking news of the assassination of McKinley came. Mr. Rhind's work shows the young statesman (without quite the characteristic look of the man, largely because of lack of the eyeglasses he habitually wore) who was soon to step into the duties and responsibilities of President

PORTRAIT FROM A FAMILIAR PHOTOGRAPH

A medal by Anna Vaughn Hyatt

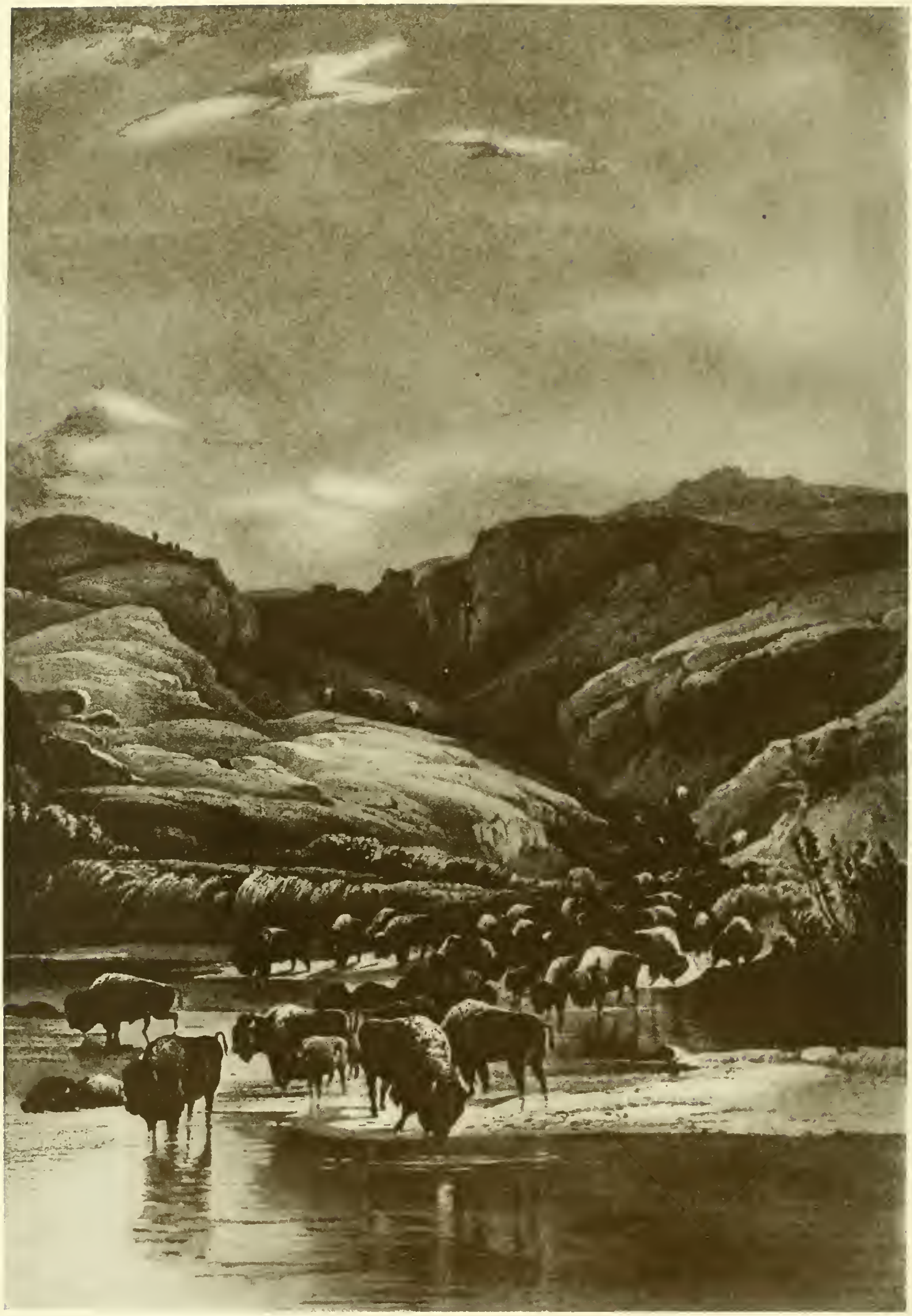
Subscribers to the fund of the Woman's Roosevelt Memorial Association, representative of all political parties and every religious faith, are presented with a copy of this medal. The Association has purchased the house in which Theodore Roosevelt was born, at No. 28 East Twentieth Street, New York City, and will make it, together with the house which adjoins it, into a permanent memorial, with the aim of continual promulgation of the principles of Americanism

On October 27, the anniversary of the birth of Roosevelt, Major General Leonard Wood, in speaking for the Roosevelt Memorial Association, said: "Theodore Roosevelt stood for universal service in war as well as in peace, service for each one wherever he could best serve. Theodore Roosevelt stood for the square deal, one flag, one language, and one loyalty—loyalty to the American people—for industrial justice, for public and private morality, for a strong and vigorous America, charitable and helpful, ever ready to do her duty to civilization and humanity, but an America always under the dictates of her own conscience rather than under the direction of others"

FOR ALL TIME A LEADER AMONG AMERICANS

The Roosevelt who will always stand for that "intense Americanism" which will make us use our strength not only for ourselves but also for the less fortunate, "well-behaved" small nations of the earth. Bust by James E. Fraser (compare with profile view)

Article X of the League of Nations embodies the intense Americanism Roosevelt preached—a promise that the United States, Great Britain, and France, will not abandon the small peoples of the earth, proclaimed free at the Peace Conference in Paris. Never before in all the course of history has any other nation enjoyed the profound admiration given to the people of the United States—because our spirit of Americanism, both in the World War and at the Peace Conference, stood firm as a rock for the rights of others. It is the pleasure of the great, as well as their sacred duty, to protect the weak



BISON HERD WENDING ITS WAY TO A WATERING PLACE ON THE UPPER MISSOURI

In the days when the bison grazed at will over the continent and herds numbering thousands moved together through the hills to their watering places, they made trails which were masterpieces of engineering. Many of these well-worn pathways remain as conspicuous monuments of the bison's former numbers, and mark out the routes now followed by automobile road or railway.

This illustration shows a section of a picture by Bodner, the artist who accompanied Prince Maximilian on his famous trip through central United States in 1832–34

The Coming Back of the Bison

By C. GORDON HEWITT

Consulting Zoölogist to the Commission of Conservation, Ottawa

THE disappearance of the American bison to the verge of extermination constitutes one of the greatest and most striking catastrophes to our wild life that have occurred in the experience of modern man. The manner in which the total loss of this magnificent animal as a member of our fauna has been prevented should fill all who are endeavoring to conserve our wild life on this and other continents with confidence and hope.

There has always remained in my mind the impression which I received when, as a student of zoölogy, the tragedy of the American bison was brought home to me by a little colored chart in the Manchester University Museum showing the past and present distribution of this animal and its gradual decrease in numbers. Frank Evers Beddard's excellent volume on "Mammalia" in *The Cambridge Natural History* had recently been published, and the sad history was summarized in these words: "The Bison of America, formerly present in such numbers that the prairies were black with countless herds, has now diminished to about a thousand head." Little did I think at that time that I should later become directly interested in the bringing back of the bison.

The extent of the destruction of the bison appalls us by its immensity when we consider the character of the animal. It would seem inconceivable that this, the largest of the wild fauna of our continent, should have been reduced within the limits of the last century from countless millions to the point of extermination. Formerly ranging over about one third of the entire continent it has been practically wiped out of existence except for a small band of so-called "wood bison" now to be found in the Athabaska region of Canada. That its disappearance was an inevitable result of the development of the country does not diminish the character of the tragedy. The bison is the greatest of all our American animals and undoubtedly the most noble of its family in any part of the world. Now it has practically disappeared from the face of the continent and only by the foresight of the Canadian and United States governments has it been prevented from becoming completely exterminated. The history of its disappearance and the most complete account we have of this noble member of our native fauna have been given in a memoir by Dr. W. T. Hornaday, director of the New York Zoölogical Park.[1]

Its former range in North America according to Hornaday, was as follows: "Starting almost at tide-water on the Atlantic coast, it extended westward through a vast tract of dense forest, across the Alleghany Mountain system to the prairies along the Mississippi, and southward to the Delta of that great stream. Although the great plains country of the West was the natural home of the species, where it flourished most abundantly, it also wandered south across Texas to the burning plains of northeastern Mexico, westward across the Rocky Mountains into New Mexico, Utah, and Idaho, and northward across a vast treeless waste to the bleak and inhospitable shores of the Great Slave Lake itself." The vast herds of bison seemed to clothe the prairies in a coat of brown. They were as thick as the leaves in the forest. These immense herds greeted the ad-

[1] W. T. Hornaday, *The Extermination of the American Bison*, Washington, 1889.

Photograph by C. Gordon Hewitt

Jamieson Lake is one of several in Buffalo Park. These serve not only as watering places for the bison, but also as sanctuaries for large numbers of waterfowl. In time the bison ranges should support herds of elk also, of deer, and antelope, natural neighbors which live together in the greatest harmony. The bison, when given a chance by protection against hunters, increases so rapidly that already the problem has arisen as to what disposition should be made of the surplus animals. It is hoped that new ranges will be established and possibly that domestication for commercial purposes may be inaugurated

vance guards of civilization and that process spelled their doom.

The history of the bison is an illustration on the largest possible scale of the history of every species of wild animal when man invades its natural haunts with an unrestrained desire to kill. No part of our wild life can withstand the destructive influence of man armed with modern guns; the only salvation for any species is the restriction by law of the number that may be killed. These considerations, however, had no part in the early days with the bison. It was faced by men armed with powerful firearms who killed without any regard for the future, and there was a complete absence of any restrictions on the part of all the governments concerned. The Indians who had always regarded the bison as the source of their meat supply had their point of view entirely changed so far as the number of animals to be killed was concerned. Their passion for killing was inflamed by the example of the white hunters with serious economic results when their source of meat was wiped out.

Various methods of slaughter were followed. The extraordinary stupidity of the animals made them an easy prey for the still-hunters. Still-hunting was conducted on business lines and was highly profitable when more than a hundred animals could be killed from one stand and the robes were worth \$2 and \$4 each. The practice of hunting on horseback provided an exciting sport and when the hunters, white, halfbreed, and Indian, went out in armies the results were disastrous to the herds, particularly as the cows were especially chosen owing to the superior value of their skins. A favorite method employed by the Indians was that of impounding or killing the animals in pens into which they were driven. This method was commonly practiced among the Plains-Cree in the South Saskatchewan country. The terrible scenes that attended these wholesale slaughters of the herds are beyond description. Other methods of slaughter on a large scale were surrounding, decoying, and driving the animals, and all tended toward the same end—complete extermination of the herds. As the animals became scarce the half-breeds and Indians vied with the white hunters in destroying them. Far more bison were destroyed than could possibly be utilized.

But this could not long continue. No longer did the prairies thunder with the sound of thousands of galloping hoofs. The great herds were driven farther and farther afield. Indians who formerly merely cut out the tongues of their victims, if they took any part of the carcass at all, now almost starved for want of food. In 1857 the Plains-Cree inhabiting the country around the headwaters of the Qu'Appelle River decided that on account of the rapid destruction of the bison by the white men and half-breeds they would not permit them to hunt in their country or travel through it except for the purpose of trading for their dried meat, pemmican, or robes.

Catlin[1] has given some idea of the enormous numbers of bison that were killed during the first half of the nineteenth century. In 1832 he stated that 150,000 to 200,000 robes were marketed annually, which meant a slaughter of 2,000,000 or perhaps 3,000,000 bison. So great was the destruction that he prophesied their extermination within eight or ten years. Frémont about the same time also bore witness to the appalling destruction.

[1] George Catlin, *Illustrations of the Manners and Customs and Conditions of the North American Indians*, London, 1841.

The death knell was struck when the construction of the Union Pacific Railway was begun at Omaha in 1866. Previous to the advent of the first transcontinental railway the difficulties of marketing the results of the slaughter served as a slight check on the rate of extermination for, although the bison were being killed out at a rate greatly in excess of their natural increase, they would have existed for some years longer than the coming of the railroads and additional swarms of white hunters rendered possible. This railroad divided the original great body of bison into southern and northern herds. That was the beginning of the end. Although the range of the northern herd was about twice as extensive as that of the southern, the latter contained probably twice as many bison. Hornaday estimates that in 1871 the southern herd contained 3,000,000 animals, although most estimates give a higher total than this.

Photograph by C. Gordon Hewitt

Bison do not always show respect for a fence; consequently the enclosure must be given genuine stability. The nine-foot fence at Buffalo Park is composed of fourteen strands of galvanized steel wire, strengthened with upright wires at one foot intervals. On either side of the fence a strip twenty five feet wide is kept plowed as a fire guard and similar guards against prairie fires are cut across the preserve. A one-horse team, journeying nearly five hundred miles throughout the year, keeps the guard strips permanently broken up

Photograph by Wainwright Studios

THE MONARCH OF THE PLAINS ON HIS ANCIENT FEEDING GROUNDS

Buffalo Park, near Wainwright, Alberta, has been secured by the Canadian Government for its great bison herd. Numerous traces of buffalo trails and wallows prove this well-watered park with its luxurious growth of buffalo grass to have been a favorite pasturage in ancient days. Canada has set aside 160 square miles and surrounded these with a seventy-six-mile fence including more than 25,000 posts and 1700 miles of wire. The bison were recruited in 1907 by purchase of a private Montana herd of 709 head, and by natural increase under ideal conditions these have multiplied to 3711 head, or more than three times the number of bison alive in 1889. The United States Government has also established several bison ranges so that now there are probably more than 7000 bison on the continent and the species is well out of danger of extinction

Photographs by C. Gordon Hewitt

SALVAGED REMNANT FROM THE MILLIONS THAT ONCE ROAMED THE CONTINENT

Probably no large quadruped has ever developed in such prodigious numbers as did the American bison in the days of its glory. The Central Plains, literally black with these huge oxen, supported countless millions which, except for a small tribute to the Indians and the wolves, roamed undisturbed. Even as late as 1871 there was observed migrating across the southern plains a single wedge-shaped herd on a twenty-five-mile front with a depth of fifty miles. Such a drove could contain no fewer than four million head. But of former myriads there were left in 1889 only about six hundred wild bison over the entire continent. From this small nucleus several herds were recruited of which the largest is now in Buffalo Park, Alberta, Canada. The photographs show the bison in small scattered groups as is their usual custom on the range

The slaughter of the southern herd began in 1871 and reached its height two years later. From 1871 to 1872 the wastefulness was prodigious. The skins that were marketed bore no indication of the enormous slaughter. In four short years the great southern herd was wiped out of existence, and by 1875 it ceased to exist.

By the time the destruction of the northern herd began in earnest, the bison in Canada had already become very scarce. The remnants of our former herds were assiduously hunted by the Indians as they constituted their main supply of food. As Hornaday states: ". . . the herds of British America had been almost totally exterminated by the time the final slaughter of our northern herd was inaugurated by the opening of the Northern Pacific Railway in 1880. The Canadian Pacific Railway played no part whatever in the extermination of the Bison in the British Possessions, for that extermination had already taken place. The half-breeds of Manitoba, the Plains-Cree of Qu'Appelle, and the Blackfeet of the South Saskatchewan country swept bare a great belt of country stretching east and west between the Rocky Mountains and Manitoba. The Canadian Pacific Railway found only bleaching bones in the country through which it passed. The buffalo had disappeared from that entire region before 1879 and left the Blackfeet Indians on the verge of starvation. A few thousand buffaloes still remained in the country around the headwaters of the Battle River, between the North and South Saskatchewan, but they were surrounded and attacked from all sides, and their numbers diminished very rapidly until all were killed."

The main part of the northern herd was to be found in the United States. Here the Indians of the northwestern territories were waging a relentless war on the animals. Hornaday computes that the number of bison slaughtered annually by those tribes must have been about 375,000. The destruction of the northern herd began in earnest in 1876 and became universal over the entire range four years later. By this time the annual export of robes from the buffalo country had diminished three fourths. The construction of the Northern Pacific Railway hastened the extermination of the herd. White and Indian hunters killed so long as there were buffaloes to kill. The hunting season which began in 1882 and ended in February, 1883, completed the annihilation of the great northern herd and only a few thousand head were left, broken into straggling bands. The last shipment of robes was sent out from the Dakota Territory in 1884. In 1889, Hornaday, on the basis of all available data, estimated that the number of buffalo running wild and unprotected was 635 animals! Was the destruction of an animal ever so completely brought about? It furnishes what is undoubtedly the most striking and appalling example of the fate of an animal existing in apparently inexhaustible numbers, when left exposed to unrestricted slaughter, and should be a serious lesson to the people of this continent and of the world for all time. That in the face of advancing civilization the buffalo had to go was inevitable. It occupied lands that were to furnish homes and occupation for millions of immigrants and that now produce so large a part of the world's staple crop.

Time, however, will not efface the traces of the bisons' occupation of the continent. They blazed the trails that later became important highways. As A. B. Hulbert in his *Historic Highways of America* has pointed out, the bison selected the route through the Alleghanies by which the white man entered and took possession of the Mississippi Valley. They found the best routes across the continent and "human intercourse will move constantly on paths first marked by the buffalo." It is interesting that the bison found the strategic passageways through the mountains; it is also interesting that they marked out the most practical paths between the heads of our rivers, paths that are closely followed today by the Pennsylvania, Baltimore and Ohio, Chesapeake and Ohio, Wabash, and other great railroads.

But there came finally a brighter period in the history of the bison in America. In 1889, when they had reached their lowest level, there were only 256 buffalo in captivity, 200 protected by the United States Government in the Yellowstone Park, and 635 running wild, of which number 550 were estimated to be in the Athabaska region of the Canadian Northwest Territories; the whole bison population at that time was estimated to be 1091 head. An attempt was now made in the United States to protect the remnant and by 1903, according to the census of the American Bison Society, they had increased to 1753 head. These were chiefly confined in the national reservations and parks of the United States Government; some were owned by private individuals. The largest private owner appears to have been Michael Pablo, of Montana, who had a herd of about 700 animals in 1906, the value of which he fully appreciated.

In 1907 the Canadian Government learned that the Pablo herd was for sale and with commendable foresight purchased it, realizing the importance of acquiring so valuable a herd of what had formerly been the most abundant of our large native mammals. For its reception and maintenance a special national park was established at Wainwright in Alberta. This reservation covers an area of about 160 square miles, the whole of which is enclosed in a special wire fence about 76 miles in length. Judging by the abundance of old bison wallows it evidently formed a favorite place for bison in years gone by. Several lakes, the largest of which is Jamieson Lake, about seven miles long, provide an ample water supply. The difficulties involved in the capture of the Pablo herd of bison and the transportation of the animals to the Buffalo Park at Wainwright, Alberta, can better be imagined than described. From the date of the receipt of the last animals in 1909 they have increased steadily each year until in 1918 they numbered 3711 head, or more than three times the total number of bison known to be living in North America in 1889.

The United States Government also took steps to protect and increase the herds of bison remaining. A national bison range was established in Montana; and in the Yellowstone National Park and other national reservations

Indian hunters under cover of wolf skins approaching a herd. From a sketch by George Catlin the bison were carefully protected, with successful results.

There are now eight herds protected by the United States Government comprising altogether 891 animals. The largest number is contained in the Yellowstone National Park, Wyoming, where there were on January 1, 1919, 457 animals. In the Montana National Bison Range there were 242 animals on the same date, and the third largest herd is to be found in the Wichita National Forest and Game Reserve in Oklahoma where there are about 100 bison.

The total number of captive bison in the United States in January, 1919, according to a statement kindly furnished to me by Mr. M. S. Garretson, secretary of the American Bison Society, was 3048 head. It is estimated that there are also about 70 wild bison, making a total of about 3118 bison in the United States.

In Canada the Canadian Government has bison in three of the national parks. In 1918 the numbers of bison in these reservations were as follows: in Buffalo National Park, Wainwright, Alberta, 3520 animals; in Elk Island Park, Alberta, 183; and in the Rocky Mountains Park, Banff, Alberta, 8; making a total of 3711 head. In addition it is estimated that there are about 500 wild bison, or wood bison, in the Athabaska region where they are now protected. Scattered throughout the Dominion in public and private parks there are approximately 40 additional bison. The total number of bison in Canada at the beginning of 1919, therefore, was about 4250 animals.

From the above estimates it will be seen that we have now approximately 7360 bison in the United States and Canada, as compared with 1091 in 1889. These figures show that the bison are coming back, and that they are doing so rapidly.

The rapid increase of the bison in our national reservations raises the question: "What shall we do with our surplus?" In the Buffalo Park at Wainwright, Alberta, this question is becoming a serious one as they will soon occupy as much range as is capable of sustaining them. The natural answer to this question is to create additional reservations, which policy undoubtedly will be followed, particularly in the United States where much additional range suitable for bison but less suitable for agricultural purposes is available. In addition provision is being made for the donation of surplus animals to municipalities, public organizations, and institutions. But cannot we go a step farther and consider the desirability of encouraging farmers to purchase surplus animals from the government and to maintain them? Anyone who has visited the bison in our national reservations will agree that if they were maintained in a semidomesticated state they could be treated in the same manner as range cattle, provided they were enclosed. The cost of building suitable fencing might prove an obstacle in many cases, but it should not prove insuperable in view of the high price of beef. As a beef animal the value of the bison is well worth the careful consideration of our agricultural authorities. In addition it provides a robe of proven value in more northerly states and provinces. Not the least of the advantages of the bison over domestic cattle is their ability to "rustle" for themselves in winter and under climatic conditions which prove a hardship to our introduced cattle.

The proposal to utilize the bison in the manner suggested may appear impracticable, but how many of our ideas as to what was possible and what was impossible have, in the course of time, proved unfounded? The future alone will show. In the meantime all who are interested in the conservation of our wild life will be encouraged to further efforts by the story of the manner in which the bison was rescued from the fate which has befallen less magnificent members of the world's mammalian fauna.

Impounding bison was the wholesale and wasteful method of killing employed by the Assiniboin, Plains-Cree, and other Indian tribes of the Northwest, a method which allowed all members of the tribe, even the women and children, to be in at the death. The pound was constructed of logs and its gate placed under a ledge down which the bison could jump but which was too high for them to climb again. From this gate a fan-shaped runway several miles out into the plain was constructed by means of bunches of branches and bushes, known as "dead men," lined up fifty feet apart. Behind these "dead men" the Indians hid and frightened back the herd whenever it showed signs of departing from the track. After the bison had been stampeded into the pen the tribe gathered around to slay the fright-maddened animals which charged wildly about crushing and tossing one another. Several hundred might be killed by this method in a single foray. The illustration is from a cut (engraved from a photograph) in Hind's *Narrative of the Canadian Red River Exploring Expedition of 1857*

"The Still Hunt," from a painting in the National Museum, Washington, by J. H. Moser, 1888.—With the coming of the railroads through the West and an increased demand for buffalo robes, the butchery of the "still hunt" began. Other methods were too slow for the commercial hunter who must kill hundreds of bison in order to realize on pelts worth but from 65 cents to $4 a piece. The still hunter approached the herd to within one hundred to two hundred and fifty yards and proceeded with great deliberation to shoot down the animals without stampeding them. Their leader, usually the oldest cow, was first disposed of, and then the others slaughtered one by one. Any individual of the herd which attempted to lead off the others was promptly stopped by the hidden rifle. The target on a bison is about a foot in diameter but even with a mark of that size and employing a high power rifle, the professional hunters were usually such poor shots that they scored only one death out of about every three hits, the other two bullets inflicting broken legs and collar bones. One to two shots a minute could be fired and with good luck a hundred bison killed from one "stand" so that one hunter was able to account for from one to three thousand head a season

THE DANGEROUS SPORT OF BUFFALO RUNNING

From a drawing by Bodmer, the artist of the Maximilian Expedition, 1832–34

The hunting of bison by charging a herd on horseback was an exciting and dangerous sport, undertaken at the hazard of the hunter's life. The danger was not so much from the bison, which rarely turn on their assailants, but from the likelihood of being thrown from one's mount in the mad charge where neither horse nor rider could see the ground ahead with its irregularities, its badger holes, and its prairie-dog towns. The Indians rode wild ponies, trained for the hunt. These were the fleetest animals of the plains and easily brought the hunters alongside the game, which were dispatched with arrows or spears. The pony was obliged to take an active part in the chase, for, as can be seen in the picture, it was ridden without bridle and with only a lasso tied to its lower jaw and trailing on the ground behind so that the rider might regain his mount if thrown. With the advent of firearms even more skill was required than for the bow and arrow, but the slaughter was more sure and rapid. When the breech-loading revolver came into use, "running buffalo" became a factor in their extermination

A "SURROUND" BY MINNETAREES ON THE UPPER MISSOURI

From a painting in the National Museum, Washington, by Catlin, 1832

On the plains where timber was scarce and a pen or corral could not readily be built, the Indians employed the "surround" for wholesale slaughter, stampeding the bison from all sides simultaneously. Around the eddying mass of bewildered animals the hunters galloped and dispatched their victims with spear and arrow. Now and then an infuriated bull might charge his assailant, or horse and rider be entangled in the mêlée, the latter escaping only by his agility, but on the whole it was not very dangerous hunting. Catlin witnessed the hunt pictured here on the upper Missouri in 1832. The battle resulted in the total destruction of the herd in the space of fifteen minutes. Of the animals which plunged off on the prairie and escaped many were overtaken and killed, while the others returned of their own accord to rejoin their comrades of the doomed herd. The Indians were as prodigal as the white hunters of their great natural food supply and far more meat was left for the wolves than was carried away. In earlier days on the southern and western range the "surround" was effected by a ring of fire on the prairie, followed up by the hunters on foot

IN PURSUIT OF THE HERD

From a painting (damaged by fire) in the National Museum, Washington, by James M. Stanley, 1842–52

For the Indian the hunt was a display of prowess next to war, and accordingly the number of animals he could kill became the paramount object—rather than provision for his family needs. Among other causes of the rapid extermination of the bison was the fact that, during the earlier years of the systematic slaughter, only cows were extensively killed, either for robes or meat. Hunting was correspondingly dangerous, however, for the cows were the swiftest runners and led the herd so that the hunters were obliged to penetrate the rear phalanx of bulls, an undertaking by no means unattended with serious risk. In fact one of the greatest dangers of the hunt lay in the possibility of getting caught in front of an onrush of bulls

WHERE THE MILLIONS HAVE GONE

From a painting in the National Museum, Washington, by J. H. Moser, 1888

The black, unskinned heads of the dead bison, in striking contrast with their bones ultimately bleached white, gave a ghastly appearance to the slaughter grounds of the bison. The bison were killed by the Indians only to obtain choice cuts of meat, especially tongues, and to a lesser extent for the pelts and other products; by the white men they were killed for robes and saddles of beef, while the main part of the animal was left by all hunters for wolves and vultures, or wind and sun. The miles of bones eventually gave rise to a traffic which became remunerative as there grew up a demand for phosphate for fertilizers and bone black for refining sugar. In 1874 the Santa Fe Railroad alone shipped nearly seven million pounds of bones which brought as much as $18 a ton crushed. The white hunters who finally exterminated the bison were an unprepossessing lot and led hard lives with little to reward them. Their hunting required no skill because of the stupidity of the animals, and the prices for either meat or robes were excessively low so that the canvas-clad begrimed followers of the herds were anything but the hunters of our storybooks

G A Boulenger
Aug. 1919.

All American zoölogists pay tribute to the work of Dr. George Albert Boulenger and voice thanks for the fundamental assistance that his work has been to them. He has been in charge of the collections of amphibians and reptiles, department of zoölogy, in the British Museum, since 1882, and besides a constant yearly output of technical papers in English and French scientific journals, he is author of works on African fresh-water fishes in four volumes and on the world's reptiles and amphibians in nine volumes. He is associate, corresponding, or honorary member of most of the great scientific societies of the world, and by his indefatigable personal effort in scientific research he has brought honor to the British Museum for all time

Boulenger, the Man and His Work

By THOMAS BARBOUR

Associate Curator of Reptiles and Amphibians, Museum of Comparative Zoölogy, Harvard College

BOULENGER—what charming memories may be awakened by a name! Unfailing candor, erudition, courtesy, a simple dignity, a flaming love for Belgium of his birth and for England the land of his adoption, a son wounded at Gallipoli yet who paused later during the horrors of the campaign on the Euphrates to send his father specimens of a favorite genus. Yes, these and many more were the natural flashes of impression which this photograph caused when first I had the pleasure of seeing it. It recalled delightful chats and visits, amazement at the wealth of treasures in his care, and cups of tea before a cheery blaze.

To be more matter of fact, however, Dr. George Albert Boulenger has had opportunity, by which he has richly profited, to become entirely familiar with most of the fishes, amphibians, and reptiles in the world; probably more familiar than anyone who has ever lived. While the common British custom of not fixing types and of not drawing up descriptions from specifically indicated specimens rather grieves students in this country—yet Dr. Boulenger's writings have been more widely used and of more general service than those of any predecessor or contemporary.

Proud to be numbered among the systematists in a day when many seeking an easier highway to recognition speak of them with scorn, he has fared afield as well, and his contributions to our knowledge of the habits especially of the European amphibians are well worthy of careful study as examples of painstaking observation, well recorded, and then left entirely unadvertised. They stand in dignified contrast to some of the capitalized "new discoveries" we oft have dinned into our patient if somewhat skeptical ears, though happily not by American herpetologists.

The Honorable Position of Naturalist

By G. CLYDE FISHER

Associate Curator of the Department of Public Education, American Museum

THE greatly famed village of Selborne, England, looks much today as it did a century and a half ago when Gilbert White was humble curate, naturalist, and fellow citizen there. Today, as then, it has a single street, picturesque and straggling, set in "lovely landscapes and beechen groves," and everywhere inviting footpaths. Here a path leads across a pasture, through a wicket gate, meandering on beneath the shade of bosky trees, and through undergrowth tangled with dog-rose and meadowsweet. Yonder on the right hand of the village street footpaths cross the village green, the "Plestor," with its central sycamore tree, still the focus of village life on summer evenings; and here, most wonderful, a footpath zigzags up a steep beech-grown hillside, the "Hanger," curving back and forth upon itself until it reaches the summit and stops at a great "Wishing Stone." And in the "Outlet" back of Gilbert White's house are many interlacing footpaths which lead about garden, hedge, and meadow.

Gilbert White gave to Selborne village the fame it bears. What he did unusual was to hold a great and true sympathy with nature, in consequence of which he was led to observe, through very many years until he was sure of his facts, and to describe, simply and truthfully, the wild flowers, insects, birds, and many other living things of the fields about his native village. He wandered daily through the footpaths of his "Outlet" and the byways of Selborne; he made new paths and planted new trees; with his brother's help he built the steep "Zigzag," and placed the "Wishing Stone." Finally, in the *Natural History of Selborne,* he described the countryside in a way so simple and alluring that everyone who read saw Selborne with its walks and loved it.

Gilbert White is very much the type of naturalist we need throughout America today. The importance of the position of naturalist has been enhanced by the war in a new valuation set on all original investigation along scientific lines. Any man, if he be a sincere student in natural history, will be more or less a leader in his locality—a leader in study, appreciation, and protection of local birds, of wild flowers or of insects, of woodlands, of scenic beauty.

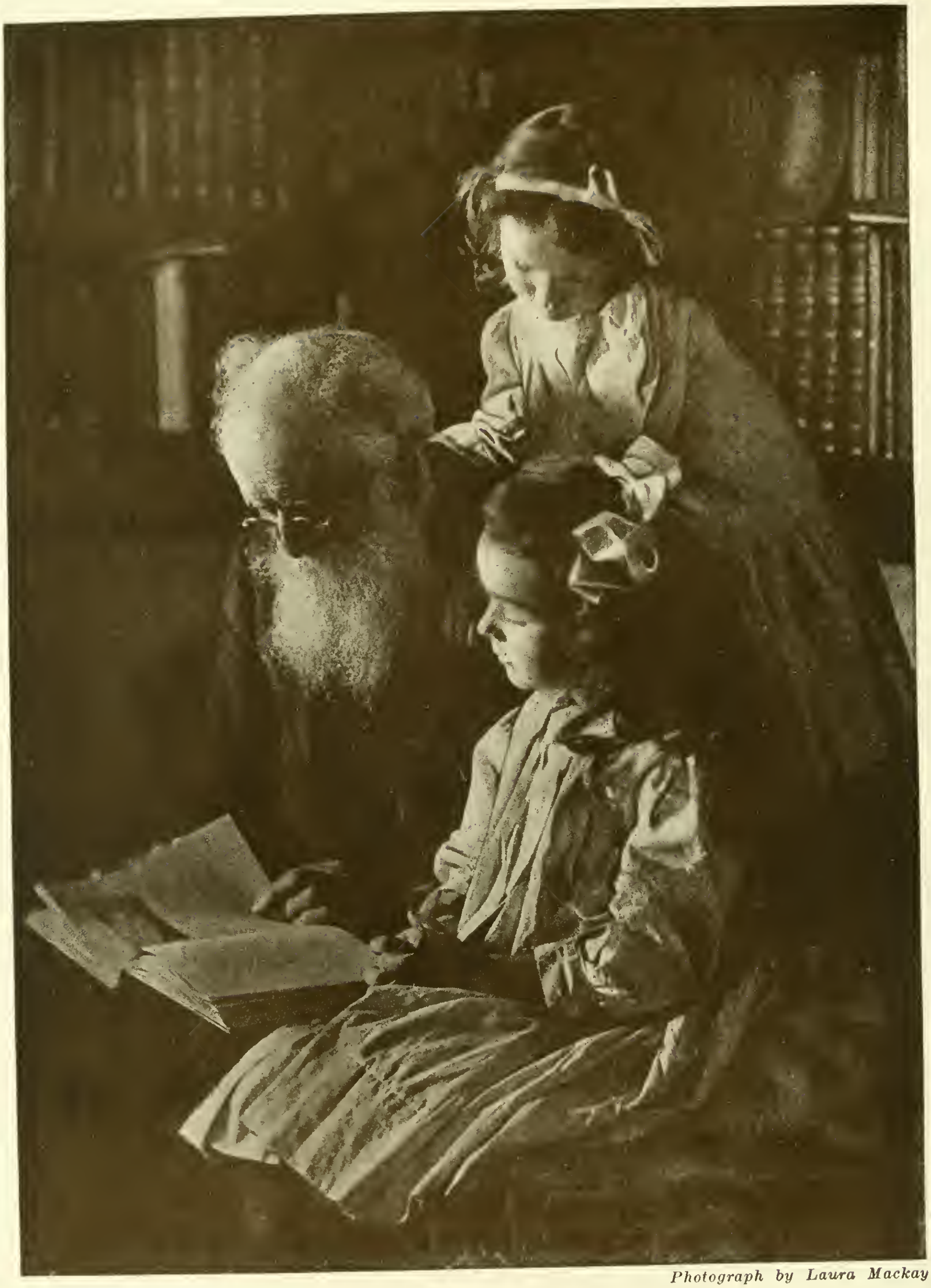
There is in Selborne a suggestion for each village of America. If we walk in the country is it not most often in the middle of the dusty or muddy roadway? Even in New England how often are there paths along the edges of fields where the stone wall is covered with bittersweet and clematis and the chipmunk wanders and the bobwhite calls, or across the meadow where the bobolink starts up from the grass, or across pasture land, through the wood lot, around the hill, along the river—or anywhere except where dread business takes us? We have no smallest chance to get close eye views of the world of wonderful small life forms that call our countryside their home.

I venture that one great step toward developing a love and knowledge of nature in America would be to make and open up inviting paths over and through the farm land for the use of members of one's family and for friends; and, for the use of all in the community, similar footpaths and byways about the environs of the village. Even the most weary will return again and again to the refreshment of a shaded path to some vantage point of view or rest, and it is by such frequent and leisurely wandering over the same way, until it is as familiar as the house, the garden, or the village street, that we come to know and appreciate the abundant wild life about us.

Photograph by Frank M. Chapman

THE HOME OF GILBERT WHITE'S "NATURAL HISTORY OF SELBORNE," 1788

Photographed in the summer of 1919 from the beech-wood hill known as the "Hanger," the most beautiful feature of the countryside, remaining unchanged from the eighteenth century until today. Selborne village and countryside, Hampshire County, England, will remain famous as long as the story of English literature is told, for here was written a book, through a long period of twenty years, which was so delightfully readable and so filled with interesting and true observations that it soon gained an assured fame and has since been listed with such classics as Bacon's *Essays*, Defoe's *Robinson Crusoe*, Walton's *The Compleat Angler*, and Bunyan's *Pilgrim's Progress*



Photograph by Laura Mackay

BOOKS AND NATURE

First-hand observation of the living world—of birds and flowers, trees and rocks—can be supplemented from early years with what others have seen and thought, or with historic incidents in which these objects have played some interesting part. Thus, enjoyment of life is manifolded in an association of knowledge of nature, literature, and history. Burroughs rates high "the pleasure of knowledge."

The work of John Burroughs, our American nature essayist, representing sympathy with all phases of country life, has become an influence for good in America through its entrance into the school life of children. Children like Burroughs' plant and animal stories, and as various teachers have explained, city children especially are benefited by the gentle influences of this literature from the woods and hills

The Love of Nature[1]

CONTEMPLATION OF THE BEAUTY AND INCIDENT OF THE NATURAL WORLD BRINGS RENEWED STRENGTH TO THE MIND

By T. D. A. COCKERELL

Professor of Zoölogy, University of Colorado

AMID the disorderly chaos of human affairs even the most vigorous become weary in time and long for some refuge where the mind may relax and renew its strength. For the tired muscles comes the benediction of sleep; but sleep, as we know too well, does not mend a sorrowful heart or relieve the anxious mind. There can be no doubt that William Morris was right when he described our activities as normally governed by two moods, which he called the moods of energy and of idleness. In the mood of energy we must be doing something, or at least pretending to do something; but in the mood of idleness the mind wanders over pictures of the past, or contemplates that which is beautiful or interesting. The major purpose of art, as distinguished from the obviously utilitarian, is to render the period of contemplation pleasant and fruitful. Thus it may be rescued from mere inanity on the one hand, and corruption on the other.

Morris was lecturing on the aims of art when he put forward this theory, but he was also keenly alive to natural beauty and incident, as his writings abundantly show. Powers of observation and description are combined in these charming lines from *The Earthly Paradise:*

"They left the house, and, following up the stream,
In the low sun saw the kingfisher gleam
'Twixt bank and alder, and the grebe steal out
From the high sedge, and, in his restless doubt,
Dive down, and rise to see what men were there;
They saw the swallow chase high up in air
The circling gnats; the shaded dusky pool
Broke by the splashing chub; . . .
They watched the poppies burn across the grass,
And o'er the bindweed's bells the brown bee pass
Still murmuring of his gains. . . ."

Morris had little use for modern science, and might even have been a trifle impatient if we had criticized the last line, on the ground that it was certainly a *female* bee. Mr. Burroughs is more scientific and less poetical, yet he tells us: "In my excursions into nature, science plays a part, but not the leading part; it is like a silent monitor and friend who speaks when spoken to. Or I may say that I carry it in the back of my head and only now and then in the front. I do not go forth as an ornithologist taking note of the birds, nor as a botanist taking note of the flowers, nor as a zoölogist studying the wild creatures, nor as a biologist, peeping and prying into the mysteries of life, but as a nature-lover pure and simple, who gathers much through sympathy and observation."

The English naturalist Wallace kept a beautiful garden in the latter years of his life for pure relaxation and en-

[1] John Burroughs, *Field and Study*, Houghton Mifflin Company, 1919.
With previously unpublished portraits of John Burroughs, the American naturalist and author, and scenes from his favorite haunts; followed by a series of bird photographs of unusual distinction published in his honor. In connection with the illustrations it is especially a pleasure to be able to quote through the courtesy of the publishers, Houghton Mifflin Company, various brief passages from the writings of Burroughs.—THE EDITOR.

joyment, not for scientific experiments. He was working to the last, but the flowers were for what Morris called the periods of idleness. Happy the man who at ninety years of age, after a life of fruitful labor, can still enjoy nature with the simplicity of a child! Contrary to the imagination of some, science is in no sense inimical to this faculty, and it would be easy to recall many scientific men who retained it unimpaired. Even Herbert Spencer found his moment of maximum enjoyment in the contemplation of a beautiful landscape, with the accidental accompaniment of music.

In the case of our nature writers, whatever may have been their original attitude, the problem of art is necessarily in the background. Mr. Burroughs, when he walks in the woods, cannot altogether forget that he is a reporter. He tries to forget it, and would if possible communicate his feelings to others by some process of telepathy: ". . . I try to get language out of the way as far as possible, and to put my mind directly to that of my reader. Hence, when I have been told that my page does not seem like writing, that it offers no resistance, and so on, I feel highly complimented. I would have it fit the mind as water fits the hand. Deliver me from language as such, from fine phrases; in short, from conscious style."

It is this simplicity and directness in Mr. Burroughs' writings that constitute their charm. He is a friendly companion, keen-minded but not too remote from the ordinary level of mankind. He brings us no astounding revelations, but introduces us to the good company all around us. For some he quickens pleasurable memories, for others reveals a new world. He writes, it would seem, for those who may see the things that he has seen; his book is a species of guidebook, not literature independent of time or place. He is even chary of his words, and does not tell us so much about the woodchuck or the warbler that we can form a clear picture of the creatures, never having seen them. Those who read Burroughs, never having lived in the northeastern United States, will wish that the publishers had introduced a series of pictures of the *dramatis personæ*. Yet, as he himself well says, literature cannot be merely photographic. When we make literature or art out of things, ". . . we must invest them with a feeling, an atmosphere, that the literal fact cannot give; we must work some magic upon the facts."

The question is, how much magic, how much of the human element, how much of that element personal and peculiar to the writer? Says Mr. Burroughs, ". . . Burns's 'Mouse' is a real mouse, but not the one you catch in a trap; and Shakespeare's violets—where do they grow save in the magic page of Shakespeare?" Poets throughout the centuries have employed the worn images of antiquity, things once real and immediate: now chosen rather for their accumulated content of human emotion, like the "blessed word Mesopotamia."

No doubt the highest art is that which is most completely humanized, which expresses most perfectly vital human emotions, connected usually with periods of activity and with the interplay of personalities. It catches the flood of human passions at its height, and preserves for us images of the maximum products of heart and brain. Hence it is often relatively independent of external circumstances, appealing to the facts of nature within rather than without the man.

Nature writing cannot be all this, and must not be it, if it is to serve its true purpose. One hesitates to declare that its humbler objects are the more vital to our needs, but who can contemplate modern life and not perceive the necessity for more healthy simple objectivity, more restful contemplation of beauty and incident?

It is an interesting question, how much of the love of nature as shown in the observations of any mature mind is simple and naïve. I had, when a child, a delight in bright colors which I no longer possess in its original simple form. The blue of the sky, the red of the rose, produced an intensely pleasurable sensation which had no relation to previous knowledge or experience. With the years, one necessarily loses his simplicity. Even the unfamiliar reminds us of something; hence the American "robin," which is no robin, and "primrose," which is not a primrose.

This brings us the question: should we cultivate the association of ideas in the young, or leave them to weave unconsciously a web of thought around every familiar object? Certainly, it is possible to go too far in cultivating association—to hide the real thing under a mass of the débris of the ages, things which have accidentally stuck to it rather than issued from it. One recalls the occasion when Lord Brougham and the Duke of Wellington met and chaffed each other in this wise: "My lord," said the Duke, "I used to suppose you would be remembered as a statesman, but now I know that you will go down to posterity in the name of a very uncomfortable sort of carriage." "Your grace," replied Brougham, "I once thought you would always be known as the hero of a hundred fights, but it appears that you are to be famous for a cumbersome type of boots!" "Damn the boots," said Wellington, and we rather agree with him. In a certain sense, the United States to the eagle, Scotland to the thistle, Rome to the geese, are all "boots." Yet when I see a species of woodpecker common in this vicinity, I am likely to think, not of the structure and habits of the family of woodpeckers, the Picidae, but of Lewis and Clark and their ever memorable expedition. It is pleasant and profitable to do so, and I often remind my students of such associations.

Were it possible, however, to develop our ideas of each animal and bird through pure observation we should know and understand it as we do our intimate friends. It is really to the credit of Mr. Burroughs that the animals do not remind him continually of the classical authors or of the poets; or if they do, that he keeps the fact to himself. He tells us what he has seen, and the ideas he associates with each creature are those derived from previous experience with it.

But again, life is short and one cannot learn everything at first hand. Those of us who cannot know nature in detail in this way are glad to see what Mr. Burroughs has seen, in some measure with his eyes. Much of the pleasure of a woodland ramble comes from expectation, and from appreciation of the meaning of what one sees. If a bird is rare, it is well to know it; if it is high in a tree, one likes to know what it would look like close at hand. I know a lady whose eyesight was defective, and to whom a tree was simply a mass of green. When at length she was fitted with glasses, she was greatly astonished to find that it was possible to see the separate leaves. So might one learn to know many animals and birds at a distance, and be surprised to note their finer markings and peculiarities of form when seen close at hand.

The painted lady butterfly (*Pyrameis cardui*) is rare in England, but occasionally visits the country in great numbers from the continent. As a boy in Kent, I had read the interesting life story of this butterfly before there came a certain famous *Pyrameis cardui* year, and I particularly remember my first capture of the species. My hand trembled, and in my enthusiasm I insisted on showing the butterfly to a telegraph boy who came along. The insect was indeed a lovely thing, but I could not have felt as I did without already knowing what it was and something about it.

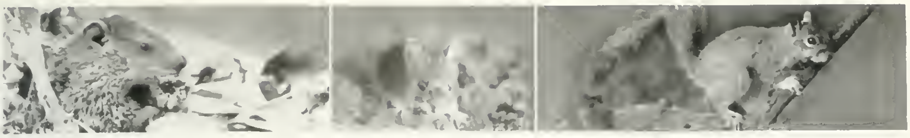
The answer to our question seems to be, that we should teach even young children something about the facts of nature, and the result will be to increase their pleasure and quicken their interest. It is undesirable to leave them to see everything for themselves, for indeed, they usually will not look. In Europe, where there is so much traditional nature lore, children grow up little naturalists: but in many parts of America, where the parents neither know nor care, the children remain ignorant.

More especially, perhaps, should we emphasize those facts which, though vital, could not be appreciated by the mere observation of a single individual. The migrations of birds and the data of geology have been elucidated by many men working at different times and places, and yet the general results can often be stated lucidly in a few words, and readily appreciated in relation to what is actually seen. It is not always easy judiciously to combine book learning and observation: and even Mr. Burroughs, compared with whom most of us are slaves of the book, falls into the error of referring to the "*Halictus* moth," because he had never

Photograph by G. Clyde Fisher

This great stone under the ironwood tree, where John Burroughs played when a boy, lies in pasture land less than a half mile from the house of his birth on the old farm in Delaware County, near Roxbury, in the western Catskills. On this stone he posed for "The Seer," a bronze figure by the late C. S. Pietro (see photograph on page 581).

Burroughs, commenting on the work of the camera, and the value of photographs not only for the accurate delineations of science but also for portraiture of friends and reproduction of scenes linked with personal associations, writes in *Field and Study:* "The camera has no imagination, no sentiment, and no memory, and its literal truth is not art; but for that very reason, it gives us the nude reality. . . . Our own memories and feelings do the rest. . . . Who could paint for me the old homestead with the charm it has in my memory, not changing a single feature, but touching every feature with the pathos with which it haunts me?"



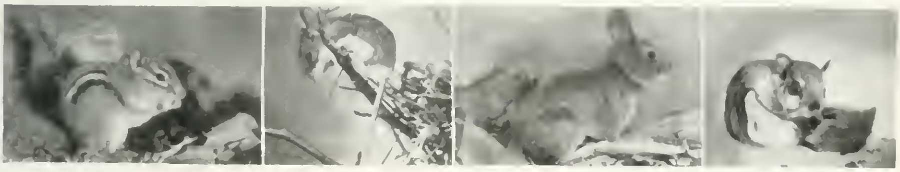
Young woodchuck, jumping mouse, and gray squirrel—friends of Mr. Burroughs about his home on the Hudson

seen the little bees of that genus, which certainly abound in his own garden. On the other hand, Fabre, most marvelous of observers, made a mistake concerning the identity of an insect because he did not sufficiently consult the books, and had to be corrected by his friend Pérez.

We need many nature writers. Not only is the field too great to be covered by a single man in any locality, but every part of the country must have its own observers and writers. We doubtless have in our midst the necessary ability, potentially at least, but it is difficult to stimulate it to production. Unless the work is based on observation, it has small value, and how many can take the time to master the mysteries of nature? The professional scientific man usually works under high pressure, and has little leisure to sit in the woods and watch the procession of events. Many thousands may be true lovers of nature, but as amateurs they cannot prepare themselves to interpret her in literature. A lifetime is short for this, and who can be sure that, even so, he will succeed? It is a high calling, demanding exceptional ability and fidelity. Perhaps public appreciation, coming with the spread of higher education, will eventually smooth the way.

The underlying unity of nature may come to be reflected in the human mind, creating harmonies in place of discord. Out of simple pleasures and reactions may grow a philosophy of life more in harmony with the facts of existence than other more pretentious schemes. Every true naturalist is probably something of a mystic, because he cannot fathom the depths of life, and will not concede that the greater may be completely explained in terms of the less. Yet he increasingly feels the bond which unites all living things, and desires to play his game according to the rules which he perceives to have been established in the dawn of the world. He is not convinced so much by rigid logic, as by a multitude of concordant observations. He comes to trust nature as one trusts a friend. Of him we may write, as we wrote some years ago in Wallace's *Malay Archipelago:*

The love of nature makes the whole world kin,
To East and West the gospel preached herein
Must stir the soul.
All living things his comrades were, he saw
The harmony which underlies all natural law,
Saw nature whole.



Chipmunk, white-footed mouse, cottontail rabbit, flying squirrel—still other good friends in the fields and woods about Mr. Burroughs' home

"SLABSIDES," BURROUGHS' CABIN IN THE WOODS

"Slabsides" is nearly two miles west of John Burroughs' home, "Riverby," at West Park, Ulster County (on the Hudson, eighty miles north of New York City). Within the cabin one sees partition walls made of yellow birch, a skeleton stairway, and rustic chairs and beds. The late Theodore Roosevelt and many other noted men among Burroughs' friends have visited him here. John Muir was one of his first visitors, in 1897, the year after the cabin was built. At one side of the cabin Burroughs made a garden for celery and other vegetables which demand black rich soil—for in recent geological time the land here had been the bottom of a small lake. When digging into the peaty soil, he found sections of wood which had been gnawed by beavers in days long past

Photograph by G. Clyde Fisher

IN THE GARDEN AT FOURSCORE YEARS

The squash that eventually grew to great size in Burroughs' garden at Woodchuck Lodge on the old homestead farm, and was presented to his friend Thomas A. Edison

But no garden or other matter can hold his attention if he hears a new or unwonted bird song; he hears even faint and distant calls, inaudible for the man of fewer associations with woods sounds. "If we have no associations with these sounds, they will mean very little to us. Their merit as musical performances is very slight." On this matter Burroughs quotes Roosevelt: "Yet I cannot say that either song [meadowlark's or skylark's] would appeal to others as it appeals to me; for to me it comes forever laden with a hundred memories and associations, with the sight of dim hills reddening in the dawn, with the breath of cool morning winds blowing across lonely plains, with the scent of flowers on the sunlit prairie, with the motion of flying horses, with all the strong thrill of eager and buoyant life. . . . I doubt if any man can judge dispassionately the bird songs of his own country; he cannot disassociate them from the sights and sounds of the land that is so dear to him"

Photograph by G. Clyde Fisher

WHERE MAY AND JUNE ADD BIRD SONG TO THE SOUND OF FLOWING WATERS

Each May Burroughs comes to the woodland along these falls on Black Creek, near Slabsides, to look for the Louisiana water thrush and other warblers, for the scarlet tanager and phœbe. Here he often camps and cooks his favorite "brigand" steak.

"The camper out often finds himself in what seems a distressing predicament to people seated in their snug, well-ordered houses; but there is often satisfaction when things come to their worst,—a satisfaction in seeing what a small matter it is, after all; that one is really neither sugar nor salt, to be afraid of the wet; and that life is just as well worth living beneath a scow or a dugout as beneath the highest and broadest roof in Christendom. . . .

"When one breaks camp in the morning, he turns back again and again to see what he has left. Surely he feels he has forgotten something; what is it? But it is only his own sad thoughts and musings he has left, the fragment of his life he has lived there. . . . Where he hung his coat on the tree, where he slept on the boughs, where he made his coffee or broiled his trout over the coals, where he drank again and again at the little brown pool in the spring run, where he looked long and long up into the whispering branches overhead, he has left what he cannot bring away with him,—the flame and ashes of himself."—From *Pepacton*

MEMORIES

". . . The voice [of the nut-hatch] is that of a child, soft, confiding. . . . His call in the spring woods when we made maple sugar in my boyhood—'yank, yank, yank'—how it comes back to me! Not a song, but a token—the spirit of the maplewoods finding a voice."

"How distinctly I remember where our schoolboy path through the woods crossed an old brush fence, and in winter the fresh prints in the snow of the feet of the red and gray squirrels to whom the old fence served as a highway. How vivid the picture of it all is in my memory! The delicate tracks of the wood mice here and there beside our path—they are

Photograph by G. Clyde Fisher

Photograph by G. Clyde Fisher

still unfaded in my mind, after a lapse of more than seventy years . . . The wild life around us becomes interesting the moment one gets into the current of it and sees its characteristics and by-play. The search for the elements of the interesting in nature and in life, in persons and in things—well, is an interesting search."—From *Field and Study*. (The fireplace is built of native rock from the vicinity of Burroughs' home. From this little red schoolhouse he went to Cooperstown Seminary.)

Photographs by G. Clyde Fisher

IN THE SOUTHERN CATSKILLS

Mr. Burroughs has written various chapters of charming description of the Catskills. "The Heart of the Southern Catskills," in the volume which he calls *Riverby*, is a delightful invitation to the mountains and valleys he portrays. No quotation can carry the spirit of it; one must read the whole thirty pages,—seeing with him the wide sweep of view from Wittenberg (the mountain top at the left in the lower photograph), sleeping the night on the moss under balsam boughs; following the trail down into the wonderful Woodland Valley (upper photograph) with its fine trout brook, its sweet seclusion; watching the change from the summer fruit of shadbush and wild strawberry to springtime flowers during the difficult climb of Slide Mountain (at the right in the lower photograph).

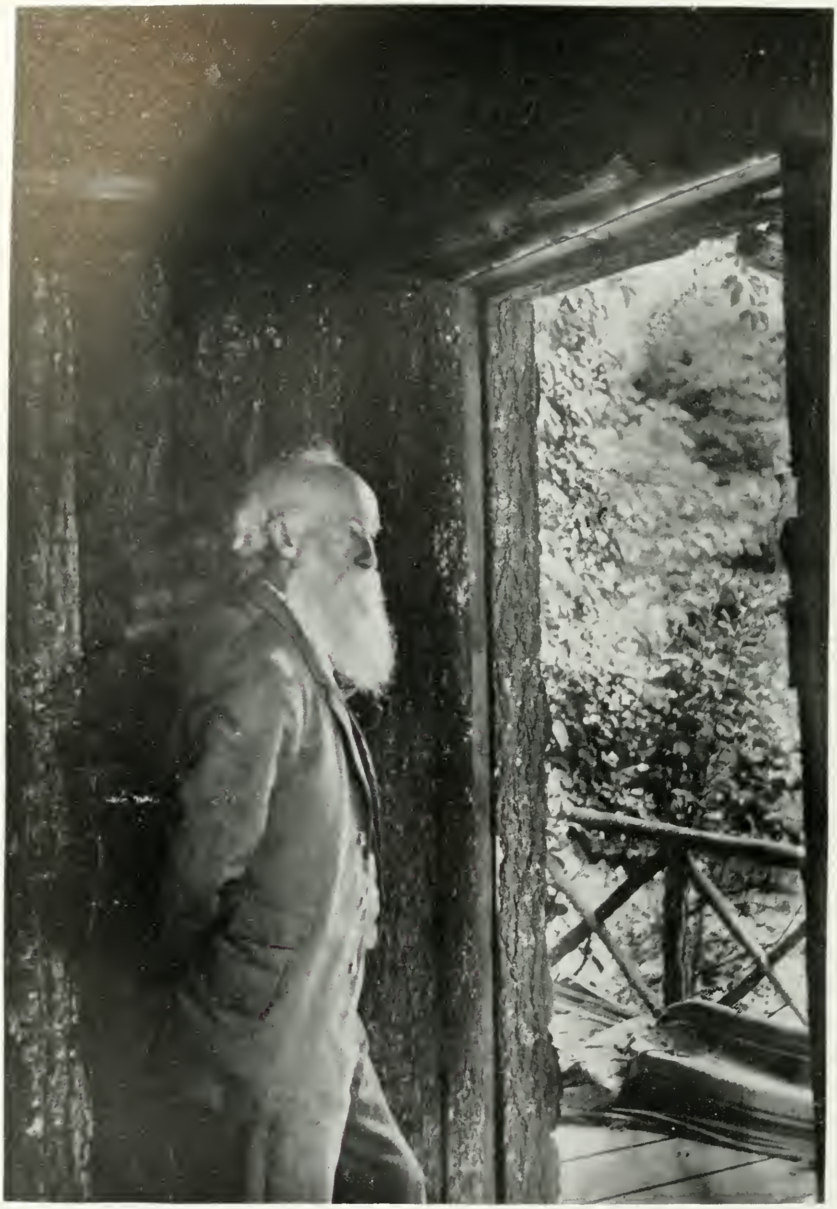
"In any such view [from Slide Mountain, 4000 feet elevation] the wild, the aboriginal, the geographical greatly predominate. The works of man dwindle, and the original features of the huge globe come out. Every single object or point is dwarfed; the valley of the Hudson is only a wrinkle in the earth's surface. You discover with a feeling of surprise that the great thing is the earth itself, which stretches away on every hand so far beyond your ken." —From *Riverby*

Courtesy of Toledo Museum of Art

JOHN BURROUGHS

"I never tire of contemplating the earth as it swims through space. As I near the time when I know these contemplations must cease, it is more and more in my thoughts—its beauty, its meaning, and the grandeur of the voyage we are making on its surface. The imaginary and hoped for other world occupies my thoughts very little. There is so much to know here, so much to enjoy, so much to engage every faculty of the mind and develop every power of the body, such beauty, such sublimity, and such a veil of enchantment and mystery over all—how can one ever tire of it, or wish for a better. I am in love with the earth"—From *Field and Study*.

This portrait of John Burroughs was modeled by the late C. S. Pietro, and is the property of the Toledo Museum of Art. The rock on which Mr. Burroughs posed is on his old home farm in the western Catskills. A photograph of it is reproduced on page 574



Photograph by J. D. Johnson

IN THE DOORWAY AT SLABSIDES—A BIRD SONG SUGGESTS A TRAIN OF THOUGHT

"The traveler sees little of the Nature that is revealed to the home-stayer. You will find she has made her home where you have made yours, and intimacy with her there becomes easy. Familiarity with things about one should not dull the edge of curiosity or interest. The walk you take today through the fields and woods, or along the river bank, is the walk you should take tomorrow, and next day, and next. What you miss once, you will hit upon next time. The happenings are at intervals and are irregular. The play of Nature has no fixed programme. If she is not at home today, or is in a noncommittal mood, call tomorrow, or next week. It is only when the wild creatures are at home, where their nests or dens are made, that their characteristics come out."—From *Field and Study*

BIRD PHOTOGRAPHS OF UNUSUAL DISTINCTION

THE SERIES ON THE PAGES FOLLOWING, THE WORK OF SOME OF OUR NOTED BIRD PHOTOGRAPHERS AND NATURALISTS, IN MANY PARTS OF THE COUNTRY, IS PUBLISHED IN HONOR OF JOHN BURROUGHS, WITH MANY BRIEF QUOTATIONS FROM HIS WRITINGS

WHERE CAN BE HEARD "THE WHISTLE OF RETURNING BIRDS"

"I do not know a bird till I have heard its voice . . . A bird's song contains a clew to its life, and establishes a sympathy and understanding . . . "—From *Wake-Robin.*

"One sees the passing bird procession in his own grounds and neighborhood without pausing to think that in every man's grounds and in every neighborhood throughout the State, and throughout a long, broad belt of states, about several millions of homes, and over several millions of farms, the same flood-tide of bird-life is creeping and eddying or sweeping over the land. . . . Think of the myriads of dooryards where the 'chippies' are just arriving; of the blooming orchards where the passing many-colored warblers are eagerly inspecting the buds and leaves; of the woods where the oven-birds and water-thrushes are searching out their old haunts; of the secluded bushy fields and tangles where the chewinks, the brown thrashers, the chats, the catbirds, are once more preparing to begin life anew—think of all this and more, and we may get some idea of the extent and importance of our bird-life. . . .

"The birds . . . are always the same familiar birds, the birds of our youth, but they are new as the flowers are new, as the spring and summer are new, as each morning is new. Like Nature herself they are endowed with immortal youth . . ." – From *Field and Study*

Photograph by Leslie W. Lee

THE BROWN THRASHER—IN NEW ENGLAND

"People who have not made friends with the birds do not know how much they miss. . . . The only time I saw Thomas Carlyle, I remember his relating that in his earlier days he was sent on a journey to a distant town on some business that gave him much bother and vexation, and that on his way back home, forlorn and dejected, he suddenly heard the larks singing all about him,—soaring and singing, just as they did about his father's fields, and it comforted him and cheered him up amazingly. . . .

"There is something almost pathetic in the fact that the birds remain forever the same. You grow old, your friends die or move to distant lands, events sweep on, and all things are changed. Yet there in your garden or orchard are the birds of your boyhood. . . . The call of the high-holes, the whistle of the quail, the strong piercing note of the meadowlark, the drumming of the grouse,—how these sounds ignore the years, and strike on the ear with the melody of that springtime when your world was young, and life was all holiday and romance!"—From *Birds and Poets*

Photograph by Norman McClintock

THE LITTLE GREEN HERON IN FLORIDA

Burroughs identifies himself with nature and looks at it from the standpoint of one in sympathy. He points out again and again in *Field and Study* that each creature in any given bit of country is living its individual independent life, quite irrespective of the life of man and wholly apart from it—each is "a jet of vital activity with a character and purpose of its own."

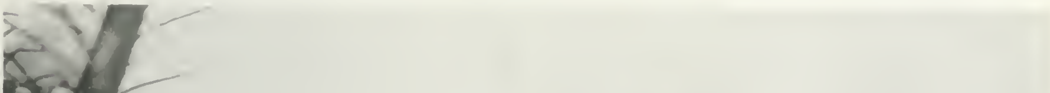
Photograph by Alvin R. Cahn

IN TEXAS—ONE OF OUR FAMOUS SONG BIRDS A KINSMAN OF THE MOCKING BIRD

"It might almost be said that the birds are all birds of the poets and of no one else. So true is this that all the great ornithologists . . . have been poets in deed if not in word. Audubon is a notable case in point, who, if he had not the tongue or the pen of the poet, certainly had the eye and ear and heart . . . the singleness of purpose, the enthusiasm, the unworldliness, the love, that characterize the true and divine race of bards. So had [Alexander] Wilson, though perhaps not in as large a measure; yet he took fire as only a poet can. While making a journey on foot to Philadelphia, shortly after landing in this country, he caught sight of the red-headed woodpecker flitting among the trees . . . and it so kindled his enthusiasm that his life was devoted to the pursuit of the birds from that day. . . . The very idea of a bird is a symbol and a suggestion to the poet. A bird seems to be at the top of the scale, so vehement and intense is his life,—large-brained, large-lunged, hot, ecstatic, his frame charged with buoyancy and his heart with songs."
—From *Birds and Poets*

Photograph by William L. Finley and H. T. Bohlman

Pacific yellow-throat—in Oregon.—"The current notion that the parent birds teach the young to fly—that of set purpose they give them lessons in flying—is entirely erroneous. The young fly automatically when the time comes, as truly so as the witch hazel nut explodes, and the pod of the jewel-weed goes off when the seeds are ripe. The parent birds call to their young, and I have thought that in some cases they withhold the food longer than usual to stimulate the young to make the great adventure . . ."—From *Field and Study*



Photograph by William L. Finley and H. T. Bohlman

Black-throated gray warbler—Oregon.—"Till the middle of July there is a general equilibrium; the tide stands poised. . . . But as the harvest ripens beneath the long hot days, the melody gradually ceases. The young are out of the nest and must be cared for, and the molting season is at hand. After the cricket has commenced to drone his monotonous refrain beneath your window, you will not, till another season, hear the wood thrush in all his matchless eloquence. The bobolink has become careworn and fretful. . . Some of the sparrows still sing, and occasionally across the hot fields, from a tall tree in the edge of the forest comes the rich note of the scarlet tanager."—From *Wake Robin*

Photograph by G. K. Noble

GREAT BLACK-BACKED GULLS ON A LAKE OF NOVA SCOTIA

This species is the most majestic of the Atlantic Coast gulls in the winter time. It is a silent, alert sentinel of uninhabited beaches, never seeking the protection offered by civilization nor the ready sources of food about the fishing village. A glimpse into the summer colony, however, gives a very different idea of these shy winter visitors

Photographs by William L. Finley and H. T. Bohlman

INHABITANTS OF INLAND WATERS

The western grebe (above), and a young avocet, of the Malheur marshes.—Malheur Lake, Oregon, with its surrounding marshes, was set aside in 1908 as a federal wild bird reservation by special proclamation of President Roosevelt. It is the greatest wild bird reservation in the United States, but is about to be destroyed by promoters shutting off all water from entering the lake[1]

[1] EDITORIAL NOTE.—In letters to the Editor Mr. Finley calls attention to the destruction in prospect for this and Klamath Lake reservations: "I do not know whether you have any way of helping us in regard to Klamath and Malheur Lake reservations. Lower Klamath Lake where Dr. [Frank M.] Chapman got his great habitat group for the American Museum, is now dried up and the reservation is practically destroyed from the bird standpoint—unless the United States Reclamation Service opens the dykes along Klamath River and lets the water back in. We have a continual fight against this sort of commercialism that wants to destroy everything in the hope of turning it into money." (See page 736)

Photograph by Edward A. McIlhenny

THE BLUE GOOSE IN ITS WINTER HOME—THE LOUISIANA MARSHES

Photograph by Frank Overton

THE MARSH HAWK ON LONG ISLAND, PHOTOGRAPHED RISING FROM ITS NEST

Photograph by William L. Finley and H. T. Bohlman

The California condor (adult) in southern California.—Several hundred photographs were taken, showing the life history of the California condor. Eight different trips were made back into the mountains to the nest. The old birds became tamer at each visit until, on the last trip, they were photographed at a distance of only a few feet

Photograph by William L. Finley and H. T. Bohlman

We recall John Burroughs' characterization of the late Theodore Roosevelt as an observer "in preëminent degree." He says apropos this power: "You may know the true observer, not by the big things he sees, but by the little things; and then not by the things he sees with effort and premeditation, but by the quick, spontaneous action of his mind"

Photographs by Arthur A. Allen

STUDIES IN NATURE'S EBONY—IN NEW YORK STATE

Bronze grackles have been accused of doing damage in the cornfield, but they feed on cutworms and other insects in summer, and this particular bird, while under observation at arm's length from a blind, fed its young upon grasshoppers.—"The great thing in observation is not to be influenced by our preconceived notions, or by what we want to be true, or by our fears, hopes, or any personal element, and to see the thing just as it is. A person who believes in ghosts and apparitions cannot be depended upon to investigate an alleged phenomenon of this sort. . . . Above all don't jump to conclusions. . . . Be sure the crow is pulling corn instead of probing for grubs, before you kill him."—From *Riverby*

Today State Conservation Commissions, aiming to keep extant our native races of game birds and to introduce others like the pheasants, are giving the crow an unsavory reputation so far as unselfish respect for the rights of others is concerned. Burroughs is evidently aware of this objectionable feature in the crow but likes him withal; he gives many a bit of virile character description of him: "The crow is always in the public eye or ear. His color gives him away, his voice gives him away; on the earth or in the sky he is seen and heard afar. No creature wants his flesh, no lady wants his plume, though a more perfect and brilliant ebony cannot be found in nature. He is a bit of the night . . . yet the open day is his passion, publicity his passion. He is a spy, a policeman, a thief, a good fellow, a loyal friend, an alarmist, a socialist, all in one . . . he is never disgruntled, come rain, come shine, come heat, come snow. . . ."—From *Field and Study*

Photograph by Edward A. McIlhenny

MALLARDS REARED IN NORTHERN NESTS FIND WINTER REFUGE AT THE SOUTH

From the social gathering in lake and pond they rise, toward the close of day, and fly with incredible speed, scattering in small bands, to their feeding grounds in marsh or rice field.

"The ways of nature,—who can map them, or fathom them, or interpret them, or do much more than read a hint correctly here and there? Of one thing we may be pretty certain, namely, that the ways of wild creatures may be studied in our human ways, inasmuch as the latter are an evolution from the former, till we come to the ethical code, to altruism and self-sacrifice."—Burroughs in *Ways of Nature*

Photograph by Edward A. McIlhenny

MALLARDS FEEDING—IN LOUISIANA

With heads submerged they search the marsh bottom. After their migration to the North to nest, ducks will return in the fall to a given pond at the South, if this pond be protected and if something of the wild surroundings of the accustomed natural environment be provided. In the beginning a few wing-clipped ducks can be made a start for the colony, other ducks will join, and by suitable attention to their needs the colony will grow. After a return the first fall the success of the colony is assured. This is a method for conservation of our wild fowl that will be increasingly practised in the years immediately ahead

Photograph by Edward A. McIlhenny

AT THE SOUTH IN WINTER TIME—OUR AMERICAN ROBIN

"We never know the precise time the birds leave us in the fall: they do not go suddenly; their departure is like that of an army of occupation in no hurry to be off; they keep going and going, and we hardly know when the last straggler is gone." (From *Pepacton.*) A few individual robins remain in sheltered spots in the North.

In comparison with English song birds it is said that ours are fewer in number and less famous as musicians. Burroughs says: "Our birds are more withdrawn than the English," with "notes more plaintive and intermittent." The robin comes very near the head of the list of well-known American bird musicians, in the family with the thrushes and bluebird, and sharing the honors with the family of mocking bird, brown thrasher, and catbird. He is one of the greatest sources of cheer and companionship in city or country. It is therefore all the more pity that spring after spring the number returning to the North has been smaller and smaller, owing to destruction of the migrating flocks at the South,—robins shot in thousands for food

Photograph by Ernest Harold Baynes

At the North in winter time, just chickadee.—A view within the window

Photograph by Ernest Harold Baynes

A view without.—"If you would study the winter birds . . . you can bring them to your own door—chickadees, nuthatches, downy woodpeckers, brown creepers . . . little waifs from the winter woods that daily or hourly seek the bounty you prepare for them . . . The woods and groves seem as barren as deserts, the earth is piled with snow, the trees snap with the cold . . . the wonder is that . . . these little adventurers can subsist at all. . . . How much company they are to me! What thoughts and associations they bring!"—From *Field and Study*

Freeman Art Co., Eureka, Humboldt County, California

THE HERITAGE OF AMERICANS

The northern redwood forests are a heritage for every American—yet all are in the hands of private capital. We must purchase sections of this redwood land from the lumber companies who own them, at once before everything has been leveled by the ax and fire. For these forests are the greatest the earth has ever seen in all the millions of years of its history. The trees tower into the sky between three and four hundred feet and attain a prodigious thickness of trunk; and so ancient are they that the largest of them have seen the passing of more than four thousand generations of men

Freeman Art Co., Eureka, Humboldt County, California

The contrast!—Hundreds of thousands of acres of redwoods in California have been cut in the last sixty years. Each sawmill is a center of incalculable loss not only through the timber removed but especially through waste and fire

Sequoia—the Auld Lang Syne of Trees

AN IMMEDIATE WORK FOR EVERY LOVER OF AMERICA IS THE PRESERVATION OF THE REMNANTS OF REDWOOD FORESTS IN NORTHERN CALIFORNIA

By HENRY FAIRFIELD OSBORN

President of the American Museum of Natural History, Member of the Council of the Save the Redwoods League

IT was said pithily by John Muir that any fool can destroy trees: they cannot run away from him, and if they could they would still be chased and hunted to their death—as long as fun or a dollar could be got out of them. Speaking of the Sequoias, he contrasted the ability of the Creator to protect their race, as he has done, through millions of years from drought, disease, avalanches, tempests, and floods, with the inability of that same divine power to protect them even for a generation from fools—"only Uncle Sam can do that."

If the American Museum, by some magic of power, could hope for large influence in conservation matters, it would vote to save these Sequoia woodlands. Their venerable and colossal splendor is a heritage for the future America. Many of these trees have lifted their heads to the sunshine of more than a thousand summers, and the largest of them have outlived the passing of four thousand generations of men. Mere matter-of-fact and commercial consideration, moreover, entirely apart from any sentiment regarding their beauty or their age, should save them: "in the name of thrift, and foresight, and love of country"—as Roosevelt would have said.

The destruction has progressed far, and has been especially augmented of late. The most majestic among the manifestations of life on the globe are being cut for—breathe not aloud the uses to which they are being put, lest the recorders of human history laugh! Sequoias towering more than three hundred feet into the sky are being brought to the ground for grape stakes for the vineyards of California; for shingles and railroad ties for the temporary convenience of a mankind which is slow to evolve beyond aims of immediate personal gain.

Do we ask why the burden of saving the redwood forests falls so immediately on the shoulders of the state and national governments—outside of the general reason that state and national governments should look out for the welfare of the people? Uncle Sam owned all this western timber country—yet Uncle Sam was so desirous of giving every man in the free United States his chance, that millions of acres of timber land were sold at two and one half dollars an acre when just one individual tree of the wide-stretching forests was worth at the lowest figure one hundred dollars. Thus the timber went into the hands of private and corporation capital—and "nothing could be done about the crazy bargain!"—at least the sales could not be undone.

This was the condition when Muir wrote these words in 1900, and the twenty years since that time have seen the ranks of the redwoods pushed farther and farther back from the sea, by lumbering methods involving frightful waste. Some solution of the problem must now be sought which will return to the government as large a part of the redwood lands left as money for purchase can be found, to remain permanent possessions of the American people.

One of two courses we shall follow. Either we shall now, at a goodly expenditure of money, save the redwood forests as they stand, or we shall lose them, and after a few years, at an exceedingly greater expenditure of money, try to save a few small mutilated tracts which may be left, knowing that we have doomed the redwood as a race to an eternal extinction. We recognize the second course as that usually consummated in the forest policy of any new community. Have we not learned the lesson of loss, especially in the East, so that we can apply the principle to the redwood? We all realize that we long ago passed the day when we could afford to look upon trees as giant weeds to be got rid of by any method, as our forefathers in America looked upon them, or even as inexhaustible gifts of Heaven to be managed wastefully. They are one of the few vital assets of the country. If we have not learned the lesson, we shall in this particular instance not merely burden our children with the bond issues of an attempted restoration of what we have destroyed, we shall lose the redwoods beyond all possibility of restoration. For in the case of trees such as white pine, black walnut, and others now nearly exterminated, we have not been dealing with species that take half a thousand years to reach maturity and two or three times that to attain their greatest nobility of size. One hundred years has been more nearly the maximum—and that has seemed too long to the man who lives for himself only and for today.

The species of Sequoias are only two,[1] the big tree (*Sequoia gigantea*) and the redwood (*Sequoia semperv-*

[1] The genus *Sequoia* is not closely related to any other living group of trees, but in former geological times, reaching back as far as the Jurassic and Trias, near relatives of our Sequoias were common, with many species scattered widely over the northern lands of the globe. Their fossil remains have been discovered in Europe and in various lands bordering the Arctic seas—Siberia, Spitzbergen, Greenland, Canada, and Alaska. The big tree and the redwood are therefore representatives of a family whose existence with small variation must be measured in millions of years—they are "the auld lang syne of trees."

rens). If we journey southward through the warm interior valley of California, on our left hand tower the snow-capped Sierra Nevada Mountains. These bear in their high altitudes on the seaward slopes the big trees. They are heroic in size. Mixed with other conifers in open groves, they stand massive and battered like ruins from an age when life was measured not by single revolutions of the earth around the sun but by thousands and tens of thousands. Fortunately, this species of Sequoia is protected by its very inaccessibility, from five to eight thousand feet up the mountain slopes.[1]

On the right hand as we journey southward through California is the low verdant Coast Range (one thousand to two thousand feet elevation); and over its seaward slopes and in its wide moist valleys are the remnants of the forests of the redwoods. But a very few years ago they reached from north of the California and Oregon boundary line southward in an unbroken belt of forty miles maximum width, to the southern boundary of Mendocino County, California, then on farther south in isolated small forests as far as the Bay of Monterey, a total distance of nearly five hundred miles, twice the north and south lap of the big trees in the Sierras.

These redwoods show striking adaptation to the depth of soil and amount of moisture. On the steep slopes where the soil is shallow, they do not attain a height of more than 225 feet, with greatest diameter of trunk ten feet, and here they grow in open stands more or less mixed with other trees (especially red fir). At increasingly low altitudes and consequent greater depth and moisture of soil the redwoods increase in size and predominate the forest more and more until they form close, crowded stands unmixed with other trees. On flats and in the bottoms of valleys where rivers cut their way through the Coast Range to the Pacific they make giant redwood fastnesses, many of the trees reaching well above three hundred feet, frequently with a diameter of trunk from sixteen to eighteen feet.

Many of us have entered these greatest forests of the world, in our own northern California. "Architecturally" they consist of long curving aisles between the giant columns of the trees, sometimes with spacious vistas opening to the sea; and the ground and the dark fluted trunks are patterned with shifting mosaics of sun and shadow. For long ages they have stood here in the rage of the winter rains that sweep down from the northwest. They have been wrapped about by the moisture-laden summer fog that drifts in from the sea and dips low among the green spires. So great is the moisture among the redwoods of the bottom lands that not only are the trees themselves wonders of growth and verdure, but they are draped with mosses and the ground at their feet is bedded with ferns.

It has been said that this tree, from the standpoint of its timber, is "too good to lose," and certainly history has proved it so since the white man first entered its home along the Pacific. The wood has all the qualities to recommend it for the uses of commerce; it is rich in color and takes a beautiful polish, the grain is even and fine, it is firm yet soft and easy to work,[2] it is

[1] This is the Sequoia gigantea [illegible] thanks to the eloquence of John Muir, whose [illegible] work was in the Sierra Nevada Mountains. And it is the great scenic feature of Sequoia National Park, one of the first of our national parks, established in 1890, the same year as Yosemite, and the first to be instituted after the Yellowstone in 1872. The greater number of the remaining big tree groves are now under the protection of the National Park Service. On the other hand, the big tree, although it has received so much more attention and protection, is not so great in commercial [illegible] the redwood [illegible]

[2] [illegible]

Courtesy of Mrs. Edward L. Ayer

In Montgomery Grove above Ukiah.—It is hoped and believed that Mendocino County will buy the Montgomery Grove of redwoods. This would make the town of Ukiah the entrance to the great scenic State Highway through the redwood region. Isolation of the United States during the war has emphasized travel within our own boundaries, while rapid development in the ease of motor touring has added a new possibility to such travel for all. Northern California will now find it to the advantage of the many among its population to save its scenic beauty. Meager profits from redwood lumbering for the few lumbermen among its citizens will no longer be considered adequate return for the present desolation and future poverty of the country

Courtesy of Mrs. Edward L. Ayer

Luxuriance of growth in a redwood stand near Mendocino.—Sonoma County has taken a step in the right direction in purchasing the Armstrong Grove; Humboldt County has very recently bought up the holdings of operating lumbermen along the State Highway; Marin County fortunately has been presented with the Muir Redwoods on Mount Tamalpais, by former Congressman William Kent, of San Francisco; but the world has yet to hear from Mendocino and Del Norte counties that their enthusiasm and patriotism have saved valuable sections of local redwoods almost fireproof—and in addition to all these good qualities, it is incomparably durable. It is said that trees which have lain five hundred years on the damp ground in the forest have been carried to the mill and made into good lumber.[1]

Do we need to ask if our redwood forests are economically worthy of preservation? Or can we question that they should be removed from individual and corporation interests which must perforce look to an immediate gain in order to realize on investments? Under the ownership of state and national governments, experts in forestry can *keep them forests* while still making them yield a product of timber.[2]

Hundreds of thousands of acres of redwoods have been cut during the last sixty years. San Francisco is largely built of redwood. The whole state is a land of redwood bungalows, paneled and beamed with the choicest grains of the wood,—which is good, except that on an average one half of a tree has been wasted for every one half used, and all the young trees which grew near the mature trees cut have been killed. Especially during the last thirty years, since improved equipment came in, redwood lumbering has proceeded with disastrous speed, and the wood has been used not only for construction and finishing, for shingles and grape stakes, but also for a multitude of other things, among them telegraph and electric light poles, paving blocks, and water tanks. And now recently, because of a scarcity of available timber brought about by the war, the United States Railroad Administration authorized the use of redwood for railroad ties. This, coupled with the building of the roads of the new California State Highway through some of the best of the remaining northern redwoods, started an army of small contractors into lumbering operations, with resulting destruction and waste.

Such was the condition in the early summer of 1919 when Colonel Graves, chief of the United States Bureau of Forestry, and Secretary Houston, of the Department of Agriculture, visited Humboldt and Del Norte counties and impressed upon the people the irreparable loss they were sustaining. It was still the situation in July, 1919, when the "Save the Redwoods League" was organized at San Francisco under the spur of interest of various public-spirited men (see page 605).

The Redwoods League National in Scope

The Redwoods League has the support of the national and state governments, and is national in scope.[3] Although its Council is made up mainly of influential men from California, it includes also prominent representatives from the East.

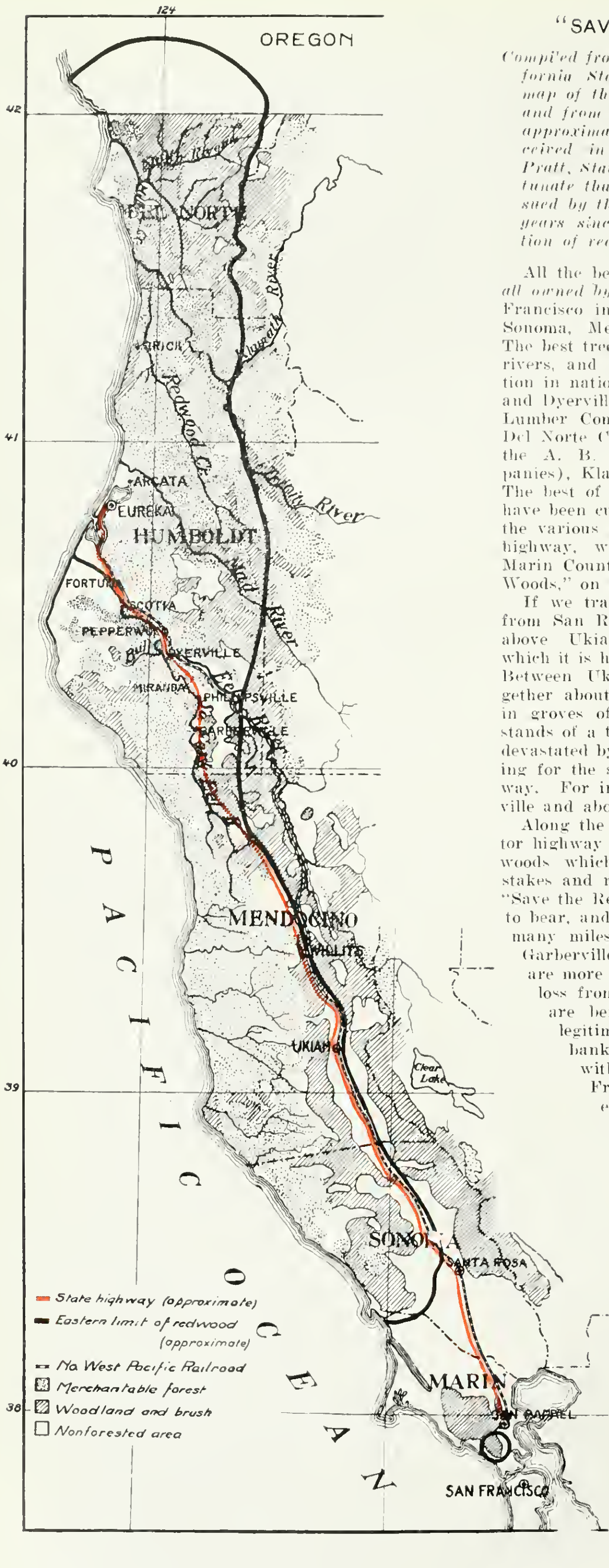
One of the first steps of the League was to call the attention of the United States Railroad Administration to the injury to the California State Highway by the cutting of railroad ties along its margin. At once the Administration issued an order that no ties should be purchased from areas which would come within the proposed reservations, or

[1] Bureau of Forestry, *Bulletin* No. 38, "A Study of the Redwood," 1903.

[2] That this can be done is largely owing to the fact that the redwood is an active dominant type of tree although of such ancient lineage. It sprouts vigorously from the stumps when cut, soon forming great circles of tall young trees. Circles of mature trees with the central stump no longer in existence are found in the primeval forest, indicating that this has been the method of growth. It is probable that, if the redwood lands can come under government ownership, such second growth forest with proper management can be made to supply a large part of the demand for redwood timber, and the primeval forests be left undisturbed except as certain trees may need to be removed for the health of the others.

[3] The story of the work and aims of the Redwoods League and of the survey of the northern redwoods which was made under its auspices is told by Mr. Madison Grant, a member of the Council of the League, in the September issue of the *Zoological Society Bulletin* of New York—an article which carries the interest and conviction of authoritative knowledge.

Many of the facts in the accompanying statement of the situation of the various groves and forests and of the plans for their conservation are taken from the typewritten Official Report of the Survey made under Mr. Stephen Tyng Mather, director of National Parks, and from Mr. Grant's article.



"SAVE THE REDWOODS" MAP

Compiled from the 1916 geological map of the California State Mining Bureau, the 1911 forest map of the California State Board of Forestry, and from data regarding the state highway and approximate eastern limit of redwoods, received in December, 1919, from Mr. M. B. Pratt, State Forester of California.. It is unfortunate that a 1919 forest map has not been issued by the California Board, because the eight years since 1911 have seen appalling destruction of redwoods, especially bordering the sea

All the best redwoods remaining (and *they are all owned by lumber companies*) are north of San Francisco in the coastal counties of California—Sonoma, Mendocino, Humboldt, and Del Norte. The best trees grow on the bottom lands along the rivers, and those especially adapted for preservation in national or state parks are the Bull Creek and Dyerville stands (owned mainly by the Pacific Lumber Company) in Humboldt County, and in Del Norte County the Redwood Creek (owned by the A. B. Hammond and Sage Lumber Companies), Klamath River, and Smith River stands. The best of the Mendocino and Sonoma redwoods have been cut, some very recently; it is hoped that the various groves left, especially along the motor highway, will be set aside by these counties. Marin County has no redwoods left, except "Muir Woods," on Mount Tamalpais, near San Francisco.

If we travel northward on the State Highway from San Rafael, we find the first redwoods just above Ukiah—the small "Montgomery grove," which it is hoped Mendocino County will purchase. Between Ukiah and Bull Creek there are altogether about 10,000 acres of redwoods, scattered in groves of a few acres with occasional larger stands of a few hundred acres, most of them badly devastated by lumbering and fire but all worth saving for the sake of the attractiveness of the highway. For instance, there are 5 acres at Phillipsville and about 500 acres near Miranda.

Along the South Fork of the Eel River the motor highway runs through some extremely fine redwoods which were rapidly being cut for grape stakes and railroad ties until the influence of the "Save the Redwoods League" was recently brought to bear, and which are still threatened along very many miles of the highway. In fact, between Garberville and Eureka, lumbering operations are more or less in full swing, and the nation's loss from waste and fire in the forests which are being cut about equals the loss from legitimate uses of the timber. The right bank of the Eel River below its junction with the South Fork resembles devastated France, and the devastation is complete everywhere on the left bank also except for one fine stand just beyond Bull Creek, which belongs to the Pacific Lumber Company.

There is need for immediate action if the last of these most ancient and heroic trees are to be saved. Who will dedicate a redwood grove to the health and happiness of the American people? The lumber companies offer every coöperation in selling for such purpose

Scale

10 0 10 20 30 40 50

Miles

10 0 10 20 30 40 50 60 70 80 90

Kilometres

within four hundred feet of any state highway. This is the federal coöperation we should expect and explains that the situation was not previously understood.

Situation of the Redwood Forests

A survey of the northern redwoods was at once inaugurated by the League, especially with reference to the selection of a suitable area for a national park.

The survey (August 5 to August 10) was made by Mr. Stephen Tyng Mather, director of National Parks, and Mr. Madison Grant, accompanied by Mr. Charles Punchard, landscape engineer of the National Park Service. On the way northward from Ukiah to the junction of the South Fork of the Eel River with its tributary Bull Creek and with the main Eel River, the surveying party passed about ten thousand acres of redwoods (see map). These are in groves of a few acres each with occasional larger stands of a few hundred acres,[1] many of them badly devastated by lumbering, most of them pitiful remnants of the original forests, but all of vast importance from the standpoint of the attractiveness of the highway.

Northward beyond these scattered groves are more nearly solid stands grouped naturally by the drainage of the region into great forests. Prominent are the Bull Creek and Dyerville flats, culminating the northward stretch of the South Fork groves, Bull Creek at the west in the triangle between the South Fork and its tributary Bull Creek, the Dyerville forest at the east in the triangle

[1] It must be understood that one acre of forest even on the most crowded bottom lands means only about three dozen redwoods, 20 inches and more in diameter (known as merchantable timber), with about a dozen additional trees less than 20 inches in diameter. In the mixed forests on the slopes the number of redwoods to the acre may run below 25, inclusive of all sizes.

Officers of the Save the Redwoods League are as follows:

President, Franklin K. Lane, Secretary of the Department of the Interior
Secretary and Treasurer, Robert G. Sproul

COUNCIL OF THE LEAGUE

E. C. Bradley
Former Assistant Secretary of the Interior

William E. Colby
Past President of the Sierra Club

George M. Cornwall
Publisher, *The Timberman*, Portland, Oregon

Wigginton E. Creed
President of the Alumni Association, and Regent, University of California

William H. Crocker
Regent of the University of California, Trustee of the California Academy of Sciences

Frank S. Daggett
Director, Museum of History, Science and Art, Los Angeles, California

Joseph D. Grant
Trustee of Leland Stanford Junior University, Trustee of the California Academy of Sciences

Madison Grant
Chairman, New York Zoological Society

Henry S. Graves
Forester, Forest Service, Washington, D. C.

Willis L. Jepson
Professor of Dendrology, University of California

William Kent
Donor of Muir Woods, California

Stephen Tyng Mather
Director of National Parks

John C. Merriam
President, Pacific Division, American Association for the Advancement of Science

Ralph P. Merritt
Comptroller, University of California

Walter Mulford
Professor of Forestry, University of California

Henry Fairfield Osborn
President, American Museum of Natural History, New York

Charles F. Stern
State Superintendent of Banks, San Francisco, California

Benj. Ide Wheeler
President Emeritus, University of California

Ray Lyman Wilbur
President, Leland Stanford Junior University

Charles B. Wing
Acting Chairman, State Redwood Park Commission of California

The immediate purposes of the League are stated as follows:

1. To purchase redwood groves by private subscriptions and by county bond issues.
2. To secure a state bond issue to buy the finest redwood groves along state highways.
3. To establish through federal aid a National Redwoods Park.
4. To obtain through state and county aid the protection of timber along the scenic highways now in course of construction throughout California.
5. To encourage the state to purchase cut-over redwood areas for reforestation by natural means, or by replanting where repeated fires have made sprout reproduction impossible.

The fee for annual membership in the League is two dollars. "Membership is an expression of desire to support the plans proposed. It is hoped that through the cooperation of all organizations and individuals definitely giving their interest to this project the purposes of the movement may be realized while it is still possible to secure those ancient groves which now invite protection." Professor John C. Merriam is chairman of the Executive Committee

Courtesy of Mrs. Edward L. Ayer

IN THE LUXURIANT BULL CREEK FOREST

The hope is strong that the Bull Creek and Dyerville forests can be purchased for a state or national park. But the purchase will have to be accomplished, largely at least, by public subscription and donations of money throughout the United States. And it will have to be done soon, for these redwoods, among the best stands left, are owned by large and active lumber corporations. It is the need for immediate attention that has brought about the organization of the Save the Redwoods League (see pages 603 and 605).

John Muir said more than twenty years ago that large reservations of redwoods should be made in Mendocino and Humboldt counties. The devastation by ax and fire since then has been unbelievably great. Fortunately, however, through the efforts of public-spirited men we have been awakened at the beginning of 1920 instead of a few years hence when it would be too late. Now there are still remnants of forest worth saving

Courtesy of Mrs. Edward L. Ayer

IN THE EEL RIVER REDWOODS

No pictures, or words, can convey the attractiveness of the redwood forests. In combination with the majesty of size of the trees are many other features,—there are the fantastic forms of fallen tree trunk and upheaved root, the blending greens in ferns and mosses and tree foliage,—there are sunshine, the living air, the forest fragrance, the sound of wind in the branches,—and if the sea fog is shifting low among the trunks a fine mist falls upon the observer and veils everything in gray made by the junction of the South Fork and the main Eel. Then in order northward along the coast, the Redwood Creek forest, the Klamath River groves, and, just south of the Oregon boundary, the Smith River groves (see map).

The report of the committee makes it evident that all these forests, or a major part of each, should ultimately be made state or national reservations—national parks or forest reserves. The Smith River tracts are picturesque with old, weirdly shaped trees, and have good camping sites and good fishing. The Redwood Creek stand is similarly picturesque and is especially tropical and fantastic in its luxuriant growths of moss and ferns. In both of these areas the trees are larger and older than elsewhere, less adapted for good timber, and more suitable for park purposes.

Choice for Immediate Reservation

The Survey would direct the first purchase for park purposes either to the Redwood Creek Forest, or to the more southerly Bull Creek and Dyerville stands, connecting with the groves along the South Fork of the Eel River, 20,000 to 25,000 acres altogether. Bull Creek is described as a magnificent stand of about 10,000 acres, belonging in largest part to the Pacific Lumber Company, and the Dyerville forest has about an equal acreage. The Dyerville stand is sharply bounded on the lower right bank of the Eel River by land as devastated as the battle fields of France,—an urgent demand upon the observer to save what remains from a similar desolation. On the lower left bank of the Eel, however, is one of the best stands examined, about 20,000 acres, belonging also to the Pacific Lumber Company and with the new State Highway traversing it,—although it also is bounded beyond by devastated territory. If the great expense of this 20,000-acre tract precludes its purchase in the reservation of Bull Creek, Dyerville, and the South Fork areas, the Survey recommends its addition to these forests at the earliest date possible.

The Money for Purchase

That all these redwood lands are under the ownership of lumber companies means that saving them from the ax will be done only so fast as money can be found for their purchase. The survey committee gives seven suggestions as to ways by which the money may be raised—outside of direct federal appropriation.

1. State taxation
2. County taxation
3. Local taxation
4. Public subscription
5. Donations of money
6. Donations of forest lands within the redwood area
7. Exchange where possible of state or federal forests for private forests within the desired area

Action of the state of California is certain to rescue one or more of the large tracts. That of Dyerville Flat, for instance, is especially threatened at present by the operations of the Pacific Lumber Company.

It cannot be said that the state of California has been wholly indifferent to its redwood forests heretofore. More than twenty years ago $250,000 was appropriated to buy redwood land near Santa Cruz which remains today a state park. On the other hand, the state must be blamed for the unfortunate work of its Highway Commission in failing to get a right of way wide enough to protect the scenic effects along the roadway. In the future the need for the coöperation of a landscape engineer will be understood; also, that the right of way should never average less than three hundred yards. The Commission even went so far in certain areas as to buy only a one-hundred-yard strip of land *with the proviso that the owners remove the timber!*

Anyone who has lived even briefly in California can understand the loyalty of Californians to their homeland—apart from the influence of the great friendliness of its people and its prominent commercial position. Surely they may well ask if there is any sunshine like that which falls on California's valley meadows, and over her warm foothill slopes, and through the mist-draped redwoods against the sky. These things have profound influence even if we are not conscious of it. The public sentiment of the whole state has now been aroused to the danger threatening its northern forests, and Governor Stephens, the Legislature, and the people may be trusted for the result.

Humboldt County Purchases 800 Acres along the State Highway

As to county action there is already, since the formation of the Redwoods League, a definite story to be told. It is a story of activity on the part of the citizens of Humboldt County, coupled with personal generosity of two members of the League—as well as a spirit of coöperation which included members of the State Highway Commission and all the operating lumbermen. A matter of paramount importance was accomplished in early September when there was stopped all work of lumbermen directly bordering the highway under construction along the South Fork of the Eel River.[1] And now the deeds for the holdings are in the hands of the county. This gives immediate protection, for a part of the distance, to the narrow strip of the forest which contributes so much toward the beauty of the roadway—and also to its popularity through protection from sun and blowing dust.

County action has thus proved itself, and county and local money are certain to accomplish much, but cannot be expected to purchase the great tracts. The area occupied by the redwoods includes relatively small communities of people. It cannot be expected that the local population should carry the heaviest burdens of taxation.

Sonoma County had previously purchased one small grove of redwoods, the Armstrong Grove; and it is hoped that Mendocino County will buy the Montgomery Grove. This is situated just beyond Ukiah, on the west side of the State Highway, and if saved will, together with the town, form the motor tourist entrance to the northern redwood region.

Certain lumbermen among those owning the land have already made gifts to the state and others are certain to do so, but it is scarcely fair that they should be expected to be more generous than the rest of us. It speaks well for these men, who know the forests and their value, that they have already shown themselves willing to coöperate in a manner advantageous to the Government in any transfer of ownership. What the Redwoods League hopes for is not only gifts of redwoods from the owners in the proposed reservations, but, especially, gifts of redwoods owned, or purchased, in other areas, which can be exchanged for sections in the proposed reservations.

Let All the Nation Contribute

Public subscription and donations of money over the whole United States are among the most hopeful methods for saving the redwoods, and the quickest. But every means must be taken to spread a knowledge of the situation or it will not be possible to catch the thought and heart of the people in the complex condition of national and international affairs today.

All the people of the nation are concerned in the matter. So unique are the redwood forests and so especially fitted for recreational purposes that they should become possessions of all the people, looked upon with a sense of ownership by every American. As brought out in the report on the League's survey, in connection with the large expenditure necessary, "the resultant benefits from the area preserved will be measured in units more valuable than gold or silver—in health, in joy and pleasure from the recreational opportunities afforded, and in pride that we have saved these trees from the ax and the circular saw and that they belong to us and to our children forever."

As to direct federal appropriation, notwithstanding recognition of the need the process will prove a slow one in the present reconstruction period. Uncle Sam has usually designated national parks and forest reserves out of some part of the public domain; redwood conservation, unfortunately, is a case for purchase. Congressman Clarence F. Lea, of California, has presented a resolution to the House of Representatives calling for an investigation of the problem with reference to the establishment of a national redwoods park.

The following relative to federal action is quoted from a recent letter from Colonel Graves, chief of the United States Bureau of Forestry:

"I regard the movement as of very great importance and one which should be backed up by the entire nation. In many ways the redwoods represent the most remarkable forests in the world. They may not be quite as large as the giant trees of the Sierras but, growing as they do in dense continuous

[1]There have been many printed reports of the notable meeting held at Eureka, September 6. The small lumbermen who were operating along the Highway, cutting grape stakes and shingles, were brought together, and they agreed to suspend cutting for the sum of $60,000 and to give two-year options on their property. The county gave $30,000 toward the amount, Mr. Mather, $15,000, and Mr William Kent, $15,000. Mr. Kent had previously proved himself interested in the relation of these trees to the public welfare by presenting to the nation the Muir Woods on Mount Tamalpais.

A MAY DAY IN THE SIERRAS AT 5500 FEET ELEVATION

Redwood groves in the low altitudes of the Coast Range are never made inaccessible by heavy snows

Photograph by George J. Reichel

THE DRIVEWAY PASSES THROUGH THE BIG TREE "WAWONA"

Big trees of Mariposa Grove, "Wawona" probably 3000 or 4000 years old, height 227 feet.

stands, there is impressiveness which to me makes them unique among all the forests that I have ever seen.

"This splendid undertaking is going to be possible only through combined action of the Government, the state, and the public at large. As to the contribution of the Federal Government, it is very likely to be delayed and to come as aid to a project in which the state and the citizens of the nation are already liberally contributing."

What will appeal to the country as the thing to do in the necessity of the case is that we, each and all, shall purchase these forests as fast as we can, *for our own,* with money subscribed in small or large amounts; then, that we shall present them to Uncle Sam so that they may remain forever under his protection. This will be a definite recognition of the unitedness of government and people in America, and of the interest and generosity Uncle Sam has always accorded the people in the matter of the country's natural resources.

I am including in this article only photographs of the northern redwoods unmolested by lumbering (with the one exception, page 599). The frightful destruction continues.[1] It is not to be wondered at that the people of the northern coast area who see it going on about them and realize that their prosperity, their very existence commercially, depends on the maintenance of these forests, have awakened to the waste.

But the point is, the country is now awakened, after the many hundreds of thousands of acres are gone, and it is still not too late to save the tens of thousands of acres left. There is now, besides, a definite organization in the Save the Redwoods League to represent the people of the country and to handle money or gifts of land to the best advantage.

I would put emphasis, therefore, not so much on what is lost, as on what can be saved. There are parts of the northwestern highways where for miles the road is narrowed and blocked with piled grape stakes and shingles, and on either hand the ground is covered with a jumble of treetops, branches, slabs, and bark, which should have gone to the manufacture of some by-product. But also there are stretches where the roadway leads from open sunshine and distant views of green, wooded mountain slopes into the giant forest and on through colonnades of trees where the air is cool and fragrant and long beams of sunlight slant down through the green of redwood foliage.

Nor would I direct the gaze to the miles of desolate country where everything has been leveled and only charred stumps of giant trees mark the site of the forests destroyed. Instead I would bring to the imagination the acres of forests still uncut and the potential joy for Americans of today and tomorrow in their possession.

The war has made the surface of the earth seem smaller and all the lands nearer and the peoples nearer. If France and England and Belgium and Italy seem not far away from America today, how very close to all other parts of the United States is California! To go to the western coast, to tour through these northern forests is no longer the impossible dream for the many. It will be realized by tens of thousands of people in 1920.

The redwoods are not only the "glory of the Coast Range" and the pride of Californians, they are the pride and satisfaction of all Americans. Good luck will surely attend us if we save our Sequoia woodlands.

[1] See many full page illustrations in Mr. Grant's article, *Zoological Society Bulletin,* September, 1919.

Freeman Art Co., Eureka, Humboldt Count

CATHEDRAL AISLES—IN HUMBOLDT COUNTY, CALIFORNIA

The sunshine penetrates the roof of green far above and illumines the aisles between the giant pillars, imparting a effect of architectural grandeur. Redwood forests are the planet's vast cathedrals for the spirit of worship of its peopl Somehow—American money will dedicate these forest cathedrals to the American people

PHOTOGRAPHS OF LLEWELLYN GLACIER, BRITISH COLUMBIA, WITH FIELD NOTES

BY L. C. READ

PANORAMIC VIEW OF LLEWELLYN GLACIER, SOUTH END OF ATLIN LAKE, BRITISH COLUMBIA

Photographed August 10, 1918, from a point high up on Mussen Mountain, by Mr. L. C. Read, of Atlin. Mr. Read's descriptive notes, made on the occasions of his annual visits to the glacier, are presented under the photographs

Llewellyn is one of the largest glaciers outside the Arctic regions but so remote from routes of travel that it has received little scientific investigation; very few people have even seen it. This panoramic view is a combination of three negatives, showing about thirty by sixty miles of glacial ice nearly all of which is above timber line. Llewellyn Mountain in the distance at the left is about twelve miles away. To the left of this is the Sloko Range, Sloko Lake being at the foot of the heavy snow banks near the top of the range. In the lower left-hand corner may be seen the point where Mussen Mountain extends its forefoot into the ice field.

In the central region can be seen part of the firn or fountain-head of the ice region. The Pacific Ocean, about seventy-five miles away, should be visible from the summit at the center of this view, in clear weather. This whole area is far above timber line and consequently it may be that the ice is very deep in its central portion. The medial moraines (the two dark lines crossing the view) show the trend of the ice movement; they come to within two or three hundred yards of each other, then separate gradually until they are fully ten miles apart at the foot of the glacier.

At the right is seen a giant nunatak or rock mass, protruding through the glacier, with a fine cirque above two cascading glaciers which assist in bringing rock fragments and heaps of bowlder clay to the medial moraines.

It is supposed that the peaks of the firn are at least two thousand feet above the ice. The scene is so vast that this view gives but a very poor conception of the immense distances and dimensions.

I made the trip to Llewellyn Glacier and up on the south peak of Mussen Mountain in the summer of 1918, thinking that perhaps photographs of the glacier might be of value to students of the movement of glacial ice and medial moraines. Not often, certainly, has a camera stood facing the vast scene.

We made camp at timber line after leaving the ice, and spent the night on the mountain. Shadows of the peaks above and to the west of us slowly crept over the valley of ice, and the sky with its golden sunset colors of the North was particularly impressive. The lonely cry of the whistling marmot and the call of the mother ptarmigan sounded across the gulch, while continually from below could be heard the dull subterranean rumble of the stream under the ice. We saw a mountain goat for a few seconds before the night came, silhouetted against the sky. He stood on the highest crag, a dignified, contemplative figure, looking over the vast expanse of ice and mountain with no one to dispute his ownership. Soon darkness came and we went to sleep listening to the sound of the water beneath the bergs—while Vega, Deneb, and Altair, with the Northern Cross, stood watch overhead

LLEWELLYN MOUNTAIN COVERED WITH CASCADING GLACIERS AND COMPLETELY SURROUNDED BY LLEWELLYN GLACIER

The cascading glaciers on Llewellyn Mountain are very beautiful in the late summer when the snow has melted from their surfaces; this being the north side, the snow and ice melt slowly, while the south side is bare early in the season. In 1916 the whole ground moraine was converted into a quicksand. About the tenth of July there was a river fully a hundred and fifty yards wide where usually there is solid gravel that may be easily traversed. This photograph was taken in June before the waters flooded the moraine to any great extent. The ice front (seen along the middle of the photograph) is about three miles wide at this place. Llewellyn Mountain in the distance is twelve or fifteen miles away. The exceptionally clear atmosphere enabled me to obtain from a distance of several miles detailed views of the cirques, where accumulating snows had constructed "armchairs for the gods"

FROM LLEWELLYN GLACIER LOOKING NORTH

There is abundant evidence of former glacial action high up on the rocky sides of the mountains adjacent to Atlin Lake and far from any ice today. That the flow of the ice then was in the direction of the outlet of the lake seems well established by the tilt of the glacier-worn rocks. Atlin Lake is the logical head of the great Yukon River, and consequently the ice flow must have been to the north in the last glacial period

ICE ARCH ON LLEWELLYN MOUNTAIN

Photographed August 28, 1919, view from the north side

This great body of ice was thrust up on the side of Mussen Mountain by a lateral movement of ice years ago. A small stream from the mountain-side cut a channel through the ice where the arch is now, then took a lower course as the ice receded, leaving the arch to its own destiny. A heavy deposit of morainic material protects the upper part from the action of warm winds and sun but underneath the arch there is no such protection and the space has increased from year to year. For several years I had noted this ice but had no idea of its real nature. I remember seeing, some years ago, a stream of water coming through what must now be the arch, but, being about a half mile away, it was so hidden that I paid no attention to it

LLEWELLYN MOUNTAIN ARCH OF ICE, VIEWED FROM THE SOUTH

This arch is located about a half mile back from the ground moraine, near the present moat or space between the ice and the mountain-side (see page 620 for detail of moat). The ice evidently has been receding along this moat in the last few years. I am convinced, however, that the rate of flow of this glacier as a whole is slow. The great bed of the glacier does not seem to have advanced or retreated to any considerable extent since my first trip in 1911. I think that one hundred feet would cover all the recession. There is abundant evidence, however, that it has made a great retreat at some recent period, as the willows and alders show that their growth does not extend beyond twenty or twenty-five years. There are no forest trees on the present ground moraine.

The region of alimentation of Llewellyn Glacier is about halfway between the south end of Atlin Lake and Taku Glacier on the Pacific coast, estimated three days' travel by the Indians, seventy-five miles by white prospectors. The ice is continuous from Llewellyn Glacier to Taku Glacier. Llewellyn Glacier evidently ought to be classed as a through-mountain glacier of piedmont type. I cannot ascertain that the earthquake of 1899 had the effect of advancing this glacier, as it did the Hidden and others on the Alaska coast

SERACS ON LLEWELLYN GLACIER, VIEWED TOWARD THE SOUTH

This battalion of seracs or ice pinnacles, from 50 to 150 feet in height, was formed as the glacier cascaded over the rocky ledge which connects the bases of Mussen and Llewellyn mountains

THE ICE OF A PRIMEVAL WORLD

The bare rock forefoot of Mussen Mountain, where the rocky reef starts across the ice field toward Llewellyn Mountain.—This photograph, made by L. C. Read from a camp at timber line on Mussen Mountain (about 4000 feet above sea level), shows well the seracs at the upper part of the glacier mass (the left above) and the moat between the ice stream and the mountain-side

The Dawn of Art

By GEORGE LANGFORD

I

IN age remote when beasthood was in flower,
A race of broad-cheeked, big-boned stalwart men—
Vanguard of first full-fledged humanity—
Moved westward from the dark mysterious East
And settled near the bounds of southern France.
Beneath the shadow of the Pyrenees
Where caves and rock-walls served them to defy
Chill storm-wrath of the glaciers sweeping down
From Scandinavia and the Baltic Sea.
Bold spirits, these true pioneers of France,
Warriors of Crô-Magnon.

II

Troglodytes—cave men of the Old Stone age—
To whom the use of metals was unknown,
With flint-tipped dart and hafted palæolith
They fought the mammoth and rhinoceros
And matched their strength with lion, wolf, and bear.
Naught but the skins of beasts and gloomy dens
Shielded their nakedness, while kindled fires—
Divine bequest, the Staff of Human Life—
Guarded their thresholds from fierce prowling brutes
And furnished means to thwart the glaciers' chill—
Long-headed, high-browed, of five senses keen,
With human attributes deeply ingrained,
Hunters of Crô-Magnon.

III

All praise for those to whom meet praise is due,
Whose heritage inborn full well compares
With the Athenian Greek true ken of art.
How small their means and crude! Gravers of flint
For etching work, and pigments black or red
Laid over incised lines or bas-relief
Carved on the walls and ceilings of their caves.
The forms of beasts—not those of men—they drew;
None knew just why. Some mystic awe inspired
These ancients to portray their mural work
Not at the cavern's mouth but far within
The dark cramped depths befouled with slime and ooze,
Where none but bats and owls dared penetrate:
Where kneeling, crouching, lying prone to earth
Beneath low roofs, betwixt converging sides,
With fat-fed lamps of stone to light the way,
Laboriously they scribed each masterpiece
With flint-point on the mold-stained limestone walls—
Artists of Crô-Magnon.

Creating a National Art

By HERBERT J. SPINDEN

Assistant Curator, Department of Anthropology, American Museum

Nationality develops the essentially intellectual bond of common thought. Because of this common thought there is before the people of America the possibility of evolving an art which will represent a new complex of life, based on a philosophy of logical and mechanical efficiency, political equality, and personal service to society. The art to come which fittingly embodies these things will be our national art.

This art must be useful in itself and not a senseless load upon the utilities of the age, nor an empty gratification of vanity. It must be beauty in cotton as much as in silk, in copper as much as in gold. It will be joyous Romance and heartfelt Ceremony in our homes and in our streets, in our work and in our play, for the seven days of the week.

TRUE nationality has always expressed itself in art: we judge the nations of the past by the objects of use and beauty which they created. Likewise by our peculiar art shall the nations of the future judge us. But have we been able, up to the present time, to stamp a clear imprint of our collective individuality—or nationality—upon the things that we make and the thoughts that we think? And, if so, are we content to let the record of our achievement stand for all time on the qualities of form and ornament that now enter into our lives?

Most persons, thinking of art only as fine art and knowing the works of European nations where collective individuality is seen in literature, music, costumes, architecture, and many other things, will humbly admit that we have failed to produce in America a mass of works that fittingly embodies our national hopes and ideals. But art is more than fine art and therein lies the promise of our future. We have already laid the ground for coming excellence in ways which few consider.

The Length and Breadth of Art

Art, in its widest meaning, is man's expression or embodiment of his ideas of use and beauty in different modes and materials. If the emphasis is laid on use, the product is called utilitarian art; if on beauty, it is called esthetic art. But never are use and beauty entirely dissociated, for the utmost development of usefulness depends upon orderly construction, and the finest expression of beauty is necessarily organic. There are law and order in common speech as well as in poetry: there are qualities of form which please the eye while they administer to mechanical excellence, in the canoes, cooking pots, and automobiles of everyday life as there are, for instance, in marble statues of all but forgotten gods that we now regard as purely esthetic.

Of course these marble statues of ancient gods originally played an important and useful rôle in the life of the people to whom they are accredited, although to us they are merely beautiful. It was an intensely practical thing for the Greeks to bribe and flatter a god into bestowing his divine favor upon an individual or a city by pledging a statue in his honor, as they believed such means effective. And when to this idea of ensuing benefits were added religious awe, pride of place, and good craftsmanship abetted by competition of fellow workers, the marble monument found a quality greater by far than the quality of the man who carved it. Such art is not individual—it is communal. The attention of the Greek sculptor may have been directed toward the human body as an almost exclusive subject for skillful portrayal not because this is necessarily any more beautiful than the bodies of other animals, or plant growths, or shapes of land and sea, but because in the communal understanding the gods had human forms. Other cultural facts doubtless contributed to this specialization but the religious idea was foremost. If the great florescence of Greek culture had come a thousand years earlier, perhaps Hera would have been represented as a cow, like Hathor of the Egyptians, instead of as a stately woman. Under such conditions Greek art would have had a different scope and interest without a necessary decrease in esthetic qualities. In a word, every great expression of art has its roots in communal concepts, religious or otherwise, and the artist is at his best when he forgets himself and speaks for his people and his times. The frieze of Phidias was obscure architectural decoration wrought with sincerity in a place where the gods could see better than the critics. In the history of dead nations from least to greatest there was never art for art's sake, but always art for life's sake.

The Creative Civilizations

History shows comparatively few great civilizations that gave rise to high and original forms of art but it shows many lesser and derived cultures which were able to develop a considerable degree of individuality. Even among the great creative civilizations there are numerous features taken from earlier or outside sources. The type civilizations, upon the products of which must be based any statement of what a national art can and should be, are as follows:

1. Assyrian
2. Egyptian
3. Greek
4. Chinese
5. Mayan
6. Peruvian
7. Christian

In addition to these, mention may be made of the welter of signs and symbols strewn over the Far and the Near East by the great religious tides of Buddhism and Mohammedanism. Then there are the numerous specialized fields of decorative art spread across all the continents and down the centuries. For instance, there is the realism of Palæolithic art in ancient France and Spain, and its modern counterpart among the Bushmen of Africa. There are the Neolithic, Bronze, and Iron age cultures of Europe and the rich remains of pottery from various archæological provinces in America. Lastly, there are the various "culture areas" of the ethnologists among our present day Indians, South Sea Islanders, and African Negroes.

The term national art may, perhaps, be used in connection with these great creative civilizations but it must be admitted that linguistic bounds, which many persons hold to be the bounds of a nation, are exceeded in nearly every instance by cultural bounds. Community of thought is established more easily within a single language than across several languages, yet there are numerous instances where a single culture covers the field of several languages. A good example is that of the Pueblo Indians of the Southwest, the descendants of the ancient cliff dwellers, who speak four distinct languages yet have practically identical religious beliefs, art forms, and social organizations. We naturally think of imperialism and military conquest in relation to the spread of culture, but some of the most artistic peoples have been singularly devoid of the military spirit. Religious conversions account for the spread of significant and symbolic art in some instances and in other instances there simply has been expansion from the area of high culture into adjoining areas of low culture, a phenomenon known to anthropologists as acculturation.

Of the type civilizations already listed the Assyrian, Egyptian, Chinese, and Mayan are primary in features such as the invention of writing, and the development of elaborate religious and social systems strongly reflected in ceramics, textiles, and architecture. But, long before the foundation of these civilizations, must have come the inventions of agriculture which were independently achieved in the New and the Old World and which made possible a great increase in population and stimulated the growth of religious and social orders.

The Greek efflorescence had as its base the developed art, religion, and philosophy of the earlier civilizations in the classic field. It started from a higher level of positive achievement. Greek art is characterized by a cold, chaste realism which speaks to all peoples, but it is singularly weak in ornament and is practically devoid of the formal creations arising usually from a belief in beast gods, that are so important in the arts of Asia and the New World.

After the militant era of Rome the art of Greece passed into eclipse and was succeeded by the warm art of the Christians, which on the ornamental side drew many of its forms from the Bronze age and Iron age products of northern Europe. The Renaissance was a rebirth of classic form but not of classic spirit, although in the minds of many persons the most satisfying productions of the sixteenth and seventeenth centuries are really the full-blown flowers of Christian symbolism.

The political units of modern Europe have distinguishable products but none of them has a really great national art. The mere variation in languages creates a feeling of greater difference than actually exists. After all, language affects only a part of the art products of a country, and, at that, nearly all European languages belong to one great family.

The Substance of National Art

National art means more than an objective "complex" of design motives, or a mass of monumental sculptures formally related to history, or schools of painting with distinguishable technique. It means permanent and continuous expression of the ideals and emotions that characterize and unite the members of a large social group. Without this spiritual and intellectual content, art is nothing more than an assemblage of shapes and sounds which react harmoniously on sensory organs that are practically the same for all humanity.

Many artistic shapes of universal occurrence have come about for no other reason than that they express absolute esthetics in line and mass, just as various scales in music express absolute harmony in sounds. Among such shapes may be mentioned the fret, spiral, and swastika. Geometric art can be understood universally for the simple reason that it has no meaning but, instead, a sensuous appeal. Of course it can be given a meaning: sometimes one hears it said that the swastika is a sign of good luck and that the fret meander represents the endless wandering of the soul after death. Those universal shapes came into being in different parts of the world, as has been said, because they embody a simple and fundamentally artistic relation of lines just as the pentatonic scale embodies a fundamentally artistic relation of sounds. In one region these shapes may have been given the arbitrary meanings stated above, but such meanings are not inherent in the shapes.

Realistic art can be understood universally because it is frankly objective. Of course South American Indians might not understand a drawing of an elephant or a walrus, and an Eskimo would probably turn the picture of a palm tree upside down before he recognized it as the feather duster of the missionary. The first graphic art in the world, that of Palæolithic man, was realistic and rather finely so. But realistic art may have significance quite beyond the objective fact. To France the *fleur-de-lis* is more than a flower.

Conventionalized art, as it is often called, or formalized figures that have elements of realism and elements of geometric order, are more intellectual than either realistic or geometric art. They are not found among the lowest peoples but only among those who have ceremonies, religious beliefs, and so on, of fairly developed types, and their significance is relative, or cultural, rather than absolute. They constitute a positive contribution to the mass of human creations.

The esthetic quality of art will take care of itself if only there is a proper field and sufficient time for selection and the survival of the fittest. The eye and the ear are mechanical organs that naturally select shapes and sounds with certain physical characters. Moreover, many kinds of construction, especially in textile art, compel a fine quality of order in decoration. Besides this, animal and plant forms and even shapes of land and sea have esthetic qualities which are the direct result of the mechanical forces that operate within or upon them, with the result that finely realistic art reflects organic beauty in nature.

But before we can have a really national art we must express or embody a mass of national ideas and emotions in things of everyday life. We have solid ground to build upon and blocks for the building. Politically, the democracy that exists in America today is of a type and quality that has never existed elsewhere in the world. The old religion of rewards and punishments is giving place to a new religion of social service. Mechanically, we have wonderful new appliances to save labor and turn the energy of the hand into energy of the mind. In other words there is before us the possibility of writing into art a new complex of life, based on a philosophy of logical and mechanical efficiency, political equality, and personal gratification attainable only through service to society. The art to come that fittingly embodies these things will be our national art even though it spreads beyond our political limits and proselytes the world.

Out of Efficiency Comes Beauty

Out of efficiency comes beauty, that is the law not only of human art but also of that greater art seen in the refinement of all natural forms. Survival in the struggle for life among plants and animals is made possible by the proper correlation of many functions in the body of an organism which is, in effect, a complicated, self-operating machine. When the mechanism is perfect, the lines are good. An esthetic interest resides in shapes modeled for use.

The proof of the mechanistic basis of esthetics is manifold. In this connection it is interesting to read a passage from the ancient writings of Plato in which Socrates instructs Protarchus concerning the place of knowledge in the handcraft arts. After saying that little will be left if arithmetic, mensuration, and weighing be taken away from any of these arts, he continues:

> SOCRATES. The rest will be only conjecture, and the better use of the senses, which is given by experience and exercise, in addition to a certain power of guessing, which is commonly called art and is brought to perfection by pains and practice.
>
> PROTARCHUS. That is very certain.
>
> SOCRATES. Music, for instance, is full of this sort of thing as is seen in the harmonizing of sounds, not by rule, but by conjecture; and this is always the case of flute music, which tries to discover the pitch of notes by a guess, and therefore has a great deal that is uncertain and very little of pure science.

After two thousand years these statements come pretty close to the truth. But by "the better use of the senses" draftsmen discovered the facts of perspective drawing centuries before demonstration and proof of vanishing points and horizons were made by an English mathematician. Similarly the harmonies of sound were written down in scale music long before Helmholtz and others elaborated the facts that vibrations carry sound, and that harmony is due to mathematical correspondences between the numbers of vibrations in a given period of time. Some day, science, after gaining a proper understanding of the human eye as a super-delicate keyboard of rods and cones for the testing and selecting of shapes, tones, and colors, will be able to demonstrate exact rules of visual esthetics. In the long history of human art these rules are illustrated by the independent invention of the same shapes and color combinations in different parts of the world.

A close parallel may be drawn between the life history of the art of a social group of human beings and the life history of plant and animal families. Both are organic and have a long period of development and a shorter period of florescence. In the case of human art the cycle is completed in a few centuries while in plant and animal life it may take geological epochs. Conservative and radical forces operate throughout nature as they do in human art. If we take a given form embodying use, which may be a tool, a magical design, a plant, or an animal species, we find it modified, first by a continual refinement leading to a type form that meets the general conditions and requirements of life, second by a continual selection of special forms that meet special conditions. A canoe, for example, is refined until it reaches a shape that moves most readily through the water. Such a shape cannot avoid having an esthetic interest because it is orderly. But while such refinement leads to a type form, it is found that the canoe men have also been introducing changes in shape for sea-going canoes as contrasted with those for river navigation. Usually there is a new factor of mechanical advantage entering into the question. Differentiation in plants and animals is usually along lines of new mechanical advantage.

But specialization, while it strengthens in a special field, weakens in the general field of activity. Thus Palæolithic man had at first a stone tool that came to have pretty definite shape and which he used to chop, cut, and drill with. Later special shapes were developed for these special uses but general efficiency was lost in the process. In other words it was more difficult to chop or cut with the drill form than it was with the original undifferentiated tool of all work.

In any case esthetic qualities come into a form which is developed by and for use. There is a point of fine balance and after that the quality of esthetics in an object becomes a growing danger. Biologists recognize as "end products" many highly specialized plants and animals which have developed esthetic characters along with their adaptations to narrow conditions. Such esthetic characters are iridescence and similar bright color effects, spines, and other fantastic excrescences, and extreme convolution or attenuation of the body. Among plants the orchid family shows many examples of extreme specialization in life associated with strange shapes and colors, and among animals, the many-chambered nautilus is analogous. These are about to die, as the sea lilies, trilobites, ammonites, brachiopods, and giant lizards have already died through over-specialization, leaving only a few of the more sturdy members to represent the family.

The life story of human art on the esthetic side is from strong simple forms associated with use to complicated and flamboyant forms in which the usefulness is largely suppressed. Then comes the end. There is flamboyant Greek art, flamboyant Gothic art, flamboyant Mayan art, all showing the same tendencies that parallel the end products of natural history. Out of efficiency comes beauty, and out of beauty comes death.

The Art of a Mechanical Age

It has never fallen to the lot of any nation to give to the world so many new ideas in processes, machines, and constructions as we of the United States have given in the brief span of our history. Invention has been riot among us ever since the English officer observed that the children on Boston Common breathed in freedom from the very air. Our faculty of doing new things unthought of before, or of doing old things in new ways, is essentially a social phenomenon coming out of the release from traditional restraints. The citizens of the United States of America have shown a collective quality of mind as regards mechanics, which does not owe its origin to any particular line of blood or training. That something "from the very air" infected John Ericsson no less than Robert Fulton, and it continues to infect the heterogeneous sons of a hundred Old World nations who come to our shores to build new homes in the sunlight of a new philosophy.

The decoration that goes into the lives of people in this mechanical age must be largely produced by machinery: but it must be given spiritual and intellectual content. We may wink at Homer and take our designs where we will, but we must fill these designs with the spirit of our own times. There is work for great artists, and those who regret they could not learn their trade at the feet of Phidias or Michelangelo need not apply.

There are still many persons in America who judge art by three tests when only one is necessary. For them, a thing to be artistic must be rare and costly as well as beautiful. As a result of this curious kink in appreciation the industrial art of a previous epoch is to these people fine art while that of today is not. An invidious distinction has been fostered in the public mind that objects of art, passing into quantity production, necessarily lose fineness and spirituality and take on a smell of machinery.

It is true that to have fine art you must have the scrutinizing care of fine workmen over their product. But there have always been machines and each age has used the best it could devise. The sculptors of today model in impermanent materials and then turn the making of the permanent copy over to an artisan operating a power-driven chisel or to a bronze founder who knows the technique of casting metals.

There are class distinctions among artists which have come down from the days when princes were patrons and which hardly belong in a democracy. A portrait painter is put on a higher artistic plane (quite aside from the merits of his work) than a maker of costumes who may administer to the same personality for a comparable reward. One kind of art is condemned as regards the higher values of appreciation by being called commercial and the other vaunted as noncommercial. The distinction is no longer a real one. As to the relations between emotional expression and money, everyone has heard divergent sentiments like the following: "No real work of art was ever made for money." "Poor man, his finest efforts were potboilers." There is a great deal of false sentiment concerning artists. They are nothing more than specialized workers, like physicians, lawyers, and scientists, and they earn a precarious or magnificent livelihood by a display of individual ability. But there is also splendid romance amid the whir of wheels, or where the cantilevers reach out to join hands across the river. There are men in all walks of life who have faith to follow airy voices and logic to prove the impossible easily possible. There are master workmen in mills and factories who, while they recognize the master workmanship of a distant past, see in it only a spur toward greater achievements in the future.

Has decorative art a practical value in commercial products? In the naïve minds of savages designs are often regarded as magical devices to bring good and ward off evil, and as continuous prayers to the gods. I like to think that decorative art is still magical and able to fill dark places with sunshine. But the business man often wants practical value counted out on the table. Successful decoration adds distinction to any product. American textile houses during the last four years have learned how to add good decoration to good construction. As a result American silks have sold in Paris, and selling silks in Paris is like selling coal in Newcastle. With such a guarantee of artistic quality, should we not sell to the most discriminating buyers both at home and abroad? Artistic quality in the goods of commerce means a higher proportional value of mind and a lesser value of material in the manufactured article. Where the raw materials have to be imported as in the case of silks, fine pottery, and the like, it behooves the manufacturer to enlarge the proportional value of workmanship in the completed product.

Art education in America has until recently been in appreciation rather than in production. The most successful artists in textiles and costumes have come out of commercial workshops rather than art schools. But the schools are better capable of inculcating a sound and fundamental philosophy of art than are the workshops. The youth of America should be taught that only the good is beautiful and that only normal and organic ornament deserves praise. Let the slogan be "Beauty is as beauty does."

Symbols and Loyalties

Because man is a herding animal he cannot avoid community loyalties. There are the family, the tribe, the nation, each based upon a larger and larger idea of coöperation. There are also other human associations that fall outside the three already mentioned and that compete with them for a share of loyalty and support. For instance, secret societies and lodges are found among both primitive and civilized peoples; there are ceremonial organizations of warriors, hunters, and medicine men; there are masons' and drapers' guilds, granges, trade unions, clubs, and political parties. But as a supreme human group the nation goes far beyond the primitive bond of blood or the selfish bond of common vocation and develops the essentially intellectual bond of common thought. For a civilized people the first of all group loyalties should be loyalty to the nation, and this becomes stronger as symbols are invented to express it.

The flag is preëminently a symbol of nationality, and other symbols are public buildings and utilities such as highways and wide-arching bridges, which give a sense of common ownership stretching beyond narrow acres. And there are many other subtle or direct symbols that unexpectedly voice widely felt but inarticulate desires. National art brings about social amalgamation whether the means of expression be slogans and rallying songs, monuments, parades, uniforms that put rich and poor in the same rank, or simple objects of use and beauty, such as costumes, flower jars and fountain pens, that build up an understanding of life which is good, true, and of our own times. With common thoughts as warp and weft a strong fabric may be woven which shall become truly beautiful as it is embroidered with deeper and deeper emotions.

And loyalties that are developed through art, what part may they take in the political life of a people? It is strangely true that loyalty thrives on the very duties and sacrifices that its existence makes practicable. If an organization, great or small, does not demand service of its members it can hardly continue to exist. The success of revolutionary movements in art, politics, or religion is measured by the degree in which the individual is made to feel his submersion in the group. Always there must be symbols, like the carved fishes in the catacombs, to lighten the hours of trial and torment and to record permanently the hours of joy and triumph. The nation is best equipped to exert its full power for progress and production when it can oppose the forces that would undermine its hold on individual members, by loyalty that is personal, concrete, and pictured in every mind.

We hear much of internationalism. Perhaps this means sympathy and a sense of justice among nations and a *modus operandi* of securing these things. Nationalism divides mankind geographically and develops vertical loyalties that unite different classes of society into an organic whole capable of diversified production. There is, of course, always the danger of conflict between two nations just as there is between two individuals. But if internationalism means a horizontal division of mankind on the basis of class, with the threat of conflict above or below, it can offer no advantage to the world. History indicates that the nation is the largest association of human beings capable of having and adequately expressing communal ideas of use and beauty. It may expand far beyond the limits of blood and speech and may, perhaps, even encompass the world. Let there be friendliness between political units by all means but let there also be refreshing contrasts in thought.

A truly national art will express and extend the joys and satisfactions of the people as a whole; it will awaken a consciousness of universal sympathy, and put new purpose and beauty into many lives. The esthetic art will be organic and useful in itself and not a senseless load upon the utilities of the age, nor an empty gratification of vanity, nor a mere sensuous tickling of nerve ends. It will be beauty in cotton as much as in silk, in copper as much as in gold. It will be joyous Romance and heartfelt Ceremony in our homes and in our streets, in our work and in our play for the seven days of the week.

POSTSCRIPT

SINCE the preceding article was written the first general American exhibition of textiles and costumes, illustrating the splendid advances in industrial decorative art during the last six years, has been held in the halls of the American Museum of Natural History. The exhibition developed the value of first principles in construction and decoration even where commercial vogue in fabrics and women's clothes is concerned. Historical sources were shown for the machine, for the design, and for the costume.

The great roaring machines of today are but the logical extension of mechanical parts and principles known of old, weaving in some form or other is as old as human society, and there has always been personal adornment forming a basis of the costumer's art. The Jacquard looms, with their busy shuttles and myriad harness strings, bewilder with a multiplicity of detail. Yet the essential features can nearly all be seen in simple machines used by Philippine tribes. All the types of weaving, as well as many methods of decoration, such as cylinder printing, block printing, warp tie-dyeing, batik, embroidery, appliqué, and steneiling, are found among the lesser and earlier nations. The modern designer and artist cannot afford to neglect fields in which the fittest and finest have been determined by centuries of selection.

The special contributions of our age are new sources of power to replace the muscles of man, new possibilities of collection and distribution that bring us materials from afar and that send our made products across the limits which divide nations, and, lastly, new horizons of suggestions and inspiration for our ideas that are practicable and profitable.

In five or six years America has come a long way toward developing an adequate expression of her artistic individuality. But this progress has been in the shops rather than in the schools. It has come from a use of facts, not theories, and from an objective study of the relations between form and ornament, between the technical process and the design. The examples of applied art in the various museum collections have aided in this forward movement.

Behind all progress, however, there are human personalities. Always there are some men and women who see with an inner eye the things that may be and then with ingenuity and courage make them the things that are. It is not only to the new artists who have found success that praise should go for the recent advances of American industrial art and for the bright hopes of the future. Likewise a tribute should be given to certain definite individuals: M. D. C. Crawford, who established contacts between science and the trade and who wrote, talked, and clarified till the last doubt died; E. W. Fairchild, who put money and enthusiasm into a program of publicity when the skies were unpropitious; David Aaron, Albert Blum, Charles Cheney, Irving E. Hanson, Max Meyer, and Jessie Franklyn Turner, who from the first have joined their faith with ours and whose artistic skill and perception have stamped qualities of distinction on new products.

The problem now broadens to one of general education in the public and private schools of America. For the schools will be called upon to supply the industries with craftsmen whose minds and hands have been prepared for efficient service in the present world. The explorers and the pioneers have blazed a trail and marked a road. They have come with an earnest of accomplishment in their hands and an offer of experience and tested success that those who come after may build safely and grandly.

The principal exhibitors who coöperated with the American Museum of Natural History in the exhibition of Industrial Arts in Textiles and Costumes were as follows:

David Aaron & Co., Inc., embroideries
American Bead Co., Inc., dress accessories
A. Beller & Co., cloaks and suits
Emile Bernet, tapestry yarns
Blanck & Co., embroideries
Sidney Blumenthal & Co., Inc., velvets
Bonwit Teller & Co., tea gowns and negligees
Cheney Brothers, silks
Harry Collins, costumes
B. C. Faulkner, blouses
Marshall Field & Co., Inc., cretonnes
A. H. Flanders & Co., blouses
Funsten Bros. & Co., sealskins
Johnson, Cowdin & Co., Inc., ribbon weaving
Otto Kahn, Inc., fur garments
Kevorkian Galleries, oriental art
H. R. Mallinson & Co., Inc., silks
J. A. Migel, Inc., Jacquard loom
Marian Powys, laces
Ruth Reeves, batiks
Martha Ryther, batiks
Barbara Simonds, hand prints
Hazel Burnham Slaughter, batiks
Mary Tannahill, batiks
J. Wise Co., Inc., costumes
Women's Wear, costume books

The Museum gratefully acknowledges the assistance of many of these exhibitors toward the cost of the following photographic insert covering the exhibition.

SERIES OF PHOTOGRAPHS FROM THE FIRST EXHIBITION OF AMERICAN TEXTILES, COSTUMES, AND MECHANICAL PROCESSES

HELD AT THE AMERICAN MUSEUM OF NATURAL HISTORY, NOVEMBER 12 TO DECEMBER 1, 1919

LEGENDS BY HERBERT J. SPINDEN

YOUNG AMERICA IN THE RAIMENT OF OLD PERSIA

In former times each nation had its few special styles in dress and there were slow processes of refinement that operated upon these styles. Now dress is cosmopolitan, but cosmopolitan with an almost personal variation in detail. There are fundamental types that return in the vogue from time to time, and these go back to the old national styles. The wraiths of the past come and go like shadows—or shall we say silhouettes!

Kevorkian Galleries

A Bokhara Reproduction.—*Bonwit Teller & Co.*

Proposed Museum

Connected with the American

AMERICA has reason to be vastly proud of her recent progress in expressing beauty through the things of everyday use. The Exhibition of Industrial Art in Textiles and Costumes, covered in part by the series of photographs that accompanies this brief statement, disclosed new forces in American life. It disclosed a will of the people to work and think together, an ideal of individual satisfaction in the common good, a conception of the nation as the exponent of a philosophy of justice, industry, and well-being, and a recognition of the place of beauty and good craftsmanship in the things that men and women spend their lives to create.

Such emotional forces, engrossing society, are the surest protection against the doctrines of individual or class selfishness. When the national consciousness shall be duly expressed through all the little things that touch life, through garments and dishes and house furnishings, the great things will assume a new significance. And in bringing about such a realization what would be more effective than a great Museum of the Passing Today, which would stage kaleidoscopic expositions of those emotional qualities that glorify labor and serve as an educational clearing house of objective teaching in what is good?

A museum of commercial arts would, in effect, be a museum of the ethnology of today. It would be entirely justifiable from every scientific standpoint and would receive public support because of its direct relation to life in its broader aspects and to the special problems of arts and industries. Such a museum need not be involved directly in the competitive activities of commerce. It can reserve for itself a position above criticism as an umpire of the best in construction and decoration and as a teacher of facts and fundamentals.

The great arts into which decoration enters, or into which it may enter, involve tremendous values in men and money. Mention need only be made of textiles, costumes, pottery, jewelry, and house furnishings. All of these have their foundations set deeply in the arts and crafts of the lesser and earlier nations. It would not be proper to show such arts except in historical perspective and the American Museum of Natural History with its great collections from all times and all parts of the world is best able to furnish such a perspective. Moreover, this public institution has a record of solid achievement in its relation, first to industry, and second to education.

Let us imagine a large section of the American Museum of Natural History given over to the needs and uses of commerce. First there would be halls so arranged that the modern materials could be placed on temporary exhibition without risk or deterioration. Second, there would be more permanent educational collections covering the world range of definite processes. Third, there would be ample provision for classes in design coming from public or private schools and for professional designers coming from manufacturing establishments. Fourth, there would be scientific laboratories where special problems relating to fibers, dyes, pottery clays, cabinet woods, and so on, could be studied by experts.

After the Coptic.—*Bonwit Teller & Co.*

A STUDY IN SOURCES AND RESULTS

In this exhibit we see a clear demonstration of the use of art motives from all parts of the world in modern machine-made embroidery. The map in the foreground shows lines leading from Africa, Asia, Central America, and the islands of the Pacific to New York, and bears the story-telling label: "The world pays tribute of ideas to American art." Design, and sometimes colors, are followed, but materials and mechanical processes are different. Aside from the practical commercial value of new notes in decoration there is another practical value that comes from arousing the interest of craftsmen in their work

David Aaron & Co., Inc.

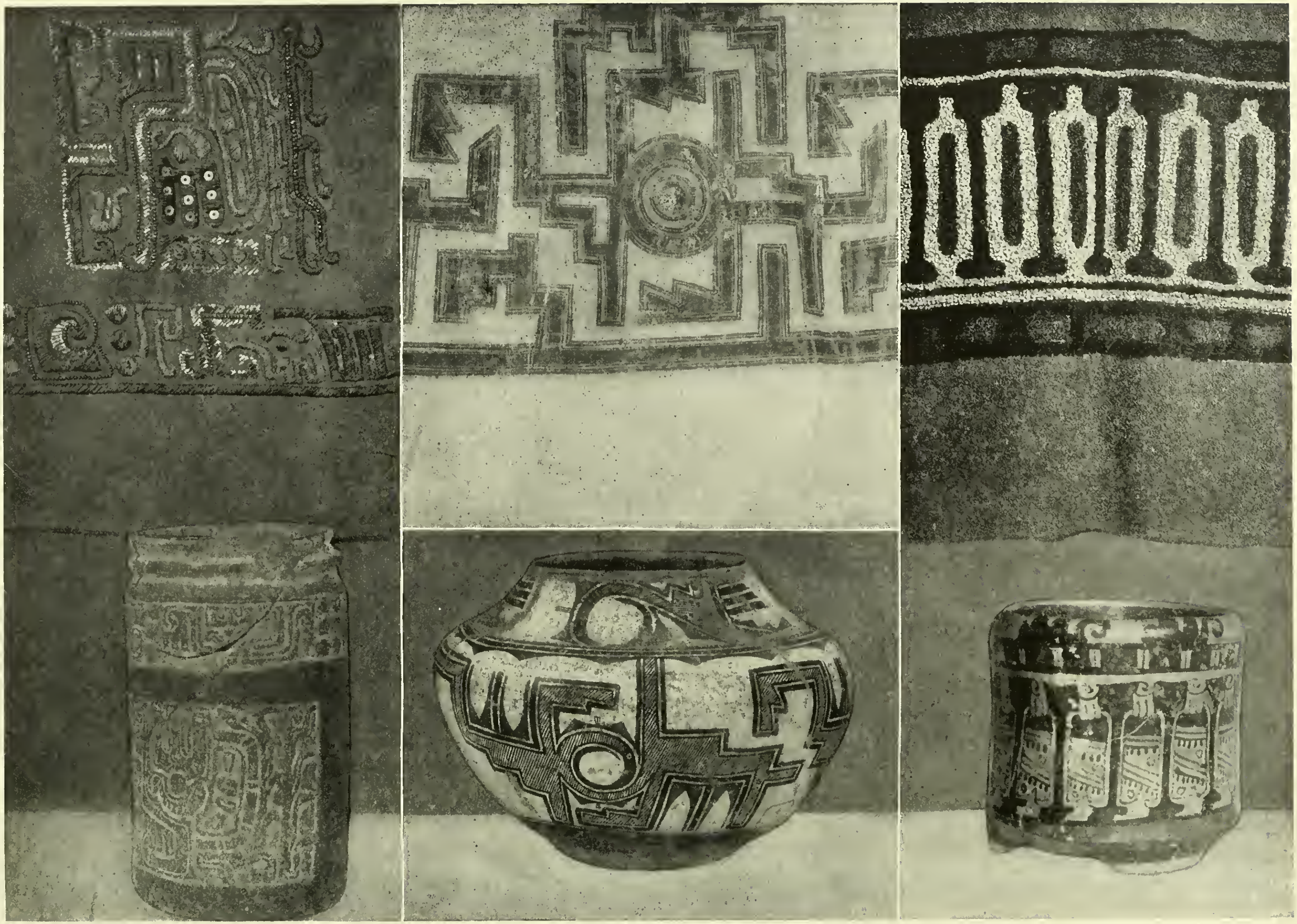
HOW THE CULTURE OF THE AMERICAN INDIAN MAY BECOME OUR OWN

There is something refreshing in the art of the American Indian. It is simple, direct and sincere; it is fundamentally good and all its possibilities of development have not been exhausted. Upon such art an education in good taste may be based. In the extensive series of photographs which the American Museum of Natural History has brought together for the use of teachers, students, and professional designers, stress is laid upon the decorative qualities that exist in the geometric and formalized motives of primitive art.

It is not the intention that the primitive motives should be used directly and without change or adjustment. Rather it is the hope that the primitive philosophy of art should be followed. According to this philosophy beauty is as beauty does. The decoration grows out of the construction and does not interfere with use or weaken the objects in any way. Instead, the decoration often actually strengthens, as when beaded strips are placed over seams or along margins in primitive garments. This primitive philosophy of art is one that Mother Nature herself follows. The blossoms of the wild rosebush grow organically out of the plant and perform useful functions. But with the excessive esthetic development achieved by over-cultivation, the qualities of usefulness disappear in the blossom. So too in art—there is a point of balance where fine efficiency is joined with fine decoration.

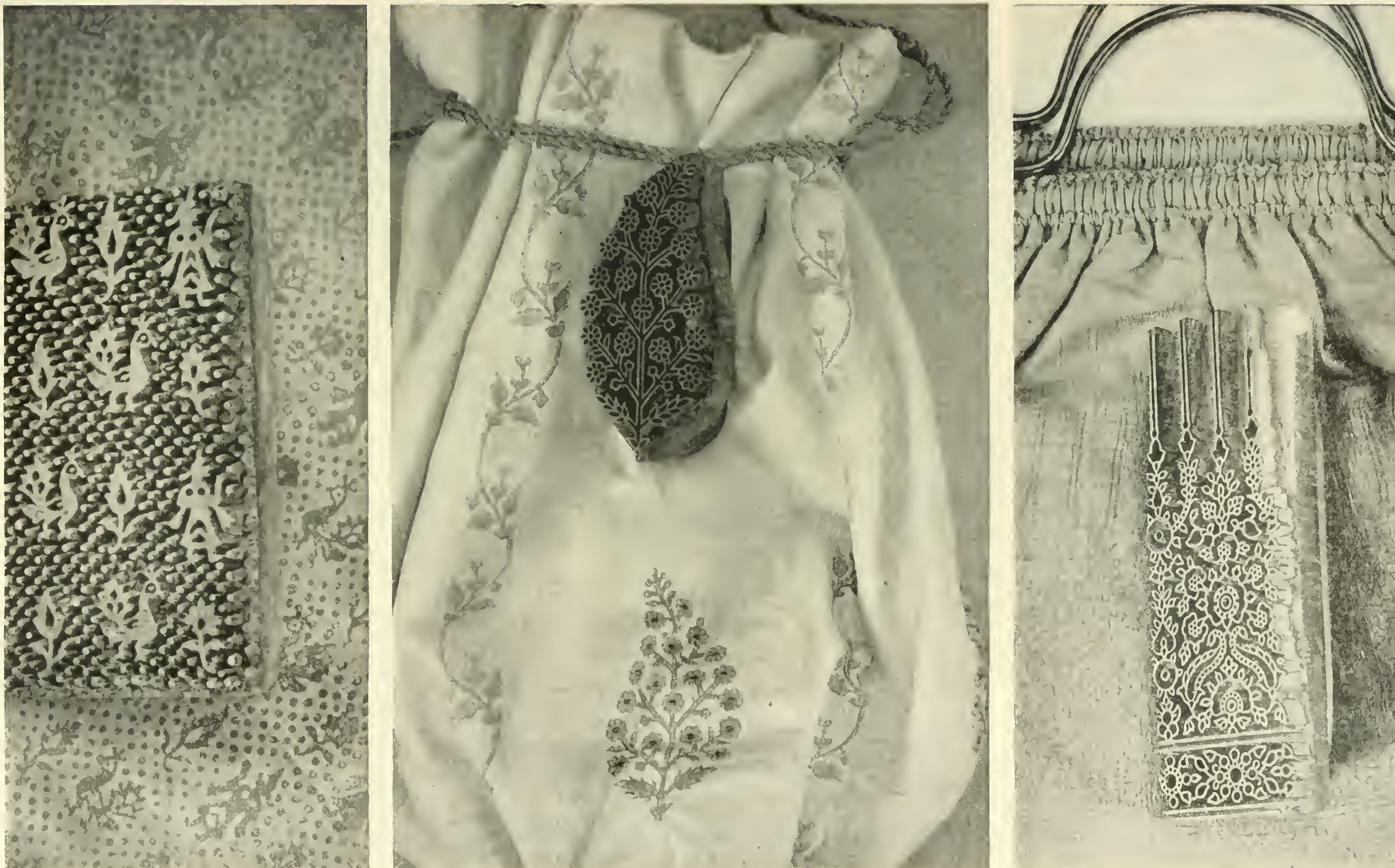
The acorn basket of the Maidu Indians of California furnishes a strong note of beauty that can be turned to many uses. Here we see an application in which the fundamental motive is applied in leather over silk. The development is accomplished by the use of beaded outlines and scroll work to fill in the open spaces

David Aaron & Co., Inc.



ADAPTATIONS OF POTTERY DESIGNS FROM CENTRAL AMERICA AND NEW MEXICO, IN EMBROIDERY

David Aaron & Co., Inc.



AMERICAN PRINTS FROM ASIATIC BLOCKS

Teakwood blocks from British India are here used to print designs on hand bags and other articles of New World use. In things of beauty America is the heir of all the ages—but she must learn to put something that is herself into whatever she accepts from the past

Barbara Simonds

COPPER CYLINDERS AND CRETONNES PRINTED FROM THEM

Cylinder printing was known to the Indians of Mexico, Colombia, and Peru, as well as to the Assyrians and Egyptians. Truly there is nothing new under the sun, for textile printing presses are looked upon as triumphs of modern engineering. And they are triumphs in the delicate adjustment of parts

Marshall Field & Co., Inc.

SINGLE AND CUMULATIVE PRINTS FROM CYLINDERS

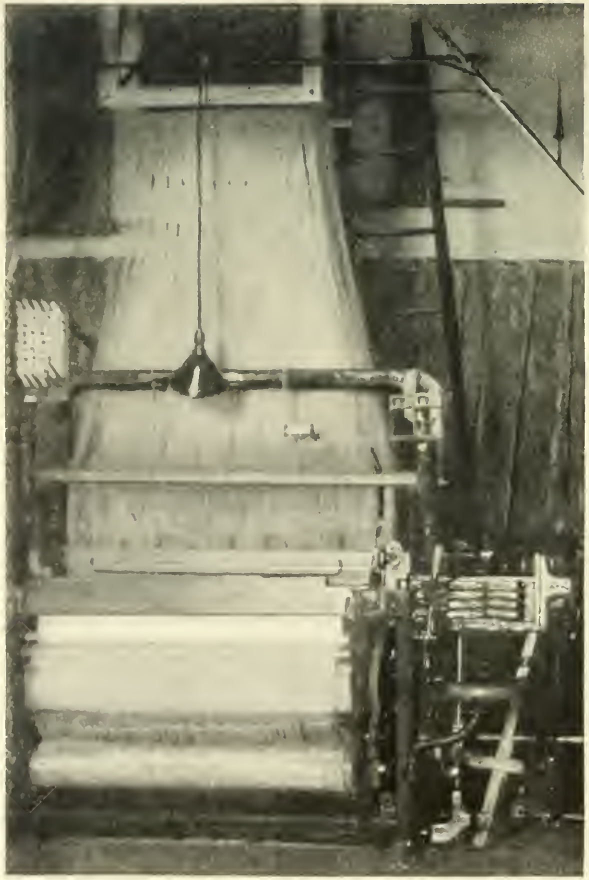
In roller printing of textiles there must be a separate cylinder for each color. These cylinders must be ground down to exactly the same diameter and in the machine the registration must be perfect

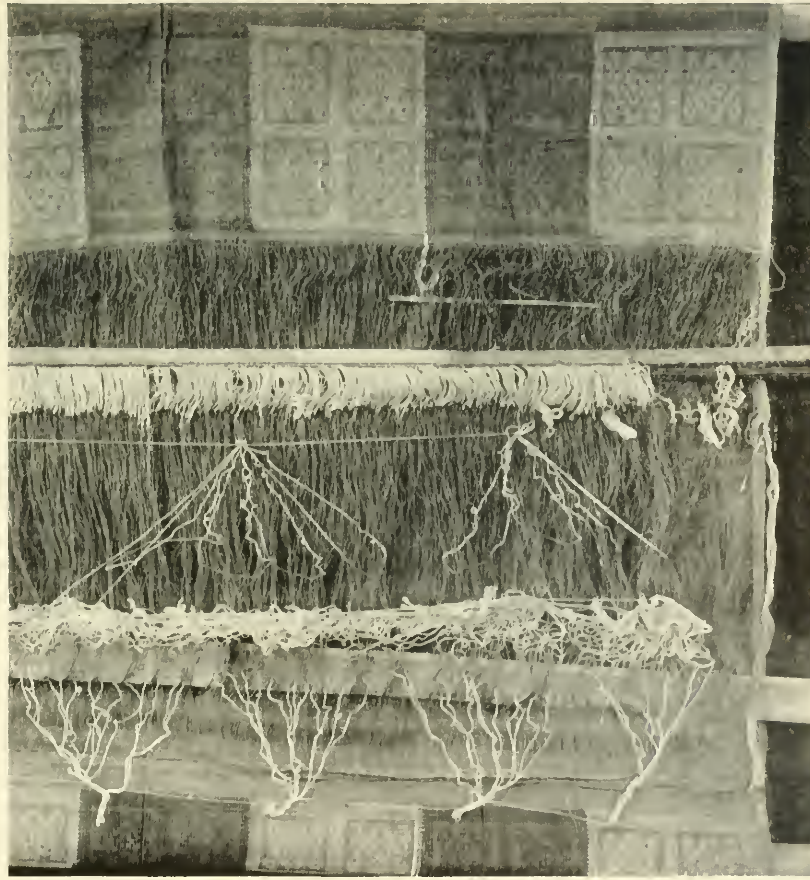
Marshall Field & Co., Inc.

BLOUSES OF MODERN AMERICAN CONSTRUCTION

In the popular blouses of today emphasis is laid on harmonious colors and on designs that have been refined to the point of simplicity. An effort has been made to relate the colors and the elements in the decoration to events in the world's history in accordance with primitive symbolism

B. O. Faulkner



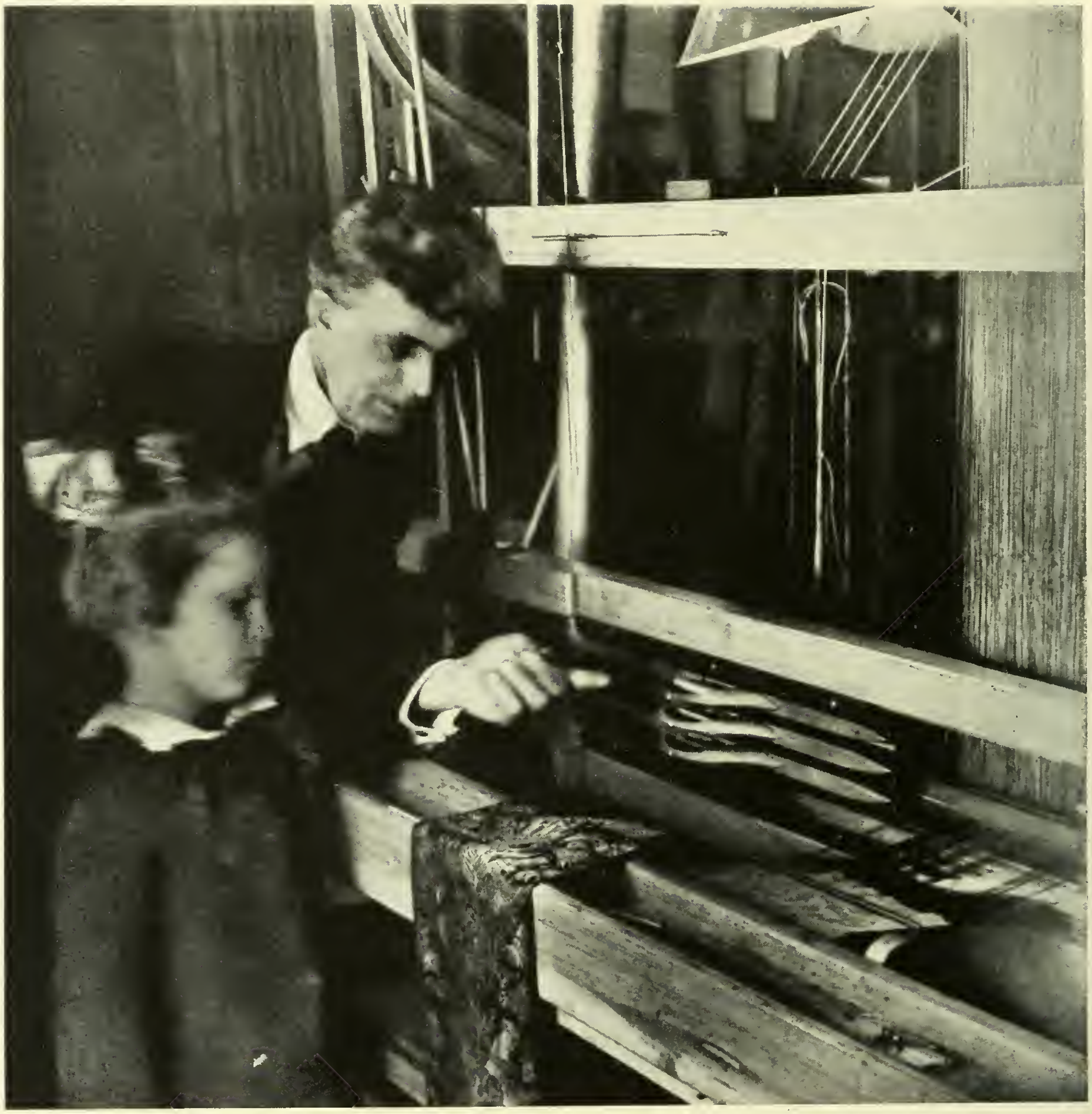


A JACQUARD LOOM AND A PHILIPPINE PROTOTYPE

A Jacquard loom (at the left) for broad silk, installed at the recent exhibition and operated by J. A. Migel, Inc., was a center of attraction. With rapid mechanical precision the shuttles were thrown back and forth, a myriad shining strings rose and fell and a long train of perforated cards traveled jerkily, carrying the design as a pianola record carries music. The effect was one of bewildering motion and multiplicity of parts.

Yet the essential devices of the Jacquard loom, with the exception of the perforated cards, are seen in looms from the Far East. The Philippine example chosen to illustrate these likenesses has many sets of leases, as the harness strings for the warp are called, and when these leases are lifted up in definite order, and the shuttle is passed back and forth in the space formed between the upper and lower warp threads, a complicated design is produced. The shuttle is a stick wrapped with the weft thread and the weaving is made tight by a "beater in," that resembles a wooden sword, or by a heddle very like that seen on modern looms

J. A. Migel, Inc.



SHUTTLES CAUGHT IN FLIGHT

The mystery of rapidly moving shuttles, spilling their spider's thread of color, was solved for this child and for many adults no less interested. In the ribbon being woven on the loom installed by Johnson, Cowdin & Co., the warp threads are black and the design is brought out through the use of four shuttles each with a thread of a different color. The lowermost shuttle is seen in the act of passing between the lifted warp threads and those that have not been lifted.

In the Jacquard attachment, which makes possible the weaving of exceedingly complicated designs, there must be a separate, perforated card for every weft thread that crosses the ribbon until the repeat in the pattern is reached. In the case of the ribbon being woven here there were 1200 cards. When the card reaches a certain place it is pressed against a surface of projecting pins. All the pins are pushed back except those that are in position to enter one of the holes in the card. In this way a mechanism is released that determines which warp threads are to be lifted so that the colored weft threads will appear upon the surface to form the pattern.

The narrow loom is used among many primitive nations in the weaving of belts and hair bands, which were the first ribbons. In America ribbons with beautiful patterns are found among various Indian tribes in New Mexico, Arizona, northern Mexico, Guatemala, and Ecuador

Johnson, Cowdin & Co., Inc.

THE GUATEMALAN HUIPIL AS A COSTUME TYPE

Three days south from New Orleans lies Guatemala where the Indian women wear gaily embroidered huipiles. These are simple, sacklike blouses but the designs are striking and the colors brilliant.

J. Wise Co., Inc

MOSAICS IN FUR MADE BY THE KORYAK TRIBE OF NORTHEASTERN SIBERIA

The Siberian tribes that are dependent upon the reindeer are the world's most skilful workers in fur. Their long coats are provided with a hood and with a high neck piece or collar that ties up under the chin when the hood is raised or is made to lie down flat over the breast when the hood is thrown back. The decoration on these garments is often a patchwork or mosaic of fur in contrasting colors. In the garment shown here it is estimated that there are nearly twenty thousand separate pieces carefully cut and sewed together

American Museum of Natural History

A COAT FROM SIBERIA AND A WRAP MODELED AFTER IT

The natives of Siberia are wonderful makers of fur garments. In the specimen shown at the right the material is reindeer skin with the fur turned in and the decoration consists largely of medallions of blue and white beads. The essential features of this Siberian coat are followed in the exquisite wrap of blue velvet trimmed with fur, reproduced at the left *A. Beller & Co.*

MODERN USES OF BEADS IN DRESS ACCESSORIES

In years gone by, a few handfuls of glass beads figured largely in the purchase price paid the resident Indians for Manhattan Island and surrounding territory. But how lovely were the necklaces and pouches which the Indians made from these beads. The vogue of beaded accessories to woman's dress has led to the use of numerous aboriginal designs. A special interest in beadwork lies in the fact that many soldiers disabled in the war have found in it pleasant and profitable occupation

American Bead Co., Inc.

A SUGGESTION FROM SIBERIA

It is a far cry from prepared fishskin to Fan Ta Si silk yet a wonderful fishskin garment from the Amur River in Siberia, decorated by the stencil and appliqué methods, gave form and character to this lovely gown

J. Wise Co., Inc.

EXAMPLES OF CLASSICAL REPRODUCTION

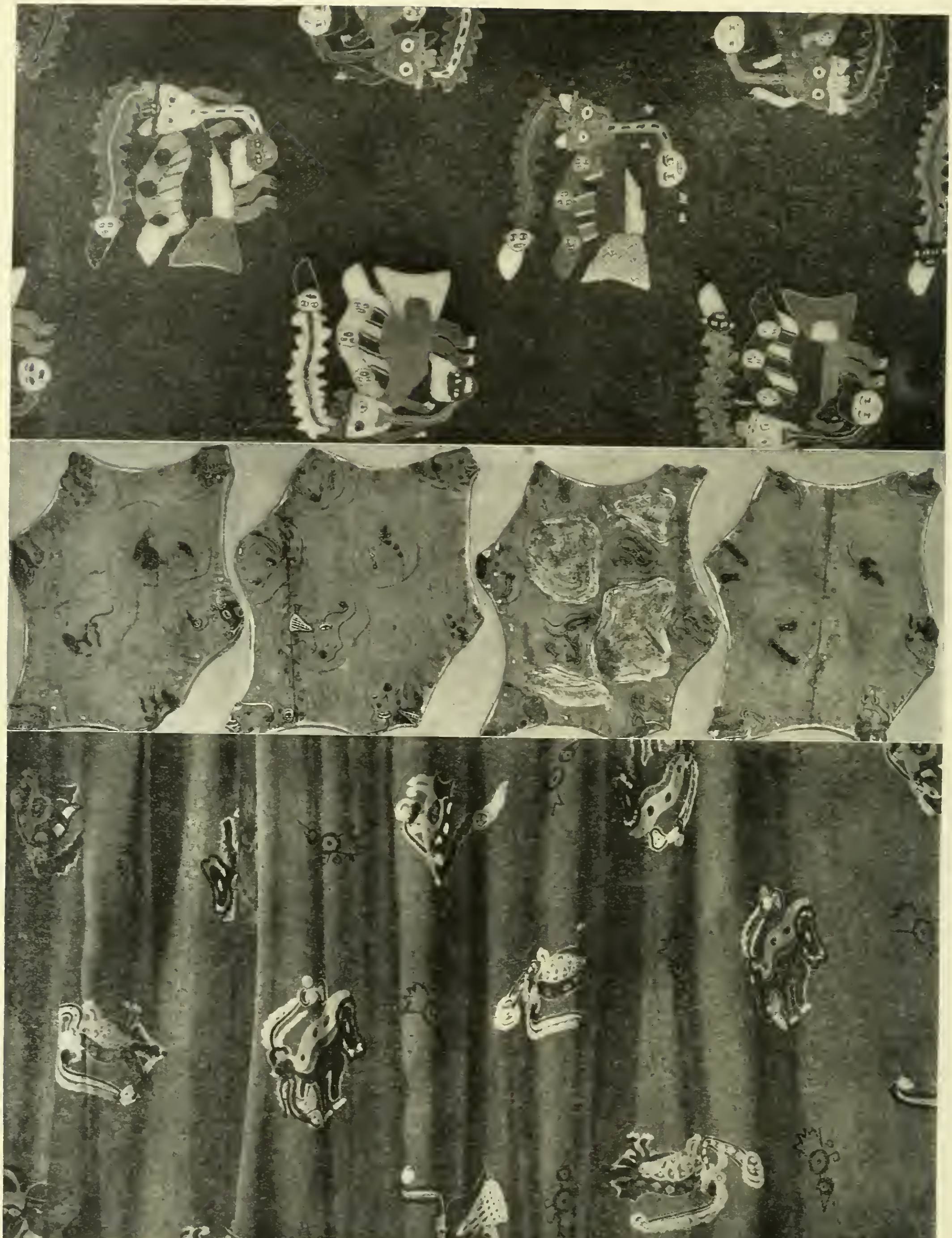
From the products of the Renaissance we may select an anthology of design that has great educational value. Particularly is this true of velvets and brocades. All the brilliancy of color and the perfection of construction that characterized the hand-loom work of Italy and France in past centuries have been reproduced on American machines

Cheney Brothers

A MODERN AMERICAN BATIK

"Batik is a wax-paint process making possible [illegible] It was used on ancient American pottery as well as [illegible]. The decoration on this graceful gown is in the spirit of South Sea Island art."

Mack [illegible]



A STORY OF ADAPTATION OF DESIGN THROUGH BLOCK PRINTING

Above we see a detail of an ancient Peruvian mantle with embroidered figures in soft but brilliant colors and below a commercial use of this design. In the central strip are some of the blocks used in the printing

H. R. Mallinson & Co., Inc.

A WOMAN'S DRESS OF THE PLAINS INDIANS

The Indian women of the Great Plains wore graceful dresses made from two deerskins. The decoration by beadwork and fringes grew naturally out of the construction. The lines of construction and decoration of garments as simple as this one contain suggestions of value to modern dressmakers *Harry Collins*

A COMMUNITY OF INTEREST BETWEEN NEW YORK AND THE PHILIPPINES

The Bagobo tribe of the Philippines make hempen jackets which they decorate with beads. A distinguished example showing how suggestions in primitive garments can be applied in the dress of today is seen in this graceful suit of brown cloth with decoration in brown beads. Note how the shape of the Bagobo jacket has been copied, as well as the little pockets, the strings in front that take the place of buttons, and the design that follows the edges and runs down the sleeves

A. Beller & Co.

CHILDREN'S DRESSES

A distinct field for development is to be found in the clothes of children. Here we see two little girls wearing adapta tions of Guatemalan and Philippine models. The colors are pleasing and the designs unusual.

The romance of design is one that children can understand better than grown-ups, at least in certain of its phase Children live in a state of make believe. Birds and beasts which never were on land or sea, but which appear in primitiv designs and perform in primitive myths, appeal strongly to youthful imaginations. Geometric art gives the chords and scal of abstract beauty, realistic art pictures the things that exist in the world, while formal or conventional art, growing, a it does, out of strange religions and philosophies, results in the creation of forms that have no existence except in the min of man

J. Wise Co., Inc.

A BLOCK-PRINTED CURTAIN FROM INDIA

Block printing and hand painting as means of decorating large surfaces in pictographic manner are finely developed in India. In the example we see a medley of more or less realistic details drawn out of all proportion to one another but with fine decorative effect

M. D. C. Crawford

An "Old Tramp" Among the Florida Keys

By CHARLES T. SIMPSON[1]

IN days gone by the only way in which a naturalist could visit the Florida Keys was by boat, but since the completion of the extension of the Florida East Coast Railway he can get off the train at Jewfish on Cross Key, tramp to Largo, Long and Windlys islands, Upper and Lower Matacumbe keys, Long, Grassy, Crawl and Vaccas keys, Bahia Honda, Big Pine, Torch, Ramrod, Cudjoe, Sugarloaf and a number of other islands of lesser importance, until he finally reaches Key West. By following the track of the railroad he will visit most of the principal islands of this interesting chain and will cross many miles of the wonderful causeway built across the sea. The stupendous arches carry a single-track railroad and are too narrow for a train and foot passenger to pass, but the company has built wooden cages hung out over the water at regular intervals along the viaduct, and the tramp can always reach one of these before the train passes.

I have been familiar with the Florida Keys since 1882, having resided in Lower Florida the greater part of the time since that date and from time to time I have made collecting and exploring trips among them. Now, although more than threescore and ten, I cannot resist the temptation to visit them occasionally in order that I may study their natural history and the geographical distribution of their life. Such a trip I undertook the latter part of October, 1919, running from my home near Miami to Big Pine Key by rail and making that island my headquarters while I visited the keys near by in a small boat. My outfit consisted of two suits of khaki—including the one I wore, an old, narrow-brimmed slouch wool hat, the best thing for getting through the thick scrub, socks, a high pair of strong canvas shoes, a coat, toothbrush, and some small sacks for holding snails. Instead of a grip, which is an awkward thing to carry through thick, tangled growth, I put my things into a large sack which I hung over my shoulder. A blanket, mosquito netting, and two-quart water can completed my stock. Fresh water can be obtained on the keys only at the cisterns of the natives or at the railroad tanks. Meager as this outfit was, it became a heavy burden when one tramped long distances on the railroad or through the scrub on a hot day.

The objects of my trip were to study the distribution of the tropical vegetation, make a list of the butterflies seen, and collect specimens of the large and beautiful arboreal snails belonging to the genera *Oxystyla* and *Liguus*. The snails were once abundant in the hammock growth of nearly all the keys but of late years are becoming scarce or are in some cases exterminated. The shells of all are highly polished; those of the genus *Oxystyla* are colored with various shades of brown; the *Liguus* are white, yellow, green, brown, black, orange and scarlet, while a few are tinted with violet or blue. All of our *Liguus* specimens have been derived from Cuba, having crossed the Florida Strait on floating timber, and are among the most wonderfully painted of any snails on earth. I wanted to observe the effects of the hurricane of early September, the one which wrecked Corpus Christi, Texas, and which had been

[1] Collaborator, United States Department of Agriculture, author of works on mollusks, especially of the West Indies and Florida, and recently of a book on the Florida Keys, their geology, and the geographical distribution of their fauna and flora, entitled *In Lower Florida Wilds*, published by G. P. Putnam's Sons.

among the most destructive of any recorded in Lower Florida; there were also two or three points in the geology of the keys which I wished to study.

The geology of Lower Florida, including the keys, is simple but interesting. During middle Pleistocene time, perhaps, a subsidence of the Floridian area occurred and all that part of the state south of the Caloosahatchee River was carried beneath the sea. A great bed of limestone was formed along what is now the southwest coast; another, an oölitic, in the Key West region, is the Key West limestone. A somewhat similar formation was laid down along the southeast coast of the mainland which bears the name of the Miami limestone. A period of elevation followed during which the land of south Florida assumed something of its present shape and dimensions, but the greater part of the Key West beds probably formed a single island. Various tropical tree and plant seeds, drifted by the Gulf Stream, were deposited along these old shores and became established as colonies, and the same was true of many different kinds of land animals which belonged to the Antillean region.

A subsidence of a few feet followed, then a second elevation in which the land of Lower Florida reached a slightly higher level than it has at present. At this time an old dry-land connection existed between the upper part of the Florida Keys and the south shore of the mainland, over which plants and animals migrated. The upper part of the chain of keys is a worked-over coral reef which formed outside the shore of the Miami limestone country and it extends from near Cape Florida to the Newfound Harbor keys which come to an end south of Ramrod Key. The curious tail of land which forms the lower part of Big Pine Key is a part of this coral reef and is connected with the main island of Key West limestone by an irregular mud flat.

During the two subsidences, the eastern end of the Key West island was depressed so that the water of the Gulf of Mexico was driven across the lowest parts of it into the Florida Strait during severe northers, thus scouring out channels which have a north-northwest, south-southeast direction, leaving long, narrow islands between them. The tides are high in the gulf at the time they are low in the strait and *vice versa,* hence they continually scour out these passages and eat away the limestone by means of the carbon dioxide which the sea water contains. The upper and lower islands are thus of entirely different origin. That the upper are much the younger of the two is proved by the fact that, although the dry land of the two groups is nearly equal, the flora of this upper group is meager in species while that of the lower islands is very rich, the latter having more than 175 forms not found on the Upper Keys.

The latest earth movement of this region was a slight subsidence which has been sufficient to submerge and partly destroy the old land connection between the Upper Keys and the mainland. At no time since the present life has existed in this area has the subsidence been sufficient to drown out the dry-land flora and fauna, nor has the elevation been great enough to form a dry-land connection between the upper part of the chain and the Miami mainland. Although the elevated land of some of these islands lies within eight miles of the high, rocky east coast, the floras of the two regions are quite distinct, and there is a slight difference in the faunas of the two areas.

For several days I made my headquarters on Big Pine, making cruises to the neighboring keys in a row boat propelled by a big, good-natured Bahama darky. The hurricane had wrought terrible havoc in these islands.

During its continuance the wind blew from nearly every point of the compass and it drove the water of the sea high up over the dry land everywhere. Along the railroad, between Big Pine and the West Summerland keys, it broke over the tracks which are perhaps eleven feet above the level of ordinary tide, piling débris up on the side of the roadbed to several feet above it. Houses were torn down or drifted away, trees broken or uprooted; in places the seashore was encroached upon, and in others sand and débris were built far out into the sea. Every conceivable kind of drift and rubbish was carried far in on to the dry land. In well-elevated hammocks there were millions of tropical seeds, washed in perhaps from Cuba or the Bahamas and mixed with broken wood, trees, and bark. This material lay in drifts and immense beds, and already many of the seeds were sprouting and coming up—the forerunners of colonies of imported plants.

No finer lesson could be given of the manner in which our tropical flora has been planted and established, and it is in just this way that the work has been done in past ages. The land mollusks of the West Indian region which are now inhabitants of Lower Florida together with some other members of the animal kingdom have been carried in and established in much the same way, arriving on floating timber which has been carried inland on tidal waves. The splendid *Liguus,* for which I was searching, lives entirely on the trees and lays its eggs in the ground or in decaying wood on the floor of the forest. Both animals and eggs sink in sea water but the former may be transported while clinging to the trees on which they live and the eggs may be carried in the rotting wood which is washed into the sea during great floods. The snails are not injured in the least by immersion in salt water even for many hours, as I have ascertained by experiment, and the eggs suffer no harm from a sea bath.

My entire search of the lower islands resulted in finding nothing more than a few broken and faded shells of *Liguus* and *Oxystyla.* On one of the exposed beaches a considerable number of fragments were washed up and some of these still showed the characteristic color of the shells belonging to these islands. But it seems probable that both of these genera of splendid snails are now extinct on the Lower Keys.

My next run was to Marathon on Key Vaccas. This island is invariably called "Key Waccy" by the natives. Outside of Boot Key Harbor and Marathon, it is inhabited by a few Bahama Negroes who live by fishing, turtling, sponge gathering, and charcoal burning. They are a peculiar people who do not seem to relish having the whites come among them. Their speech, which is little changed from that of the Bahamas, is sometimes difficult to understand. The letter "a" is pronounced as it is in the word "what," and there is a peculiar monotony in their conversation.

Five years before, when I had visited the island, I met an old darky by the name of William Lowe, who told me he had seen *Liguus* on the trees in some hammock land which belonged to him. Questioned more closely, he said he had seen the "black snail," as a certain very dark-colored variety of *Liguus* is called, in this forest. I had hired him to make a half-day search and he found a single living specimen. When I left him he promised to keep a diligent lookout for this variety or any others whenever he had opportunity. Although this dark form was formerly abundant and by diligent search I had found about fifty dead specimens, I had never taken it alive. So far as I know, it is now to be found only in this island, although it once existed on Cape Sable, at Chokoloskee among the Ten Thousand Islands near

Miami and on one or two islands in the lower part of the Everglades. I made my way to Lowe's house and was told that he was in the field at work and would be home at night. When I asked Mrs. Lowe if I might stay all night she refused, and said I would have to talk with her husband. I sat on a stump in the little yard, tormented by mosquitoes and sand flies until dusk when he appeared. He didn't seem to remember me, although I had written to him that I was coming and wanted him to help me collect. All the people in the little settlement apparently resented my presence and made me feel that I was anything but welcome. When I asked Lowe if I might stay all night he replied very emphatically that I could not, and he also said in answer to my inquiry that no one about there would keep me. He wasn't even willing that I should sleep on the floor of his little cookhouse. I asked him if he intended to turn me out to sleep in the rain, for a steady downpour had set in. He at last reluctantly permitted me to come into the house. It was a little better than most of the dwellings of the natives, being in size about 14 by 20 feet, with board sides and a shingled roof; a narrow hall, not more than three feet wide, ran from side to side of it, and dark ill-smelling little rooms or cubby-holes were partitioned off in the rest of it.

I determined to get into the good graces of these people if possible, and began to tell them of my adventures and mishaps. I wanted to get them interested and to have them become friendly, and I hoped to have their assistance in collecting. Soon Lowe began to listen in an interested way and I could hear the women, who had crawled into one of the little rooms, laughing; two or three neighbors came in and stood in the smoke of the everlasting smudge pot and eagerly listened. Finally Lowe got up, unlocked a door opening into one of the rooms and from a shelf brought out a Mason's fruit jar and unscrewed the top. To me, although the odor was nauseating, the sight was thrilling, for it was nearly full of dead specimens of *Liguus* and *Oxystyla* which he had captured from time to time and shut up in this glass prison. Among them I saw some specimens of the black snail which I was so eager to obtain, and when I asked him if the lot was for me he replied, "Yas, sah, w'en you pays me foh dey." I offered to give him the money then but he was not ready to take it and he wouldn't even allow me to take the jar in my hand.

I wanted to get him to collect for me the next day but he said he had a charcoal pit on hand and couldn't leave it under any circumstances. Finally after some dickering, when I offered him a price that would have tempted a striking union labor man to go to work, he scratched his head and said, "Maybe I can fix dat pit so she go ovah one day, and den I he'p yo'."

I rolled myself up in my blanket and lay down on the floor at bedtime in one of the dirty, awful-smelling little dens. Lowe shut the doors; the windows, which are of boards, are always closed at night. I asked him if I might open the window in my room but he was not willing. Twice in the night, however, when nearly suffocated I got up and quietly pushed it open while I gasped in a few breaths of fresh air.

In the morning I went with the old man to the hammock and he seemed to be in an excellent humor. "Mans in dis islan'," he said, "gwa' cut down timbah an' Ah tell him yo' pay him good money foh any of dem tree snail. He fine some of dey and pick dey off an' lay dey on de groun' 'side he coat an' he t'ink he get dey w'en he go home at night. Well, sah, w'en he go dare at night dey ain't no snail dare; Ah reckon dey half mile away, up in de tree likely laughin' at him." And he threw back his head and shoulders and laughed, "Yah kya

kya kya!" until he fairly made the woods ring. "Ah reckon he t'ink dem snail gwa' to lay dare and wait till he get ready to come an' git dey. Yah yah yah yah!" And he laughed again uproariously.

We hunted together for several hours with the result that he found four of the black snails, two of which were dead but in good condition, while I got none. I asked him how it was that he could see them so much better than I, who had been used to hunting for them so long, and he said, "Ah reckon it 'ca'se I been bohn an' bred in de scrub, sah." No doubt this was the reason. The eyes and other sense organs of men who habitually live in the wild are much sharper than those of any one whose abode is within the pale of civilization. Such persons live in a great degree by the use of the senses while the man of civilization lives by his wits.

While on the island I took a long tramp to its upper end, then over to Little Vaccas, an unnamed key, also to Lower, Middle and Upper Crawl keys, but though I made diligent search everywhere, I found but few *Liguus*. On my way back I went into a piece of fine, original hammock near the upper end of Vaccas and found a magnificent orange-colored variety. Some of the shells were superbly shaded and stained with scarlet and I collected until night was coming on. Near a little pool in the hammock a water moccasin, which was partly concealed under a palmetto leaf, struck viciously at the inside of my left leg as I was walking forward. I happened to carry in my hand a stick about four feet long and less than an inch in diameter, which I used to push off snails from the trees. Instinctively I struck at the snake as it lunged at me, and hit it a sharp blow on the "neck." This knocked it to the ground, but the force of its stroke was so great that its head shot on between my legs.

It seemed to me that all the darkies in the settlement gathered at Lowe's house that night to hear my adventures, with the result that they all became quite friendly. Next morning old boxes and corners were searched in all the houses and a number of fine *Liguus* and *Oxystyla* shells were brought to light which their owners sold to me at a good round price. Lowe got me a box to pack my shells in and accompanied me to the railroad, carrying it for me. When I bade his wife good-by she said, "Boss, we shorely miss yo' tonight," which I felt was a very high compliment.

I next visited Long Key and found a fine piece of rocky hammock near the flag stop called Crescent, but although I searched it diligently for several hours I did not find even a fragment of a *Liguus*. Then I went on to Upper Matacumbe and was fortunate enough to be taken in at the home of a Mr. Lee Pinder at the village of Matacumbe. The room which I occupied faced on the open sea and to me it was a paradise after the miserable den I had recently occupied. I tramped to the southwest end of Lower Matacumbe Key and back one day, a distance of more than sixteen miles, and searched the island carefully but found only a few living snails. Another day, Mr. Pinder took me to Lignum Vitæ Key in his launch and we spent several hours searching for snails with rather meager results. Formerly *Liguus* swarmed on this island but it seems as though some cause besides the encroachment of civilized man is acting to exterminate these beautiful snails. Very little of the fine hammock has been cut and no one lives on the island.

I tramped up the railroad track from Matacumbe and crossed over to Windlys Island which has the distinction of being the loftiest of any of the entire chain of keys. Two little knolls near its eastern end rise to a height of about eighteen feet above the sea and in so flat a region they seem like small mountains. To the left of the flag stop called Quarry, I noticed some fine, lofty hammock at a little distance and, although I had searched it through without results several years before, it looked so tempting that I hid my belongings by the railroad track and pushed through the tangled, thorny scrub until I reached it. Tramping through it I saw again the very rare West Indian tree *Hypelate trifoliata*, or white ironwood, which is not known to exist elsewhere in the United States.

I searched the tall trunks of the trees diligently for two hours but saw no snails, so at last I turned toward the railroad and concluded there were none. As I went back I saw at some distance high up on a tree something which looked a little like a white *Liguus*, but it seemed to be altogether too large. I hurriedly made my way nearer to it, and saw to my astonishment an enormous specimen which, although it was more than thirty feet above me, I was sure was the largest I had ever seen. I at once set my wits to work to study how I might secure it. I could not possibly cut with my knife any pole that would reach it, neither could I handle such a pole if I had it. Mr. Pinder, who had been with me to Lignum Vitæ Key, was very expert at throwing chunks of wood, and he could strike a lofty limb and loosen a snail nearly every time, but I am a poor thrower. I might hit the side of a barn if it were not too far away and the wind was favorable, but that is about all. Besides, if loosened, the shell would most likely be broken by falling on the rocks below. The only thing to do was to climb for it, but much of the way the trunk of the tree on which the snail was fastened was bare of limbs. I dragged a dead trunk of a sapling and leaned it against the tree so that by working up it I could reach the lower branches which extended along the trunk for perhaps ten feet. Then, at a distance of about six feet above these, a stout limb grew out which had been broken off a foot or more from the trunk by the hurricane. If I could only get up and stand on this broken branch it seemed to me that I might reach the snail.

I cut out with my big pocket knife the top of a small live tree which the storm had overthrown. It had two strong branches about two feet apart near its base and I believed I could use them for steps. I trimmed up the somewhat slender main shoot and carefully bent it in a loop, tying the upper end to the stem below, and when my "contraption," as Uncle Remus would have called it, was finished, it looked something like a gigantic sixteenth note or semiquaver. At one of the platforms along the railroad I had found a long piece of stout string and I tied one end of it to the contrivance and the other to my suspender and commenced my ascent of the trunk of the sapling I had leaned against the tree. When I got up about six feet above the rocks this dead trunk broke and I fell with a crash but was not much hurt. Then I cut off the only root which held the little tree that had been overthrown, dragged it up, and leaned it against the tree bearing the snail. Although it sagged it bore me and soon I was among the branches, and stood on the topmost one. I pulled up my ladder and hung the loop of it on the broken limb, securely tying its base to the trunk, then I carefully worked up by stepping on the rungs until I stood on the broken limb.

But I had miscalculated the distance and I found that I could not reach the snail by more than three feet. Must I give it up after all that trouble? I wouldn't push it off and let it fall for I was certain it would be broken. It looked so large and handsome that I determined I would try to shin up to it. Shinning a tree is pretty good exercise for a young fellow but for a man nearly seventy-four and weighing more than

175 pounds it is a good deal like hard work. I slowly worked my way up and whenever I was completely exhausted I rested, clinging tightly to the tree, while the sight of the great, glittering jewel above my head tempted me to make further efforts. At last by reaching far out I could just touch it; then one more tremendous struggle and I held it in my hand. I carefully loosened it, put it in my overalls pocket, and in less than a minute had slid to the foot of the tree. Then I took it out; I fairly shouted and capered about like a boy; I rubbed it against my cheek and talked foolishly to it. No miser ever gloated over his gold as I did over that magnificent snail. Years before I had found on a shell mound back of Chokolaskee in the Ten Thousand Islands a *Liguus* which until now was by far the largest I had ever seen. Sometime during its life this specimen had had a quarter of an inch of the tip of its shell broken off and it had soldered up the opening. But even with that, when I came to put it beside my Chokolaskee shell, this was longer, more solid, and had greater diameter. Counting in the broken part, my new shell is exactly three inches in length and one inch and nine-sixteenths in diameter. It is a glossy ivory white with faint bronzy green, revolving lines, which are more distinct on its base, and it must be about seven years old, a veritable patriarch, since most of our *Liguus* do not live more than three or four years. This magnificent specimen amply repaid me for all the hardships of my trip.

From Windlys Island I worked my way along the railroad through Long Island and into the great Key Largo which has a length of nearly thirty miles, and at the little flag stop called Keylargo I took the train for home.

The greater part of the original forest of the keys has been cut—that along the upper part of the chain in order that pineapples might be planted. As soon as the roots of the trees decayed, most of the soil which covered the fields was washed down through the loose rock, and pines would no longer grow on it. Then the hammock sprang up again, this time a scrubby growth, filled almost solid with thorny trees, shrubs, and vines. In most places it is so dense that one cannot work his way through it and it is possible to progress only by hunting out the more open parts of it. The heat is almost intolerable and mosquitoes and sand flies swarm everywhere during the wetter part of the year. Most of the few residents are poor and live in small, badly constructed shanties. It is difficult to get entertainment, even the privilege of sleeping under a roof, no doubt because of the number of tramps and bad men who are found on the keys. But the whole region possesses a peculiar charm; it is a bit of the tropics, it has a rich and interesting vegetation which, with its rather meager dry-land fauna, presents some remarkable problems in geographical distribution and evolution. During the winter there are comparatively few annoying insects, the sky is marvelously clear and beautiful, the few clouds have a summery look, and the water is lovely with a hundred tints of green and blue. A vast marine fauna literally swarms in the seas, and for the naturalist no more attractive region exists in the United States.

Everywhere I went I was taken for a tramp—my appearance no doubt helping to create this impression; but in every place I stopped I was able to convince some one that I was all right. One evening I tramped into the little village of Plantation and applied to a woman at a decent-looking house for a night's lodging. She told me to go away and shut the door in my face. At another house the women ran in, but by persistent hammering on the door one of them came and told me that no one in the hamlet would keep me, that a short distance down the beach I would find a house. I hid my bag and walked a half mile along the shore to find no house and concluded that she expected me to sleep in the sand. When I came back I spoke to an elderly man who stood in a door and asked to be allowed to sleep on his floor. He refused to let me come in and didn't want even to converse with me. Finally I asked him if he thought I was a tramp and he said he did. I pulled out a gold watch and asked if tramps carried things like that. Then I took out a roll of money and said, "Do tramps carry this?" His severe scowl changed into a smile and he said, "Oh, come in, I guess you are all right." He gave me a good supper and breakfast and we parted the best of friends. As I left he said, "I'll tell the folks here what a fine visit I had with the 'old tramp.'" At a little flag stop where the postmaster sold railway tickets I asked for one to a neighboring station, and the man said, "Have you any money?" I handed him a twenty-dollar bill and in surprise he said he couldn't change it. Then I counted him out the exact amount and told him that he mustn't always judge people by their appearance.

My trip was a complete success for it enabled me to solve several problems that I had puzzled in vain over before going. I added not a little to my collections and as usual found things in places where the books said they should not grow. All the scrub was glorious with flowers—I have never seen such an array in the tropics. Two *Echites,* vines closely related to the oleander, had glossy leaves and charming flowers, the one sulphur-colored, the other rich yellow, and both should be introduced into cultivation. There were masses of a yellow-flowered *Cassia* and acres of a lovely morning glory with great purple, blue, or pinkish salvers. In the scrub its slender, half trailing, half climbing stems catch and trip whoever ventures into it, but whenever I gazed on its splendid masses of bloom I forgave it. In the early morning and late in the evening the moonflowers were as conspicuous as their blue-flowered cousins, the morning glories. Such tramps bring one into the closest contact and communion with nature, and renew one's health and vigor.

Tree snail shells (*Liguus fasciatus*, about one half natural size) from the collections of the American Museum of Natural History

Island Animals and Plants

THEIR CONSERVATION IS URGENTLY NEEDED

By WILLARD G. VAN NAME

(Department of Invertebrate Zoölogy, American Museum of Natural History)

ALTHOUGH the animal and plant life of small islands and of island groups, particularly of those which are more or less remote or inaccessible, is characterized by the presence of fewer species than on the mainlands, these species are often peculiar and strictly limited in their distribution, or of especial interest to science for other reasons.

Islands have in many cases been the last refuge of species of animals and plants which were unable to maintain themselves against the more numerous enemies that beset them on the continents. Sometimes the islands have preserved some survivors of forms which used to inhabit larger areas of land, now submerged under the sea, a remnant of which the existing island represents. The more or less complete isolation of animals and plants living on islands restricts or altogether prevents their interbreeding with members of their species from other regions, and the variations they may develop from climatic or other causes may become fixed and permanent, resulting in the formation of the new species found nowhere else. Such islands often afford exceptional advantages for observing the processes of evolution, as the factors affecting these processes in such isolated species are often fewer and simpler than on the continents. There is no doubt that Darwin in developing his theory of evolution was influenced by the observations of island animals and plants made during his earlier years as a naturalist.

The relationships existing between the creatures inhabiting the various groups of islands and those of other regions, and especially the presence or absence of terrestrial forms which could not easily cross wide stretches of water by any natural means, disclose facts about the geography of past geological periods and aid in determining when and where former land areas now submerged must have existed. In this way they have afforded a valuable check on the conclusions arrived at by geologists by entirely different methods, for while they indicate that many existing islands were formerly a part of some continent or of a much larger island, they lend no support to fantastic theories of vanished continents or former land connections across what are now extents of wide and deep ocean. Added to all this, the strange character and, in many cases, the great and increasing rarity or the recent complete extinction of some of these creatures lend interest to them from a more popular point of view also.

It is not only distant oceanic islands that possess such interest, since even those close to the shores of continents occasionally have certain peculiar species not found anywhere else, or they may afford, through their comparative inaccessibility and freedom from predatory mammals, safer breeding places for animals such as seals or sea turtles, or ground-nesting sea birds, than can be found elsewhere. There is no question that, but for the breeding places provided by the islands off the Atlantic coasts of the United States and Canada, many of our sea birds such as the gulls and terns and members of the auk family would by this time have been practically exterminated from this part of the world. The gannet, for instance, one of the largest and most beautiful of our sea birds, now breeds on this side of the Atlantic in two island colonies only, both much reduced from their former size; fortunately these colonies have at length been taken under the protection of the Canadian government. On the coast of southern New England, the breeding colonies of terns and laughing gulls on Muskeget and a few other more or less inaccessible islands were able to persist during the years of persecution to which these birds were subjected for the millinery trade, and have served as centers of distribution for repopulating other parts of our coast with these beautiful species, now that protection is given them everywhere.

The survival of the heath hen on Martha's Vineyard is another striking example, while the development of a species of sparrow, the Ipswich sparrow, which appears to be confined in its breeding entirely to Sable Island south of Nova Scotia, although it migrates in winter to the mainland, affords an instance near home of the tendency of insular life to result in differentiating new species.

In another respect Sable Island, just mentioned, is of interest, for although it is but little farther north than Portland, Maine, its shores were in the early days of the settlement of America still inhabited by a herd of walruses, the most southern colony of that species of which we have any historical record.

Forty miles off the coast of Lower California, not very far south of the United States boundary, is a small island, Guadaloupe, remarkable in much the same way. It was probably the last home of an extinct species of fur seal, and possessed three or probably four peculiar species or very distinct varieties of land birds that have recently become extinct. But its chief interest lies in its being the last stronghold of the California sea elephant, closely related to the sea elephant of the southern hemisphere. This animal formerly inhabited the coast of the mainland of southern California, as well as Lower California. It was supposed to have been entirely destroyed, when a small herd of about one hundred individuals was found still in existence in 1911 at Guadaloupe Island, so that even at that recent date, it would still have been possible to save this remarkable animal from extinction.

Unfortunately the rapid increase of human population and the commercial expansion during recent times, and especially the development of rapid and convenient transportation, have put an end to the immunity of these places from occupation or at least from frequent visitation by the most destructive enemy of nature that this planet has ever seen—civilized man. As a result, hundreds of the forms of animal and plant life peculiar to them have already become totally extinct, and each year that passes adds more to the list. Some of the most beautiful of the birds of paradise are of very restricted range and have become nearly or entirely extinct because of their slaughter for the millinery trade. Members of many groups are on the list of extinct or threatened species, especially birds, reptiles, land mollusks, insects, and many trees and smaller plants. Their remote and isolated homes protected them against their natural enemies but do not avail against the unnatural ones that now beset them.

Our own Hawaiian possessions afford a good example of what is taking place on many island groups. The native land birds of Hawaii are remarkable for the large proportion of peculiar species and genera found in no other part of the world. A recent writer[1] states that "Due to the operations of various malign influences, the native forests and birds have greatly diminished within historic times.

[1] MacCaughey, in *The Auk*, January, 1919.

Many known species of plants, trees, and birds have become wholly extinct, and many others are on the verge of extinction. A time is speedily approaching in which the extinct avian species will exceed in number those still surviving." Farther on he says, "Oahu has been more completely despoiled of its native bird life than any other of the larger islands. More of the known Oahu passerine species are extinct than are living today. The Oahu elepaio [a small flycatcher] is the most abundant of the remaining native birds and is practically the only species commonly seen."

That this unpromising outlook is no exaggeration is proved by many other writers and observers. A study of Rothschild's account of the birds of these islands, although published nearly twenty years ago and based chiefly on collections and observations of considerably earlier date when conditions were better than at present, records 7 of the 70 indigenous birds considered peculiar to this group of islands as already certainly extinct, and a number already very rare, known, in spite of extensive collecting, by but very few specimens, while of the remainder only a comparatively small minority were widely distributed and common on one or more of the larger islands. The Hawaiian Islands are characterized also by the great number of land mollusks, one family, the Achatinellidæ, being almost restricted to those islands and differentiated into a large number of species, some of them of extremely local distribution. Many are entirely extinct and others are becoming very uncommon.

A species restricted to one or more small islands for its habitat is at a disadvantage for many reasons some of which can easily be recognized:

First, because island species usually comprise but a small total number of individuals, even though being crowded on a small island may make them appear abundant. If many are killed it means a seriously large percentage of those in existence.

Second, some catastrophe, perhaps a natural one such as a volcanic eruption, but more often one in which man has some complicity, may wipe the entire species out. An example of this is the destruction of the greater part of the race of heath hens on Martha's Vineyard (which under careful protection had been increasing in numbers) by a single forest fire in May, 1916, so that the total extinction of the species is now probably only a matter of a short time. In the case of widely distributed species this could hardly happen. But if the breeding places of a species are restricted, even though it ranges widely at other seasons, it is exposed to the same danger. The Galapagos albatross breeds only, so far as is known, on Hood Island of the Galapagos group. If this breeding colony were destroyed we cannot be sure that another would be successfully established.

Third, a species confined to a small island has no place to escape to from enemies which it cannot resist, or from the destructive changes, such as deforestation, that man may bring about. On scores of islands, human occupation has been followed by the destruction of every bit of the former forest growths, in many cases resulting in the complete extinction of some of the trees and other plants composing them, and of the birds and animals peculiar to them and dependent on them for food and shelter.

Fourth, the advent of man is invariably accompanied by the introduction of destructive animals, especially domestic cats, rats, dogs, hogs, and goats, and in warm climates often of the mongoose, to say nothing of noxious insects, weeds, and disease germs accidentally imported. The species thus introduced are apt to have many advantages over the native ones. They are forms which have lived for long periods in association with man. The wild species among them know his habits; they do not fear him unnecessarily, understanding how to take advantage of the results of his labor, while evading the consequences of the hostility that their depredations cause; the domestic species benefit by his care and protection. They are vigorous and prolific creatures. The changes in the condition of the land brought about by clearing and cultivation make the environment more and more suitable for them as time goes on, but less adapted for the native forms. Moreover, among the new arrivals there are apt to be some that find their new home peculiarly well adapted to their needs, so that they increase to an extent that crowds other species practically out of existence by the mere effect of their numbers, and by their consuming the available food supply, even if they are otherwise harmless. This is especially the case when domestic animals are allowed to run wild in such places. It was a common thing in the early days of navigation to stock uninhabited islands with cattle, goats, or hogs, so that ships visiting them for water could also get a supply of fresh meat, an item of no small importance when voyages were of indefinitely long duration and cold storage was as yet undreamt of. The literature of many of these islands is full of references to the deforestation and other damage that these animals caused.

Fifth, as the number of individuals in a species becomes reduced, inbreeding becomes unavoidable, and its well-known weakening effect makes the long survival of the species impossible. If an animal is to be saved, protection must be given before its numbers become too small. Laysan Island, an outlying member of the Hawaiian group, possesses among other peculiar birds a species of duck, the Laysan teal, found nowhere except on this one small island. Fisher, in 1902, reported this species as reduced to fewer than one hundred individuals. Bailey, in the April-May, 1919, number of NATURAL HISTORY, reports it as reduced to seven. Even if among these seven individuals there are members of both sexes that can breed, it is inevitable that the species will soon die out from the effects of inbreeding. It is inbreeding that is likely to make the permanent preservation of the heath hen impossible, unless it may be found practicable to introduce the necessary new blood by crossing with a few individuals of the prairie chicken of the western states. The two species are fortunately so closely allied that crosses in all proportions would probably be fertile, and any changes in plumage or other visible characters produced by the crossing would probably soon breed out. Such an experiment seems well worth trying, as it appears to offer the only possibility of preserving the heath hen.

Last, but by no means least, life in the more uniform and protected environment of islands, produces in course of time a lack of adaptability in the species to endure changes or to resist new enemies, and may result in the loss of certain powers and functions through their disuse. Some of the birds for instance, having only short distances to travel and few enemies to escape from, have more or less completely lost the power of flight. Such retrogressive changes are not physical only but also mental. Compare, for instance, with the clever resourcefulness of the crow and the red fox, which maintain themselves in thickly settled districts in spite of man's hostility, the stupid tameness of the dodo and Steller's sea cow described in contemporaneous accounts, or the senseless timidity of certain small native Hawaiian birds of which it is said, though probably not without some exaggeration, that they are afraid even to cross a road cut through the forest, and remain always on the side where they happened to be when it was built.

We cannot expect that among the small population of remote islands there will be many influential people with a taste for scientific or popular natural history, or with any appreciation of the unique character of the native plants and animals and a realization of the urgent need for their care and protection—although few communities are now without some persons with such interests. But if these peculiar island species are allowed to become extinct through neglect and indifference, it is not merely a matter of local concern; it is also a loss to science and to scientific men, and to all with an interest in zoölogy and botany, scientific or popular, throughout the world; a loss that cannot be repaired in the future and that will always be a reproach and a discredit to the present generation.

Our Government and our scientific societies should see to it that on our own island possessions at least the rare and disappearing species are given every care and protection, but the matter is such an urgent one and of such importance to science that the duty should not be considered as limited by political boundaries, and we should regard it as a proper ground for international coöperation, or for assisting those even in foreign possessions who need encouragement or help to enable them to carry on such protective work. Even if we regard science as such a lofty and transcendental conception as to be indifferent to the mere extinction and annihilation of the most interesting part of the material with which it deals, the information about the life, habits, food, and reproduction of these vanishing species that would be acquired in a serious effort to preserve them would add to our knowledge facts that must be studied now or never. Neglect of this plain duty and of this last and only opportunity will be a cause of regret in the future.

The whole subject of conservation is one that must receive greater consideration than that which has yet been conceded to it. We too often dismiss it from our minds, and silence our consciences with the thought that it can be dealt with by the Government or by other people who have not sufficient troubles of their own. That we ought to do as little damage to the world and to nature as we can during our brief stay here, and that we should leave for those who come after us some of the natural resources and as many as we can of the wonderful and interesting animals and plants and the other beautiful objects in nature which we enjoy, instead of turning the world over to them in the condition of a squeezed lemon, is a doctrine too seldom taught in our schools or colleges and too rarely preached in our churches. But after it is too late—and that time is now not far ahead—there is likely to come a realization that the greatest mistake ever made by the human race was not to have taken that idea as the foundation of its code of ethics and conduct.

MAJOR ROBERT M. YERKES

Lately Chief of the Division of Psychology, Medical Department, United States Army

Line of draftees entering the psychological examining building for intelligence rating

The Army Intelligence Tests

By GEORGE F. ARPS

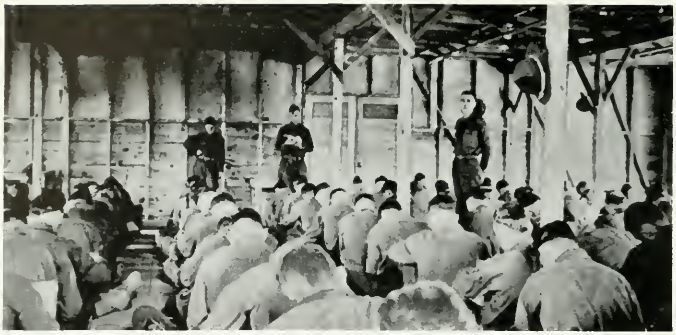
Professor of Psychology, the Ohio State University; lately Major, S. C., U. S. Army

WHEN the internecine struggle of 1914 drew this nation into the vortex the American Republic was confronted with an emergency of such proportion as appeared likely to require the services of every phase of modern science. That psychology, in many respects the most youthful of the applied sciences, was able to place at the disposal of the Government a technique whereby a fairly accurate mental measurement could be made of each raw, problematical recruit, is but a striking illustration of American resourcefulness, originality, and initiative. It is likewise an effective commentary on the relative merit of American versus German points of view in the problem of human behavior.

A workably accurate scientific classification of brain power of the manhood of the Army would not only enormously abbreviate the period of organization, but also make possible a wise expenditure of this power and thus prevent wastage of material resources as well as man power. It has been the writer's experience that commanding officers are everywhere and always eager to adopt any technique or method which will enable them to discover native resourcefulness and utilize it in positions of leadership and responsibility. It is equally important to discover those so low in the scale of intelligence as to constitute a menace in the use of firearms and to the success of any military undertaking.

In recognition of these clearly desirable ends the Medical Department of the Army, in August, 1917, accepted for trial the details of the technique, methods, and procedure prepared by the Committee on the Psychological Examination of Recruits, whereby a mental classification of all recruits could be made shortly upon arrival in the various cantonments. The trial results led the Surgeon General of the Army to recommend to the War Department the extension of intelligence examining to "all company officers, all candidates for officers' training camps, and all drafted and enlisted men."

Early in 1918, the War Department approved the recommendation of the Surgeon General and created the Division of Psychology in the Sanitary Corps of the Medical Department for the purpose of carrying into effect the psychological service.



Group of literate draftees taking ALPHA intelligence test

Scoring ALPHA examination papers. By means of stencils it was possible to score the papers almost as rapidly as succeeding groups were examined. Commanding officers received the results within twenty-four hours after examination

Psychological Personnel

Upon the creation of the Division of Psychology in the Medical Department, about one hundred officers and three hundred enlisted men were mobilized at Camp Greenleaf, Georgia, in the Medical Officers' Training Camp, and there given intensive military training, instruction in the technique and methods of psychological examining, army paper work, and such other instruction required of the regular medical officer.

The above personnel were then assigned to the various large cantonments to carry into effect the methods of psychological examining. From three to five commissioned officers and four to eight enlisted men were assigned to each of the larger training camps. In addition, from twenty to sixty privates were assigned for temporary duty as scorers, clerks, typists, and orderlies, to assist in the conduct of the examinations and to make readily available the results to the various commanding officers.

With this organization and by means of the group method, it was possible to examine, in times of pressure, as many as three thousand recruits in a single day in a given cantonment.

Variety of Tests Employed

ALPHA.—This is a group test and is intended for literates who can read, write, and understand English with a fair degree of ease. The general practice was to segregate recruits as they entered the examining station on the basis of the grade in school last attended—fifth grade, as a rule, for the white and eighth grade for the colored troops. Those who fell below these grades were ordered to take the illiterate (BETA) examination. With proper facilities as many as five hundred recruits could be examined in approximately one hour. The procedure was entirely objective in that the examiner and the scorers were wholly unacquainted with the men examined. The scoring was done by means of stencils and in the absence of the men examined, which procedure eliminated personal bias and prejudice.

Differences in intelligence, or degrees of mental competency, as revealed by the scores made, were indicated by seven letter ratings, each letter being the equivalent of certain numerical points. The letter grades, the numerical equivalents, and significance of each are as follows:

A *Very Superior Intelligence:* 135 to 212 points. Men who graded "A," when possessed of other necessary qualifications, were regarded as "high officer type." From three to five per cent of the drafts were "A" grade men.

B *Superior Intelligence:* 105 to 134 points. Men who graded "B" frequently possessed other sterling qualities which qualified them for the commissioned officer type. In actual practice an occasional "B" grade officer outranked in efficiency an "A" grade officer, but only when other necessary qualities were pronounced in the former and relatively lacking in the latter. The "B" grade indicates high type of noncommissioned material.

C+ *High Average Intelligence:* 75 to 104 points. This grade indicates good noncommissioned officer material, rarely material for the commissioned rank.

C *Average Intelligence:* 45 to 74 points. Good private type with fair noncommissioned material.

C– *Low Average Intelligence:* 25 to 44 points. Ordinary private material.

D *Inferior Intelligence:* 15 to 24 points. Men of this grade are slow, illiterate, and as a rule make only fair soldiers.

D– *Very Inferior Intelligence:* 0 to 14 points. This grade of intelligence represents the mentally unfit, the incompetent who are recommended for either development battalions, special service organizations, or for discharge.

Beta.—Like Alpha this is a group test but is intended for illiterates and foreigners. Knowledge of English is not essential in taking this test since the instructions are given by the examiner by means of demonstrations. This set of tests parallels Alpha in the method of scoring, the variety of grades of intelligence classification, and in the objective character of the results. A workable correlation exists between Alpha and Beta so that an "A" grade in the former is roughly equivalent to an "A" grade in the latter.

Individual Tests.—Individual tests are given to those who fail or make a very low score in Beta after having failed in Alpha. Two forms of individual examinations are used for those who understand English, namely, the Yerkes-Bridges Point Scale and the Stanford revision of the Binet Scale. By means of the Performance Scale illiterates in English are examined. The time required to give an individual examination varies from ten minutes to an hour.

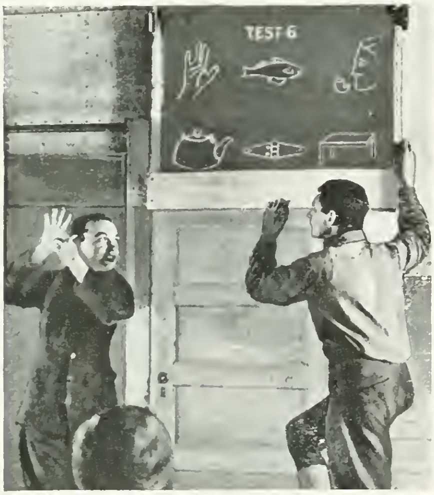
It is obvious from the above that the variety of tests covers every case and that, therefore, a complete mental classification of all recruits is made possible.

Major R. M. Yerkes, lately chief of the Division of Psychology, gives the following summary of the results of psychological examining in the various cantonments where this service was organized:

"The work of mental examining was organized finally in thirty-five army training camps. A grand total of 1,726,000 men had been given psychological examination prior to January 1, 1919. Of this number, about 41,000 were commissioned officers. More than 83,000 of the enlisted men included in the total had been given an individual examination in addition to the group examination for literates, for illiterates, or both.

"Between April 27 and November 30, 1918, 7749 (0.5 per cent) were reported for discharge by psychological examiners because of mental inferiority. The number of recommendations for assignment to labor battalions because of low grade intelligence was

9871 (0.6+ per cent). A total of 9432 men (0.6+ per cent) was recommended for assignment to development battalions in order that they might be carefully observed and given preliminary training to discover, if possible, ways of using them in the Army.



"Close-up" demonstration of BETA test.—The demonstrator is showing how to put in missing parts

Individual examination.—The manikin test, which the recruit is trying to put together, is one of the Performance tests given to those who have made a low score in the preceding group tests

"During this same period of six months, there were reported 4744 men with mental age ratings below seven years; 7762 between seven and eight years; 14,566 between eight and nine years; 18,581 between nine and ten years. This gives a total of 45,653 (3 per cent) men under ten years' mental age. It is extremely improbable that many of these individuals were worth what it cost the Government to maintain, equip, and train them for military service."

Sample Alpha Tests (for Literates)[1]

The recruits marched into the examining room, were seated, and each supplied with a pencil and examination booklet by orderlies who supervised the group during the examination and upon its completion collected the papers and pencils. As soon as the group was seated and supplied with the necessary examining material, the following general directions were given by the examiner:

"Attention! The purpose of this examination is to see how well you can remember, think, and carry out what you are told to do. The aim is to find out what you are best fitted to do in the Army.

"Now, in the Army a man often has to listen to commands and then carry them out exactly. I am going to give *you* some commands to see how well you can carry them out. Listen closely. Ask no questions. Do not watch any other man to see what *he* does.

[1] The ALPHA examination comprises eight tests given to recruits in groups numbering 500 as a desirable maximum. In practice the actual number probably did not exceed 200 as an average. Each such group could ordinarily be examined in somewhat less than one hour.

"Look at your papers. When I call 'Attention,' stop instantly whatever you are doing and hold your pencil up—so. (Examiner illustrates by raising his pencil.) *Don't put your pencil down to the paper* until I say 'Go.' Listen carefully to what I say. Do just what you are told to do. Remember, wait for the word 'Go.'"

Of the eight tests included in the ALPHA examination a limited amount of each of tests 1, 3, 4, 6, and 7 is given here.

PARTS OF TEST 1

Twelve items are included under this test of which 1, 4, 7, 11, and 12 are here reproduced (see below). Under each item are given the directions used by all psychological examiners in giving the test to recruits.

TEST 3

This is a test of common sense. Below are sixteen questions. Three answers are given to each question. You are to look at the answers carefully; then make a cross in the square before the best answer to each question, as in the sample:

SAMPLE { Why do we use stoves? Because
☐ they look well
☒ they keep us warm
☐ they are black

Here the second answer is the best one and is marked with a cross. Begin with No. 1 and keep on until time is called.

1 It is wiser to put some money aside and not spend it all, so that you may
☐ prepare for old age or sickness
☐ collect all the different kinds of money
☐ gamble when you wish

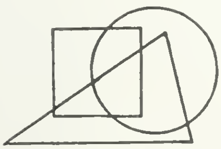
2 Shoes are made of leather, because
☐ it is tanned
☐ it is tough, pliable and warm
☐ it can be blackened

3 Why do soldiers wear wrist watches rather than pocket watches? Because
☐ they keep better time
☐ they are harder to break
☐ they are handier

---

1. 

"Attention! 'Attention' always means 'Pencils up.' Look at the circles at 1. When I say 'Go' but not before, make a figure 2 in the second circle and also a cross in the third circle.—Go!" (Allow not more than 5 seconds)

4. 

"Attention! Look at 4. When I say 'Go' make a figure 2 in the space which is in the circle but not in the triangle or square, and also make a figure 3 in the space which is in the triangle and circle, but not in the square.—Go!" (Allow not more than 10 seconds)

7. A B C D E F G H I J K L M N O P

"Attention! Look at 7. When I say 'Go' *cross out* the letter just after F and also draw a line *under* the second letter after I.—Go!" (Allow not more than 10 seconds)

11. 

"Attention! Look at 11. When I say 'Go' draw a line through every odd number that is not in a square, and also through every odd number that is in a square with a letter.—Go!" (Allow not more than 25 seconds)

12. 1 2 3 4 5 6 7 8 9

"Attention! Look at 12. If 4 is more than 2, then (when I say 'Go') cross out the number 3 unless 3 is more than 5, in which case draw a line *under* the number 4.—Go!" (Allow not more than 10 seconds)

9 If a man who can't swim should fall into a river, he should

☐ yell for help and try to scramble out
☐ dive to the bottom and crawl out
☐ lie on his back and float

After one and a half minutes the examiner called "Stop" and directed attention to test 4.

TEST 4

If the two words of a pair mean the same or nearly the same, draw a line under *same*. If they mean the opposite or nearly the opposite, draw a line under *opposite*. If you cannot be sure, guess. The two samples are already marked as they should be

SAMPLES	good—bad	same—<u>opposite</u>
	little—small	<u>same</u>—opposite

no—yes	same—opposite
day—night	same—opposite
go—leave	same—opposite
begin—commence	same—opposite
bitter—sweet	same—opposite
credit—debit	same—opposite
assiduous—diligent	same—opposite
transient—permanent	same—opposite
palliate—mitigate	same—opposite
execrate—revile	same—opposite

Forty pairs of words compose this test and one and a half minutes are devoted to it.

TEST 6

SAMPLES	2	4	6	8	10	12	*14*	*16*
	9	8	7	6	5	4	*3*	*2*
	2	2	3	3	4	4	*5*	*5*
	1	7	2	7	3	7	*4*	*7*

Look at each row of numbers below, and on the two dotted lines write the two numbers that should come next.

3	4	5	6	7	8	...	...
8	7	6	5	4	3	...	...
10	15	20	25	30	35	...	...
81	27	9	3	1	$\frac{1}{3}$	...	...
1	4	9	16	25	36	...	...
16	17	15	18	14	19	...	...
3	6	8	16	18	36	...	...

Twenty completion number series comprise the test and three minutes are devoted to it.

TEST 7

SAMPLES

sky—blue : : grass—
table <u>green</u> warm big

fish—swims : : man—
paper time <u>walks</u> girl

day—night : : white—
red <u>black</u> clear pure

In each of the lines below, the first two words are related to each other in some way. What you are to do in each line is to see what the relation is between the first two words, and underline the word in heavy type that is related in the same way to the third word. Begin with No. 1 and mark as many sets as you can before time is called.

shoe—foot : : hat—
kitten head knife penny

pup—dog : : lamb—
red door sheep book

spring—summer : : autumn—
winter warm harvest rise

devil—angel : : bad—
mean disobedient defamed good

finger—hand : : toe—
body foot skin nail

Caucasian—English : : Mongolian
Chinese Indian negro yellow

Indiana—United States : : part—
hair China Ohio whole

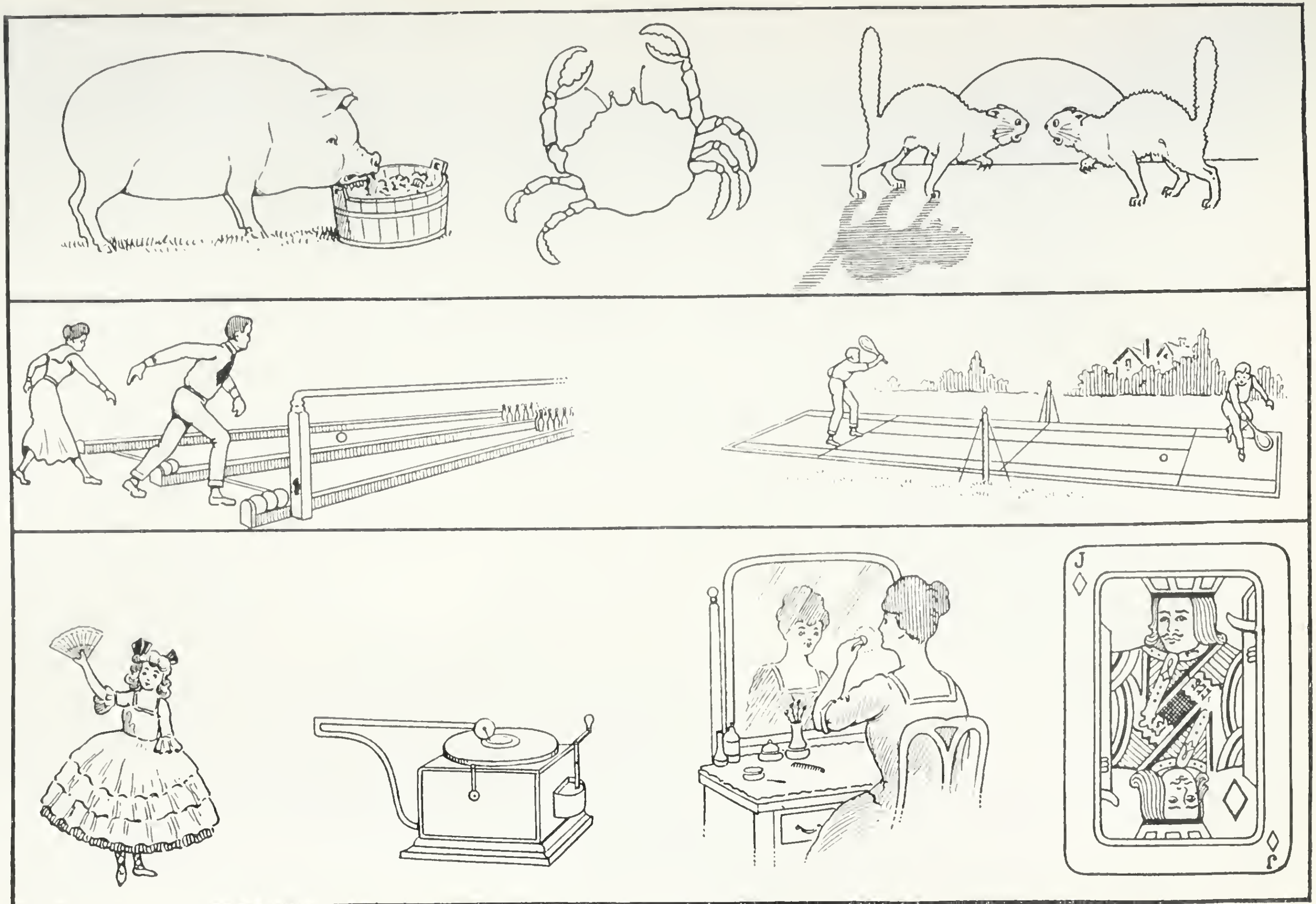
esteem—despise : : friends—
Quakers enemies lovers men

abide—stay : : depart—
come hence leave late

abundant—scarce : : cheap—
buy costly bargain nasty

Forty relational or proportional sentences make up this test. The time limit is three minutes.

The general character and procedure of the literate (ALPHA) examination are indicated by the above tests from which certain parts of each have been deleted. The total results of the Army tests give a reliable index or measure of native ability as contrasted with the conventional measurements of acquired learning. Of paramount importance are the discovery and selection of men of very superior mental alertness, of ability to think accurately and quickly, and to analyze situations, comprehend clearly, and act decisively.



PICTURE COMPLETION TEST

In this BETA test a certain part or parts are lacking in each figure and are to be supplied in a manner analogous to the demonstration which preceded. Twenty different incomplete figures comprise the test. A time limit of 3 minutes is set on the test

Sample Beta Tests (for Illiterates and Foreigners)

In the so-called BETA tests a knowledge of the English language is not necessary. It is, therefore, possible to discover foreigners and others of high grade native ability as well as other grades of mental ability.

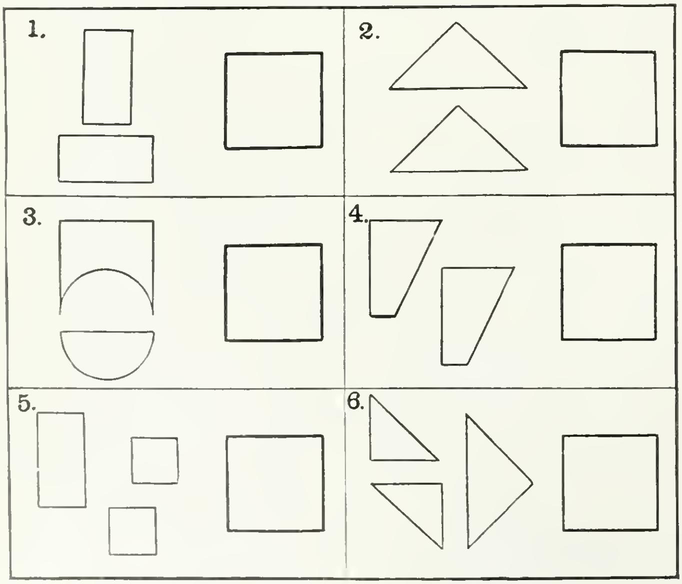
As in the case of ALPHA, the BETA examination comprises eight distinct tests. Each test is demonstrated on a blackboard, partly in pantomime, by the examiner with the assistance of an orderly. Parts of two of the eight tests are given here.

Value of the Psychological Service

If it costs $2500, as has been estimated, to equip, train a man for eight months, and send him overseas; if he is now found mentally incompetent and therefore returned, mustered out, insurance and pension obligation closed at an additional expense of $2500, then we find a total of $5000 needless expenditure.

It becomes a plain matter of arithmetic to compute the wastage in selecting, for example, 10,000 of such mental incompetents. Compare this enormous wastage with the cost of giving mental tests to one hundred times this many men at twenty-five cents per man. As a matter of fact, during six months of psychological examining there were 12,506 men reported with intellectual maturity ranging from less than seven years to under eight. It requires no particular levy on the imagination to determine the degree of responsibility attached to this grade of intelligence.

Add to this number 33,147 men with a mental rating of between eight and ten years and the economic importance of mental classification of recruits becomes apparent. When we consider the clogging effects of very low grade mentals in the development of army organization and the positive dangers connected with the assignment of these children with adult bodies to combatant units, the value of mental classification becomes increasingly manifest. Professional and emergency army officers were not slow in recognizing the importance of this type of service.



Geometrical construction in BETA test.—Through use of cardboards, blackboard, pantomime, and demonstration, the subjects are directed to fit in the separate pieces by means of pencil lines in the heavy-faced square figure to the right in each of the ten problems. At the end of 2½ minutes the examiner calls "Stop!" and the next test is undertaken

The words of Major Robert Conard, M.R.C., Surgeon, 367th Infantry, A.E.F., are significant in this connection:

"The sorting process, both physically and *mentally*, is, as it seems to me, one of the most important things to be done. I eliminated about a thousand and am now reaping the benefit in the way of a phenomenally low ineffective rate, which I hope to maintain. *The mental selection is a great thing, and cannot be given too much weight.* So much time and energy have been wasted in training men who are mentally unfit, that I am sure the value of early elimination of that element must be recognized."

Purposes of Intelligence Tests

Among the main purposes of the psychological service may be listed:

(1) Segregation of the mentally deficient from those capable of doing combatant service;

(2) Further segregation of those wholly incompetent for military service from those capable of service in labor battalions;

(3) Assistance in the selection of candidates for (*a*) Infantry School of Officers, (*b*) Quartermaster Schools, (*c*) Machine-gun Schools, (*d*) Artillery Schools, (*e*) Signal Schools, and (*f*) Noncommissioned Officers' Schools;

(4) Assistance in determining fitness for promotion or assignment to positions of responsibility;

(5) Assistance for personnel adjutants in the assignments of recruits to organizations in such a way as to secure an equitable distribution of intelligence and thus avoid loading one company of a regiment, for example, with a preponderance of relatively inferior men while overweighting another with relatively superior men;

(6) Assistance in classifying men sent to battalion schools into classes of approximate ability, thus enabling each group to proceed at a rate commensurate with the ability of the group.

General Significance of the Psychological Service

The fundamental idea back of the psychological service as a whole consists essentially in the clear recognition of the elemental fact that supremacy must ultimately, if not immediately, rest with that side of a contentious world which levies insistent tribute upon its intelligent manhood. It is a generally acknowledged principle that success hangs heaviest on intelligent leadership and that places of responsibility cannot be safely entrusted to any save those endowed with nothing short of very superior or superior ability, the gifted members of society.

In recognition of this cardinal principle, in view of the extraordinary value of native resourcefulness, and, in view of the imperative necessity of utilizing the best brains of the nation in positions of leadership, the psychologists, under the able direction of Major R. M. Yerkes, conceived the idea of applying the science of psychology to the difficult task of classifying the men of the American Army into seven grades of intelligence. The top grade representing the cream of American manhood was thereby immediately made available to the regular army officer, who, let it be said to the lasting credit of a somewhat maligned professional class, was not slow to employ intelligence tests, upon being convinced of their validity and utility, in the selection of commissioned and noncommissioned officers. It is true that "cream will rise to the surface"; it is equally true that the process is slow and wasteful. The psychological "separator" not only abbreviated the process but graded the quality.

The outstanding significance of the psychological service, its most enduring contribution to national well-being consists in demonstrating the imperative necessity of placing intelligence examination on a parity with physical examination as now conducted by the medical profession. In this respect the work of the psychologists in the American Army finds no parallel or precedent.

The Intelligence of Negro Recruits

By M. R. TRABUE

Director, Bureau of Educational Service, Columbia University

ONE of the most interesting results found by the psychologists who examined recruits entering the United States Army, during the war just closed, was the surprisingly low intellectual level of those members of the colored race who were examined. Previous studies had been confined very largely to comparisons of the Negroes in public schools with white children in the same schools. These had invariably resulted in lower averages for the colored race than for the white, but in almost every case the differences had been relatively small and the ranges of abilities for the two races had been practically identical.

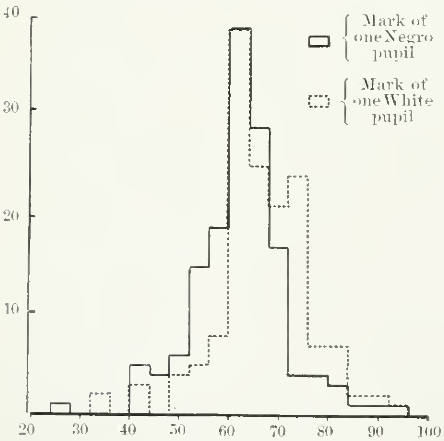
As an example of the studies which had been made, the following summary may be given of the findings of a study of the school records of one hundred and fifty Negroes entering the high schools of New York City.*

1. Only 36 per cent of the Negroes are as young at the time they enter high school as the median white child entering the same high school, the average difference between the ages of the two races being seven months.

2. The Negroes who enter high school in New York City remain somewhat longer on the average than the white pupils.

3. The scholarship marks assigned by teachers to the colored pupils in the New York City high schools average somewhat lower than the marks assigned by these same teachers to the white children. The accompanying figure shows the range of the final marks for sixty-six white pupils and for sixty-two colored pupils. It will be seen in this distribution that not more than .7 of the distribution of marks for colored pupils is below the average of the white pupils.

4. English is the one study in which there is the greatest difference between colored and white pupils. Only one fourth of the colored pupils attain marks in English which are as good or better than the average mark obtained by white pupils in the same study.



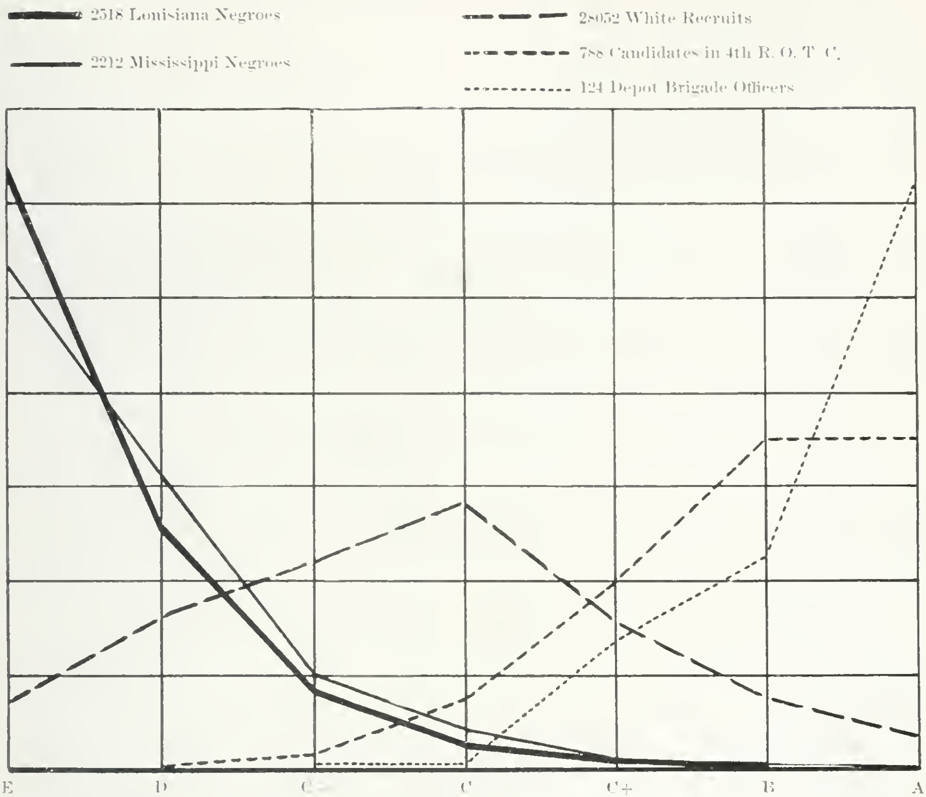
Comparison of the distribution of scholarship averages (the figures from 20 to 100, below) of white and colored pupils in New York City high schools.—The scholarship marks for an individual are the median of all marks obtained by the pupil, except those obtained in courses repeated because of failure. The figures at the left indicate the number of pupils in the respective columns who gained the average indicated below the columns

Studies by Dr. George O. Ferguson[1] had also indicated that Negroes were distinctly less capable in educational measurements than the white children in the same school systems in the South. Dr. Ferguson also found that when he classified his colored pupils into groups according to the blackness of their skins, the relationship between color and achievement was quite distinct, those with lighter skins making higher scores.

The writer was very much surprised in July, 1918, at the differences in the intelligence scores obtained between certain groups of Negroes drafted for the Army and sent to Camp Grant, Illinois, and the white men who were drafted to the same camp. The diagram opposite represents the percentages of the various "intelligence grades"

*Mayo, M. J. Mental Capacity of the American Negro, *Archives of Psychology*, Vol. XXVIII, 1913.

[1] Psychology of the Negro. *Archives of Psychology*, Vol. XXXVI. Dr. Ferguson has reported findings with the Army tests, similar to those reported in this article, in The Intelligence of Negroes at Camp Lee, Virginia, *School and Society*, Vol. IX, No. 233, June 14.



The figures at the left represent the percentages of the various groups of Army recruits examined which passed with a given rating, while the letters "A" to "E" at the bottom represent the ratings, or the degrees of excellence in the tests. The table shows that 28 per cent of the white recruits examined at this time received a rating of "C," whereas only 2½ per cent of the Louisiana Negroes made this grade; that more than 60 per cent of the Louisiana Negroes fell into the "E" or lowest class, and more than 60 per cent of the depot brigade officers received a rating of "A" or highest class

assigned to 2518 Negroes from Louisiana, to 2212 Negroes from Mississippi, to 28,052 white men from Illinois, Wisconsin, and Minnesota, to 788 candidates for commissions in the Fourth Reserve Officers' Training Camp, and to 124 officers of the 161st Depot Brigade, all examined during the months of June and July, 1918. Grade A was intended to indicate very superior intellectual capacity; grade B, superior ability; grade C+, high average ability; grade C, average; C−, low average; D, inferior; and E, very inferior.

These comparisons were rather surprising when one considered the results which had previously been found.—especially startling is the unusually large difference shown here between the distributions for Negroes and the distributions for white men. The grade of "superior" or "very superior" was obtained by only .2 of 1 per cent of the Negroes from Louisiana, and .5 of 1 per cent of the Negroes from Mississippi, while 10.7 per cent of the white men have this high standing. At the other extreme, it will be seen that only 7.4 per cent of the white men have a grade of "inferior" or "very inferior," while 52.9 per cent of the Mississippi Negroes and 63.3 per cent of the Louisiana Negroes have this low grade.

The results of the intelligence examinations in the Army are more reliable in many respects than the data used in previous studies. In the first place, previous studies had dealt entirely with school pupils; that of Mayo, particularly, had dealt only with Negroes and white pupils who had persisted in school work up to the high school grades. A very much smaller and more highly selected proportion of the colored race than of the white race persists in its efforts to secure an education; hence, previous comparison had been between the "cream" of the colored race and more or less ordinary white persons. The Army results are for relatively unselected samples of both races.

The comparison in the Army may be somewhat favorable to the colored race because of the greater possibility of intelligent white men obtaining commissions or entering some essential industry, which would exempt them from being drafted. Practically, however, this removal of many of the more clever white men from the drafted group is not important and is probably compensated for by the fact that less care was taken by draft boards in eliminating unfit Negroes than was the case with white recruits.

Mayo, in his study in New York City, had used teachers' marks as the basis for comparisons, while in the Army actual performances on the same sets of tasks and problems were used as the basis. In other words, as a basis for comparisons between the two races, the objective, definite nature of the Army tests is very superior to the estimates given by teachers in assigning scholarship grades.

During the latter part of July, 1918, a large draft of Negroes from St. Louis, Chicago, and the surrounding territory was sent to Camp Grant. In the meantime, additional Negroes from the South had been examined. Comparisons were made early in August between the scores of these northern Negroes and their southern brethren, on the one hand, and the white men among whom they were now living, on the other.

To be perfectly fair to both races and to eliminate so far as possible the probability that white men were given an undue advantage by the better educational opportunities of the North, the scores for literate and illiterate men were kept separately. Test Alpha required that the person taking it be able to understand oral and printed directions and statements in the English language and to carry out these directions thoughtfully. Test Beta did not require ability to understand either printed or spoken English. The directions were given by demonstration and pantomime, and the tasks to be done were such that ability to read or recognize the words and letters of the English language was not required. The comparisons in Table I are, therefore, for white men and Negroes who had been educated in the English language and were accustomed to reading and writing frequently. The comparisons in Table II are for men of both races who had not learned to read or write sufficiently well to make practical use of their accomplishments. The same facts are shown graphically in the figures on page 684.

Later examinations of similar groups revealed exactly the same type of thing, and correspondence with the psychological examiners at other camps indicated that our findings at Camp Grant were typical of the results obtained in other parts of the country.

There are one or two very important features which probably need to be recognized as cautions in interpreting the scores represented above. It is probable that even though the white men in Table II were just as illiterate as the colored men in that table, the white men had had, nevertheless, somewhat more experience in making check marks with a pencil than had the colored men. It may also be that a few of the pic-

TABLE I

FREQUENCY OF SCORES MADE BY LITERATE RECRUITS, CAMP GRANT, ILLINOIS

Raw Alpha Scores	*White Recruits*	*Northern Negroes*	*Southern Negroes*
210–212	....	....	....
200–209	2	....	....
190–199	12	....	....
180–189	39	1	....
170–179	106	3	1
160–169	194	6	....
150–159	325	5	....
140–149	437	8	2
130–139	583	13	1
120–129	740	23	4
110–119	1013	38	5
100–109	1311	42	5
90–99	1578	63	12
80–89	1915	79	19
70–79	2155	126	22
60–69	2506	164	22
50–59	2864	194	41
40–49	2850	231	79
30–39	2928	251	119
20–29	2451	260	179
15–19	999	161	129
10–14	810	139	217
5–9	555	106	284
1–4	213	55	184
0	19	2	11
No. of Alpha Tests	26605	1970	1336
Percentage of Total No. Examined .	76.1%	55.9%	28.3%
Median Score	57.9	40.5	14.4

TABLE II

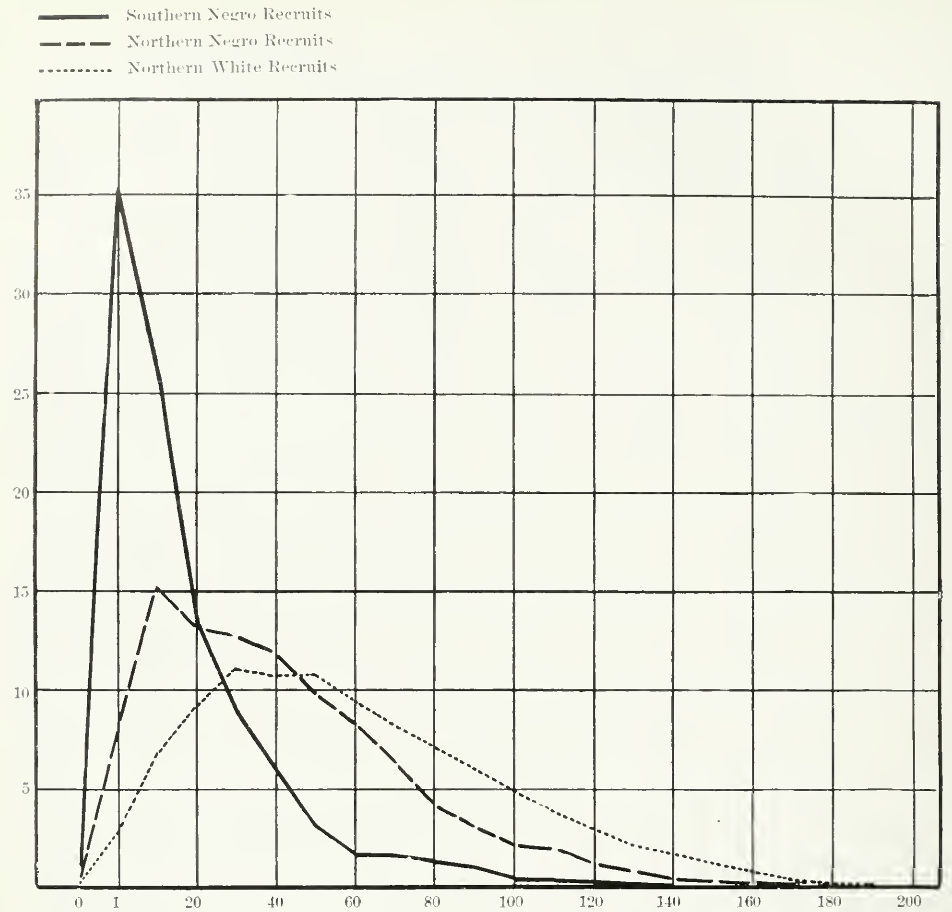
FREQUENCY OF SCORES MADE BY ILLITERATE RECRUITS, CAMP GRANT, ILLINOIS

Weighted Beta Scores	*White Recruits*	*Northern Negroes*	*Southern Negroes*
210–219	....	....	....
200–209	13	....	....
190–199	27	....	1
180–189	73	....	3
170–179	153	1	1
160–169	269	2	2
150–159	384	8	2
140–149	541	15	9
130–139	630	34	13
120–129	691	46	19
110–119	775	77	30
100–109	694	87	52
90–99	697	88	77
80–89	618	141	90
70–79	566	133	147
60–69	578	180	197
50–59	514	188	273
40–49	380	177	402
30–39	356	157	525
20–29	240	115	569
10–19	126	75	553
1–9	57	32	335
0	5	....	82
No. of Beta Tests	8387	1556	3382
Percentage of Total No. Examined .	23.9%	44.1%	71.7%
Median Score	100.8	61.9	32.9

tures presented for checking were not so familiar to the colored men as they were to the white men in the North. For example, a house without a chimney would possibly not be recognized as quickly by a Southerner as by a person in the North. It is also quite possible that northern white men, even though illiterate, are accustomed to seeing papers with pictures and diagrams much more frequently than the colored men of the South. Nevertheless, it is quite evident from the above tabulations, and still more so from the performances of the two races with blocks, guns, beds, tent rolls, squad formations, and the like, that the white race is tremendously more capable in matters requiring ability to learn and to think than is the black race.

It is also quite clear that those Negroes who live in the North are a highly selected group. It seems probable that the Negro may not have the ambition to leave his southern environment unless he has somewhat more intelligence and ability than his fellows, and that, after arriving in the North, he is not able to compete with the white laborer and to make a living for himself and his family, unless he has a degree of intelligence which is fairly comparable with that of the whites among whom he is living.

Just how this fresh and more exact information, which was the result of



Literate Negroes and Whites compared: scores in test Alpha (first trial).—These curves show the percentages (indicated by the numbers at the left) of certain groups of recruits which received in intelligence test Alpha the scores indicated on the bottom line. This test was designed for men who could read and write English. (See page 683)

Illiterate Negroes and Whites compared: scores in test Beta (first trial).—Curves similar to the above but for test Beta designed for illiterates, show that about 9 per cent of white recruits made a grade of 110, while only 5 per cent of northern and 1 per cent of southern Negroes received this rating. (See page 683)

mental testing in the Army, is going to affect the social problem of adjusting the two races, is not clear. The information presented above will be included with that obtained in many other camps when the Division of Psychology of the Office of the Surgeon General of the Army publishes its official report. The facts will be tremendously interesting and worth while as an indication of what the situation really is, but they will not, of course, in themselves indicate just what should be done about it. Each student of sociology will interpret them in his own way. The writer, being a member of the educational profession, has the following suggestions to make regarding the education of the Negro.

It would seem utter folly to try to transplant the system of schools which now exists for white people, and which has been developed for many generations with the learned professions as its ultimate goal, to the Negro race. The average northern Negro has ability to learn new things which is about equivalent to that possessed by the average eleven-year-old white school boy, while the average southern Negro is about as capable in his intellectual capacities as the average nine-year-old white school boy. Of course, there are a few Negroes of "superior" and "very superior" intelligence, but with our modern facilities for testing the intelligence of children and adults, this small percentage of the colored race might easily be selected out of the mass of their fellows and given opportunity to study the learned professions, if they so desire, without condemning the millions of ordinary Negroes to a system of education in which they are absolutely certain to fail of success.

It is just as respectable and necessary in this world of ours to till the land, to care for animals, clothing, lawns, shrubbery, and personal comfort, to serve the public as waiters, porters, scavengers, and the like, as it is to preach the gospel, explain the law, or teach mathematics. Inventive minds are cramped and become ineffective if they have to be turned constantly toward things other than the fields in which they are interested, just as dull minds are made discontented and dangerous if required or encouraged to undertake work in which they are certain to fail. We must all serve one another according to our particular capacities. The proper social ideal and educational program would provide for those Negroes and whites who will never be able to learn to read and write, effective training in some field in which they can be successful and happy. At present, about the only thing we offer is an academic education, leading nowhere in particular and impossible of mastery by more than a very small percentage of the colored race.

Such training as is suggested above should be a fundamental part of the public school system in localities where the intelligence of the citizens, white or black, is such as to demand that type of education. These courses should not be considered "inferior" or less "respectable" than the present public school curriculum. It is no disgrace for a child who is blind to have to attend a course which is prepared especially for those with his limited abilities, and it should not be any less respectable for a "dull" child, white or black, to attend that section of the public school system which is best fitted to train him in fields where he can take training and in which he will be content and successful. Contentment adds to efficiency and success leads to contentment. Our present school program is not fitted for the large mass of the Negro race, and for a considerable portion of our white race. Fundamental changes need to be made for the sake of those whose ability runs along the lines of personal service and bodily toil rather than to the juggling of words and ideas.

Central African Pygmy — *South African Bushman* — *Andamanese Negrito*

SKULLS OF THE THREE TYPES OF NEGROID PYGMIES

These skulls may be taken as fairly typical of the three groups which they represent. They are all small and rather infantile in general appearance. In the top view the skulls present a rhomboidal contour, with prominent parietal eminences and a narrow frontal region. The brain cases overhang the face and cheek bones so that these are not visible in this view. The proportion of the breadth to length of brain case is greater than it is in most Negro skulls. In the front view the low, broad, nasal openings are conspicuous. In the Andamanese skull the nasal opening is somewhat higher and narrower than in the other two. The African Pygmy and Andamanese skulls have very high orbits and the width and height are nearly equal. In the Bushman skull the orbits are slightly lower. The faces are very small in comparison with the size of the brain case. In profile the skulls show more individuality. The face of the African Pygmy is projecting or prognathous. In this it agrees with the skulls of Negroes in general. In the Andamanese skull the projection of the face is not so marked, while the Bushman face is nearly vertical. All three of the skulls have vertical foreheads but the Bushman shows an extreme development of this characteristic. The occipital regions are projecting and the mastoid processes are small in all three skulls

The Pygmy Races of Man

By LOUIS R. SULLIVAN

Assistant Curator, Department of Anthropology, American Museum

PROBABLY no other groups of mankind have inspired so many theories and so much speculation as have the Pygmy races of man. From the very earliest times up to the present, travelers, geographers, philosophers, anthropologists, and others including myself have written of them at the slightest provocation. In spite of this fact a survey of the literature impresses one with the sparsity of concrete facts upon which all the theories and speculations are based.[1]

Before detailing their geographical distribution, let us come to an understanding as to just what we mean by Pygmy. A hard and fast rule has been set by some anthropologists which admits to the classification as Pygmies, any group of mankind whose average stature does not exceed 150 centimeters or 4 feet, 11 inches, in the male sex. As we shall see later, such a definition has certain advantages, inasmuch as 150 centimeters is the starting point for a normal frequency curve of the stature of the bulk of mankind. But a too strict adherence to the rule will exclude some true Pygmy groups. At the same time it will include only a very few groups.

Many racial groups who have for years been considered and described as Pygmies and who are undoubtedly related to other tribes considered as Pygmies cannot qualify at 150 centimeters. One reason for this is that enthusiastic travelers, disregarding accurate measurements, have almost invariably underestimated the average stature of various groups by from two to four inches, as later measurements have proved.

An observer, be he ever so careful, is usually impressed by the extremes in a group and will accordingly underestimate the average stature of a tribe containing many short individuals and overestimate that of a tribe containing many tall individuals. Still others have no use for averages and will designate certain tribes as being composed of both Pygmies and tall individuals. Such tribes undoubtedly exist but are rare and one type or the other predominates by a large majority.

Normally there should be a few individuals of average stature in the shortest group of Pygmies. Likewise there should be individuals of very short stature in a group having a high average stature. To make the matter clear, let us examine the distribution of stature in a few groups having different averages.

Our comparison will be less confusing if our groups contain the same number of individuals. Since this is impossible, we can obtain nearly the same result by reducing the series to a percentage basis and assuming that each group contains 100 individuals. For the sake of variety, let us choose 100 Andamanese Negritos, 100 Kung Bushmen, 100 Italians from Sicily, and 100 Scotchmen. In the figure on page 688 I have placed in column I the range of stature in mankind in 2-centimeter intervals. The shortest stature, 136 centimeters, I have placed at the bottom of the column, and the tallest, 186 centimeters, at the top. Individuals with a stature from 136 to 159.9 centimeters, we shall call short, from 160 to 169.9 centimeters, medium, and from 170 to 186 centimeters, tall. Opposite this scale we shall distribute the men according to their stature.

Each short vertical line represents one man and is placed opposite the figure in the scale which represents his stature. In column II I have placed the Andamanese, in column III the Bushmen, in column IV the Italians, and in column V the Scotchmen. A cross indicates the approximate average of each group. It will be noted that the rows near the average contain the larger number of individuals.

As we proceed in either direction from

[1] Eliminating the mere verbal descriptions of travelers and the more accurate descriptions of very small groups of individuals, the bulk of the data on the living Pygmies has been contributed by Man, Montano, Martin, Skeat, Annandale, Sarasin brothers, Barrows, Reed, Wollaston, Williamson, Neuhauss, Schlaginhaufen, Van den Broek, Poutrin, Czekanowski, Seiner, Werner, and Johnston. The most important studies on the skulls and skeletons have been made by Flower, Turner, Duckworth, Martin, Sarasin brothers, Shrubsall, Koeze, Van den Broek, Poutrin, and Schlaginhaufen. I shall not attempt to add to the existing theories, but shall merely note the main points of interest presented by the Pygmies.

the average we find fewer and fewer individuals. The Andamanese have an average stature of 149.3 centimeters. Ninety-six of the 100 men are short and only 4 are of medium stature. The Bushmen are slightly taller on the average (156.4 centimeters). Three individuals are tall, 29 of medium stature, and 68 short. Most of us have been impressed by the short stature of the South Italians and will be surprised to note that there are relatively few very short individuals. The average stature is 165.3 centimeters. Twenty-two are tall, 61 medium, and 17 short. The Scotch present the other extreme. The average stature is 172.1 centimeters, 64 are tall, 34 medium, and only 2 are short.

From the above it will be seen that dwarfism is a relative matter and that the transitions within the group and between two given groups are so gradual that it is very difficult to draw a hard and fast dividing line. The Pygmies merge gradually into mankind proper in the matter of stature. For this reason we shall be inclined to include as Pygmies some groups whose average stature exceeds 150 centimeters. We shall also mention certain other groups who, though perhaps not true Pygmies, are borderline cases.

In the main the word Pygmy is restricted to several Negroid racial types of small stature. Best known of these are the Central African Negrillos and the Oceanic Negritos. The exact distribution of the Central African Negrillos cannot yet be stated with finality. Roughly, they are mostly confined to a belt five degrees north and south of the equator extending nearly across the African continent. The greater number of the tribes inhabit the dense for-

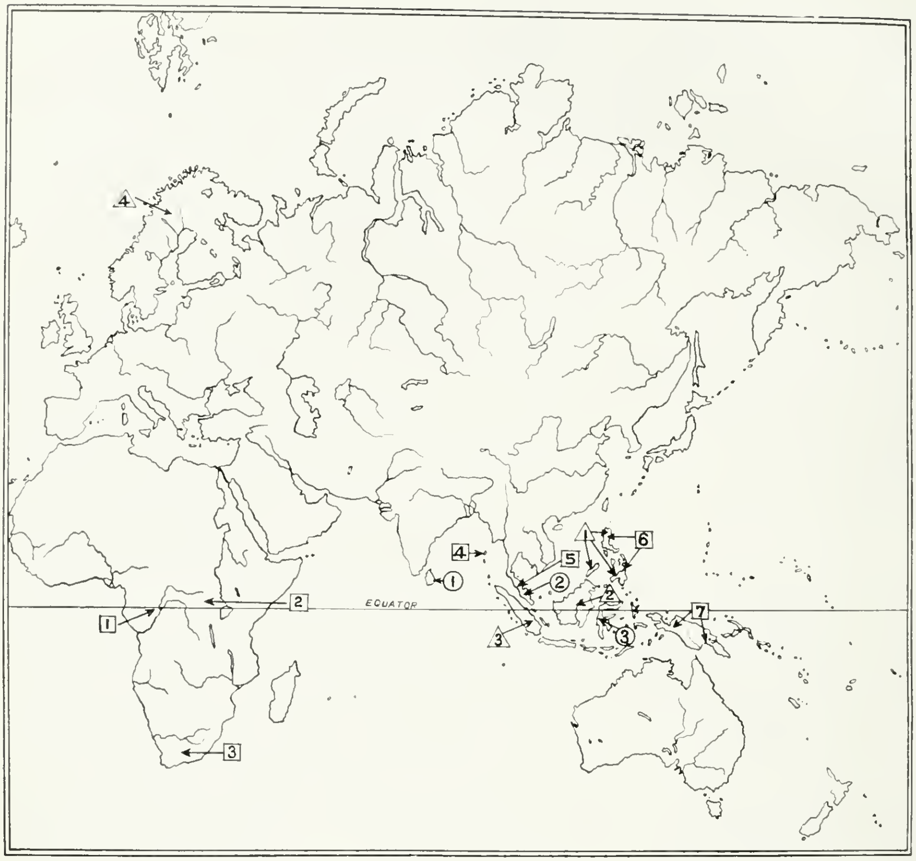
Distribution of stature in four groups having a different average stature.—Each short vertical line represents one man and is placed opposite the number on the scale (column I) representing his stature. In column II are 100 Andamanese Negritos whose average stature is 149.3 centimeters. Ninety-six of these are short, 4 are medium, and none is tall. Of the 100 Bushmen in column III, 68 are short, 29 are medium, and 3 are tall. In column IV, 100 Italians from Sicily have an average stature of 165.3 centimeters, 17 are short, 61 are medium, and 22 are tall. The Scotch in column V present the other extreme. The average stature is 172.1 centimeters and 64 are to be regarded as tall, while 34 are medium, and only 2 are short ests. The distribution of the Oceanic Negritos is more definitely known. The "Mincopies," so called, inhabit the Andaman Islands. They are of particular interest because of their long isolation on these islands. Another group of Negritos known as the Semang are found in the interior of the Malay Peninsula. Still a third group known as the Aeta are found sporadically in the Philippine Archipelago. More specifically they are found in the Apayao swamp region, in the Ilocos Mountains, in the Zambales Mountains, in the East Luzon Mountains, in the South Luzon Mountains, in the island of Palawan, and in Mindanao. Very recently Pygmy Negroid tribes have been discovered in the interior of British and Dutch New Guinea. Finally, the South African Bushmen constitute a third group. They occur sporadically in South Africa, particularly in the region of the Kalahari Desert.

But the Negro race is not unique in the production of Pygmy types. The Mongoloid race includes many groups of very short stature and the Australoid race contains true Pygmies. The Veddah of the island of Ceylon, south of India, the Sakai and Senoi of the Malay Peninsula, and the Toala of Celebes Island are all very short. They belong to the Australoid or pre-Dravidian race. The Indonesians of Mongoloid affinities, while perhaps not true Pygmies, are of very short stature. As representatives of this type we may mention the Bontok, Nabaloi, Kankanay, and Ifugao of the Philippines, the Murut, Kalabit, Kayan, Maloh, etc., of the interior of the island of Borneo, the Tenggerese of Java, the Batak[1] and Kubu of Sumatra, and possibly some of the mixed tribes of the Malay Peninsula. The Lapps of Norway, Sweden, and Russia form still another group of Mongoloid affinities, but quite different from the Indonesians. The distribution of these groups is indicated approximately on the outline map of page 690. This list includes all of the dwarfed types of living man.

It is necessary to mention, however, that prehistoric dwarfs or Pygmies are reported from Peru, South America, and the Neolithic strata of Switzerland. In both instances the reports are based on a very few specimens. Best known are three skeletons from Schweizerbild, Switzerland. All three are females and it is estimated that they belonged to individuals 140.8, 145.5, and 151.2 centimeters in height. The male stature corresponding to these would be approximately 151.0, 156.1, and 162.2 centimeters, respectively. From the same place we have a male skeleton belonging to an individual approximately 165.6 centimeters tall. Schwerz gives as the average stature of 11 female skeletons from the Neolithic of Switzerland, 149.7 centimeters, and of 7 males, 161.6 centimeters. It would seem from this that the Neolithic Swiss are not to be classed with the Negroid or Australoid Pygmies in the matter of stature and we shall not consider them further.

There are two points of particular interest in the distribution of the Pygmies. The first is their discontinuous distribution, occurring as they do only sporadically over widely separated areas. The second is the fact that wherever they are found today they are occupying the least desirable portions of the country. In the Philippines they are confined principally to the mountains and swamps; in Central Africa they are found in the forests; in South Africa they inhabit the desert regions; and elsewhere in the Malay Peninsula and New Guinea they are inland and mountain-dwelling people. Everywhere they are outnumbered and surrounded by other groups who occupy the more desirable portions of the locality. This fact has given rise to two theories. The first is to the effect that life in an unfavorable environment has been the cause of their short stature. When all things are taken into consideration it would seem that the short stature is the horse and the unfavorable environment the cart and that the Pygmies live in undesirable places because of their short stature. The other theory is that this discontinuous distribution of the Pygmies and the fact that they are always surrounded by one or more racial types are indicative of their early arrival in the regions where they now occur. In fact there are many who advocate them as the most primitive of all the living races of men. To the anatomical side of this theory we shall return shortly, but it may be pointed out here that this apparent stratification which occurs might be of quite recent origin. The fact that they are outnum-

[1] The name Batak is used indiscriminately for Philippine Negritos and Sumatran Indonesians, although there is no linguistic or physical relationship between the two groups.



DISTRIBUTION OF THE PYGMY AND SHORT RACES OF MAN

NEGROID PYGMY TYPES

1 Central African Negrillos
2 Central African Negrillos
3 South African Bushmen
4 Andamanese Negritos
5 Semang Negritos
6 "Aeta" Philippine Negritos
7 Melanesian Pygmies

AUSTRALOID PYGMY TYPES

1 Veddah
2 Sakai, Senoi
3 Toala

SHORT MONGOLOID TYPES

1 Indonesians of the Philippines
2 Indonesians of Borneo
3 Indonesians of Sumatra
4 Lapps of Norway

bered by other races wherever they are found, would lead to a stratification even if the Pygmies were very recent arrivals in a given locality.

Let us now consider briefly the physical characteristics of the Pygmies and see how much they have in common and in what respects they differ from one another. The most striking characteristics shared by all the Pygmy groups are short stature, a rather broad nose, dark skin, and hair that is not straight.

In Table I is listed the average stature of the Pygmies and some near-Pygmy tribes. For convenience these are grouped geographically and racially. The shortest group of any considerable size so far recorded is the Mawambi Negrillos described by Czekanowski. They are less than 4 feet 8 inches tall on the average. The Andamanese, Philippine Negritos, and a few New Guinea tribes are 150 centimeters or well below. The Semang are somewhat taller. Very few African groups have an average stature of less than 150 centimeters. The South African Bushmen also average more than 150 centimeters in height. The Australoid Pygmies have an average stature very similar to that of the Bushmen.

TABLE I

AVERAGE STATURE OF THE SHORT RACES OF MEN

Group, Locality, etc.	*Stature (Centimeters)*	*Inches*	*Author*
Negrito Pygmies			
Zambales, Philippine Islands	146.3	57½	Reed
Bataan, " "	145.4	57	Barrows
Batak, " "	150.0	59	"
North Andamanese	148.6	58½	Census of India
South Andamanese	148.2	58½	" "
Semang, Malay Peninsula	152.0	60	Annandale
Mafulu, British New Guinea	155.1	61	Williamson
Tapiro, Dutch New Guinea	144.8	57	Wollaston
Toricelli, New Guinea	150.9	59½	Schlaginhaufen
Goliath Pygmies, New Guinea	149.2	58½	Wollaston
Pesechem, New Guinea	152.8	60	Van den Broek
Morup, New Guinea	150.5	59½	" " "
Kamaweka, New Guinea	148.7	58½	Seligmann
Negrillo Pygmies, Equatorial Africa			
N'Gali (Ba-Binga)	148.0	58	Poutrin
M'Bio (Ba-Binga)	155.1	61	"
Lobaye (Ba-Binga)	148.6	58½	"
Ba Tua (pure)	152.2	60	"
Bambute, etc.	149.7	59	Johnston
Batwa (mixed)	159.8	63	Czekanowski
Baamba	157.3	62	"
Mawambi	140.8	55½	"
South African Bushmen			
Heikum and Kung	155.3	61	Werner
Kung	156.4	61½	Seiner
Ogowe	153.3	60½	"
Heikum	152.5	60	"
Australoid Pygmies			
Senoi, Malay Peninsula	152.0	60	Martin
Veddah, Ceylon	153.3	60½	Sarasin brothers
Toala, Celebes Island	156.1	61½	" "
Indonesian Type			
Nabaloi, Philippine Islands	149.1	58½	Bean
Kankanay, " "	150.6	59½	Barrows
Manobo, " "	151.8	59½	Montano
Ifugao, " "	155.2	61	Barrows
Bontok, " "	155.0	61	Kroeber
Mandaya, " "	153.9	60½	Cole
Bilaan, " "	154.7	61	"
Tagbanua, " "	155.0	61	Barrows
Ulu Ayars, Borneo	155.1	61	Hose and McDougall
Kalabit, "	156.1	61½	" "
Kayan, "	155.0	61	" "
Maloh, "	158.5	62½	" "
Torajda, Celebes Island	159.8	63	Sarasin brothers
Tomekongka, " "	156.9	61½	" "
Tenggerese, Java	160.0	63	Kohlbrugge
Orang Kubu, Sumatra	158.7	62½	Hagen
Arctic Mongoloid Type			
Lapps, Norway	152.3	60	Mantegazza
Lapps, Russia	155.8	61½	Anutschin

In Table II (page 692) the nose form of these races is compared. All of the groups recorded, with the possible exception of the Lapps, have a low, broad nose. We are accustomed to regard this as a Negroid characteristic but such a conception leads to confusion. A low broad nose is a primitive character universal in the Negro race, but by no means monopolized by that group. The Australoid type and the Indonesian type both have a low broad nose. The South African Bushmen have probably been the least successful of the living races of man in developing a nose. The nose bridge, very low in other Negroid groups, is almost flat in the Bushmen. In the African Negrillos and Bushmen the width of the nose is greater than the height (indicated by the nasal index being in excess of 100). Excepting the Philippine Negritos, the Oceanic Negritos have a somewhat narrower nose but still much broader than the nose of Europeans and Mongols. With the exception of the Senoi, accurate data on the nose of the Australoid Pygmies are wanting. But from the photographs of these groups it is very evident that they have broad low noses. The Indonesians have a nose which rivals that of the Negro in the ratio of breadth to height. To my mind this does not indicate Negro affinities but merely the retention of a primitive character independently in these groups.

The head form of Pygmies is also of interest. As a group the Negroes have long narrow heads, but the Pygmy Negritos and Negrillos tend to have a somewhat wider head. This characteristic is expressed by the cephalic index which records the width of the head in terms of percentage of the length. In Table III (page 693) we note that the Philippine Negritos and Andamanese have very wide heads. The Semang Negritos and the New Guinea

TABLE II

NOSE FORM OF THE SHORT RACES OF MAN EXPRESSED BY THE NASAL INDEX

(The nasal index expresses the width of the nose in terms of percentage of the height of the nose. A large index denotes a broad nose while a small index denotes a narrow nose)

Group and Locality	*Nasal Index*	*Author*
Negrito Pygmies		
Bataan, Philippine Islands	94.7	Montano
Zambales, " "	106.0	Reed
Batak, " "	97.0	Barrows
North Andamanese	92.5	Census of India
South Andamanese	88.2	" "
Semang, Malay Peninsula	97.0	Annandale
Mafulu, British New Guinea	83.8	Williamson
Tapiro, Dutch New Guinea	81.4	Wollaston
Goliath Pygmies, New Guinea	83.9	Van den Broek
Pesechem, New Gainea	83.2	" " "
Morup, " "	88.1	" " "
Negrillo Pygmies, Equatorial Africa		
N'Gali (Ba-Binga)	105.0	Poutrin
M'Bio (Ba-Binga)	105.0	"
Lobaye (Ba-Binga)	106.0	"
Ba Tua (pure)	111.0	"
Bambute, etc.	105.8	Johnston
Batwa (mixed)	86.9	Czekanowski
Baamba	86.2	"
Mawambi	91.2	"
South African Bushmen		
Heikum and Kung	102.5	Werner
Australoid Pygmies		
Senoi, Malay Peninsula	86.0	Martin
Veddah, Ceylon	Broad	Sarasin brothers
Toala, Celebes Island	Broad	" "
Indonesian Type		
Nabaloi, Philippine Islands	95.0	Bean
Kankanay, " "	88.7	Barrows
Ifugao, " "	101.9	"
Bontok, " "	99.8	Kroeber
Bilaan, " "	90.0	Montano
Tagbanua, " "	93.4	Barrows
Kalabit, Borneo	91.5	Hose and McDougall
Maloh, "	97.4	" "
Tenggerese, Java	100.4	Kohlbrugge
Orang Kubu, Sumatra	89.0	Hagen
Arctic Mongoloid Type		
Lapps	Medium	Deniker

Pygmies, for the most part, have somewhat narrower heads. The Australoid Pygmies and the Indonesians also have rather narrow heads. The Lapps have extremely broad heads.

While none of the Pygmies have straight hair, their hair form is by no means similar. The Negritos and Negrillos have typical Negroid hair, closely curled and frizzly. The Bushmen have an extreme type of Negro hair. The hair is much finer and more closely coiled. When stretched slightly it has the appearance of a very fine and closely coiled spring. The Australoid Pygmies have either wavy or curly hair. The Indonesians have straight or very slightly waved hair. The Lapps have straight coarse black hair. The Australoid Pygmies are characterized by an abundance of body hair. Some of the Negroid Pygmies also differ from the Negroes in general in having the body covered with short downy hair. This characteristic is reported for some African Negrillos and the Pygmies of New Guinea.

The Negroid Pygmies also differ from the other Negroes in having a lighter skin color. The Bushmen have a light yellowish brown skin. The Negrillos and New Guinea Pygmies have a skin color much lighter than the neighboring Negroes and in some instances almost yellow. The Andamanese and Philippine Negritos are described as having more often a rather dark brown skin color. The Indonesians show varying shades of yellow-brown pigmentation. Again, the Bushmen and certain Negrillo and Negrito Pygmies also differ from the Negroes proper in having a convex upper lip.

I have figured (page 686) three skulls from the collection of the American Museum of Natural History, representing the three main types of Negroid Pygmies. From left to right they are a Congo Pygmy, a South African Bushman, and an Andamanese Negrito. These skulls are fairly typical of the groups they represent. In the top view they show a similarity in contour, all presenting an outline more or less rhomboid in form. This form is in part due to the narrow frontal region and the prominence of the parietal eminences. These may be regarded as infantile characteristics.

In the front view there are more marked differences. The nasal opening is narrower in the Andamanese skull. The African Pygmy and Bushman skulls have low broad nasal openings and the eye openings are widely separated. The Pygmy and Andamanese skulls have very high orbits.

In profile the skulls show a much more striking individuality. In the African

Pygmy the face projects beyond the brain case more than in the others. The Bushman face is nearly vertical. The Andamanese skull is intermediate between the two. All have a more or less vertical forehead but this characteristic is most pronounced in the Bushman. In all three skulls the mastoid processes, found just behind the ear openings, are small.

The cranial capacity, which may be taken as an index of gross size of the brain, is small in all the Pygmy types. The Veddah have the smallest cranial capacity so far recorded, 1250 cubic centimeters. The Bushmen are next in size with 1260 cubic centimeters. The average cranial capacity of the Andamanese is 1269 cubic centimeters, of the Philippine Negritos 1409 cubic centimeters, and of the Semang Negritos 1338 cubic centimeters. The average cranial capacity of Europeans is somewhat above 1500 cubic centimeters. Of course the small size of these Pygmies must be taken into consideration in connection with their small cranial capacity.

TABLE III

HEAD FORM OF THE SHORT RACES OF MAN EXPRESSED BY THE CEPHALIC INDEX

(The cephalic index expresses the width of the head in terms of percentage of the length of the head. A large index denotes a wide head and a small index a narrow head)

Group and Locality	*Cephalic Index*	*Author*
Negrito Pygmies		
Bataan, Philippine Islands	81.7	Montano
Zambales, " "	82.2	Reed
Batak, " "	81.0	Barrows
North Andamanese	82.5	Census of India
South Andamanese	83.0	" "
Semang, Malay Peninsula	77.9	Annandale
Mafulu, British New Guinea	80.0	Williamson
Tapiro, Dutch New Guinea	79.4	Wollaston
Toricelli, New Guinea	77.7	Schlaginhaufen
Goliath Pygmies, New Guinea	83.4	Wollaston
Pesechem, New Guinea	80.5	Van den Broek
Morup, New Guinea	82.1	" " "
Kamaweka, New Guinea	78.1	Seligmann
Negrillo Pygmies, Equatorial Africa		
N'Gali (Ba-Binga)	78.1	Poutrin
M'Bio "	79.7	"
Lobaye "	81.7	"
Ba Tua (pure)	78.1	"
Bambute, etc.	79.4	Johnston
Batwa (mixed)	75.1	Czekanowski
Baamba	79.8	"
Mawambi	79.6	"
South African Bushmen		
Heikum and Kung	76.3	Werner
Australoid Pygmies		
Senoi, Malay Peninsula	77.2	Martin
Veddah, Ceylon	75.1	Deniker
Toala, Celebes Island	80.4	Sarasin brothers
Indonesian Type		
Nabaloi, Philippine Islands	78.5	Bean
Kankanay, " "	81.6	Barrows
Ifugao, " "	76.9	"
Bontok, " "	78.4	Kroeber
Bilaan, " "	80.4	Cole
Tagbanua, " "	81.0	Barrows
Ulu Ayars, Borneo	74.7	Hose and McDougall
Kalabit, "	78.5	" "
Maloh, "	76.8	" "
Tomekongka, Celebes Island	81.8	" "
Tenggerese, Java	79.7	Kohlbrugge
Orang Kubu, Sumatra	78.5	Hagen
Arctic Mongoloid Type		
Lapps	87.6	Deniker

The Negritos and Negrillos have not been very successful in developing a chin. On page 694 are shown the lower jaws of a Congo Pygmy, an Andamanese Negrito, a South African Bushman, and a modern European. The first two have poorly developed chins. The Bushman, however, has typically a rather prominent and peculiarly pointed chin. In this respect he is almost as highly specialized as the modern European. No other Negroid group has the chin developed to such an extent as the Bushman.

We have seen now that, although the Negroid Pygmies have a few characteristics in common, they have, to a very large extent, developed local peculiarities which distinguish them from one another. The Bushmen, perhaps, have carried this specialization the farthest and differ more from the Negrillos and Negritos than do these two from each other. In fact, it seems clear that if the Bushmen are related to the Negritos and Negrillos, this relationship is a very distant one. The Australoid group, including the Veddah, Senoi, and Toala, are quite different from the Negroid Pygmies in several important characters. The Indonesian group of short stature are Mongoloid in their affinities. Many other groups of Mongoloid affinities have very short stature. Among these should be mentioned certain Siberian tribes, some American Indians in Mexico and South America, and the Eskimo. So then we have Pygmies or a tendency to very short stature in three distinct racial types. The Caucasian or European racial type alone has no marked examples of extremely short stature, except as individuals. But the Negritos, Negrillos, Bushmen, and Australoid groups alone are true Pygmies.

When considered culturally, most of these Pygmy tribes are undoubtedly very primitive. They are all in the hunting stage.

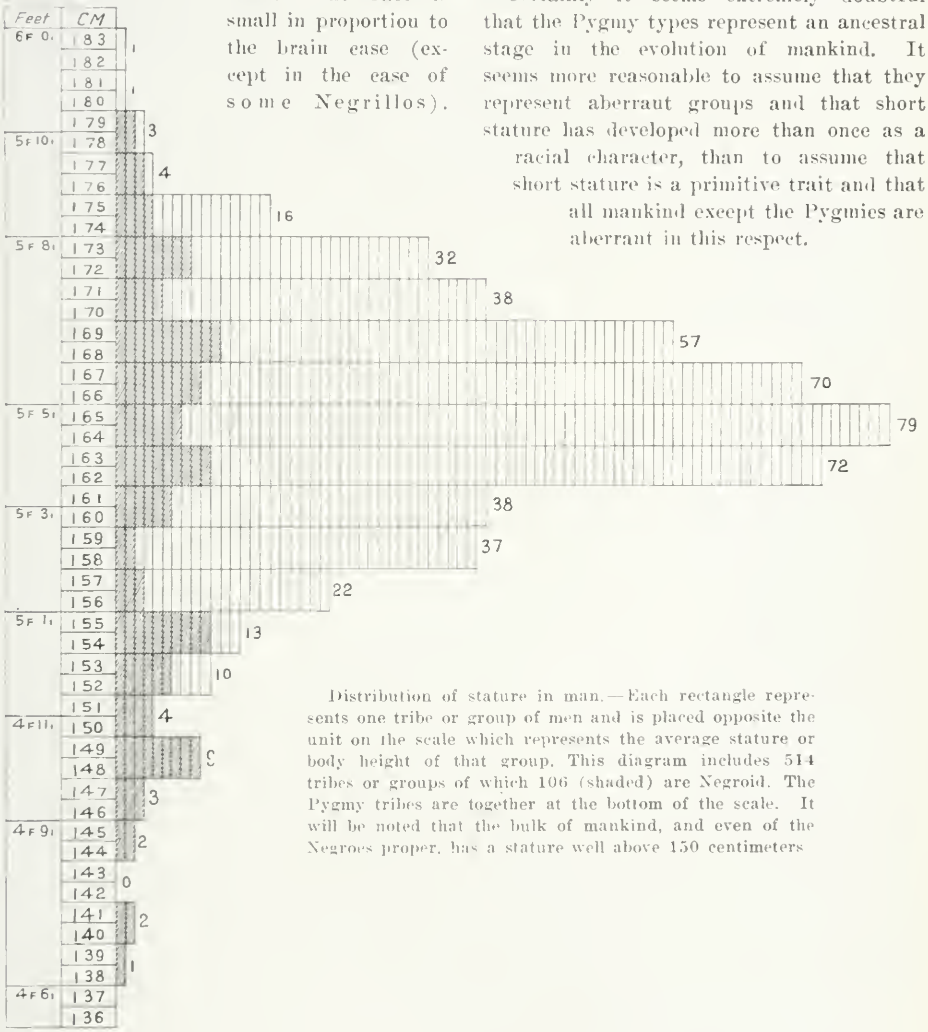
Lower jaws of the Negro Pygmy types compared with a European jaw.—From above downward are the jaws of a Central African Pygmy, an Andamanese Negrito, a South African Bushman, and a European. Of all Negro types the Bushman alone has succeeded in developing a chin. In this respect the Bushman is almost as highly specialized as the European

This fact has been largely instrumental in their being regarded as primitive anatomically and consequently as ancestral to mankind as a whole. Such a theory is due to a confusion of culture and anatomy. There is not necessarily any direct correlation between a primitive culture and a primitive anatomical structure. The two things are distinct and different. While we may have a primitive culture associated with a group having a primitive anatomical structure, the two are not related in the sense of cause and effect but are merely an association. Very few primitive anatomical characters found in modern man could influence culture to any great extent.

At the very outset it seems questionable whether short stature, the most characteristic trait of the Pygmies, is a primitive character. In the figure opposite is plotted the stature of mankind as a whole. Each small rectangle represents the average stature of one tribe or group of men. The average stature of 514 different groups is used. This should give us a fair idea of the distribution of stature in mankind. From about 150 centimeters to 180 centimeters we have a normal frequency curve with the greatest frequency at 164 to 165 centimeters. On the other hand, the Negroes, represented by the shaded rectangles, have an irregular distribution of stature with points of greatest frequency at 168 to 169 centimeters, 154 to 155 centimeters, and 148 to 149 centimeters. In other words, the bulk of mankind, and even of the Negroes proper, has a stature decidedly above that of the Pygmies. It is rather difficult to believe that only these few groups have retained the primitive form of stature while all the others have specialized in this respect. It is very seldom that such a thing occurs within a group.

Another proof that excessively short stature is not a primitive trait is found in the fact that the earliest types of man on whom we have any data for this trait were decidedly taller than the Pygmies. I refer of course to the Neanderthal race who lived in Europe during the Pleistocene. Their average stature was about 163 centimeters (5 feet 4 inches). Going back still further to *Pithecanthropus erectus*, a type showing certain characters of both the apes and man, we find a femur or thigh bone 45.5 centimeters long. This length of femur corresponds to a stature of about 5 feet, 7 inches, in man. In the upper Palæolithic, the Crô-Magnon race had attained a stature well above 6 feet.

The Pygmies do, however, present many primitive traits. They accentuate some of the infantile characteristics of the Negro group. In more than one respect they suggest a group whose development in certain particulars has been retarded. The brain case is infantile in form. The face is small in proportion to the brain case (except in the case of some Negrillos).



Distribution of stature in man.—Each rectangle represents one tribe or group of men and is placed opposite the unit on the scale which represents the average stature or body height of that group. This diagram includes 514 tribes or groups of which 106 (shaded) are Negroid. The Pygmy tribes are together at the bottom of the scale. It will be noted that the bulk of mankind, and even of the Negroes proper, has a stature well above 150 centimeters

Taken all together they are no more primitive than other Negro groups and perhaps slightly less so. Anatomically it is by no means clear that the Negro race is the most primitive. Certain Australoid and Mongoloid groups seem, on the whole, to approach more nearly to the generalized type of mankind. The extremely dark skin, the absence of body hair, the closely curled hair, thick lips, and the form of the calcaneum in Negroes are undoubtedly specializations.

Certainly it seems extremely doubtful that the Pygmy types represent an ancestral stage in the evolution of mankind. It seems more reasonable to assume that they represent aberrant groups and that short stature has developed more than once as a racial character, than to assume that short stature is a primitive trait and that all mankind except the Pygmies are aberrant in this respect.

GROUP IN THE AMERICAN MUSEUM, SHOWING A PYGMY CAMP IN THE CONGO FOREST

Nomad Dwarfs and Civilization *

A STUDY OF THE PYGMIES OF CENTRAL AFRICA

By HERBERT LANG

Assistant Curator of Mammalogy in the American Museum

FOREWORD.—A splendid habitat group representing a Pygmy camp in the Rain Forest of the north-eastern section of the Belgian Congo has recently been installed in the American Museum of Natural History. The scene depicts a lucky hunter returning with his faithful companion, a hunting dog, to the family circle consisting of a wife, two children, and an aged mother. There is thus given to the public, always eager for information about primitive types of man, an opportunity to become better acquainted with the Belgian Congo dwarfs, who still manage to eke out their meager existence in the primeval forests of Africa. The building of the group was made possible by the fact that the American Museum Congo Expedition, although chiefly zoölogical, had a wide range of activities and gathered during the six years of its stay (1909–1915), material and information necessary for the reproduction of Pygmy life. The group was designed and executed by Mr. Frederick Blaschke under the supervision of Director F. A. Lucas and the direction of the Author.

Especially interesting is the fact that the lifelike qualities of the new group are partly the result of the intelligence of the Pygmies themselves. They were the first to contribute to our valuable collection of more than 100 life masks representative of 16 different tribes of Central African races. Mr. James P. Chapin, my only white companion and an excellent linguist, explained to the first Pygmy we saw that we should like to reproduce his face by covering it with a layer of "soft, white mud" (plaster of Paris). Although apparently frightened, the little fellow suggested that before having his eyes and mouth covered with "mud," he would like to see it put on his hand or foot. The completed cast aroused his admiration, but he hastened to add that the cold plaster had become so uncomfortably hot when setting that in his mind fear arose that he was to be broiled alive. From then on, however, we had less difficulty in taking casts, and although the tall Negroes invariably became nervous and often trembled during the process, Pygmies submitted with comparative confidence.

Emandinia, chief of the Nala Pygmies, in reply to compliments on his equanimity while having his cast taken, said that fear to him was needless. Was not the white man alone, and Emandinia supported by one hundred well-tried archers, six of whom had never missed their mark? These are the bowmen shown in the photograph on page 705; they took aim at me but never released their arrows.

A counterpart of this was my experience with the Logos, when Maruka, an extremely agreeable but shrewd chief, made no objection to having his face cast, although his twelve councilors would not allow it unless they could assist, fully armed with spears, bows, and arrows, as is their custom in war. Much to their satisfaction, I invited them to be present—on condition, however, that five additional casts should accompany their chief's to America; and as the Museum enlarges its series of exhibitions, reproductions of these men may take their places in scenes representing native Negro life.—HERBERT LANG.

FROM time immemorial the imagination of poets has enriched the literature of many nations with legends of bearded, benevolent dwarfs, impish mountain sprites, and winged fairies, endowed with supernatural power and with passion for love and revenge. Today it is thought that perhaps some of these charming tales had their origin more in truth than in fiction. Homer's account of Pygmy nations, said by Aristotle to dwell beyond the lakes above Egypt, from which flows the Nile, was apparently not based upon mere fancy. More than two thousand years later, in 1870, Dr. Schweinfurth,[1] during his memorable exploration in what is now the northeastern section of the Belgian Congo, discovered the "Akkas," perhaps remnants of that very race renowned in verse, and now known as the Central African Pygmies.

For centuries Africa's black sons have struggled with the horrors of famine, cannibalism, war, and slavery, while the white man has slowly evolved civilization. The Mediterranean region and eastern and southern portions have been well enough known but the vast area south of the Sahara has only lately received serious attention when European nations have taken a more active interest in their southern neighbors. Thus within the last few decades, the Dark Continent has been forced to surrender one by one its well-guarded mysteries.

Colonizing efforts, however, in Central Africa have continually had one great check, more formidable than a Chinese wall: the white man can seldom bear for any length of time the hot, moisture-laden atmosphere or escape the many diseases lurking in the equatorial forests. In West Africa all along the routes of the Caucasian's advance are the silent witnesses of indomitable life and eager adventure come to tragic termination. To prevent loss of life and to temper the zeal of an administrative staff which forms the pillars of colonization,

[1] Georg Schweinfurth. *The Heart of Africa*, Vol. II, p. 122. New York, 1874.

* The illustrations are from photographic studies of Pygmies made by the Author during the American Museum Congo Expedition.

the wise decisions of a responsible government have now limited the residential period to two years. White man's impetus must be the motive to progress, whereas the Negro will supply the activity to bring final order from chaos. Northern, southern, and eastern Africa have in part been made a white man's country, but the great, steaming equatorial forests will long remain the stronghold of the Negro race, just as they have been the refuge of the Pygmy.

The Origin, Distribution and Classification of Pygmies

Dwarfs are far more widely distributed than any of their respective discoverers supposed, independent or mixed with a taller element throughout a large part of the world. New Guinea, the Philippines, southern Asia and the adjoining islands, all these have their typical Pygmy population, the Asiatic and Oceanic branches called "Negritos," as differentiated from the Africans, the "Negrillos." Distinct traces of them have been found in many regions and MacIver[1] reports them to have been fairly numerous in Egypt between 6000 and 4000 B.C. In prehistoric times a race of tiny men dwelt together with taller men in northern Switzerland, in France, and elsewhere in Europe. Sergi[2] records numbers of small people from the peninsulas and adjacent islands of southern Europe, existing even now. In the south of Italy and in Sardinia nearly 15 per cent of the men are rejected from military service because they fail to measure 5 feet 1½ inches. If height alone constitutes the determining factor, dwarfs are nowhere scarce, for southern Europe—and now even New York—has a large population of diminutive persons, especially among women, since 4 feet 11 inches (150 cm.) is the maximum height accepted by scientists for "Pygmy-dom."

The records of modern African Pygmies prove so heterogeneous that anthropologists have not yet been able to offer a final opinion as to their classification, although separating them into various groups. For the sake of expediency three large divisions may be recognized: the South African Bushmen, the Batwa of the Central African Lake Region, and the more widely distributed Pygmies of the West African Rain Forest. (A branch of the latter is the chief concern of this article.)

The Bushmen of South Africa are usually set apart from the other Pygmy stock on account of their wide differentiation. How far this is owing to life in a different environment—for they are now restricted to the arid regions about the Kalahari Desert—or to an intermixture with the Kafirs and Herero, their neighbors, is a question extremely difficult to answer on account of lack of prehistoric evidence. If they had any affiliations with the other Pygmies it may be assumed that a separation took place in very early times.

As regards the Batwa of the Kivu and Tanganyika regions, most of them, according to Czekanowski,[3] clearly show the effects of interbreeding with Negroes around them. An apparently purer stock is to be found in the less populated, volcanic regions where they have lived in practical isolation.

Photograph of two Pygmies who helped the American Museum Expedition. This picture might well serve to illustrate ancient stories of fairies and "little men"

[1] Arthur Thomas and D. Randall-MacIver. *The Ancient Races of the Thebaid*, p. 87. Oxford, 1905.

[2] Giuseppe Sergi. Varieta Umane Microcefaliche e Pigme d'Europa. *Bullettino della Reale Accademia Medica di Roma*, Vol. 19, fasc. 2, p. 13.

[3] Jan Czekanowski. Anthropologische-ethnographische Expeditionsarbeiten in Öst-Afrika. *Zeitschrift für Ethnologie*, Vol. 41, pp. 594–595, 1909.

In the third center, the West African forest, the Pygmies are known by several names, depending on the tribe with which they live, most noted being Schweinfurth's "Akkas" (the Mangbetu name), or "Tiki-Tiki" (the Azande term), or "Mambuti" (the name given by natives of the Ituri region and now current with Europeans).

The question arises whether the Pygmies are merely degenerate types of Negroes and therefore of relatively recent origin, or the earliest type from which all taller African races have evolved, or one entirely distinct and as old as any living race. The first hypothesis finds little actual support although Sir Harry Johnston states[1] that "British anthropologists seem to be arriving at the conclusion that the Congo Pygmies do not constitute a homogeneous type of Negro clearly marked off from the main stock in the same way as the South African Bushman. They are rather arrested, infantile, or degenerate groups of the Nilotic or Bantu Negroes produced by the depressing conditions of the dense forest." Sir Harry believes "them in the main to be dwindled descendants of the earliest pioneers of the true Negro stock (as compared with the divergent Bushmen)."

Unfortunately nothing positive is known about the epoch when man first invaded Africa, and palæontological evidence from that country is most unsatisfactory. Even the origin of numerous implements and carvings of stone found in Algeria, across the Sudan, Abyssinia, the Congo Basin, and in South Africa, as well as that of the pictographs from Mauretania and South Africa, is much disputed. Granting that the Pygmies were really the first to roam over much of the eastern portion of the African continent, the theory that tall Negroes evolved from them is rather contradicted by the distribution of both the true Negro and Pygmy stocks. It seems more plausible to assume that Pygmies sprang up at an early period in Asia, accepted by many authorities as the cradle of primitive man. In the successive migrations of the human races remnants of Pygmies could survive to the present day in certain regions where a natural protection favored the preservation of their racial characteristics.

[1] *Liberia*, II, 1906, pp. 887–888.

The third supposition, then, that these African Pygmies are the approximately pure descendants of an extremely ancient race, is perhaps sustained by their morphological characters, and by modern considerations of the controlling factors of dispersal. Mammalian distribution may be called upon to furnish an excellent analogy supporting the fact that they have come to Africa by way of Asia. The okapi and water-chevrotain, whose closest relatives are known to have flourished in the southern portion of Eurasia in Miocene and Pliocene times, are today among the most typical West African forest mammals, and undoubtedly came to the continent from the northeast. Antelopes, which have undergone such a remarkable adaptive radiation in the Ethiopian part of Africa, ranging from the size of a rabbit to that of a bull, have, as generally admitted, also derived their original stock from Eurasia. It has been argued that with the advent in the northeast of the continent of the pastoral Negroes of Hamitic origin, the tiny pioneers were forced to a speedy retreat. The powerful and evidently well-organized "giants" probably showed such pride in the purity of their stock that they refused to enslave the vanquished for fear of sullying their own race. The Pygmies, thus forced to withdraw farther and farther, finally reached Central and South Africa. The northeastern or Ituri section of the West African forest area became the center from which the Pygmies roamed south and west in the wooded portion, a few reaching the Atlantic.[1]

Personal Experiences with Central African Pygmies

So far the most important information about Central African Pygmies has come from explorers and scientists who gained their knowledge either during rather short visits to Africa, or from a few especially fine individuals exported for exhibition purposes. The American Museum Congo Expedition had penetrated 1400 miles inland to Avakubi, before we finally came across our first Pygmy, who was being unjustly held on

[1] The earliest mention of West African dwarfs dates from Andrew Battell's record in 1625, followed in 1670 by that of Dapper, who speaks of the Bakke-Bakke in the kingdom of the great Makoko, situated, according to de Brazza, in the region where in 1865 Du Chaillu discovered his famous Obongos near the Ogowe River.

a charge of murder to shield an important member of another tribe; the victim with an arrow through his heart, had been found dead on the forest trail. The prisoner gladly answered questions in return for plenty of food, and the matted hair clipped from his head was shortly added to our collections.

A few weeks later, a caravan of Bandaka came to Avakubi with rubber and bundles of rattan. Among them were two groups of about fifteen Pygmies each, who, after we had carried on a long and difficult palaver with them, allowed three of their men and two women to remain with the expedition. Without delay these turned to the task of building a shelter; and in scarcely an hour they had completed opposite our tents the usual beehive-shaped hut, arranging in shingle fashion the big *Phrynium* leaves on bent sticks held together with vines. Their rapidity and curious manner of working attracted a merry crowd of porters and members of the expedition. No wonder that later in the evening the leader of the Pygmies complained bitterly to me of the annoyance, and that next morning he and his little band had disappeared! This incident is typical of the difficulty we had at first in keeping the Pygmies with us long enough to study and understand them.

Joseph, the tall Bantu, belongs to the sturdy race of Bakusu at Stanleyville. Son of a chief, he was a devoted and trustworthy helper, and acted as headman for the American Museum Expedition, playing the part of a peacemaker rather than that of a leader. The short man, Papai, is offspring of a Pygmy mother and a Bantu father, but always resented being called a Pygmy, although according to custom he had been returned to his mother's tribe when a child. During the long years of the expedition this man made many friends among the natives we met. Once the confidence of Pygmies is gained, their friendly off-hand ways are a pleasant introduction to the happy-go-lucky life of these hunting nomads

Later we saw several other groups at Avakubi and Medje, and three years later, after our return to the forest from the Sudan and Uele plains, we often had hundreds of the small folk about us. The several years of constant contact and friendship which we had had with the natives spoke well for our reputation, and the Pygmies of Ngayu, Medje, Niapu, and Nala eagerly helped us obtain some of the rarest mammals. Most surprising was the way in which they secured the rare, great scaly anteater (*Manis gigantea*), and the aard-vark (*Orycteropus*), the latter a plains animal not known before to occur in the Rain Forest. With swaggering defiance a youngster of only eight or ten years would enter one of the animal's narrow burrows, from 8 to 20 feet in length. Down into the subterranean channel, with his dagger-like knife drawn, he would grope for a victim, while we outside expectantly listened and watched. True to the tradition of the fighting quality of his race, he would not let the battle in the dark go against him—and the creeper he held as a signal for assistance and the long, flexible rattan tied to his belt always proved unnecessary precautions. A lively time would ensue after the animal had been fastened to the rattan, and the crowd without would boisterously begin jerking it from the ill-smelling cavern. The little Pygmy hero, pushing and pulling from behind, would finally emerge amid the cheers of his comrades. But as usual the witch doctor took as much of the credit as the plucky boy: had he not foreseen the glad event and specified the most propitious time?

Physical Distinctions between Pygmies and the Tall Negroes

Descriptions, apparently authoritative, too often make us believe that there are striking differences between Central African Pygmies and the tall agricultural Negroes. But when we come to see crowds containing both Pygmies and tall Negroes, most of the so-called "clear-cut" Pygmy features prove to be individual or regional characteristics. From time to time I heard officials of many years' experience in Central Africa make the sweeping statement that they could pick out a Pygmy from among hundreds of other natives. Sure of proving the contrary, I changed the hairdresses, bark-cloths, amulets, and other decorative features of a number of Pygmies and Bantus. Thus in less than ten minutes it became impossible, or at least very puzzling, for these "experts" to make good their boast; the few physical peculiarities there were had escaped their notice.

The northeastern portion of the Congo Basin now rivals America as a racial melting pot. The incoming northern elements and the Bantu, Nubian, and Hamitic races have all contributed to what might be called a forest type, generally brachycephalic, in which the Pygmy is not a stranger. It is likely that in the future the Pygmy will gradually lose his identity and disappear in this melting pot, not even retaining what is supposed to have been his most obvious character—diminutive stature.

Looking at Pygmies in numbers, we are impressed by the fact that size alone cannot be the criterion for distinction. Of thirty-three adult males measured, none of them exceeding 4 feet, 11 inches, the average was 4 feet, 8 inches, which, with seven tall Pygmies included, at once rose to 4 feet, 10 inches. Emandinia, the chief of the Pygmies of Nala, measured 5 feet, 5 inches, a fair size even for a European. As is the case the world over the women on the whole are shorter than the men, but with the Pygmies the difference is even greater than usual. In not a few instances the striking disparity may be accounted for by the customs prevalent in their intermarriage with the tall Negroes. Women in these regions constitute the only important treasure, and chiefs of the Bantu tribes have never had any compunctions in adding

In the great African forests game animals are few and far between. The experienced Pygmy reads their presence in almost imperceptible traces—a cut leaf or a pebble displaced may be the signal for stealthy pursuit. Climbing trees in his own fashion, he varies his bill of fare with honey of wild bees, a few acrid fruits of rubber vines, and fat young nestlings. Also he traps monkeys, genets, squirrels, and birds in snares skillfully arranged in trees

pretty Pygmy girls to their harems. In most of these cases the sons return to the mother's tribe, whereas the daughters, considered a valuable asset, remain with the agricultural Negroes. These marital relations naturally help to increase the influence and prestige of the Pygmies. On the other hand, it would be "taboo" for a Pygmy to marry a woman of any of his tall friends.

It would be too daring to describe as typical these remnants of a race which has not escaped continued mingling with large neighboring communities. Each successive wave of migrants has naturally left its imprint upon the Pygmies, checking certain somatological characters and molding others. As a result of the intermixture which is continually going on, a regional resemblance to the agricultural Negroes is clearly visible in the physiognomy. Human faces the world over may show the most varied expressions and where people of different racial characters are welded together slowly, it will always be difficult to present general, all-inclusive descriptions. At present no racial characters setting aside a

Permanent assembly camp near the village of Nabodia, an Azande chief at Nala. Along the northern limits of the Rain Forest the Pygmies have already adopted the architectural style of neighboring natives and have completely abandoned the beehive-shaped huts. On this particular occasion every Pygmy had been called in from the hunting camps in the forest, and the photograph shows the most important men and their helpers with whom I made arrangements for assistance in the expedition's work

To celebrate great success in hunting, Pygmies often visit the settlements of the tall Negroes who entertain them according to prevailing customs. In this Makere village they have selected a shady nook in a banana grove from which they sally forth for an occasional dance, even a mother with her tiny baby (right center) taking part. As a rule Pygmies dance singly, the men and women frequently forming separate groups, but there is little social convention among them majority of Pygmies from the tall Negroes can be stated, and it is doubtful if physical traits have at any previous period been more uniformly pronounced. Not all Pygmies are so much smaller in size as to be readily distinguished from other Africans, and in the main they are not shorter legged nor have they longer arms than the forest Negroes. Not all of them are representative of the strongly prognathous type, and a projecting monkey-like snout, with chin nearly obliterated, is an individual feature with some Bantus in most of these regions. The Pygmies are not the only African race showing the flattened, broad-winged nose, which, lacking a bridge, sets off still more sharply a well-rounded or receding forehead. Their alertness, due to peculiarities of hunting in the forest, has impressed upon their physiognomy distinctive features, which, together with a generally long, convex upper lip, are sufficiently characteristic —although more often it is scanty attire and lack of body care which distinguish them from the tall Negroes. With good reason others have mentioned the "unsteady eyes with the brutal glare," causing an uncouth, indescribably strange expression.

Perhaps too much stress has been put by various writers upon the color of the skin, which varies from black to dirty yellowish brown or reddish yellow, these and intermediate shades being as common among neighboring tall Negroes as among Pygmies. Forest tribes, however, like the Bandaka, Mobali, Mongelima, Makere, and Medje, as well as those from the plains region, the Mangbetu, Azande, and Abarambo, contrast with the uniformly dark Nilotics. Pygmies' lips are dark and the pigmentation often extends to the gums, but the undersurfaces of both hands and feet are as light as in other Negro races. Even albinos occur, although they seem more numerous among the tall Negroes; at Poko, in the Bomokandi district, more than a dozen of them lived within a short distance of the Post.

Pygmies are hairier on the body than East African types, but the West African Negroes whom we saw, especially part Nubians, like the Mangbetu, Azande, and many forest tribes, have even longer beards and mustaches, and more hair on chest and limbs; they also show the oft-mentioned "lanugo" or body down. Undoubtedly hairiness is more usual with Pygmies, but among all males in these regions it seems to be rather an individual character, as with white men. The scalp hair varies just as in neighboring tribes, forming a thick felt-like cap of kinky black hair or, more rarely, dense patches and small, bare, meandering trails. A few Pygmies have hair of a distinctly reddish brown color, a feature not uncommon among the Negroes of the northeastern Congo basin.

Habits and Superstitions of the Pygmies; Relations with the Tall Negroes

The dusty, unkempt tufts of hair, not more than two inches long, are usually matted, and palm oil is more likely to be used for gustatory delights than to give gloss to the hair. Many Pygmies, however, favor the elaborate hairdresses so common in countries of Mangbetu culture. Illness and death are the sword of Damocles held suspended by intense superstition. A shaved head, especially in women, is a sign of mourning. In despair the cut locks are wantonly thrown in the forest trails, and although one may walk upon them with impunity, to pick them up would bring worse grief than that of the bereaved. At all other times, however, a single hair in the possession of an enemy gives him power to turn upon the original owner all the evil that witchcraft holds. No wonder that every particle from the body, a single hair or the parings of a finger nail, is carefully concealed or burned in the forest!

Pygmies in speaking of bygone days reckon time by reference to memorable incidents in their lives, such as floods, wars, and good fortune, and extent of time, of course, is not calculated in years. The aged, far more numerous among this kindly little people than among other Negroes, are highly respected, and many must be 70 or 80 years old, since in several camps we found four generations happily performing their respective duties. Throughout the region a beard with even a few grizzled strands entitles one to authority, and near Avakubi the fame of a tottering Pygmy was surely vested in the seven-inch growth framing his wrinkled face.

It is marvelous how successfully the Pygmy has fitted himself to the complexity of conditions among the more powerful Negro races, with whom in strife he has somewhat the relations of the scalp-hunting Indian to the home-seeking white man. In Darkest Africa weaklings have always been mercilessly pounced upon and either killed or enslaved. But it must be understood that among the tall Negro races where cannibalism had become one of the basic features in the maintenance of society—however strange that may sound—men of extraordinary courage and cunning, like the Pygmies, who alone or in troops could be relied on as snipers, became in the forest regions one of the leading factors of power among the Bantu chiefs.

More than any other Negro, the Pygmy, with his freedom unchallenged, proves himself keen, fearless, and full of verve. But mark when he is confronted by a strange adventure. Posing with their trophy, the hero and his friend have listened to the camera shutter's ominous click. They consider this their lucky day for they rise unharmed from the ordeal of being photographed, more convinced than ever that the white man's weapons miss their aim

On the other hand, in the open warfare of the plains area, by the very nature of things the Pygmies were of little importance. From reports by Schweinfurth, Junker, and Casati as to the great numbers of dwarfs in former years, it is clear that relatively recent invasions of the fertile outskirts of the forest by the Nubianized element, the Azande and Mangbetu, must have caused the rapid decimation of the tiny people. Old Akenge, the great chief of the southernmost Azande near Poko, proudly related to me how for years, before the advent of the Belgians, instead of hunting game for the usual store of meat, they had cleared the country of Pygmies. Secrecy and silence prevailed, and under cover of night they would hang around the camps of the unsuspecting dwarfs strong nets ordinarily destined to capture the larger antelope, and suddenly pouncing upon the little fellows, they would drive them into the ambuscade and spear them, entangled and helpless, like game!

Pygmies are the children of the forest, awed by its mysteries, which their own superstitions foster and increase. Numerous dances, carried on as a rule at twilight, serve manifold purposes, most often to do honor to good spirits or to propitiate those believed to be opposed to them; but whatever the occasion, gayety usually dominates

The intricate relations of Pygmies with the tall Negroes are much the same everywhere. A superficial observer might call

The whir of a Pygmy's arrow is the crowning step in the pursuit of a victim, be it man or beast. In the forest consummate skill does not depend upon shooting at great distances, but on the ability to steal up under the wind, unheard, unseen, and never miss the fleeting chance. Even among Pygmies there are only a few who have the patience, daring, and energy for such accomplishment

No frenzied display marks the customary dances, where measured steps are accompanied by weird, reiterated songs and monotonous refrains. The din of the drum, beaten nervously, and of the rattles, shaken with much skill, sounds above the wi'd outbursts of the leaders who spur their audience to continued efforts. Men, women, and children show keen delight as they rhythmically move in the dance, but obstreperous youngsters, satisfied only with an extra wild frolic, often break away from the formal circle them vassals, but as a matter of fact, they enjoy the independence of the irresponsible. Nobody holds them in high esteem, nor yet treats them with absolute contempt. Their natural vindictiveness and ability both to retaliate and instantly shift to safer places, make them redoubtable enemies. Acknowledged dexterity and intelligence in outwitting the foe are the secrets of their continued existence, for the Negro is inclined to respect this obscure power as much as he does brute strength. Had they any grievances they were mostly settled by a single arrow, successfully sent forth from the revengeful hand.

They never cared to feast on their human victims, who among cannibalistic Bantus became the rightful spoils of war. Considering that Pygmies usually adopted the customs of their neighbors, it speaks in their favor that they were the only race in the forest not habitually involved in the terrible practice of cannibalism. True children of the forest, success in the chase satisfied their craving for meat. A sincere fellowship among themselves did away with the miseries and horrors of tribal warfare, yet they were ever ready to ward off attack. They have been the losing minority—never masters, and yet never slaves.

Continued hunting has taught the Pygmy to be as quick as lightning. Swift of foot, brave and fearless, he succeeds where others face defeat. He rather eludes than braves his foe, and though he chafes under disappointment as much as the tall Negro, he shows greater patience and determination. Time being an unimportant element, he waits for a fair chance to slay his enemy, man or beast. His eagerness to protect himself is akin to the terror of a hunted animal; and when cornered he, too, fights to the finish.

In spite of his wonderful specialization in hunting, which with the Pygmies varies as much individually and is equally subject to hero worship as unusual excellence with other peoples, the Pygmy lacks initiative to a very marked degree. Taken out of his sphere, where though poor and shiftless as a Bohemian he knows he is a dominating factor, he rapidly becomes weak and wavering, not even able to escape degeneracy.

Tribal marks are a means of identification among Congo natives comparable with uniforms of soldiers in civilized countries, and that these and other decorations have deep significance for Pygmies is proved by their general adoption as recorded by all observers. Filed teeth, a circular block of ivory in the upper lip, elaborate tattoos, a perforated concha, and a bone crosswise through the nose are in favor according to tribal connections. Beads, bracelets, anklets and leglets of iron or brass, amulets, and ornate hairdresses mark the fashion; moreover in all decorative attempts the Pygmy is a poor imitator of the tall Negro.

Language of the Pygmies; Food, and Home

Time and again explorers have had the excitement of thinking that they had discovered a real Pygmy idiom, which, they hoped, might help solve the problem of racial affiliations. But now it is an established fact that Pygmies today have no language of their own. They always speak the tongue of the neighboring agricultural tribes. Very often they may use, out of sheer laziness, a sort of jargon which sounds like a different language. But when interrogated, they speak more distinctly, and it is discovered that two or three well-known dialects have been mingled indiscriminately. May not the curious clicking sounds, believed by some to denote Bushman affinities, have had their origin in the necessity for communicating during hunting, when oral language would betray their presence to wary game?

In these tropics of uniform climate, problems of housing and clothing seldom force themselves on the attention, and the Pygmy's foremost occupation centers in food, for on a well-fed body all passions and pleasures depend. They hunt to live, at dull times confident of future plenty, and during abundance, reënacting the story of the carcass over which the vultures fight and the hyenas yowl and laugh. Although not epicures, they like a variety of food. Hunting falls to the lot of the men, fishing and the gathering of various tidbits to that of women and children. Mushrooms, yams, snails, and caterpillars are stewed in palm oil, and termites, wild honey, bee grubs, kola nuts, and fruits of rubber vine are welcome relishes.

Once in a while Pygmies may have shot an arrow into a neighbor's fine bunch of bananas to claim it as their own, or deposited a proportionate amount of meat in

PORTRAITS OF PYGMIES, BY THE AMERICAN MUSEUM CONGO EXPEDITION

The middle two are women. Ears, eyes, nose, lips, forehead, cheekbones, and chin vary in Pygmies to the same extent relatively that they vary in other races affected by continued influx of foreign elements; moreover, the length and density of the hair and, what is otherwise considered an even more reliable racial feature, the color of the skin, are subject to variations. So far as their much talked of hairiness is concerned, a scrutiny of the faces and chests of even the few men portrayed on this and the following three pages proves that no fixed rule can be applied. These have been chosen from a series of ninety sets (each of which consists of front, side, and three quarter views). How we eliminated personal preference and prejudice in the selection of the hundreds of natives photographed in the field is explained on the next page.

Patience and tact overcame most obstacles in dealing with crowds, and the slightest amusements transformed unpleasant delays into joyful occasions. Gifts to the musicians were the means of engaging the Pygmies in dances before they even thought of fleeing the dreadful experience of being photographed, and a reward for the story that would cause the greatest number to laugh seldom failed of its purpose. To simple kindness they responded with confidence, and it was not by the exercise of power that unruly, cunning natives were most easily handled, but by a reputation for absolute fairness

FOUR MEN OF THE PYGMY RACE

Great is the temptation for a traveler to pick and choose the subjects for his picture gallery with an eye to beauty and interest. But we were anxious that our anthropological series of portraits should not be invalidated. After carefully ascertaining the tribal status of natives, we lined them up indiscriminately and took every third, fifth, or seventh individual according to the number desired from any crowd. As a reward and to keep them in good humor, those photographed received presents of salt, gilt nails, beads, or other trinkets, and although none liked to be photographed, all were willing to take the chance braved by others.

Their superstitions were not solely concerned with the "evil eye" of the camera but had a much wider range. Once a Pygmy chief asked if it was not dangerous to expose to daylight the spirit residing within the camera. I removed both lens and ground glass and passed a stick through the instrument to give him proof of the absolute emptiness of it, yet he clung to his belief in the presence of a power for evil, adding that it was evidently harbored in the dark cloth of the bellows and could be destroyed only by fire. Even the thought of sitting on a stool previously occupied by a chief seemed to disturb these little fellows, but my handkerchief merely placed on the seat was sufficient to dispel the charm and restore their childish confidence

PYGMY DWELLERS IN THE CONGO FOREST

The second figure from the left is a woman. The hat worn by the man at the right recalls an experience which illustrates the unique position of Pygmies as regards their relations with their neighbors. A very large colony in Nala was led by this old chief whose wisdom must have been equal to his age to command the respect he enjoyed. His truly original appearance prompted me to take his photograph. Matted patches of crinkled hair straggling from beneath the tattered bits of hat harmonized with his frizzly beard and the few brown rags about his waist. Mr. Petronio, in charge of the Post, in his desire to assist, thought that the slovenly Pygmy was not worth a plate in that condition and taking from an onlooking Mayogo chief his brand new hat, trimmed with a highly prized tuft of red parrot feathers, he placed it on the Pygmy's head. Imagine our surprise to learn that we, as well as the Pygmy, had broken conventions dear to the heart of the Bantu. The owner of the borrowed headgear haughtily refused to take back what a Pygmy had worn for even so short a time. We laughingly paid to the Pygmy, who also refused to keep the hat, salt to the value of ten cents, and added the ownerless article to our collections. After endless discussions among themselves, the Mayogo chief finally accepted two heavy, brass anklets, worth about fifty cents, as an atonement for his injured self respect exchange for what they took from the plantations, but today most Pygmies bring their goods to the villages of the tall Negroes and with little serious altercation barter for mere trifles until darkness puts them to rout. The meat, medicine plants, fibers, and other products of the forest gathered by the Pygmies are gladly exchanged for plantains, manioc, and maize. Plantain cider or palm wine gives them too the exhilaration enjoyed in their dances. Honest among themselves, they nevertheless appreciate the cleverness involved in outwitting others, in complete disregard of principles of fair play.

Primarily hunters, they continually shift their camps to obtain the best hunting grounds. The site, old or new, is always cleared in the high-lying, open forest, near one of the numerous clear brooks; huts are either built beforehand, or old ones are quickly restored to satisfy their meager needs for housing comforts. Every new trail means new joy. Indeed, the nomad's life is easy, Pygmy women are not fettered by hard work at home, and household articles are few. Knives and pieces of bark cloth receive first attention, and as the mother starts on her way she hoists a tiny child astride her waist, where he sits grinning with delight although the narrow supporting strap mercilessly indents his flesh. Another woman loads on her back bunches of plantains, manioc, and maize, surmounted by a pot, and fastens to her arm a sleeping mat, a calabash, and perhaps an old basket. Mortar and pestle, ax, horn, rattle and a drum for merrymaking fall to the share of the boys and girls. In single file they set out, a youth leading, and one or two able-bodied men bringing up the rear. With a dagger tucked in the belt, a quiver of wooden or iron-tipped, poisoned arrows suspended from the shoulder, they thread their way, with bow and two or three arrows in the hand always ready for instant action. Under care of the old, an ember is carried from camp to camp to perpetuate their fire, said to be obtained when strokes of lightning set aflame the gigantic trees—although Pygmies living in the plains are well acquainted with the art of making fire.

The silence of the march along the trail is broken by the yelps of the dog, which, raised to be eaten, has become nevertheless a highly prized helper in the daily raids on game. Indeed a good hunting dog in some regions is gladly accepted in payment for a wife. The place of the dog in hunting is peculiar. At the time he is started on a fresh scent a large wooden clapper is put around his neck. The noise of this clapper as the dog routs the game gives the master in ambush assurance that his arrow has a chance to hit the mark. If the dog returns to camp with clanking bell, all know from afar the jubilant news. Or should the dog be led astray in the heat of the chase the noise of the clapper makes his recovery easy.

In the forest, trapping and still-hunting are methods equally in favor. The slaying of a leopard near our camp on the Nepoko River—a leopard which had brought grief upon the village by killing the chief's daughter and two other women—justified the Pygmy's reputation. Suddenly the beating of gongs roused the whole neighborhood and a throng of exuberant natives outdid themselves to welcome the hero. He happened to be a master of mimicry and by gesture and a few, clear, short phrases vividly pictured the course of the hunt. Deep in the recesses of the forest, on the trail leading to a brook, the leopard had devoured a small antelope, and then had gained its lair. Our hunter found it asleep on a low-hanging branch in dense foliage. He roused it by the splash of a stone flung into the water. With the whir of an arrow—and a gigantic leap of the spotted beast—the leopard's last struggle began. There were a few moaning roars, and then the silence of death betokened Ngalima's success; danger lurks no more on that path. With the conclusion of the pantomime, the rejoicing and dancing of the crowd continued until late into the night.

Although the privilege of chiefs to sit upon a leopard's hide makes such a trophy theirs by right, our gifts of beads, copper wire, and indigo cloth were considered a fair exchange. The meat, also the lumps of fat, a powerful, rejuvenating medicine greater in value than all else, of course became the hunter's prize. But what priceless treasure can be hidden in the leopard's heart which the Pygmy hunter has so eagerly claimed? We were soon to see, for, frantically yelling and dancing about, he waved in his hand the iron point of his own fatal arrow, which had been snapped off from the

FURTHER PORTRAITS FROM THE BELGIAN CONGO

From left to right the first and third are men. The wearing of stylish hats draped with waving feathers is the exclusive privilege of men among the Pygmies, but hairdresses, sufficiently grotesque, adorn both sexes, and as women are most skilled in this art, married men have a decided advantage in that respect. The matted, kinky hair, to which oil is often applied, is usually cut fairly short. Like the tattoos of other peoples, raised weals, in these regions a necessary adornment of women among their neighbors, are often completely dispensed with, although of the two women pictured on page 707, one shows a line and star about the shoulders and the other a decorated forehead. Pygmies, however, are far less fond of decorative effects than are the tall Negroes. The face of the woman at the extreme right is painted with "bianga," the juice from a forest fruit (*Gardenia*) blended into an ink-like fluid with charcoal; such patterns remain for only a few days.

Although these portraits bring out the more general characteristics of the Pygmies, space is lacking for a large comparative series, which would furnish conclusive proof of the physical variations in a race subject to continued modification shaft in the leopard's struggle. Twice before it had pierced the hearts of enemies, and with the joyful grin of a devil he claimed that no foe of his could escape that magic dart.

Pygmies in the Ituri region do not often try to kill elephants with their arrows,—although a single poisoned arrow might fell an elephant. Instead, they eagerly find the site where through their cunning even this mighty beast will meet his fate. A huge section of tree trunk bearing a spear at one end is hoisted to a branch forty feet above the ground. Hidden in the entangling maze the lightly balanced truncheon betrays no danger. But a slight touch on the tiny unobtrusive vine connected with the release and stretched across the trail, will send the immense, armed weight crashing down upon the unsuspecting victim.

Or they locate the habitual resting places of solitary elephants and report their find to the tall forest Negroes, who then creep up on the tuskers and with a rush drive a broad, sharp-edged spear into the base of the trunk and quick as a flash fall back into the protecting jungle. The death of the elephant ensues from loss of blood within a few hours. But should the wound be slight, Pygmies, loath to abandon the prize, follow the victim for days, shooting poisoned arrows in an attempt to blind the great beast, and finally spear him at a propitious moment.

In testing their marksmanship a squash seven inches in diameter which I used, aroused their derision, and at a distance of forty yards not one of a dozen volunteers failed to send his wooden arrow through the target. At sixty yards, however, they asked for iron-pointed arrows to withstand the strong wind.[1]

All Pygmies, however much they may wander in hunting, have a more or less permanent home near the settlements of agricultural Negroes with whom they are connected. Fifty or a hundred may live together under a leader, benefiting by such unity, although occasional friction is unavoidable between groups serving under different Bantu chiefs. Each man claims one or two wives—three is the exception—and the great fondness for children is shown by the burdening of childless women with the drudgery, whereas mothers are treated with comparative consideration.

Old, grizzly-haired men, who held honors as chiefs in their youth, relinquish these honors apparently with no feeling of bitterness. They spend much time cheerfully helping to educate the children. The subjects of the tales told to the young are the spirits hidden in mysterious forests and the unknown dangers lurking in the jungle; and they encourage their young admirers to make traps, shoot arrows, and to wrestle.

Chieftainship among the Pygmies is generally considered hereditary, as among their neighbors, but without doubt the right to the dignity of chief would be of no avail could the claimants not back it with a muscular frame and cunning enough to stamp them as men most capable of keeping the wolf from the door; only thus can they preside over the destinies of these small and scattered communities.

No time-honored clearing in the center of the village has been set aside for their deliberations. Nor are there the dignity and order so common with the Bantu, whose auguries, however, the Pygmies use during palavers. Indeed, the Pygmy councils, from which the women are excluded, are only the stormy outbreaks of a vociferous, gesticulating crowd. When the commotion has finally subsided, a few may still dispute the

[1] Throughout the practice, a young Pygmy had amused the crowd by mimicking the sharpshooters. When asked to show his skill as a marksman he preferred to imitate the sufferings of an elephant wounded by arrows. With stiffened legs, and back in horizontal position, he made his arms serve as forelimbs—sometimes as ears—and with the help of his bow represented the trunk. At moments he was pathetically slow and at other times the eye could hardly follow his movements. Then taking the part of a duiker, he drew himself together, arched his back, tripped along for a few paces, and stopped suddenly, a splendid take-off of their peculiar, nervous movements. At twenty yards from the squash target he suddenly stood up and hit the mark, a feat announced with a savage yell and a loud thwack upon his forearm.

In the afternoon the little fellow admirably imitated an official, taking especial advantage of the latter's habit of accentuating his instructions with peculiar, abrupt gestures. When I asked him to mimic me he grinned happily. During the forenoon I had taken a number of photographs and my tripod camera was still standing in the shade. Without injury to the instrument he mimicked my every movement with just enough exaggeration to make everyone laugh. Finally he indicated that the "evil eye had seen well"—and now came the climax to the performance. The Pygmy he had pretended to photograph, instead of unconcernedly walking away, dropped to the ground, illustrating the native superstition that the "big evil eye" of the camera causes death. A block of salt laid on the "dead" man's stomach instantly resuscitated him and the two entertainers walked off joyously, but only after the clown had received a like reward.

chief's dictum, which nevertheless is executed with expedition. Especially is the signal to clear out from camp obeyed with incredible celerity and uncanny silence. Not a sign indicates their whereabouts, and more surprising still is the return, when they suddenly swarm in from every side.

Pygmies have generally been considered shy, and except in a few regions they have been unwilling to come in numbers into government stations. In many skirmishes and in actual warfare they often turned the tide of battle for the Bantus by their unfailing aim as snipers. In the palavers ensuing, the tall Negroes were only too glad to unload on the dwarfs the responsibility for loss of life and wrongdoing.

Years of trials and tribulations have finally resulted in better relations between the Pygmies and the administrative officials. Far from being indolent and evasive, they have proved intelligent and willing to give up their nomadic life. As soon as they felt convinced that the Belgian government extended them freedom and equality with other natives, their villages and plantations looked in no wise different from those of the tall Negroes. They adopted the oblong type of hut, had their own blacksmiths, and the women had long ago learned to make pottery and wickerwork, and to perform other "household duties"—which include the clearing of roads leading to their settlements. From the small, irresponsible human devil that used to roam about aimlessly in the moisture-laden forests of Central Africa to this benevolent little gnome and responsive citizen of our day is a mighty stride.

Pygmies continually shift their camps in search of the best hunting grounds. The nomad's life is easy. There are few household goods to be moved. Some of the women carry the supplies of food with the cooking pot, and the sleeping mat; the boys and girls are intrusted with ax, horn, rattle, and drum; while the mother hoists the smallest child astride her waist where he is happy although the supporting strap may mercilessly indent his flesh.

Throughout heathen Africa motherhood is regarded as a special blessing. Among people so devoted to hunting as the Pygmies, sturdy manhood becomes all important; yet even so, girls are welcomed with greater joy than boys. Women, indeed, are the sole external expression of prosperity and wealth in these regions, and the relatively small number of wives the Pygmies own stamps them as paupers in the eyes of their agricultural neighbors

Photograph by H. C. Crampton

Mt. Roraima, the highest point of British Guiana, is a sandstone plateau eight miles long rising on perpendicular cliffs, down which tumble numerous cascades from the miniature lakes on its weathered top. British Guiana may be roughly divided into two low belts near the coast, and a mountainous interior for the most part heavily forested—except for certain grassy savannahs such as shown in the photograph. At the very foot of Roraima rain falls almost every day, accompanied by heavy winds. Here giant trees of the jungle give place to low gnarled forms with ferns and mosses in dripping festoons on every branch

Residential section of Georgetown with the governor's "palace" in the left background. Nearly every house is surrounded by trees and gardens giving the city a forested appearance from a distance. The flatness of the horizon of the coastal plain is noticeable in the skyline. In the foreground can be seen one of the open trenches of the city's sewerage system along the side of the street

A Real El Dorado

BRITISH GUIANA POSSESSES NATURAL RESOURCES OF VITAL IMPORTANCE WHICH NOW LIE DORMANT

By WILLIAM J. LAVARRE

Illustrations from photographs by the Author

THE people of the United States are steadily awakening to the possibilities that are offered them for an increased commerce with South America. Reports come in, now and then, from various places; some of them say that Rio de Janeiro is to be the coming trade center of the continent, while others assert that Buenos Aires will rise more quickly in response to the commerce of the United States. If we draw a straight line from any part of the Atlantic coast of North America, say from New York, to South America, we find that it brings us to one of the three Guianas, either French, Dutch, or British. These are our nearest South American neighbors.

British Guiana is the most westward, and the largest of the three Guianas. It extends along the seacoast for 270 miles, reaches 500 miles into the interior, and is approximately 90,000 square miles in area. The topography of the country divides it into three natural regions: 1, the low coastal lands of marine alluvium rising gradually from the sea and extending from ten to forty miles inland; 2, sandy and clayey country of sedentary soil, with forests, swamps, and sand dunes, and traversed by a network of rivers and their numerous tributaries in which occur many rapids and falls; 3, the mountainous region, the eastern part of which is forested, and the southwest, an extensive area of flat grass lands elevated three thousand feet above sea level.

The forest Indian is seldom used as a laborer because of his small stature, but makes an excellent river-man and carrier and an indispensable guide in the interior [1]

Each of these natural regions has its own special resources. The coastal belt, swept by the northeast trade winds, is excellent for agricultural and pastoral pursuits. The second and third belts are covered by an exuberant primeval forest, and are rich in mineral resources. On the vast savannahs excellent pasturage and sugar lands may be found.

Looking at the map of British Guiana, the striking thing about it is the network of rivers by which it is traversed. These at present furnish the only means of access to the interior. The western part of the country is occupied by a central mass of flat-topped mountains forming a series of terraces and plateaus. Mt. Roraima, the highest of these, about 8500 feet, has a nearly flat, grass-covered top of twelve square miles. The northwest portion is rich in gold deposits, and recently diamonds have been located in paying quantities along the upper Mazaruni River

Nearly the whole of the civilized population of the colony is located along the coast and on the lower banks of the larger rivers. Here, also, are located the present-day industries. The raising of rice and sugar cane, and the making of rum and molasses, are the chief occupations of the people. Coconuts thrive well on the coastal lands,

[1] The forest Indian raises his *benab* or shed anywhere in the bush, makes a small clearing for his wife's cassava field, and then spends his days in pursuit of tropical game. It is estimated that 15,000 aborigines are scattered through the Guiana forest, a remnant of the Indians whom the Spanish vainly attempted to enslave. The famous cannibals of the coast, the Caribs who gave their name to the sea, are virtually extinct after years of warfare against the white man.

The late Colonel Roosevelt in 1915 visited the Tropical Research Station of the New York Zoölogical Society at Kalacoon and was greatly impressed by the possibilities of Guiana, particularly its forest resources. The cultivation of rubber is gaining in importance each year. The establishment of experiment plantations proves that Para rubber will grow vigorously in almost any situation outside the flat coastal lands

The Botanical Garden in Georgetown contains an experiment station where scientists may come from any part of the world for study of the tropical flora in its natural habitat. The Garden serves also as the main park of Georgetown where the populace promenades on Sundays and holidays. The photograph shows two picturesque travelers' palms in the Garden

especially where the soil is sandy, and a considerable expansion of this cultivation is taking place. There are large areas of low-lying lands on which coffee grows splendidly, but the cultivation of this plant has been gradually abandoned through lack of sufficient labor. The establishment of experimental stations has demonstrated that Para rubber grows vigorously in almost every situation in which it has been tried outside the flat coastal region. It is estimated that there are 9,000,000 acres of accessible land, the larger part of which is eminently suitable for the cultivation of Para rubber. Lime-growing is still in the experimental stage; this fruit is at present growing excellently on the coast of the Essequibo River. There are also large areas of coastal lands that are well adapted to pastoral pursuits, but lack of proper drainage causes them to be inundated during the rainy seasons, January, February, and May, June, July.

Georgetown, the capital and only large city, is situated on the coast at the mouth of the Demerara River in the form of a rectangle two miles long and one mile deep, and is geometrically laid out in wide streets, running at right angles to each other.

When entering the harbor on my last trip to the colony, I was welcomed by the braying of an ass. The memory of that greeting voice still lingers with me, and, together with a recollection of open sewers flowing through the streets, it is one of the quaintly uncommonplace experiences that a visitor to the colony may have ere he departs.

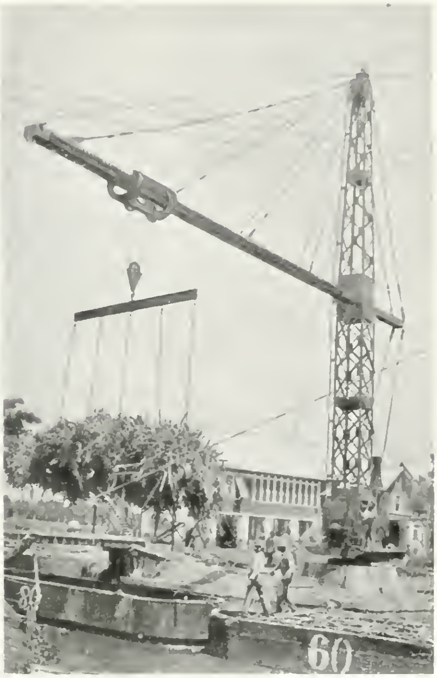
Being at sea level, the city is protected by a wide sea wall, constructed by Dutch engineers during the last few years. Here, in the late afternoon, is the city's only rendezvous, and it becomes a promenade where the natives gather and listen to a rather egotistic bandmaster conduct his Negro-Hindu band through seldom recognizable variations of well-known compositions.

The city boasts of only a few luxuries,—an up-to-date ice plant, necessitated, most probably, by the inhabitants' ever present desire for strong and cooling drinks, a single track electric street railway, which has to wage a continual battle with a multitude of small and heavily laden donkey carts for the right of way, and a large and beautiful Botanical Garden and Experiment Station, where the tropical flora grows in lavish variety and abundance and is closely studied by scientists from many lands; it is here that men have learned many of the new things related to tropical vegetation. In 1917 a commodious moving-picture theater was built where one might go three nights a week and look upon heart-rending, bloodcurdling, or dully humorous scenes that had long since ceased to be appreciated in the United States.

The sewerage system of the city, as I have hinted, is one of great simplicity. In canals that flow through the streets, the waste of the city is carried to the sea, where at low tide it is emptied. When the tide begins to rise, the canal gates are closed, often causing the canals to overflow into the streets. These canals, varying from small trenches to deep streams, are crossed by arched bridges over each of which there are signboards prohibiting fishing,—but either the natives cannot read or they are too hungry to obey an unenforced law, for coolies, with feet dangling a few inches above the dirty water, may often be seen, sitting on the edge awaiting a bite at their lines.

The 60,000 inhabitants of the city make a very cosmopolitan population indeed. Negroes from the West Indies compose most of it, with a scattering of native Africans and their descendants, relics of slavery times. Coolies, indentured from India to work on the rice and sugar plantations, are conspicuous everywhere, dressed most often in their native attire, making the tourist feel quite as though he were not in South America but in India. Under this system of indenture these coolies sign themselves into a sort of conventionalized slavery for a period of five years, for which they are paid, sometimes, seven shillings a week. When this term of labor has expired, they must reside five years longer in the colony in order to be transported back to India at one half fare. By the time they have remained this period, though, all their money has been spent, and they usually either become paupers or do odd work here and there until they die, many of them from homesickness and disease. Portuguese and Chinese keep the small shops; Chinese keep general stores, but the Portuguese specialize in gin and other liquors. When a Portuguese owns a gin shop he is considered well off by his admirers! Europeans carry on the development of the colony.

Along the coast on either side of Georgetown are scattered many small settlements among which New Amsterdam, Berbice, and Bartica are the more important. From New Amsterdam and Berbice stretch numerous rice and sugar plantations. Bartica, a village with but one street and twenty inhabitants, is located at the junction of the Essequibo and Mazaruni rivers and is the "jumping off place" where men, going into the interior for gold and diamonds, depart



The chief industry of Guiana is the raising of sugar cane on the large plantations of the alluvial coast plain. Transportation is largely by water. Numberless rivers and streams traverse the whole colony while the coastal flats are intersected by a network of canals and ditches for draining off the excessive rainfall. The lower photograph shows the cane being deposited on a moving belt leading into the grinding room

Market Street is the main thoroughfare of Georgetown, the capital, port, and only large city of British Guiana. This town of about 60,000 inhabitants is relatively modern, except for its open sewerage system, and supports a good electric street railway and telephone service. The harbor (to be seen on the extreme right in the background) is the most important shipping point of northern South America, exporting large quantities of sugar, rum, rice, and some gold and diamonds. This picture was taken Sunday morning, which accounts for the deserted appearance of the street

Surface mining and lumbering are the sole industries of the forest region. The whole interior is auriferous. Diamonds are washed from the gravels of river beds by means of the "long tom" of the placer mine. Both the gold and diamond industries of Guiana are still in the prospector stage and carried on to a great extent by nomadic bands of Negroes (a description of the methods used in diamond mining in British Guiana appeared in the AMERICAN MUSEUM JOURNAL (now NATURAL HISTORY) for October, 1918, pp. 499–502)

Photograph by A. H. Verrill

The interior can be reached at present only by the rivers. They have many rapids in them which prevent large boats from making the ascent. Thus it is impossible to convey the necessary material for mining into the interior, but some day these rapids will be utilized as an enormous source of power for the development of the colony, and especially its mining industries

from civilization. Near here is the penal settlement from which a person may easily escape if he prefer to face the jungle rather than the rock pit. Kalacoon, the biological station, is also within a few miles of the town. Here Colonel Roosevelt spent several sleepless nights while shooting vampire bats with a twenty-two caliber rifle.

Situated as it is on the northernmost angle of South America, this country offers an immense economic opportunity to the United States. Its capital city has one of the best harbors on the continent save for the one fact that it has become clogged somewhat by a bar of mud brought down by the Demerara and Essequibo rivers. The authorities have made no attempt to dredge it or keep it free; they have, instead, been content with letting ship captains try to evade it, or wait until high tide to permit their ships to pass safely over the obstruction. Every once in a while a ship becomes entangled in the slimy ooze, and its exit or entrance from or to the country is thereby delayed. This harbor presents the difficulty of the Mississippi delta, only in a lesser degree; that has been overcome by up-to-date methods,—even more easily could the harbor

A wayside Hindu market, featuring cassavas and lemons—Cassavas are parsnip-like roots, though somewhat larger than the parsnip and with much thicker skin. Boiled whole or ground into a meal which is baked, to remove the poisonous hydrocyanic acid contained in the juice, they provide the vegetable mainstay of the natives of Guiana. Salt fish, rice and bananas are the other staples of the colony, supplemented by sweet potatoes and a good supply of fresh meat of Georgetown be kept navigable for the larger vessels.

It is true that matters have been going from year to year with little advance. There seems to be a care-free languor about the country. Anything for the betterment of the colony is all right so long as it does not require much money or effort. Nothing like enterprise is to be found. Some have attributed this condition to the effects of the climate, but I do not believe that climatic conditions are wholly to blame, for England takes care of her African colonies with admirable success, and climatic conditions there are worse by far than in British Guiana.

British Guiana, from the time of Sir Walter Raleigh, has drawn many adventurers and promoters to her shores. Americans too, have gone there. They have taken with them American capital and American genius for opening up new lands, and have attempted whole-heartedly to place the colony at the head of its South American neighbors. But most of them were soon discouraged from further endeavors by the lack of friendly coöperation from the British Guiana officials. The governor in 1917 even went so far as to declare that he wanted no American capital in the colony. It is interesting to realize that at that time the American flag was flying over the Houses of Parliament in London as an appreciation of the aid that American dollars had given in the war.

A Hindu by-product of the vicious system of indenture—too old to work and too poor to pay his passage back to India. East Indians have been brought over since the abolition of Negro slavery, under agreements to labor on the rice and sugar plantations for five years at a stated wage, after which time they must remain in the colony for another period of five years if they are to be returned to India at one half fare. At the end of that time they usually have become paupers

American capital is certain to be encouraged in British Guiana, just as British capital enjoys the right of investing in American enterprises in the United States and in Alaska. When such conditions come to exist, the opening up of the interior will follow quickly. Besides containing much wealth in itself this country will provide highways over which intercourse of considerable commercial value may be established with northern Brazil, and by which Europe and the United States will gain access to large quantities of timber and valuable minerals, to say nothing of the possibilities of agriculture and cattle raising.

The first step toward this accession would be the building of a 250-mile railroad from Georgetown to the Brazilian frontier. This would mean, for one thing, that the Brazilian cattle, which by necessity are now shipped through the Takutu and Branco rivers to Manaos, and thence down the Amazon, could be brought to Georgetown less expensively and more quickly, where they could be killed and their hides tanned on the spot, or they could be shipped on the hoof to the United States and Europe.

On account of the nature of the country such a railroad would not be very difficult to build. An American company once offered to build it provided the government would give the company a franchise of every alternate mile along opposite sides of its course. The governor in reply said that the land would then be too valuable, apparently overlooking the fact that at present it is useless and always will be useless until such a railroad is built. Good railroads should also be built along the coasts, connecting the agricultural district with the central city and seaport.

Once the railroad to the Brazilian frontier is built, the development of the mining industry will come in quick succession. Because of the lack of facilities for transportation, the necessary machinery for working a mine is most difficult to convey into the interior, and so no real mining has been done. Gold has been profitably worked by both placer and hydraulic mining, but the only attempt at getting beneath the surface, accomplished in the Le Desire Diamond Mine, owned by Mr. Dudley P. Lewis and myself, was worked on a very primitive basis because it was located nearly 250 miles in the interior and could be reached only by paddling up a river the course of which was filled with treacherous rapids and whirlpools.

Bauxite has been discovered in large quantities; tin also has been located as plentiful in the interior, but for lack of transportation facilities nothing has been done with either of these ores. Gold and diamonds are the only minerals that have been prospected for extensively, usually by nomadic bands of Negroes termed "pork-knockers" because they go out supplied with only a little salt pork for food, and knock about the bush, hoping to stumble upon wealth. Even in the crude, meager way in which this sort of prospecting has been done, it has been a very profitable occupation and has yielded the government many thousands of dollars in royalties. The gold and diamonds may be mined with the roughest of tools, and when once acquired offer no great problem of transportation. An ounce bottle of diamonds would be a small fortune to a dusky pork-knocker. The gold that occurs so plentifully in quartz is usually passed by because of the impossibility of getting into the bush the crushing machinery necessary to extract it. The richness of the alluvial gold fields in this country is supposed to be due to the solubility of gold in the soil water. Mr. Harrison, geologist and general scientist of the colony, told me that to his mind, that vast interior of forest, mountains, and savannahs represents one of the richest storehouses on the South American continent.

Its great forest, containing such valuable woods as greenheart, wallaba, crabwood, and mora, would in itself be a valuable asset. Greenheart makes very durable submerged works such as wharves, piles and docks; wallaba can be very easily split and is chiefly used for shingles; crabwood, some-

These four "religious" members of the Mohammedan contingent were photographed while attending a Hindu ceremony. In Guiana the Hindus visit the Mohammedan ceremonies and vice versa, and both elements mutually participate in each other's feasts. The East Indian immigrants keep not only their religions but also their languages and costumes, in this way lending a very oriental touch to the population at Georgetown. (Photograph used through the courtesy of *Travel Magazine*) times called "British Guiana mahogany," can be worked into very beautiful and exceptionally durable furniture; mora, a hardwood, is chiefly used for flooring and firewood. These woods are of exceeding consequence.

On the Potaro River (a branch of the Essequibo), about eighty miles inland, there is the magnificent waterfall, the Kaieteur, with a sheer drop of about 740 feet and a breadth of 350 feet. At some seasons of the year the water flowing over its brink attains a depth of twenty feet. This is the highest waterfall of any consequence that has as yet been discovered, and is more than four times as high as our Niagara. At present it is inaccessible to most people, but a railroad could quite easily be built to it; this would mean the possibility of developing a tremendous water-power station, surpassing the one that is at present located on the brink of Niagara, and power generated at this place could be utilized all over the colony, even running the railroads and the mines. A resort could also be established here, where people worn out by living on the coastal lowlands, might come and recuperate in the scenic highlands where the air is cool and the water pure and clear.

Many of these things seem visionary perhaps, until we realize that the building of a transcontinental railroad in the United States was considered impossible before it was accomplished, and to talk about reindeer being bred in Alaska was a subject for mirth ten or fifteen years ago. Today there are five transcontinental railroads in the United States, and reindeer are being bred so profitably in Alaska that reindeer meat can be sold throughout the northwestern states at a considerably cheaper rate than beef. All things are visionary until they are accomplished, it seems.

The late Colonel Roosevelt said in a lecture before the Royal Agricultural Society, on his last visit to British Guiana: "You have here a wonderful country! I can see it now, with homes stretching out over the savannahs and among the hinterlands. Set your minds to thinking and your hands to working and develop it!" Surely such a man as he did not speak idly but because he was far-seeing enough to realize the possibilities of Guiana.

Photograph by H. E. Crampton

Kaieteur Falls, set among the forested hills of the interior, make one of the chief scenic features of the province and the highest waterfall of any consequence as yet discovered. The Potaro River makes at this point a perpendicular drop of 740 feet, or about four times the height of Niagara, and continues by a series of cataracts with a farther fall of 81 feet. During the rainy season the stream is nearly 400 feet wide and carries a torrent twenty feet deep over the brink of the falls

Birds and a Wilderness

OBSERVATIONS OF THE EFFECT OF FOUR YEARS OF WAR ON A FERTILE COUNTRY, WITH SPECIAL REFERENCE TO THE BIRD POPULATION

By MAJOR ALLAN BROOKS, D.S.O.

MANY observers have had the opportunity to note the effect on wild life of the reclamation of a wilderness, as in the clearing and cultivation of a forested country; but it is seldom one has the chance to see the change effected by the reverse condition—the turning of a fertile country into a literally howling wilderness.

Eastward from Arras stretches the once fertile plain of Artois, quite unlike the much enclosed plain of Flanders—climate, soil, and methods of agriculture are all different. The soil, also unlike the clay of Flanders, is light, and underlaid in most places with chalk. Fences and hedges there are none, trees scarce and, except for a few large parks, usually confined to the borders of the main roads (I am speaking now of conditions before the war), and the houses of the farmers, instead of being scattered over the countryside, are congested into small villages, usually in a hollow, somewhat after the old Danish style one sees in the south of England.

It is not a pastoral country. Cows are always kept in barns, therefore no fences are needed. Grain and beets were the principal crops, and the bird life was such as one might expect in a cultivated prairie country. Let me now try to describe what this country looked like after being fought over for nearly four years.

One would expect to find a rank growth of weeds, volunteer crops of grain, and a large increase of bird life due to the cessation of all sport—the kind of sport that used to kill larks and finches galore. Instead, there was a rolling plain covered with grass, weed patches were very scarce, and volunteer crops had ceased to exist. The grass was usually short but sometimes quite rank in the hollows, and in many places a species of dewberry ran along the ground, fruiting plentifully.

The trees were all gone save for a few splintered stubs along the highroads; the ruined villages, being in hollows, did not usually show from a little distance; here and there low piles of shattered bricks and rubble indicated a village, but they were never a prominent feature of the landscape. The whole effect put one irresistibly in mind of our western prairies.

Just after our first jump in August, 1918, the plain near Monchy-le-Preux looked as if a rolling stretch of virgin prairie had suddenly been thrown open to settlers, and their wagons and encampments had flooded the country, the horse lines of our artillery looked like great herds of stock, and overhead the sky was as blue and clear as in Alberta or Dakota.

The lines of observation balloons struck the one incongruous note, for the circling planes looked like great hawks—and the birds added to the resemblance. Large coveys of partridges, sometimes fifty or more, whirred up like prairie chickens, and skylarks fluttered up out of the grass like longspurs. On the remains of the trenches and wire entanglements were a few loose congregations of migrating birds, whinchats which acted like bluebirds, a few black redstarts with a similar resemblance, pipits much like our own pipit, and an occasional shrike that might have been our own butcher bird. Raptores were very scarce, there being only a few hovering kestrels, and in the dusk a bobbing Athene owl, reminding one of the sparrow hawks and burrowing owls seen on a similar prairie in America.

The great flocks of seed-eating birds like finches and buntings which should have been in evidence were absent, with the exception of only a few scattered yellow buntings. Rooks and magpies, so common wherever the land is cultivated, were also absent, and starlings nearly so. Except partridges, all birds had decreased in number.

Of mammals, hares were common and, in their resemblance to jack rabbits, added to the prairie-like aspect of the country. Voles swarmed—a vole plague in fact, and domestic cats which should have been very much in evidence were gone with the inhabitants, although in Flanders there were plenty. Gas and gas shells apparently could not have affected the cats, for hares and mice showed no ill effects from the gas.

Birds also do not seem to suffer from gas in any form. A friend who was with the French during a very heavy cloud-gas attack put over by the enemy, observed that the only birds killed were the kingfishers along the stream, although the gas was strong enough to kill cattle miles behind the lines.

Also I failed to see a single bird victim of the chlorine gas attack of April, 1915. Up to the summer of 1918 I had invariably noted that birds seemed to be almost indifferent to shell fire, but now it was too much for even them.

Partridges (gray, I never saw the redleg) were always in evidence during our attacks, their little brown figures skimming low over the ground, silhouetted against the gray wall of our rolling barrage, often among the legs of our advancing infantry, and many were killed. In every case I found actual wounds, none seemed to be killed by concussion, although this killed horses. With skylarks we found the same condition, all dead birds picked up showed the marks of shrapnel or fragments.

Hares, during these periods, were also absolutely panic-struck. One jumped right into the arms of our general's cook, and one can guess where it went after that. All dead ones picked up, like the birds, had wounds sufficient to cause death. But the underground mammals had the hardest time of all; one would have expected them to remain below, but the concussion must have been worse there, for they came to the surface during heavy cannon fire. When lying flat for obvious reasons, I often saw voles within a few inches of my eyes, and could take them with my hand—too paralyzed to move. Many were lying about dead without any visible wound, having died either of fright or concussion.

These intervals of intense gunfire were only short periods, for there were none of the bombardments lasting for days which were a feature of the war before this stage. In the long, quiet intervals one would expect to see more birds, but they were not much in evidence.

As we neared Cambrai the country was more wooded, with fine large reedy meres near the canals. This region had been cleared of all its inhabitants by the Germans on their first occupation, for a depth of ten miles or more. Here for four years there had been no cultivation, or next to none,—wide stretches of grassland between the belts of fine trees, open spaces, wood, and water, everything a bird would need, yet birds were as scarce as in the fighting zone.

But once we got through this and into the inhabited and cultivated country, like magic the birds were everywhere—sparrows, buntings, and finches—in ropes on the telegraph wires, or whirring up in great flocks from the stubble, chaffinches chinking from the wayside trees, starlings in clouds, and swallows circling around the church steeples or gliding low over the meadows, just as in the cultivated country behind our own lines on the French side. Even the ugly coal-mining districts had a good quota of birds, but the densest bird population was always where the land was most intensely cultivated.

Later near Brussels we came into a curious country largely under glass, where grapes were the main product; here birds became comparatively scarce again, even the adjacent beech woods had few small birds, but I was delighted to see bird boxes, little sections of hollow branches, nailed to the trees in many places—not near the houses but in out-of-the-way places.

Wild pigeons (*Columba palumba*) swarmed in these woods; all firearms had been confiscated and so the "Chasse du Ramier" had died out, with the result that the pigeons had multiplied without check. Flocks miles in length, resembling the old-time flocks of passenger pigeons, flew over the beech woods to their roosts. But disease, the inevitable result of overcrowding, had made its appearance, and beneath every roost were the remains of hundreds of pigeons, eaten by foxes and hawks, while scores of dying birds moped in the trees or fluttered to the ground. This disease I found to be well known in England—a form of diphtheria.

But this is a digression and has led me away from the point which I wish to make—that absence of enemies will not by itself bring about a large increase of bird life, especially small bird life. Cultivation is the principal factor, coupled with adequate cover; when this cultivation ceases bird life goes.

I would ascribe the large increase of partridges not so much to their comparative immunity from pursuit by man, but to the fact that magpies were practically absent, and food and cover plentiful. In other parts of northern France, unlike England, the magpie is always present in numbers, his huge nest is always a conspicuous feature in the tree tops along the roads, and partridges have small chance to rear their broods, and if they do, the broods are small.

In the thoroughly devastated region where partridges were so plentiful, magpies had practically disappeared owing to the fact that there were no trees, nor even bushes, for them to build in.

To recapitulate: Leaving the well-cultivated country on the French side of the war zone with its wealth of bird life, one came first to a partly devastated belt about six miles wide where birds became scarce, only a few species like sparrows and starlings persisting in good numbers, feeding around our horse lines; also swallows, fairly numerous, as there were plenty of buildings for them to build in. I will call this six-mile belt A. Next, came a belt ten or twelve miles wide, completely devastated, B. Sparrows, starlings, and swallows had abandoned this region; birds scarcer than in A. Next, was a belt on the enemy's side like A of our side, with similar physical and faunal conditions. Farther eastward stretched a ten-mile belt, not devastated nor destroyed in any way but depopulated, except for soldiers' billets, and uncultivated, with birds as in A, or probably a little scarcer than in the belt A on our side, owing to the fact that there was less waste of horse-feed, also probably because the magpie came into his own again in this belt. Lastly came the well-cultivated country that had not been depopulated, with birds in full strength as under similar conditions on the western side of the war zone.

An impression of Bourlon Wood on the Artois plain during our advance of September 27, 1918. Gray partridges and hares scurried away from the rolling barrage, running panic-stricken between the legs of our advancing infantry. The partridges, thanks to the evacuation of the devastated countryside by their enemy the magpie, grew very numerous, but most other birds left when cultivation was interrupted. Many of the birds, hares, and field mice were killed during the shelling, but always from actual wounds and not from the concussion or from gas.

In a letter to the Editor Mr. Brooks comments regarding the drawing: "This is something out of my line—my first picture of a battle and birds. It makes me laugh every time I look at it, but it is true enough all the same. Don't use it if you have any doubts. I might have drawn a little shrew I saw one particularly hectic day marching down the middle of a *pavé* road—midday and bright sunlight—his world was disintegrating"

The New York State Wild Life Memorial to Theodore Roosevelt

By CHARLES C. ADAMS

Director of The Roosevelt Wild Life Forest Experiment Station at the New York State College of Forestry, Syracuse

THE interest of the late Theodore Roosevelt in wild life was not the diversion of a busy man; it was one of his vital needs, for which he found, with all his extensive resources, no substitute. His strong, spontaneous interest in animals was of the kind that comes only from a man with the heart of a naturalist and that cannot be suppressed or pretended.

The naturalist is generally an observer of live animals and of what they do. It was this which appealed to Roosevelt, and it is thus eminently fitting that the new memorial station, established by the legislature of New York in May, 1919, should be called "The Roosevelt Wild Life Forest Experiment Station." That it should be located at the New York State College of Forestry at Syracuse, is appropriate because of what he, with Gifford Pinchot, did for forestry, and, furthermore, because in the future the forests are destined to be one of the main strongholds for the preservation of wild life for a democratic people.

The public is now coming to see as never before the intimate relation between forestry and wild life. Forestry is no longer considered as solely economic in aim. It does not mean merely the growing of timber; it embraces the complete use of woodlands for public welfare, including, in addition to its economic returns from lumber, grazing animals, furs, fish, and game, other uses—educational, recreational, and scientific—which at times may far exceed in social value that of the purely economic.

Roosevelt's Approval of the Plan

It is significant that the present memorial is the direct outgrowth of plans presented to Mr. Roosevelt in December, 1916, for the study of the natural history of forest wild life. He greeted the suggestions with characteristic enthusiasm and urged that they should be taken up "in a big way." In this he clearly indicated one of the essentials of any worthy wild life memorial. The suggested memorial, in this way, comes very near to having his direct approval, and it has met with hearty commendation from Lieutenant Colonel Theodore Roosevelt, who writes: " . . . as you know it was one of the subjects that were always uppermost in my father's mind. I give my consent without reservation for the use of his name for this memorial."

The Roosevelt Wild Life Forest Experiment Station

The duties of the Roosevelt Station are clearly expressed by the New York law as follows: "To establish and conduct an experimental station to be known as 'The Roosevelt Wild Life Forest Experiment Station' in which there shall be maintained records of the results of the experiments and investigations made and research work accomplished; also a library of works, . . . together with means for practical illustration and demonstration, which library shall, at all reasonable hours, be open to the public." Furthermore, the obligations of the station are to make "investigations, experiments, and research in relation to the habits, life histories, methods of propagation, and management of fish, birds, game and food and fur-bearing animals and forest wild life."

Such a memorial station as is contemplated by the law is unique, as no other similar station or institution exists in the United States, although of course, several agencies are devoted to different phases of the problem. It opens up a vast opportunity for the "field naturalist" of the type admired by Roosevelt, and it will serve as a constant beacon of encouragement to young students, and to ecologists whose ardor may have become dampened by too much of the atmosphere of the laboratory or the museum, and to others who need to renew their youthful enthusiasm by realizing that detailed field study on animals is not a temporary, rapidly passing phase of natural history, but a permanent, ever persisting one which will continue to maintain a demand for well-trained field naturalists.

A wild life library of the nature suggested by the law will be equally unusual, as no such special research library along these lines has been assembled in America.

VALUABLE ASSETS OF OUR COUNTRY

Our trout streams and fish ponds afford examples of the kind of problems to be attacked by The Roosevelt Wild Life Forest Experiment Station, for the restocking of habitable waters with game fish involves an extensive study of the habits and needs of the species employed. Roosevelt would have rejoiced in this scientific study of forest natural history; he continually pointed out the ignorance even of zoölogists regarding the ways of the most common wild animals, and his works of travel are filled with observations on life histories. Further, he would have been the first to emphasize the need of undertaking this study in a scientific and systematic way and under the experimental conditions of a laboratory as well as in the out-of-doors

A vast number of books on fish, birds, mammals, game, and other aspects of the natural history of wild life (including many government reports) lie unused, or little used, in innumerable private libraries. These might well be concentrated for the purpose of this station. The scientific publications of the station are intended to cover every phase of the forest wild life problem, and important manuscripts are already on hand.

Investigations at the Roosevelt Wild Life Station

The variety of investigations which may be undertaken appropriately at such a station, is numerous indeed, including the entire gamut of activities of forest wild life. Practical consideration, however, will probably limit the work of the station to a few, relatively, of the more important and urgent lines. As examples of these the following may be given:

Ecology and Life Histories.—The ecology of wild life, or the relation of these creatures to their complete environment, must always remain a fundamental problem in dealing with wild animals. There is urgent need of a great increase in our knowledge of the ecology and life histories of practically all wild life. This is true not only of the larger game and fur-bearing animals, but also of great numbers of birds and fish, even of the common kinds which have long been known. Reflect for a moment upon the great number of men who have devoted a vast amount of time to trout fishing, and it seems almost incredible at first thought that there never has been made an exhaustive, scientific study of a trout stream in America! It is hoped that the trout problem will be made one of the specialties of this station, as it is certainly one of the wild life problems of first importance. The whole subject of the post-hatchery care of fish is another instance of an extensive field in need of systematic study, and furthermore, progress in stocking streams, lakes and ponds must await studies of this character.

The fur-bearing animals of the forest have in the past received but little special study, and their relation to game vermin is another subject demanding detailed attention. The Virginia deer and the beaver are the best known of the larger forest animals, and yet even today we have no thorough study of the influence of a "buck law" experiment, conducted as a scientific problem, and as contrasted with the usual exciting and emotional display which attends the discussion of this subject among sportsmen. In New York State the beaver question is one which will soon demand careful consideration if a sane policy toward these animals is to be maintained. Reliable information, and not general impressions and vague imaginings, is what is needed if wild life is to get a square deal from man.

Physiology and Disease.—There are many problems in connection with the food habits, food, and nutrition of wild life awaiting investigation. Domestic animals have received much attention in this respect, but, as wild life belongs to the public, it has been to a corresponding degree neglected. The control of algæ and other aquatic plants in relation to fish and the pollution of streams is another example of these wild life problems which only a trained physiologist or ecologist can solve. Closely related to the physiological problems are those dealing with the diseases of wild life. These are legion. The diseases of fish have, in particular, been sadly neglected, in spite of the fact that serious outbreaks frequently occur. As a rule the diseases of most kinds of wild life attract but little attention. They are, however, probably important factors in determining the abundance of many of the large game animals. In the case of fur-bearing animals there is a large field for experiments intended to study the effect of food and other influences upon the quality of fur.

Heredity.—The study of heredity in forest wild life opens up a wide subject for experimental research. Disease-resisting strains may prove to be an important means of perpetuating wild life, not only in the case of large game animals, fur-bearing animals, and birds, but in fish and other forms as well. Under proper breeding management wild furs may be greatly improved in both quality and quantity.

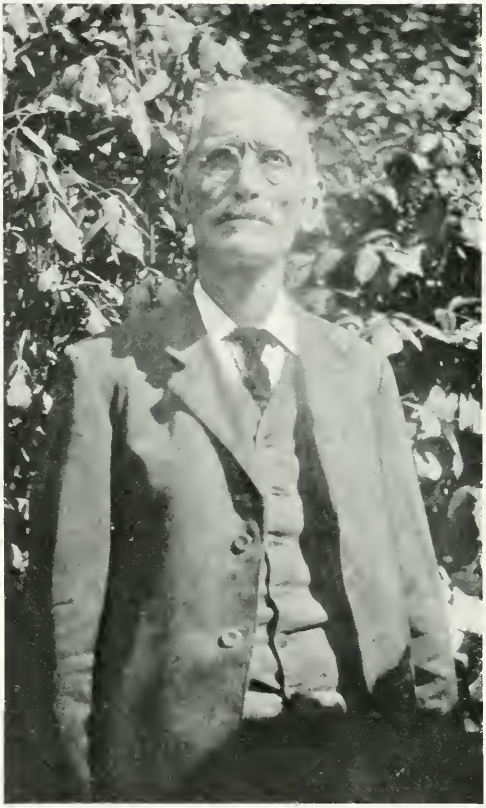
Wild Life Policies.—Upon a foundation of fact and inference such as can be built up only by investigations conducted as indicated under the preceding headings, we may hope to build up principles of management or policies for wild life which will fit them into the texture of modern social and economic life. When this is done in a scientific manner, forest wild life will be intelligently and sympathetically appreciated and used by man to the best advantage. To build up these management policies is in fact the largest wild life problem, and the smaller special problems are means toward accomplishing the greater aim. The relation of wild animals to one another and to all the items of their environment is so intricate that those which appear superficially to be wholly unrelated are so entangled that the relation of each can be properly adjusted only by a comprehensive plan which provides for every one in its proper sphere. This plan for adjustment is the most difficult problem of all, which in comparison subordinates all others. It is the capstone or climax of the whole system of use of forest wild life.

Relation of the New to the Old.—The preceding outline is a program for the activities of the new Roosevelt Station. This is in reality a new name for work already under way by the college for the last seven years. For the last five years this work has been conducted on a smaller scale than is contemplated for the new station, but, even with the limited means available in the past, considerable progress has been made. Thus the fish survey of Oneida Lake has made much progress in the study of the food of the fish, the capacity of the waters to produce fish food, in the study of the worm parasites of fish (in coöperation with the United States Bureau of Fisheries), and in the life history and economic relations of the fish of this lake. Extensive reports have been printed on this work. In the Adirondacks, also, investigations have been made of the relation of the summer birds to these forests, preliminary studies have been made of fish, and studies have been started at the timber line on Mount Marcy (made in coöperation with several other scientific institutions). Nor has the southern part of the state been neglected, because in the Hudson Highlands, in the Palisades Interstate Park region, extensive studies have been made (in coöperation with the Commissioners of the Palisades Interstate Park) of the birds and fish, in relation to park campers and visitors. The problem of leech control, and the control of mosquitoes by fish (in coöperation with the United States Bureau of Fisheries), are additional examples of the character of the park problems which are under consideration, and show how these are related to public welfare. It is to the solution of these and similar problems which will arise that the Roosevelt Wild Life Forest Experiment Station is committed by legislative act.

Few types of memorial would have received more hearty appreciation by Roosevelt himself than The Wild Life Forest Experiment Station which has been established recently at The New York State College of Forestry by the New York legislature. The work undertaken by the College and state plans not only service in wild life conservation, but also comprehensive study of habits and life histories, and the practical management from an economic standpoint of the fish, birds, and other game animals of New York. The laboratories for the present are in this building at the College in Syracuse. A special and in many ways unique library devoted to wild life will be collected at the College and maintained there for public use

Samuel Garman, of the Agassiz Museum

SOME naturalists of distinction, perhaps the most fortunate, seem always to ride on the crest of the wave of changing time and circumstance. Today they may be the pivot about which turns awakening popular interest in their chosen subject, tomorrow leaders in the faunal study of some distant clime the treasures of which are becoming available to science, or the exponents of some new point of view by which data, long accumulated, are being arranged in a clearer light. The careers of others follow a direct, unswerving path, building from small beginnings along some definite line where they are presently the recognized authority, and in passing leave a structure which stands for lesser men to build upon until the general level of knowledge rises above its heights and its interest becomes historical.



Samuel Garman, curator of fishes at the Agassiz Museum, Harvard College

Samuel Garman, curator of fishes at the Agassiz Museum of Harvard University, cannot be placed in either of these categories. It would be difficult to think of him as either carried forward by the trend of the times or bending it along the lines of his especial interests. It will never be possible accurately to estimate the sum of his contributions to his chosen science. The writer remembers, when a student in college, carrying to Samuel Garman many subtle problems in differentiating frogs and snakes, and how, although at that time he was doing little work in herpetology, he always with a few words and recourse to a specimen or two within easy reach, not only settled the difficulties, but imparted an appreciation of species characters in the groups which will always be of value. How many others must have received similar aid, for he had then been an active herpetologist and ichthyologist for about thirty years!

While other men gather and discuss the newest discovery, consult distant collections, or plan expeditions, day in and day out one may find Garman in his room in the basement of the Agassiz Museum, working with his specimens and books, independently, for the pure love of it, with infinite care. A chance allusion by Shufeldt, writing in the April-May number of *Natural History*, suggests that Samuel Garman's one-time acquaintances, themselves drifted into new lines, may not always realize that he is still there. His is the especial talent for being always there, where the writer wishes more frequent opportunities these days to take his problems, for the help sure to be received, the equally certain courtesy of welcome, and the inspiration.

A glance at the list of Garman's published works on fishes shows scarcely any acceleration or abatement of effort since the first was issued in 1875. His conclusions have not always been accepted by other workers in systematic ichthyology, but they are invariably interesting and valuable. His most widely known work on fishes is perhaps the description and discussion of a very primitive shark, *Chlamydoselachus*, a number of years ago. It is fortunate that this most interesting fish fell into the hands of so careful and thorough a descriptive naturalist.—J. T. NICHOLS.

Scientific Zoölogical Publications of the American Museum

SUMMARY OF WORK ON FOSSIL MAMMALS

By FRANK E. LUTZ

Editor of the *Bulletin of the American Museum* and Associate Curator in Invertebrate Zoölogy

THE following notices of five of the scientific publications of the American Museum are a continuation of similar notices published in the March, 1919, number of NATURAL HISTORY. Summaries of papers on recent mammals will appear later.

Life Studies Among Fossils

The paper[1] by Messrs. W. K. Gregory and C. L. Camp is one of a series of studies which are intended to clothe the fossil bones of ancient animals with the muscles that once moved them. An earlier contribution by Dr. Gregory and Mr. Erwin S. Christman comprised a restoration of the musculature of lower Tertiary titanotheres, which will be published in President Osborn's monograph on that extraordinary group of mammals. A second, relating to the jaw muscles of vertebrates, was prepared in the department of vertebrate palæontology of the Museum by Dr. L. A. Adams, and was published during 1918 by the New York Academy of Sciences. Two or more additional papers are now in progress. The specific objects of the studies, as stated by the senior author of the present number, are "to review the homologies of similar muscles in the different vertebrate classes; to make restorations of the musculature of the jaw, limbs, and axial skeleton of certain extinct amphibians, reptiles, and mammals; and to discover, one by one, some of the stages by which the more specialized mechanisms of the higher vertebrates were evolved."

Dr. Gregory and Mr. Camp certainly have given invaluable service to anatomists by placing on record their comparative review of the musculature of the limbs in certain mammals, birds, and reptiles, including such zoölogically important types as monotremes, the ostrich, crocodilians, the tuatara lizard (*Sphenodon*), a birdlike dinosaur, and the terrestrial, carnivorous, mammal-like, Triassic reptile, *Cynognathus*, a complete reconstruction of which is presented in Part V of the paper. The tabulations, which relate to the origins, insertions, and nerve supply of the principal muscles of locomotion, are based not only upon the authors' painstaking laboratory dissections, and a study of the bones of the extinct forms, but also upon the scattered literature in this field, the entire sum of present knowledge of the subject, both original and compiled, being here conveniently brought together within about fifty pages of text and illustrations. Upon these data are based the more general discussions in the paper and the excellent two-color plates which show the probable arrangement and homologies of the muscular system of *Cynognathus*.

As may well be inferred, the paper is of necessity minutely descriptive, and yet illuminating comparison rather than description for its own sake is ever the aim of both authors. By working from the known to the unknown, by ranging the flesh-clad limbs of modern animals side by side with bones which lost their blood and sinew, and even the real bony tissue itself, millions of years ago, Dr. Gregory and Mr. Camp have translated into interesting, even entertaining, language the mechanics of "walking" in its primitive stages, when, although complicated enough, it was far less intricate and specialized than among modern, relatively post-limbed mammals and birds. The differences of posture and movement between upright man and a sprawling reptile or a duck-billed platypus are obvious, but the diverse arrangement and proportions of muscular and skeletal elements, which are substantially the same elements in all three, and the evolutionary relations of the higher type of architecture to the others, are enlightening subjects which the authors of the present paper describe in detail.

In the earliest four-legged animals, as in the fishes, movements of the paired limbs were closely correlated with undulatory movements of the entire trunk and tail, while in

[1] Gregory, W. K., and Camp, C. L. 1918. Studies in Comparative Myology and Osteology. No. III. *Bull. Amer. Mus. Nat. Hist.*, XXXVIII, Art. 15, pp. 447–563, Pls. XXXIX to L. [Review by Robert C. Murphy.]

the highest stages of vertebrate evolution the limb movements and musculature become widely differentiated from those of the axial skeleton. With this progressive adaptation in mind, the authors trace the changes in the bones and muscles of the shoulder and hip girdles, explaining the significance of the expansion of this or that bony part, the development of this or that system of muscles, which, in the long course of evolution, raised the primitive reptile's belly off the ground, enabled the creature to support the entire weight of its hinder parts, for instance, on one hind leg, while it thrust the other forward, and led ultimately to that marvelous, almost inconceivable perfection of balance which permits the highest primate, the lord of creation, to stand and walk and run on two pinlike limbs without even realizing that he is doing anything remarkable.

Space for discussing an eminently successful attempt to describe and historically interpret the structures upon which movement in the higher animals depends is not available, and this notice must close with Dr. Gregory's account of locomotion among primitive vertebrates:

"In reptiles and primitive mammals the fore and hind limbs coöperate with each other in the following way: The fore and hind limbs of the same side move in opposite directions; on the other hand the right fore limb moves in the same direction with the left hind limb and vice versa. The backwardly extended fore foot is raised and moved forward immediately before the forwardly extended hind foot touches the ground. This criss-cross movement of the limbs is correlated with alternate lateral bendings and twistings of the thorax, and with corresponding turning and twisting of the girdles, in such a way that the forward and backward reach of the divergent limbs on one side is increased while the convergent limbs of the opposite are brought still nearer together. Another advantage of this arrangement is that the pull and push of the limb muscles is supplemented by the powerful spiral and spring-like action of the axial musculature, while a third advantage is that by stretching the limbs of the same side in opposite directions the forward thrusts and pulls are brought nearer to the mid-line, and thus the speed is increased. Hence, it should and does follow that the faster a reptile moves the narrower is its trackway."

Studies on the Evolution of Animals of Our West

Dr. W. D. Matthew, curator of vertebrate palæontology in the American Museum, published[1] a continuation of researches on fossils from the Snake Creek beds in Western Nebraska, discovered by the Museum Expedition of 1908 and further explored in 1916. Fossils are very abundant at this locality, but mostly fragmentary, the teeth of three-toed horses being more numerous than anything else; jaws and skulls occur occasionally. There is a great variety of animals, more than sixty species. They belong to the late Miocene or early Pliocene epoch of the Age of Mammals and represent a stage in the evolution of the animals of the western plains which is still very imperfectly known. Various new species and genera of mammals are described, and more complete specimens of others. The most interesting new types described are a large bear-dog, a rodent about the size of a beaver, a peculiar soft-nosed hornless rhinoceros, and a peculiar horned animal supposed to be a ruminant but with a single median horn on the top of the cranium as in the fabled unicorn. An expedition in the summer of 1918, after this article was published, has obtained further interesting collections.

American Museum expeditions in 1909–16 secured large collections of fossil mammals from the Lower Eocene formations of Wyoming and New Mexico, more than all that had previously been obtained, and with the very exact records and careful study of the geology of the strata, it has been possible to clear up the correlation and succession of faunas in a very precise fashion. Many new types have been discovered, and better specimens of others previously known from fragments. The affinities of various genera are discussed, and their bearing on the origin and evolution of the later Tertiary animals. A paper[2] by Dr. W. D. Matthew and Walter Granger takes up the

[1] Matthew, W. D. 1918. Contributions to the Snake Creek Fauna. With Notes upon the Pleistocene of Western Nebraska, American Museum Expedition of 1916. *Bull. Amer. Mus. Nat. Hist.*, XXXVIII, Art. 7, pp. 183–229, Pls. IV–X. [Summary furnished by Dr. Matthew.]

[2] Matthew, W. D., and Granger, Walter. 1918. A Revision of the Lower Eocene Wasatch and Wind River Faunas. *Bull. Amer. Mus. Nat. Hist.*, XXXVIII, Art. 16, pp. 565–657. [Summary furnished by Dr. Matthew.]

primitive insectivora, rodents, and edentates, all of them showing early stages in the evolution of these orders, now widely differentiated but so difficult to distinguish in the Eocene that their true affinities have been a matter of much controversy.

Revision of Ancestral American Horses

The Memoir[1] by Professor Henry Fairfield Osborn, president of the American Museum and honorary curator of vertebrate palæontology, is a very fully illustrated revision of all the described species of ancestral horses from the later Tertiary formations of this continent. The original type descriptions and illustrations are reprinted with carefully revised drawings and redescriptions of each, and of many more perfect specimens referred to one or another of the described forms. The geological correlation is carefully and exactly revised, so that the succession in time is shown as accurately as is possible in the light of all the later researches. Conclusions as to the exact evolutionary succession and phylogeny are mostly postponed until the author's final monograph on the evolution of the horse, but some probable relationships are indicated here and there, and much that will serve as the fundamental evidence for such conclusions.

This volume will be of great aid to all who are interested in the evolutionary history of the horse, as it brings together a vast mass of data and evidence hitherto scattered through a great number of miscellaneous publications, and corrects many errors or inaccuracies of the older descriptions and illustrations; and more than all because it describes for the first time a large part of the fine collections of Tertiary Equidæ secured by various American Museum expeditions.

Exploration of the Cave Deposits of Porto Rico

A Memoir[2] by Mr. H. E. Anthony, associate curator in mammalogy in the American Museum, is of unusual interest because of its bearing upon the geological history of the West Indies. Whether these islands are the remnants of a former Antillean continent, or have always been islands since they first rose from the sea, whether they were formerly connected with North or with South America, or, as some have thought, with Europe or Africa, are problems which have been much discussed by geologists and zoölogists. Almost nothing had been known of the extinct animals of the West Indies, which might afford valuable evidence on such problems. A few years ago important discoveries of fossil animals were made in Cuba by Dr. Carlos de la Torre, professor of biology, zoölogy, and zoögraphy in the University of Havana, and in Porto Rico by Dr. Franz Boas. Mr. Barnum Brown, cooperating with Dr. de la Torre and other friends of the Museum, has followed up the earlier Cuban discoveries with great success. Mr. Anthony undertook a systematic exploration of the cave deposits of Porto Rico and other West Indian islands with equally satisfactory results. Valuable evidence has also been obtained by explorations for the National Museum and the Museum of Comparative Zoölogy.

In this Memoir Mr. Anthony describes and illustrates the fossil mammals obtained through his expeditions in Porto Rico. They consist of a remarkable new insectivore, a small ground sloth, a number of rodents large and small, and a few bats. Except for the bats, the fossils are all new and rather distantly related to any continental mammals, the nearest affinities being with South America; but they are quite closely related to the fossil mammals found in Cuba and Hayti. This would seem to show that the larger islands have been united at no very remote date, geologically speaking, and that they have not been united to either continent since the Miocene or Pliocene, if at all. The evidence is wholly against any former union with Europe or Africa. Mr. Anthony is disposed to believe in a union with South or Central America in the Miocene, as against the alternative theory that these mammals are descended from a few stray waifs drifted across by seas and currents on "natural rafts" from the South American rivers.

[1] Osborn, Henry Fairfield. 1918. Equidæ of the Oligocene, Miocene, and Pliocene of North America. Iconographic Type Revision. *Memoirs Amer. Mus. Nat. Hist.*, II, N. S., Part 1, pp. 1–330, Pls. I to LIV and 173 text figures. [Review furnished by Dr. Matthew.]

[2] Anthony, H. E. 1918. The Indigenous Land Mammals of Porto Rico, Living and Extinct. *Memoirs Amer. Mus. Nat. Hist.*, II, N. S., Part 3, pp. 331–435, Pls. LV–LXXIV and 55 text figures. [Review furnished by Dr. Matthew.]

White pelicans and other bird inhabitants of the Klamath Lake Reservation on the Oregon-California boundary, as shown in the bird habitat group at the American Musenm

Region too Alkaline for Crops

Soil expert of the United States Department of Agriculture pronounces lands about the Malheur Lake and Klamath Lake Bird Reservations in Oregon and Northern California too alkaline for growing crops

By E. W. NELSON

Chief, Bureau of Biological Survey, United States Department of Agricnlture

DURING the last few years conditions have arisen in Oregon and northern California which have become increasingly threatening to the existence of the Malheur Lake and Klamath Lake Bird reservations. These are perhaps the most notable migratory-bird reservations in the United States. Malheur Lake is situated in eastern Oregon, a part of the arid Great Basin; the Klamath Lake Reservation is located partly in Oregon and partly in the adjacent part of northern California. Both contain a great area of swampy land with a shallow-water lake in the middle, thus forming ideal homes for enormous numbers of migratory wild fowl, including myriads of ducks, geese, and pelicans, during the nesting season as well as during the spring and fall migrations.

In a region where marshy or swampy areas are as scarce as they are in the northwestern states such areas become of the highest importance in connection with the conservation of our wild bird life. In their prime these two reservations were perhaps the finest and most populous of any federal bird preserves in the United States. With the growth of settlement in the West land promoters have found opportunity to ply their calling in the districts about both of these reservations and have made continued efforts to secure the abolition of the reservations in order that the lands might be utilized for other purposes.

The marshy lands about the borders of the lakes which form the center of both of these reservations produce an abundant growth of tules, rushes, and other grassy growth which has a certain value as forage for live stock. Owing to the alkaline character of the lands within both of these reservations, the United States Biological Survey has for a long time been convinced that they would be of no value for cultivated crops and that their present production of forage furnished their sole agricultural value.

During the summer of 1919, in order to get definite information as to the facts concerning the value of these lands for agricultural purposes, one of the most experienced and competent of the soil experts of the Department of Agriculture made a reconnaissance of the lands in both Malheur Lake and Klamath Lake reservations. In the report of his reconnaissance the soil expert states definitely that he considers the percentage of alkali in these lands so high that they are valueless for the purpose of growing crops, and that if the water were drained from the lakes the marshes and lake bottoms would become alkali flats.

Malheur Lake is maintained by water which is drained into it by the Blitzen and Silvies rivers. The broad belt of marshy lands surrounding Malheur Lake, covering thousands of acres, produces forage enough to support numerous settlers with their live stock. It is now proposed to divert the water of these streams high up in their courses for purposes of irrigating other lands. If this plan is carried out it means inevitably that Malheur Lake will become dry and the stock ranches which are now scattered around the lake will be rendered perpetually worthless. Thus a large number of the earliest settlers in that region will be deprived of their homes and property, to a value possibly approaching $1,000,000.

So much for the destruction of the property involved in case the present plans are carried out, but further than this will be the great loss to the state in depriving it of one of the most notable wild-fowl resorts in this country, where enormous numbers of ducks and geese and other birds have reared their young from remote times. The loss of this reservation will be irreparable since there is nothing to replace it in that region. Similar consequences will result from the drainage of the Klamath Lake Reservation with the idea of making it into farms.

There is now a bill in Congress for the taking over of the Klamath lands for the purpose of their being opened to settlement, especially for the benefit of soldiers of the late war. In view of the recent survey of these lands by the soil expert and the determination that they are too alkaline for crop cultivation it appears as though any soldiers who are led to locate there with the idea of building up homes will have no reason to thank those who led them into such locations.

In view of the practical worthlessness of the lands in the Malheur Lake and Klamath Lake reservations for cultivation and the exceeding value of these areas for wild fowl, it is to be hoped that they may be continued as bird reservations and the people living about them under present conditions may thus be enabled to retain their homes. If this is done these reservations will serve as important supply points for providing migratory wild fowl for other parts of the country. Such locations are becoming so few that the loss of each one now becomes irreparable. This is especially true of such large and notable areas as Malheur and Klamath lakes.

Biological Surveys of States

By the United States Department of Agriculture during 1919

WORK in biological investigations of birds and mammals by the Bureau of Biological Survey, United States Department of Agriculture, and coöperating institutions, while somewhat interrupted by the war, is rapidly getting back to normal.

In Wisconsin the State Geological and Natural History Survey is coöperating with the United States Department of Agriculture in the work, which is in charge of Dr. Hartley H. T. Jackson for the Department of Agriculture, and Professor George Wagner, of the University of Wisconsin, for the state of Wisconsin. Work was begun May 15 and continued until September 20. The principal field of coöperation was the northwestern part of the state, special attention being devoted to the Apostle Islands in Lake Superior. Mr. Harry H. Sheldon for the Biological Survey, and Mr. Arthur J. Poole for the Wisconsin Survey, assisted.

In Montana, Mr. Marcus A. Hanna, assisted by Mr. Harry Malleis, worked the valley of the Missouri and the bordering plains and mountains from the mouth of Milk River westward, under the general direction of Mr. Edward A. Preble. The Little Rockies, Moccasin Mountains, Big and Little Belt Mountains and Castle Mountains were visited during the latter part of the summer. Mr. Victor N. Householder was a member of the party during the early part of the season.

The biological survey of Florida was continued by Mr. Arthur H. Howell. Field studies were carried on during March and April over a large part of Lee County and in the region around Lake Okeechobee. The collections in the Florida State Museum were examined and the specimens carefully identified. A collection of bird records from Florida, both published and unpublished, shows approximately 390 species and subspecies recorded from the state.

Coöperating at different times with the Biological Survey in field work in the state of Washington were the following: Prof. William T. Shaw, State College of Washington, Pullman; Prof. H. S. Brode, Whitman College, Walla Walla; Prof. J. W. Hungate, State Normal School, Cheney; Prof. J. B. Flett, National Park Service, Longmire; Mr. William L. Finley and Mrs. Finley, Portland, Oregon; and Stanton Warburton, Jr., of Tacoma. The Biological Survey was represented for a part of the time by Mr. Stanley G. Jewett, Pendleton, Oregon; and throughout the season by Mr. George G. Cantwell, Puyallup, Washington, and Dr. Walter P. Taylor, of the Biological Survey, the last named in charge of the work. Investigations were made in the Blue Mountains area of extreme southeastern Washington, in which occurs an unusual mixture of Rocky Mountain and Cascade Mountain types; and in Mount Rainier National Park, in connection with which the circuit of Mount Rainier was made for the first time, so far as known, by any vertebrate zoölogical expedition.

In North Dakota Mr. Vernon Bailey worked through September and October to get data on the hibernation of mammals and on the stores of food laid up for winter by nonhibernating species. He has returned with many valuable notes to be added to his report on the mammals of the state, and with an interesting collection of live rodents for study of habits in captivity.

Latest Conservation News from Pacific Coast[1]

In northeastern California Burney Falls, tributary to the Pitt River, with the surrounding 160 acres of forest, have been donated to the state by the owners.

Tumalo Cañon, near Bend, Oregon, with alternate rock-walled gorge and forest- and flower-decked bottom land, has been set aside for the people. This is through the generosity of the Shelvin-Hixon Lumber Company, which gives the cañon, and with it a strip of timber along the highway, as a memorial to the late Thomas Shelvin. The company did not own some of the most beautiful parts and bought them at a cost of $20,000 to include them in the gift. This bit of protected highway will be in striking contrast with the road leading into Bend, which for many miles is a desolation of burned and cut-over yellow pine.

From Washington comes news of the organization of a league called the "National Parks Association of Washington," with Major Everett G. Griggs, of Seattle, chairman. In a small folder the league announces its purpose—which is worthy the attention of the citizens of every state in the Union:

> "To preserve the natural features of our state as a part of our inheritance, and to retain in their present beauty our mountains, lakes, trails, and points of scenic interest; to advocate new national parks and the creation of state, county, and municipal parks and highways to connect the same; to preserve our lakes, rivers, and streams from pollution, and conserve our natural supply of food and game fishes; to protect our wild animal life from extermination; to encourage love of nature; and to preserve in the virginal state some part of our great forests."

Washington and Oregon have no great forests of redwoods, but they have mighty forests of other conifers only less majestic. For the sake of the water supply these forests should no longer be cut on the slopes and peaks of the Cascade Mountains and along streams and around the borders of lakes; and for the sake of the beauty of the

[1] Through the courtesy of Mr. Madison Grant, who served as organizer for the Save the Redwoods League, we are enabled to publish these results of activity and influence of the Save the Redwoods League, the National Park Service, the United States Forest Service, and local western conservationists.

highway and the comfort of the traveler who follows it, the forests should be protected along both sides of the road. Preservation of scenic beauty in Oregon and Washington without doubt will be handicapped. The region is sparsely settled and the pioneer idea of destruction still predominates. One immediate point of contest lies in this work on the highways. If, however, a right of way from 300 to 1000 yards wide be purchased, there will result some of the most beautiful drives in the world.

In addition to the need of attention to the highway problem and to the northern redwood problem, there are other conservation matters along the Pacific Coast that should have the light of publicity thrown on them. Among these is the needed rescue from real estate development of the Seventeen-Mile Drive and its unique cypress forests, near Monterey, California.

A vast satisfaction must be felt by the man who has accomplished a national good, or helped in accomplishing it. To do something for others is the great joy-giving requirement of the human mind, and to be able to give largely, where it will bring good to many thousands, hundreds of thousands, or even millions of fellow Americans—that must bring a broadening of vision great to the extent of dwarfing most of the really insignificant things of life.

An example of such giving was set in 1908. Mr. William Kent bought the redwoods on Mount Tamalpais overlooking Golden Gate and the waters of the Pacific, the last of the redwood race in all that bay region of California. Then he sent a deed of gift to the National Government. Also he requested that the monument be named the "Muir Woods," for his friend John Muir, even after Roosevelt wrote from the White House that he would greatly like to name it the "Kent Monument."

Mr. Kent characterized these redwoods, standing strong and self-reliant, shelter for the hosts of ferns and flowers of the ground, as signifying the chivalry of the forest and suggesting the ideal of individual and social life in America: "Stand straight and strong, who can; protect and shelter the weak." The characterization has even broader application in 1920 than this national meaning he gave it in 1908. And for one thing, surely, it sets the way, for those of us who can give, to make the United States, both East and West, the kind of country in scenic beauty and recreational opportunity which will best serve all the people.

"Stand straight and strong, who can; protect and shelter the weak"

Courtesy of "Bird Lore"

William Brewster—In Memoriam

By FRANK M. CHAPMAN

WILLIAM BREWSTER died at his home in Cambridge, Massachusetts, on July 11, 1919, six days after the completion of his sixty-eighth year. For nearly half a century he has been in the front rank of American ornithologists. He was the moving spirit in the organization of the Nuttall Ornithological Club of Cambridge, which, formed in 1873, was the first society of its kind in this country, and much of the success of this club during the succeeding forty-six years was due to his unfailing support.

From the Nuttall Ornithological Club there developed the American Ornithologists' Union, a body which has exercised a profound influence upon the study of birds in this country, and in the formation of this society Brewster also played a part of first importance. He served as president of the Union from 1896 to 1898, and, from its organization in 1883 until his death, he was an active member of its Council.

Mr. Brewster was also one of the Founders of the original Audubon Society which grew from the American Ornithologists' Union; he was for years a director of the National Association of Audubon Societies, and president of the Massachusetts Audubon Society.

From 1880 to 1887, Brewster was assistant in charge of birds and mammals in the Boston Society of Natural History; from 1885 to 1900 he held a similar position in the Cambridge Museum of Comparative Zoölogy, and from the last-named date to the end of his life he was, in effect, honorary or advisory curator of birds of that institution. His active curatorial duties, however, were connected with the development of his private museum. This, a fire-proof, brick structure, perfect in all its appointments, was erected on the grounds of his Cambridge home. It contained his library and collection of North American birds. The latter, by the terms of Mr. Brewster's will, has been given to the Museum of Comparative Zoölogy to which he also left the sum of $60,000.

William Brewster occupied a unique position in American ornithology. Well grounded in the fundamentals of the science, the peer of any of his colleagues in technical research, conservative in statement, as accurate in the presentation of facts as it is humanly possible to be, he still never let his interest in the science of ornithology absorb or diminish his love for the sentiment of ornithology. It was the bird in the bush rather than the bird in the hand which commanded his attention, and his more important contributions to ornithology consist of the results of his study of birds in nature. These were made with a born naturalist's enthusiasm and sympathetic insight, and with a trained observer's discrimination, while their results were presented in a literary form which has rarely been approached in the annals of ornithology.

The achievements of a scientist are not to be measured alone by his published works, but also by the influence he exerts upon his time. Viewed from this standpoint, William Brewster occupied an enviable position among ornithologists. Possessed of an exceptionally attractive personality, sincere, unselfish, considerate of others, of sound judgment, he won the esteem, respect, and confidence of everyone who knew him. It was therefore not alone his knowledge of birds, but also the nobility of his character which made William Brewster a potent factor in the development of the science of ornithology in this country.

Forest Conservation in New York State

Extracts from statement by the State of New York Conservation Commission

THE area of the New York Forest Preserve at the close of 1919 is 1,886,550.81 acres. The acquisition of additions to the Preserve during 1919, has been carried out with funds provided by a bond issue authorized by the voters in 1916. The work of acquisition is now carried on under a carefully developed plan, which permits it to proceed systematically and with complete assurance that the state will receive full value for every dollar expended.

In order that a purchase price may be agreed upon with the owner, all large tracts offered are thoroughly cruised by foresters of the Commission, who determine the quantity of timber on the property. The work that the foresters do is entirely in the nature of a topographical and quantity survey. They are then followed by appraisers, who ascertain the value of the timber in the place where it stands. It frequently happens that the owner of the property also makes a valuation survey, and in case of dispute, the Commission in some instances has the land cruised a second time by different parties, as a check upon the work of the first.

During the past year the land examined by foresters and appraisers, some of which had been offered in 1918, included 67,295 acres in the Adirondacks and 17,029 acres in the Catskills, a total of 84,324 acres; and of these amounts the Commission has negotiated the purchase of 42,371.98 acres in the Adirondacks and 16,415.30 acres in the Catskills, a total of 58,787.28 acres. The average price agreed upon for the Adirondack land was $14.90 per acre, while the average price of that in the Catskills was $6.26 per acre. The purchases made during the year amounted to $734,059.51. In addition there have been appropriated 92,810.89 acres in the Adirondacks and 1740 acres in the Catskills. All of these acquisitions have been approved by the Commissioners of the Land Office, although some of them must still be approved by the Attorney General and other steps taken before the purchases will be completed and the titles vested in the state.

The first effort of the Commission is to acquire land that lies on the high mountain slopes, where the danger of denudation following lumbering and forest fires is the greatest. These are the sections that should be forever maintained as protection areas, and upon which no lumbering should ever be permitted. When the region was formerly lumbered, the forests on these upper slopes were left untouched because the low price of timber and pulp wood at that time made it unprofitable to operate in those more inaccessible locations. Now, however, the price of lumber and pulp wood is much higher and the timber on a portion of these high, steep slopes could be removed for manufacturing purposes. These facts account for the relatively high price of certain of the lands acquired.

The Shore Owners Association of Lake Placid in 1918 raised a fund of $30,000 as a gift to the state to pay part of the purchase price of land lying on the slopes of McKenzie and Saddleback mountains, in order that these slopes might be immediately acquired for the purpose of stopping denudation. Since that time, public-spirited citizens interested in the welfare of the Adirondacks have organized the Victory Mountain Park Association, for the purpose of collecting funds to assist in the acquisition of portions of Mt. Marcy and the forest surrounding it, as a memorial to the soldiers and sailors who lost their lives during the war. This fund is being raised by popular subscription in amounts ranging from one dollar up, and it will eventually be turned over as a gift to the state. Meanwhile, however, to check the lumbering that had already started on the mountain, the Commissioners of the Land Office, acting upon the recommendation of the Conservation Commission, have authorized the appropriation of all of the tract that is now threatened with denudation.

Lands already acquired during the year, or the acquisition of which has been authorized by the Commissioners of the Land Office, include all or parts of the upper slopes of Mounts McKenzie, Saddleback, Whiteface, McIntyre, Marcy, Skylight, Redfield, Allen, McComb, Seward, Seymour, Esther, Sawtooth, Colden, Cliff, and Wallface. While some of these lands have cost a comparatively large amount owing to the fact that they contain large virgin growths of softwood, nevertheless they are the forests of greatest value to the people of the state of New York as protection forests for the sources of some of the largest rivers, and as vacation grounds, including within their boundaries the most beautiful and impressive scenery of the Empire State.

English Sparrows live below Sea Level

THE apparent ubiquity of the common English sparrow frequently causes us to forget that this bird is not indigenous to this continent and that its advent in some parts is relatively recent. Dr. Joseph Grinnell, director of the Museum of Comparative Zoölogy of the University of California, has discovered a new "outpost" of sparrows in the heart of Death Valley, California, at Greenland Ranch, 178 feet below sea level. Sparrows, which were introduced into New York City sometime between 1860 and 1864, arrived in California in 1871 or 1872, but they required nearly forty-two years more to extend to San Diego in the southern part of the state. This Death Valley location, however, involving the greatest extreme of temperature with low relative humidity in the country (134 degrees Fahrenheit on July 10, 1913), presents a novel problem of adaptation. It will be interesting to watch the subsequent development of this bird colony under these extreme climatic conditions which formulate a natural experiment that may throw some light on the question of the development of subspecific characters.

Honor to Adam Hermann

Address on the occasion of his retirement after nearly thirty years of service as head preparator of fossil vertebrates at the American Museum

TO Adam Hermann, his friends and fellow workers present their congratulations upon his record of high achievement. For nearly thirty years a leader in the preparation and mounting of fossil skeletons, his skill, ingenuity, and inventiveness have revolutionized the technique of his chosen profession and aided greatly in the progress of science.

In his early days at Yale University he was trained under the vigilant eye of Professor Marsh to an exact and scrupulous regard for finish and accuracy of detail, and the perfect preservation and safety of specimens and records. Coming to the American Museum in 1892, he found an opportunity for broader and more progressive work, retaining the high standards of his early training, but adapting them to new methods of preparation and exhibition which combined strict scientific accuracy with the largest possible utility in popular education.

When Mr. Hermann came to the Museum the department of vertebrate palæontology was in its infancy. A beginning had been made in the field expeditions and some valuable collections stood ready to his hand. But little or nothing had been done toward preparation and exhibition. During the twenty-seven years that have passed since that time, he has seen the exhibits, beginning with a little group of specimens that stood in the corridor next the elevator, grow steadily year by year. They expanded first into the hall of fossil mammals, then overflowing these limits, filled the great dinosaur hall, and finally, a third and still larger hall has been required to contain the great and ever increasing series of fossil skeletons, and a fourth hall is urgently needed. Step by step with the expansion of the exhibits their fame and reputation have grown steadily both at home and abroad, so that the people of the city are justly proud of their great Natural History Museum and of its wonderful skeletons of extinct animals.

His methods of preparation and mounting have been very generally adopted for similar work in other museums, often by preparators trained in this Museum under Mr. Hermann's direction. Gidley and Horn in Washington, Peterson and Coggeshall in Pittsburgh, Miller in Chicago, Martin in Lawrence, George Sternberg in Ottawa, all received their training here, while many scientists and museum men in this country and in Europe have come to the American Museum to learn the best methods of preparing and exhibiting fossil vertebrates.

Mr. Adam Hermann, head preparator in vertebrate palæontology at the American Museum, who has just retired

The first skeleton which Hermann mounted for this Museum was the *Cœnopus tridactylus*, a fine example of the panel or low relief mount, which has been so largely used in our later work. Next came the *Metamynodon*, the first of our open or full relief mounts, the first attempt, I think, to mount a Tertiary mammal in this style. Then came the great *Brontops* skeleton, which has been the pride of our Tertiary mammal hall for twenty-four years, and will, we hope, remain standing in broad and sturdy massiveness, defiant of all rivals, for many a year to come. The acquisition of the Cope mammal collection in 1893 provided a new series of valuable and classic specimens, and as the expeditions brought in new material year by year and the laboratory staff enlarged, the exhibits grew more and more rapidly. The famous *Phenacodus* skeleton afforded an opportunity for what was then thought a remarkable *tour de force:* to make an open mount in which every bone of the skeleton could be conveniently removed if desired for separate study. Today this method has been very widely applied, and it is customary to arrange any rare or unique skeleton so that the parts can be readily dismantled for study.

In 1897 the department entered a new field, extending its work to the dinosaurs and other fossil reptiles. This brought up new problems for solution. The gigantic size and fragile character of the skeletons of the dinosaurs made them far more difficult to restore and mount than anything that had previously been attempted. The first work done on the dinosaurs was of the nature of preliminary experiments; first, in mounting the limbs, then, in devising mounts that would hold securely the individual vertebræ; finally, in restoring and mounting the entire skeleton of a *Brontosaurus.* These various experiments, along with studies in pose and musculature, took time, so that it was not until 1905 that we were able to exhibit the completed *Brontosaurus* skeleton. Meantime our friends in Pittsburgh had studied and profited by our experiments and were able to complete their *Diplodocus* mount a little before the *Brontosaurus* was ready for exhibition. It is but fair, however, to say that the chief credit for devising methods to mount the skeletons of the giant Sauropoda belongs to Adam Hermann.

Another very different problem was presented by the great marine reptiles and fishes of the Kansas Cretaceous. The skeleton of *Tylosaurus dyspelor* was one of the first and is still the finest mounted skeleton of a Mosasaur on exhibition. The method of mounting this specimen included ingenious devices for reducing the weight of the great block, 26 × 6 feet, and for strengthening it and securing its permanency.

The later history of the laboratory has been one of continued progress and prosperity. Always ready to experiment with new devices, new tools, new cements or preservatives, many improvements have been introduced, others tried and abandoned. Gum arabic replaced glue, and to a large extent shellac[1] has replaced gum arabic. New cements of various kinds have been tried out. Electric power has been applied to various operations. The numerous and conspicuous mountings of the early skeletons have been reduced to a few inconspicuous simple lines.

[1] First used in this laboratory in 1901, I think.

The laboratory methods and technique have always been fully and freely explained and displayed to all who were interested. No petty rivalries or secrecy for the supposed selfish advantage of this institution has been allowed to interfere with the progress of the science. A spirit of friendly coöperation has become more and more prevalent and has aided no less than ingenuity or inventiveness in placing our American Museum laboratory technique in its present position of acknowledged leadership. In furtherance of this spirit of mutual helpfulness Mr. Hermann prepared and published in 1909 a fully illustrated description of his methods and technique which has served as a textbook in laboratories of vertebrate palæontology and has been of great help to preparators both in this country and abroad. While credit for the initiation of this liberal policy is due to Professor Osborn, yet to Mr. Hermann, as to other department leaders, belongs the credit of carrying it out loyally and effectively.

In a recent census of the fossil skeletons it appeared that no fewer than one hundred were at that time mounted on exhibition, ranging from the giant *Brontosaurus* to the tiny *Pterodactylus.* Most of these skeletons have been prepared and mounted in our laboratory, the greater number either by Mr. Hermann himself or under his direction. This is a record which it is safe to say is not equaled nor is likely to be by any other preparator of fossil vertebrates.

And, last but not least, we who have worked with Adam Hermann for so many years cannot fail to express our appreciation of his loyalty to the American Museum and to the department of vertebrate palæontology, his watchful care over the expenditure of both time and money in the prosecution of our work, the aid and instruction freely given to his subordinates, his frank appreciation of good work, and criticism of all that failed to reach the Museum's standards. To this spirit of loyalty and friendly coöperation, not less than to diligence and skill, we ascribe the growth of the department from its small beginnings in 1892 to its present position.—W. D. Matthew.

Mona Island Declared a Forest Reserve

IN connection with Dr. Lobeck's mention of Mona Island in his article on the physiography of Porto Rico (page 523), American naturalists will be grateful to know that Mr. E. M. Bruner, forester of Porto Rico, has taken the steps to have Mona declared a forest reserve, and that his efforts have been rewarded with success. On December 22, 1919, Mona Island and Monito (an islet three and one half miles northwest of Mona) were declared an Insular Forest by proclamation of the governor. This insures the preservation of the highly interesting natural conditions, especially by preventing the indiscriminate cutting of the scanty timber for charcoal.

Mona Island is situated in Mona Passage, halfway between Porto Rico and Santo Domingo. It consists of a nearly flat tableland of limestone averaging about two hundred feet in height, with a sheer sea cliff on the north and east, where it is subject to the most continuous wave action, and a terrace of flat sandy soil at the base of the scarcely less precipitous cliff on the south. Partly successful attempts to grow corn and cotton are being made on this terrace, and coconuts and bananas grow along the base of the cliff where the soil is moister and where there is an occasional spring.

The very unusual native vegetation of the table-land is practically untouched, however, and in its adaptation to extremes of aridity and sterility presents habitat conditions which can scarcely be duplicated in either Porto Rico or Santo Domingo.

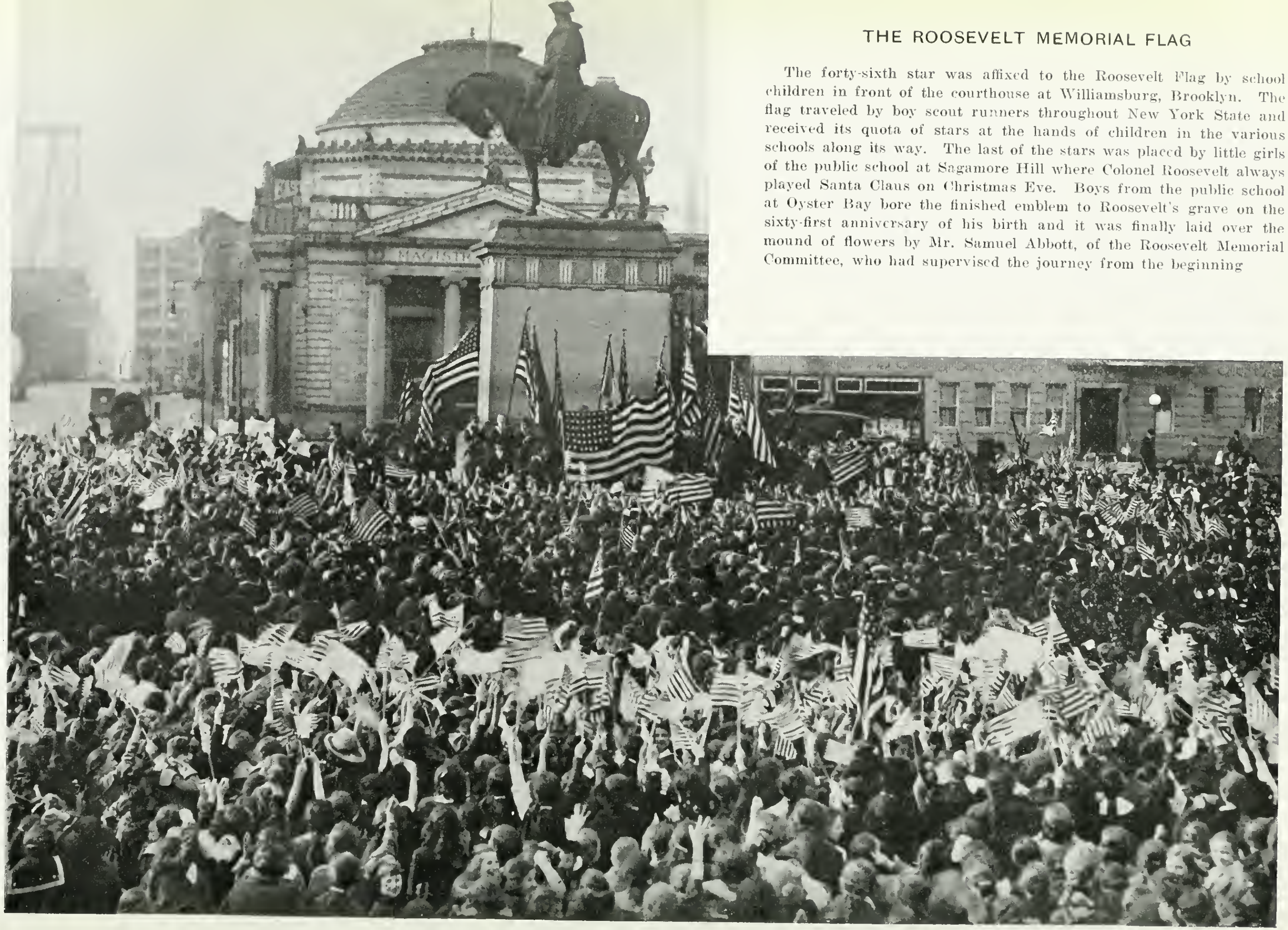
Most interesting of the animals on Mona is the large rock iguana (*Cyclura stejnegeri*), which, it is to be hoped, will continue to exist there now that its habitat will be preserved. The inaccessibility of the island affords it the necessary protection from man, its only other enemies being the dogs which are used to hunt the wild goats, pigs, and cattle. The rock iguanas are extinct in Porto Rico, although their bones are found in caves, and the related species in Santo Domingo appears to be on the verge of extinction also.—K. P. SCHMIDT.

Destruction of Yellowstone Park Elk

THE Yellowstone Park herd of elk has been driven from the park ranges this winter by the unusually severe snow storms and as a consequence from 6000 to 7000 head have been slaughtered by hunters in the state of Montana. A *News Bulletin* from the National Parks Association tells of this wild-life disaster which for pure blood lust recalls the last days of the buffalo.

This Yellowstone Park herd of about 30,000 elk is a genuine remnant of the wild life of former days and not a product of stocking the Park, but in its present restricted range it usually requires some assistance through at least a part of the winter. The animals have become almost fearless of men because of their long residence in the sanctuary of a national park, and consequently the herd could easily be approached. Hunters killed them in many instances by firing volleys into the bands and shipped out carcasses by the carload. The state of Wyoming has established game preserves along the park boundary to protect the elk, but Montana has not only refused to act likewise but has even this year extended the open season from October 15 to December 24. Those animals which escaped the hunters now face starvation on the snow-covered grazing grounds.

The southern herd has been saved with funds provided through the activity of Dr. E. W. Nelson, chief of the Biological Survey, but, even with the diversion of next spring's road improvement money for additional hay, sufficient forage cannot be procured. Congress has been asked for an appropriation but in the present crises of national and international affairs action is likely to be slow. Meantime the National Parks Association is receiving contributions for a fund for the rescue of the elk. It is also preparing to bring pressure to bear on the legislature of Montana, in order in the future to protect the southern herd along the park boundary, and to permit it to recuperate.



THE ROOSEVELT MEMORIAL FLAG

The forty-sixth star was affixed to the Roosevelt Flag by school children in front of the courthouse at Williamsburg, Brooklyn. The flag traveled by boy scout runners throughout New York State and received its quota of stars at the hands of children in the various schools along its way. The last of the stars was placed by little girls of the public school at Sagamore Hill where Colonel Roosevelt always played Santa Claus on Christmas Eve. Boys from the public school at Oyster Bay bore the finished emblem to Roosevelt's grave on the sixty-first anniversary of his birth and it was finally laid over the mound of flowers by Mr. Samuel Abbott, of the Roosevelt Memorial Committee, who had supervised the journey from the beginning

Courtesy of Underwood & Underwood

Notes

NATURAL HISTORY greatly regrets that owing to the printers' strike in New York City no numbers of the magazine were issued during October, November, and December. The present number, dated December, covers these issues and closes the publication of the 1919 volume. Also, it is regretted that, because of the extraordinary present cost of material and labor, a change of policy is necessary in the issuance of NATURAL HISTORY. Announcement has already been made to readers of the magazine that during 1920 it will be issued as a bimonthly, in six numbers (instead of eight as heretofore), appearing about the first of February, April, June, August, October, and December. It is hoped that by this plan the same standard of quality can be maintained notwithstanding the increased cost of production.

A LEAGUE of the Red Cross societies of Great Britain, the United States, France, Italy, and Japan has been founded with headquarters in Geneva. This new Red Cross organization plans to function as an agency for relieving national and international disasters. It has also projected the formation of an international bureau for coördinating sanitation and knowledge of sanitation and the prevention of disease throughout the world. In this capacity it has already been called upon for help by the Supreme Economic Council in Paris. Lieutenant General Sir David Henderson, K. C. B., is director general of the league, and Henry P. Davison, a trustee and treasurer of the American Museum of Natural History and formerly chairman of the War Council of the American Red Cross, is chairman of the board of governors. Dr. Richard P. Strong, professor of tropical medicine at Harvard University, has charge of the medical and public health activities of the league.

SIR WILLIAM OSLER, regius professor of medicine at Oxford University, died on December 29 in his seventy-first year. But a few months previously on the occasion of his seventieth birthday, two volumes of medical essays, contributed by distinguished British and American colleagues and former colleagues, were presented to Sir William. The presentation was made at the Royal Society of Medicine (London). Sir William was a Canadian by birth and held his first professorship at McGill University, but, as he remarked, the list of contributors to the volumes in his honor recalls a "vagrant career. . . . Toronto, Montreal, London, Berlin, and Vienna as a student; Montreal, Philadelphia, Baltimore, and Oxford as a teacher." He was honorary professor of medicine at Johns Hopkins University at the time of his death.

DR. ABRAHAM JACOBI, physician and teacher, died on July 10, 1919. He came to this country from Germany in 1853, after having suffered imprisonment from the Prussian government as a result of his participation in the Revolution of 1848. In New York he started a modest practice and in 1857 began lecturing in the College of Physicians and Surgeons on the diseases of children. Later he taught in Bellevue Hospital College and the University of New York and became clinical professor of pediatrics in Columbia University in 1870, retiring as professor emeritus in 1899 after nearly half a century of instructional work. His contribution to the literature of children's diseases was large and includes a number of very important treatises.

ONE of the most conspicuous phases of recent work of the Rockefeller Foundation, which was established in 1913 "to promote the well-being of mankind throughout the world," has been an educational and medical campaign against tuberculosis in France. By spectacular methods of advertising, the propaganda was carried far and wide over the country and many dispensaries and laboratories were established. In the United States the Foundation has demonstrated in two states that it is possible and profitable to get rid of malaria, either by destroying the malarial mosquitoes or, where this is impossible, by curing the human "carriers" of the disease. In the case of yellow fever, an attack has been made against the strongholds of the disease in Guatemala, and an expedition was sent to Ecuador for the collection of important information. The

Courtesy of Underwood & Underwood

The King and Queen of Belgium, during the recent visit of their Majesties to this country, honored New York City by planting a tree in Central Park—a European beech. In the photograph taken at the time, the King in the uniform of a Lieutenant General can be seen standing just back of her Majesty. The King and Queen were greeted in the park by 30,000 New York school children before the tree planting

campaign previously begun against the hookworm has been continued, and the infection surveys were completed in São Paulo, Brazil, in Jamaica, and in Guam, while new work was started in Queensland, Australia, and in Minas Geraes, Brazil. The China Medical Board of the Rockefeller Foundation is constructing thirteen buildings for the Peking Union Medical College. Thirty-two instructors have been appointed on the medical faculty, and laboratory facilities are now ready. Since 1914 the large fund of $22,444,815 has been distributed among recognized agencies for special war service in camp and community welfare, medical research and relief, and humanitarian aid for Armenia, Syria, Belgium, France, Poland, Serbia, and Turkey. Plans for public health and medical education have been laid on broad international lines, and a new School of Hygiene and Public Health has been opened in connection with Johns Hopkins University. The Rockefeller Foundation fortunately has received a large share of the Christmas Day gift by John D. Rockefeller of $100,000,000 for public health and education throughout the world.

A GOLD medal has been presented to Dr. M. E. Conner, chairman of the Rockefeller Foundation Commission to Guayaquil, at a special meeting of the Guayaquil municipality, in recognition of his services and success in stamping out yellow fever in that region.

THE Rockefeller Foundation has established a division of medical education to which Dr. Richard M. Pearce, professor of research medicine in the University of Pennsylvania and member of the medical advisory board to the War Council of the American Red Cross, has been appointed director.

THREE trees were planted by distinguished visitors to New York City last fall in the "Honor Grove" of Central Park where the English elm, set out in 1860 by the Prince of Wales, later King Edward VII, still stands. On the afternoon of September 9, General Pershing, while attending a gathering in the park of 35,000 school children, put the first earth around the roots of a pin oak as a memorial to the men who lost their lives in the World War. A month later, on October 3, after addressing a similar gathering of school children, the King and Queen of Belgium planted a European beech, and on November 21 the Prince of Wales set out an elm near the tree which his grandfather planted more than half a century before.

THEIR Majesties the King and Queen of Belgium, the Crown Prince, and their party visited the American Museum of Natural History on the afternoon of Saturday, October 4, and were received by Professor William K. Gregory and other members of the scientific staff present. The royal party visited several of the halls and viewed important exhibits, expressing a cordial interest in the Museum's work.

ON November 6 *Nature* celebrated its fiftieth anniversary with a Jubilee Number. The issue is occupied, for the most part, with retrospects by noted British scientists of fifty years' progress in various fields of learning, and an appreciation by Dr. H. Deslandres, vice president of the Academy of Sciences of Paris, of the founder and editor, Sir Norman Lockyer, who still continues his astronomical investigations at fourscore and three years. Fifty years have seen vast changes in science and scientific education in England, and of these changes *Nature* has been the faithful weekly chronicle. Sir Norman, in his "Valedictory Memories," records the encouragement in starting the weekly he received from various men of the past generation, including Mr. Alexander Macmillan, Sir Joseph Hooker, Huxley, and Tyndall. This was ten years after the appearance of Darwin's *Origin of Species* and at about the time when science began to take its first hold in public education in Great Britain.

A NEW magazine, the *Scientific American Monthly*, will succeed the *Scientific American Supplement*, which was established in 1876. This monthly will be devoted to current events in pure science and technology. It will officially represent the National Research Council by a special department and keep the public informed of the Council's activities. A particularly important feature of the new magazine, as it was of its predecessor, is the publication of translations of complete texts of significant articles appearing in foreign scientific magazines.

THE University of Paris has presented to the universities of the Allied countries a medal commemorating the achievements in the World War of the men of the respective institutions.

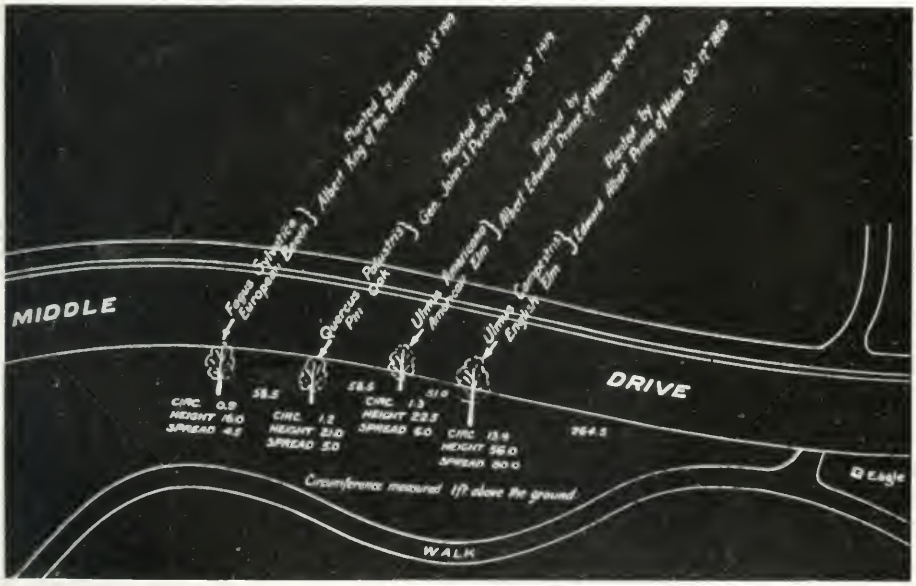


Diagram by J. S. Kaplan, City Forester

"Honor Grove" in Central Park, New York City, where General Pershing and three royal guests of the city have planted trees, lies along the east side of the Middle Drive between the Drive and the Mall.

A medal, presented to H.R.H. the Prince of Wales by the American Numismatic Society on the occasion of the Prince's recent visit to the United States

The medal was presented to the Prince in a case made of the wood of an elm which his grandfather, King Edward VII, at that time Prince of Wales, planted in Central Park, New York City, in 1860. A limb from this tree is on exhibition in Memorial Hall at the American Museum, through the courtesy of the New York Scenic and Historic Preservation Society and the Commissioner of Parks. The tree has grown to a height of 62 feet and at the time of its planting Central Park was only partly developed, and the whole region west of the park was "in the country." There were only a few houses and Manhattan Square, now occupied by the American Museum of Natural History, was still in its natural wild state, containing a small lake which contributed its waters to the lake in Central Park

Dr. George Ellery Hale, director of the Mount Wilson Observatory, foreign secretary of the National Academy of Sciences, and, during the war, chairman of the National Research Council, now holds the honor of being foreign associate of the Paris Academy of Sciences. Dr. Hale was elected honorary chairman in perpetuity of the National Research Council after his resignation as chairman, in recognition of his services during the war.

Dr. Charles D. Walcott, geologist, and secretary of the Smithsonian Institution, has been elected foreign associate of the Paris Academy of Sciences to fill the vacancy left by the death of Dr. Élie Metchnikoff. Foreign associates are limited to twelve. This distinction has been previously held by five Americans, Benjamin Franklin, Count Rumford, Louis Agassiz, Simon Newcomb, and Alexander Agassiz.

A suitable tablet has been erected on the grave at Philadelphia of Constantine Samuel Rafinesque, botanist and zoölogist. The grave had previously been unmarked. Rafinesque, born in Turkey, of French and German parentage, made his first trip to the United States in 1802 to collect botanical specimens in Pennsylvania and Delaware. He settled permanently in this country in 1815. Shortly after his emigration he occupied the chair of botany in Transylvania University, Lexington, Kentucky. Rafinesque wrote extensively in English, French, and Italian on his special researches.

A departure in government recognition of science was evidenced in the appointment of Professor C. E. Mendenhall, of the chair of physics in the University of Wisconsin, as scientific attaché to the United States Embassy in London. The appointment, however, was a war measure only and has since lapsed.

The proposal has come from various high scientific quarters to convert Heligoland into a bird sanctuary. The island is only a little rock of about one fourth of a square mile in extent, lying in the North Sea forty miles northwest of the mouth of the Elbe River. Although no birds regularly nest there except the English sparrow, it is a resting place for myriads of feathered travelers during the two annual migrations. As the island has been retained by Germany, however, with only the stipulation that the fortress be reduced, it will remain with that government to make this island, one of the greatest bird migration observatories of the world, a protected reservation.

At Pilawin, southeastern Russia, the great game preserve of Count Potocki, one of the very few preserves in Russia, has been completely destroyed by the Bolsheviki, according to a letter from M. Pierre Amédée-Pichot of the French National Society of Acclimatation, printed in the *Zoological Society Bulletin*, New York. "Hundreds of deer, wapiti, European bison, and animals of all sorts were kept in 7000 acres of enclosed forest, which was part of a great tract of 30,000 acres. The place was invaded by 2000 Bolshevik Red Guards, who shot every animal, and left the carcasses to rot on the ground. The palace, its furniture, and collections were destroyed, and the servants and keepers of the game were tortured to death."

Destruction of the herd of elephants in the Addo Bush Forest Reserve (South Africa) was authorized by the provincial council of the Cape of Good Hope in the summer of 1919. This herd of from 100 to 200 animals was the last remnant of a variety (*Elephas africanus capensis*) which once ranged over the whole of southern Africa. The variety is characterized by a strongly arched forehead and enormous ears recorded as 4 ft. 5 in. × 4 ft. for a female 8 feet high (in the British Museum). The preserve at Addo Bush near Port Elizabeth has been opened up to agriculture by irrigation projects and the elephants naturally assumed that the improvements were for their benefit and acted accordingly. To confine the elephants would have required a thirteen-mile fence, costing at least £20,000, and in addition it would have been necessary to provide a water supply for them. All this makes it appear that African elephants are likely to fare worse than our American bison before the onrush of civilized man because they are so difficult to hold and care for in captivity.

The Yucca House National Monument in the foothills of Sleeping Ute Mountains just west of Mesa Verde National Park, Colorado, has been established by a proclamation of President Wilson. This monument contains the ruins of what was once an extensive Indian village. Mr. Henry Van Kleeck, of Denver, donated to the Federal Government the ten acres on which the ruins stand.

Dr. Clark Wissler, curator of anthropology in the American Museum, has been elected chairman of the Section of Anthropology and Psychology of the National Research Council.

Sir E. Ray Lankester, the distinguished British zoölogist, has just completed fifty years' editorship of the *Quarterly Journal of Microscopical Science.*

The National Academy of Sciences, Washington, has awarded a gold medal to Dr. A. Fowler, professor of astrophysics in the Royal College of Science and secretary of the Royal Astronomical Society, London, in recognition of his researches in astronomy.

Mr. William Henry Fox, director of the Brooklyn Museum, of the Brooklyn Institute of Arts and Sciences, New York City, has been named a Chevalier of the Legion of Honor by the French Government.

International Control of Minerals is the subject of a pamphlet by C. K. Leith, professor of geology in the University of Wisconsin, issued by the United States Geological Survey. His purpose is, apparently, to state the problem in its various phases rather than to argue for or against it, and to put emphasis on the imperative need for study of the world mineral situation. The joint organization and systematic distribution of the mineral output of the world, brought about under pressure of war, has illustrated the possibility of international control. There are several fundamental facts in reference to the world's mineral supply which make it a matter of international concern: (1) About one third of the mineral output moves between nations; (2) In most instances it moves along a few restricted routes to a few centers, for instance, manganese is exported from three sources to four or five consuming centers; (3) No country is entirely self-supporting, for example, the United States lacks almost entirely nickel, platinum, and tin, and imports a large part of its aluminum, chrome, magnesium, and potash. Free trade in the metals instead of giving unrestricted opportunity has rather concentrated the materials in a few hands, a fact which at times hinders both national and industrial developments in other countries or localities. The question has accordingly arisen as to "the extent to which national interests can and will be subordinated to international interest" and the centralized control of the war maintained. There seems to be official sanction in Great Britain and France for such a control, the aim of which will be to insure an equitable distribution of the minerals of which there may be a world shortage, an adjustment of ship space, and an equality in the use of basic raw materials. An important aspect of the control would also be the part it might possibly play in the maintenance of peace.

The International Research Council was opened at Brussels, July 18, 1919, in the presence of King Albert, by M. Harmignie, minister of science and arts, who welcomed the members to Belgium. Statutes for the Council were agreed upon and its objects outlined, according to *Science*, as follows:

"(*a*) To coördinate international efforts in the different branches of science and its applications.

(*b*) To initiate the formation of international associations or unions deemed to be useful to the progress of science.

(*c*) To direct international scientific action in subjects which do not fall within the province of any existing association.

(*d*) To enter, through the proper channels, into relations with the governments of the countries adhering to the council to recommend the study of questions falling within the competence of the council."

Brussels will be the legal domicile of the Council where it will hold triennial meetings, but the special associations affiliated therewith will probably maintain the custom of meeting successively in different countries. Between the triennial meetings the work of the Council is intrusted to an executive committee of five, consisting for the present of Professor E. Picard (France), Dr. A. Schuster (England), Dr. G. E. Hale (United States), M. Volterra (Italy), and M. Lecointe (Belgium). The general secretariat will be established at Burlington House, London, where the Royal Society has set aside a room for its use. All of the nations which remained neutral during the war were unanimously invited to affiliate with the Council.

Dr. W. W. Campbell, director of the Lick Observatory, headed the American delegation to the meeting of the International Research Council at Brussels. This delegation included representatives from the National Academy of Sciences, the American Astrophysical Society, the American Mathematical Society, the American Physical Society, the Naval Observatory, and the United States Coast and Geodetic Survey. As a result of the Brussels meeting two subsidiary societies came into existence, the International Astronomical and the International Geophysical unions. The American Section of the Geophysical Union was organized under the Division of Physical Sciences of the National Research Council and, as approved by this Division, will include geodesy, seismology and volcanology, meteorology and aërology, earth and ocean tides and mareology, and terrestrial magnetism. Mr. William Bowie, chief of the division of geodesy of the United States Coast and Geodetic Survey, was appointed acting chairman of the American Section.

Progress in Negro education is reviewed in a recent Bulletin of the United States Department of the Interior by Dr. Thomas Jesse Jones, of the Bureau of Education of that department. Because of the exodus of Negro labor from the South the legislatures of southern states have taken a more active hand in this question, and Texas has even appointed a state supervisor of rural Negro schools. The great illiteracy of the southern Negroes was called to public attention by the examinations of Negro recruits in the late draft. Short terms (frequently only a few weeks), poor schoolhouses, and low salaries for teachers, however, will demand correction in many localities before the deplorable state of affairs can be ameliorated to any notable extent.

Medicine as a determining factor in war was discussed by Dr. Alexander Lambert in his presidential address before the 1919 meeting of the American Medical Association. The death rate in the Civil War of killed in action or died of wounds was 33 per thousand and of death by disease 65 per thousand. The American Expeditionary Force lost from wounds in action 31 per thousand and from disease only 11 per thousand. Malaria, which was the great scourge of the Civil War, has become almost negligible, while typhoid, which caused so many deaths in the Spanish American War and 22 per cent of the deaths in the Civil War, was chargeable with only 0.4 per cent of deaths in the World War. Pneumonia was the most dreaded disease of the recent war and to it are ascribed 85 per cent of all deaths from disease. The pneumonia, however, was part of a world-wide epidemic and beyond control. Dr. Lambert points out that, if the Medical Department is to increase its usefulness, it requires representatives on the General Staff, for authority must be united with responsibility. An example of what lack of authority entails is found in the case of meningitis which caused 4 per cent of deaths as opposed to 2 per cent in other wars. The increased morbidity and fatality were owing in this case, Dr. Lambert says, to overcrowding and bad ventilation of barracks, factors outside the control of the Medical Department.

The fact that 34.19 per cent of the late draft in the United States was rejected from military service on the basis of physical inferiority raises serious questions in the field of public hygiene. Dr. J. Howard Beard, of the University of Illinois, analyzes in the *Scientific Monthly* the principal causes of rejection with a view to their preventability. All in all, the draft demonstrated that, if the country is to conserve its human lives as well as its other natural resources, it must turn its collective attention to adequate medical care and instruction in the schools. And, further, parents must be educated to save themselves expense by paying the family doctor a small sum to prevent, rather than a large sum to cure, illness in their children.

The decoration of Commander of the Order of the Crown of Belgium was presented to President Henry Fairfield Osborn on November 20 by Colonel Osterrieth, chief of the Belgian Military Mission to the United States, representing the King of Belgium. Two volumes of the scientific researches made as a result of the Congo Expedition of the American Museum have been sent to King Albert, inscribed with the following legend:

"In grateful appreciation of the generous coöperation of the Belgian Government in promoting this scientific research, the contributions in these two volumes representing the reports of the Belgian Congo Expedition so far as published, have been assembled for presentation to his Majesty, the King of Belgium, by the President and Trustees of the American Museum of Natural History on the occasion of his visit to America."

THE collection of big game trophies made by the late Captain F. C. Selous, D.S.O., who was killed in action during the British campaign in East Africa, has been presented by Mrs. Selous to the British Museum (Natural History). Captain Selous hunted during a period of forty years in Africa, Canada, Newfoundland, the southern Carpathians, and Asia Minor, and it is said that the collection is one of the largest ever brought together.

AN expedition to Africa under Mr. Edmund Heller sailed from New York on July 15 for Capetown whence it will proceed to Victoria Falls, from there entering the Belgian Congo and traveling eastward to Lake Tanganyika. Mr. H. C. Raven has been delegated by the Smithsonian Institution its representative on the expedition.

AN expedition to discover the sources of the Wahi Shebeli River which flows from Abyssinia through Italian Somaliland, left Naples during October. It was under the leadership of Prince Luigi, Duke of the Abruzzi, who was commander in chief of the Italian navy during the war, and has held both farthest north and highest altitude records, the one made in an attempt to reach the North Pole from Franz Josef Land, the other by an ascent of Mt. Austin, India, to a height of 24,000 feet. On a previous expedition to equatorial Africa he scaled Mt. Ruwenzori, altitude 16,801 feet.

THE British Imperial Antarctic Expedition under Mr. John L. Cope plans to leave New Zealand in July on the ship "Terra Nova." In announcing his expedition Mr. Cope says that it will aim to ascertain the position and extent of mineral deposits in Antarctica, to locate any waters abounding in whales, to investigate the meteorological and magnetic condition in the Ross Sea area and at Cape Ann, and to circumnavigate the Antarctic Continent.

THE death is announced of Herbert Ward, British sculptor, traveler, and author. Mr. Ward early went to Africa and was one of the survivors of Stanley's Emin Pasha Relief Expedition in 1888. He later turned to sculpture and exhibited in Paris many notable bronzes of African natives, some of which are now in the Luxembourg. As sculptor he received the decoration of Chevalier of the Legion of Honor. In 1916 Mr. Ward lectured in the United States for the benefit of the work of the American War Relief. Among his books are *Five Years with the Congo Cannibals* (1890), *My Life with Stanley's Rear Guard* (1891), and *A Voice from the Congo* (1910).

THE creation of a Mexican government bureau of archæology and ethnology has been announced by the Secretaría de Agricultura y Fomento. The bureau will carry on scientific investigations of the Mexican aboriginal cultures on the basis of a regional survey of the country.

THE erection of signposts, indicating distance and direction of watering places, through the deserts of southern California and Arizona under the direction of the United States Geological Survey has progressed rapidly. The water supply of the region is of strategic importance because it includes about 350 miles of the Mexican frontier. All the watering places of the region have been examined and 635 signs erected. All maps and data have been turned over to the United States Army for incorporation in the progressive military map of the United States. The work will ultimately be extended to all the western arid lands.

A COMPREHENSIVE outdoor course in biology was successfully conducted last summer by the department of zoölogy of Oberlin College under Professor Lynds Jones. Students of ecology were taken on an automobile trip to the Pacific Coast of Washington, including in their route the Yellowstone Park and part of the Columbia River. In the summer of 1920 the department expects to conduct a similar trip through Colorado to the Yosemite Park, California.

A MUSEUM of natural history has been founded in Yellowstone National Park by the Department of the Interior. Such institutions will render important service in the utilization of our national parks as great outdoor universities.

The United States Forest Service reports from California that the aviators who made daily flights over the national forests during the summer and autumn of 1919, discovered many incipient fires and thus prevented great loss. So valuable has this work proved that an air service may ultimately become a permanent part of the forest protection.

The Mineral Deposits of South America is the title of a new work by Benjamin L. Miller, professor of geology in Lehigh University, and Joseph T. Singewald, Jr., associate professor of economic geology in Johns Hopkins University. This book is the result of an extended trip by the two authors through South America, together with an exhaustive study of the literature of South American mineralogy of which they have collected the first extensive bibliography. After an introductory chapter on the economic geology of the southern continent there follow *résumés* of the mineral products and topographical and geological descriptions of the various countries together with detailed descriptions of localities important mineralogically. The book will serve as a valuable source of information for the merchant, investor, or prospector as well as for the student of South American geology.

We learn from *Nature* that a conference of delegates from the Mediterranean nations met in November at Madrid to consult on and organize a plan for an international hydrographic and fishery investigation, particularly with reference to the life histories of food fishes. Four vessels will be at the immediate call of the organization, provided by the Prince of Monaco, and by Italy, France, and Spain, respectively. The results of this research will be published ultimately in French, Spanish, Italian, and English.

Progress in the tanning and preparation of fishskins for commercial leather is reported by the *Fisheries Service Bulletin*. The United States Government Bureau reports that samples of the leather made from shark and porpoise hides is much superior to that previously submitted and is soft, pliable, and strong. The Bureau has developed a special net for catching sharks which appears well adapted to this difficult and sometimes dangerous sport.

The United States Bureau of Fisheries has established an experiment laboratory in southern California to study the problem of preserving and canning fishery products. The methods developed will be placed at the disposal of the commercial packers.

A giant panda (*Ailuropus melanoleucus*) from eastern Tibet, one of the rarest of animals, has recently been placed on exhibition at the American Museum. The panda was discovered in 1869. In general appearance it resembles a bear and is about the size of our black bear, but it is really a distant relative of the raccoon. The striking black and white coat, short muzzle, and curious black patches about the eyes give it a very extraordinary appearance. Almost nothing is known of the animal's habits, but it is said that it feeds on roots and the young shoots of bamboo. It is believed that the specimen shown at the American Museum is the first brought to this country; the skin was purchased from Mr. Joseph Milner, a missionary, who had obtained it from some natives of Ta-Chien-lu, Tibet. Mr. Blaschke, sculptor in the American Museum preparation department, mounted the specimen.

An interesting collection of birds, taken in northwestern Peru, has just been received at the American Museum from Mr. Harry Watkins, field representative of the department of ornithology. Several new forms, including a new genus of ovenbirds (*Hylocryptus*), are described in the December *Proceedings of the Biological Society of Washington* by Dr. Frank M. Chapman, curator of the department of ornithology at the American Museum. One of the most interesting discoveries is a breeding race of the killdeer, a common North American bird, which occasionally reaches extreme northern South America in winter.

A valuable specimen of the great auk (*Plautus impennis*) has recently been added to the collections which are now in the American Museum, belonging to Dr. L. C. Sanford, of New Haven, Connecticut. The great auk or garefowl is an extinct bird formerly inhabiting the North Atlantic regions and breeding on small islands off the coast of Iceland, on the Orkneys, the Hebrides, and in the vicinity of Newfoundland. It disappeared early in the nineteenth century through persecution by fishermen and sailors, who killed it for food, bait, and feathers. The last few survivors were taken by collectors about 1840. Only about seventy-eight specimens are preserved in the museums and private collections of the world, and accordingly skins have sold for very large sums.

Bones of the Virginia deer have been found in Indian shell heaps in Nova Scotia by the Canadian Geological Survey, and the identification has been confirmed by Dr. Gerrit S. Miller, of the United States National Museum. That the Virginia deer ranged so far north, except after its introduction into the province in 1888, had not previously been known.

One of the largest and most beautiful botanical gardens of the world is to be founded in Illinois, just outside the city of Chicago, by the Cook County board of forest preserve commissioners. This garden will be made by converting 2000 acres of the Palos Forest Preserve and so will inherit a natural tree and plant endowment in the green prairies and the wooded ravines along the Des Plaines River. Exotic flowers, shrubs, and trees will gradually be added.

The first living specimen of the okapi to be brought out of the Congo country has been safely delivered to the Zoölogical Garden of Antwerp by the Commandant of the district of Bas-Uelé (Belgian Congo). The specimen was captured a day or so after its birth. At first it was fed on canned milk and then on the milk of a zebu cow, but since its arrival in Europe the young animal eats clover and other green plants. The Congo Expedition of the American Museum (1909–15) attempted to bring out an okapi, but the specimen captured died for lack of proper food.

The first part of Volume I of the final report of the *Scientific Survey of Porto Rico and the Virgin Islands* was published September 26 by the New York Academy of Sciences. It contains a history of the Survey by Dr. N. L. Britton; a geological introduction, including a discussion of the major geological features, by Professor C. P. Berkey, to which is appended a new base map of Porto Rico by Dr. Chester A. Reeds; and an interesting description of the geology of the San Juan District, an area of about five hundred square miles on the northern side of Porto Rico, by Dr. Douglas R. Semmes. The 110 pages of text are supplemented by twenty-six illustrations, four plates, and three maps.

The Survey was instituted in 1913 by the New York Academy of Sciences in coöperation with the insular government of Porto Rico, the American Museum of Natural History, the New York Botanical Garden, and with the scientific departments of Columbia University and other institutions, for the purpose of prosecuting a thorough and systematic investigation of the natural history of the island of Porto Rico, and subsequently of the Virgin Islands. A large amount of data has been assembled and a great number of specimens collected. Important preliminary papers have been published in the *Bulletin* and *Memoirs* of the American Museum of Natural History as well as in other scientific journals.

The complete report will contain volumes devoted to anthropology, botany, geology, palæontology and zoölogy. These will give a most exhaustive and valuable account of the natural history resources of the islands.

The American Ornithologists' Union held its thirty-seventh stated meeting at the American Museum, November 11–14. In connection with the meeting of the ornithologists and in celebration of the centennial of the expedition to the Rocky Mountains under the command of Major Stephen H. Long, the Museum arranged a special exhibit of specimens, manuscripts, drawings, and published volumes relating to Major Long's journey. Thomas Say and Titian Ramsay Peale accompanied that expedition which was the first American exploring expedition to which naturalists were officially assigned.

The Children's Museum of Boston has received accessions to its endowment fund amounting to $25,000. A branch will be opened in coöperation with the Barnard Memorial in the crowded south end of the city.

The bronze memorial to Lewis and Clark by Charles Keck, sculptor, a photograph of which was shown in the April-May number of NATURAL HISTORY, was dedicated by the city of Charlottesville, Virginia, on November 21, 1919.

AN expedition to the island of Jamaica for living and extinct mammals, was undertaken in November by Mr. H. E. Anthony, assisted by Mr. Charles Falkenbach, both of the American Museum. No fossil vertebrates, except for a single skull of a marine mammal, were known from this island, but a consideration of the conditions in this and other West Indian islands made it appear highly probable that some land vertebrates formerly existed there, and the geology indicated that caves probably existed similar to those in Porto Rico and Cuba from which Mr. Anthony had secured such large and interesting collections of fossil mammals, and that they might also yield fossils. Preliminary reports from Mr. Anthony leave no doubt that this forecast has been verified, but the extent and character of the collections remain to be seen. The character of this fauna will be studied with particular interest, as it should throw further light on the sources of the fauna and the manner of its arrival on the islands. The geology of the West Indies indicates that the most probable place for a mainland connection, if the fauna arrived in that manner, is by way of Hayti, Jamaica, and Honduras. Obviously, if the animals did arrive in this way, the fauna of Jamaica ought to be more like that of the mainland than those of any of the other islands—more continental in type. On the other hand, if the animals, or rather their ancestors, arrived on the islands through the agency of storms, floating vegetation, or other accidents of oversea transportation, without the aid of any continuous land bridge, then Jamaica, as a rather small and isolated island, should have a more scanty and insular fauna than the larger and more central islands of Cuba and Hispaniola, perhaps even more so than Porto Rico.

MR. ALBERT THOMSON, of the department of vertebrate palaeontology in the American Museum, assisted by Mr. George Olsen, carried on operations during the summer of 1919 in the great fossil quarry at Agate, Nebraska. From the richer part of the quarry a section was selected especially suitable to be preserved and exhibited at the Museum in the block. This block, showing sixteen skulls and corresponding numbers of skeleton bones within a space of $5\frac{1}{2}\times 8$ feet, was skillfully lifted, boxed, and brought to the American Museum without damage. Its weight when boxed was about six thousand pounds. Several other valuable fossil specimens were obtained from the quarry and vicinity.

A SIGN of the renewed period of interchange between the American Museum and its scientific colleagues abroad is the gift of a series of skeletal casts of the Neanderthal man of Krapina, Croatia, which comes from the laboratory of Professor Gorjanović-Kramberger, director of the Geological and Palæontological Department in the Croatian Natural History Museum at Zagrab (Agram). These casts have been arranged with the other material dealing with the history of Neanderthal man in the center of the hall of the Age of Man at the American Museum.

MR. LOUIS L. MOWBRAY, who was connected with the New York Aquarium for a number of years, has lately gone to Miami, Florida, to take charge of a new aquarium which is to be erected there. On leaving New York he turned over to the American Museum of Natural History two important collections of marine fishes, made by himself, one from Bermuda and the other from Turk's Island in the Bahamas. These collections contain several species which have never been described, and others which are little known. Turk's Island is famous for the variety of its fish life but the species which occur there have never before been listed or adequately collected. The fishes from Bermuda are comparatively well known and are of particular interest as perhaps giving some key to the obscure laws which govern the dispersal of marine fishes. A certain similarity between the fish life in Bermuda and that at South Trinidad Island, which lies well off the Brazilian coast, south of the Equator, should be traced to similar oceanic isolation of each locality. The occurrence in Bermuda and Porto Rico of species not known elsewhere in the West Indies is interesting, and we find that certain fishes of the Mediterranean and eastern Atlantic occur there. It seems incredible that these should not also reach other West Indian islands. Distance is proved to be no barrier to their dispersal. Possibly, however, there is some effective barrier in the trend of the ocean currents or it may be that, although they reach Bermuda, they are barred from waters farther south where they would meet a keener competition with allied forms.

A SURVEY through the Rocky Mountains for study of the nature of the folding of the earth's crust involved in the elevation of these mountains is reported on by Professor Rollin T. Chamberlin, of the University of Chicago, in the *Journal of Geology*. The line of the survey extended in a slight curve from near Lyons, Colorado, to the Grand Hogback at Glenwood Springs, so as to meet the various ranges at approximately right angles. This section of the Rockies (from the Great Plains to the Uinta Basin) was originally 140 miles in width and has been compressed into 132 miles, a shortening of only 8 miles. The section studied by the Survey was divided into thirteen parts and the thickness of the crust involved in the deformation was calculated for each section. The roots of the Gore Range reach to a depth of 87 miles and of the plateau near Glenwood Springs to 107 miles, very great depths when compared with the crustal deformation of the Pennsylvania Appalachian folds where the maximum depth is only 32 miles. Further comparison of the Colorado Rockies with the Appalachians brings out the very great amount of volcanic action there has been in the case of the former and the negligible amount in the latter. It is probably true that mountain formation in which there has been involved a thick shell of the earth's surface which has necessarily pushed downward into the earth great depths has always been accompanied by much outpouring of lava; and that the reverse has been true in the case of the deformation, however intense, of a thin shell which has pushed its roots but a few miles downward instead of several scores of miles. A theoretical division might be made of the earth's mountain ranges into thin-shell, shallow-rooted mountains which have had little volcanic eruption—the Alps, the Jura, Scandinavian chain, Scottish Highlands, Brazil range, etc.; and thick-shell, deep-rooted mountains with very great lava output—Colorado Rockies, Cascade Range, western Andes, and the Abyssinian Mountains.

A TOPOGRAPHIC mapping of the republics of Santo Domingo and Haiti has been undertaken under the supervision of the United States Geological Survey through appropriations made by the respective governments. It is also reported by the Washington Academy of Sciences that Cuba and Porto Rico are expected to join in the work. A Division of West Indian Surveys has been created for this emergency and Lieutenant Colonel Glenn S. Smith placed in charge. Survey parties have already begun work in the Dominican Republic.

AN exchange of professors between the University of Chile and the University of California has been officially ratified by the government of Chile through its Minister of Public Instruction, Pablo Ramirez. This is the first definite step in a plan by which the University of California will become a center for exchanges of professors with the leading Hispanic countries of the world and for study of the historic and contemporary problems of these countries. Dr. Charles E. Chapman, associate professor of Hispanic-American history in the University of California, will be the first exchange professor.

THOSE mammals of Australia which are now or in the past have been in the New York Zoölogical Park are the subject of a well illustrated paper[1] by W. H. D. Le Souef, director of the Zoological Gardens, Melbourne. The Australian mammalian fauna, with its dingo, kangaroos, wallabies, koala, bandicoot, wombat, Tasmanian wolf, Tasmanian devil, and platypus, is the most peculiar found on any continent, and is always of interest to the general visitor at any zoölogical garden. The New York Zoölogical Park has a representative collection of Australian mammals for which the paper by Mr. Le Souef will serve as an excellent guide.

A SCIENTIFIC application of micro-cinematography, similar in some ways to that discussed by Mr. Charles Herm in a previous number of NATURAL HISTORY, is presented by Professor Herbert F. Moore, in *Iron Age*. Professor Moore has designed a micro-cinematograph which is attached to a metal testing machine. With this he is able to take views of the change in microscopical

[1] *Zoologica*, Scientific Contributions of the New York Zoological Society, January, 1919.

structure of the metals undergoing tests and then use these photographs for study and lectures.

The publication of a work on the osteology of reptiles, left in manuscript by the late Samuel Wendell Williston, professor of palæontology in the University of Chicago, has been intrusted to Dr. William K. Gregory of the American Museum.

Dr. W. K. Gregory has in press two important monographs in the *Memoirs* of the American Museum of Natural History, one describing the Eocene lemuroid Primates, the group of animals from which the later monkeys, apes, and man evolved, the other, a comparative study of the lachrymal bone in the Mammalia.

Dr. Louis Dollo, of the Royal Museum in Brussels, who is one of the senior palæontologists of Europe, is engaged, it is reported, in the preparation of a monograph on the fossil reptiles of the Congo. He has already published a number of special papers in this field.

The second award of the Elliot Medal for the leading publication in zoölogy or palæontology was made by the National Academy of Sciences, Washington, to Mr. William Beebe, curator of birds at the New York Zoölogical Park, in recognition of his *Monograph of the Pheasants*. Professor Henry Fairfield Osborn of the American Museum presented Mr. Beebe to the Academy. In speaking of the *Monograph* Professor Osborn said in part:

"This is a profound study of the living pheasants in their natural environment in various parts of eastern Asia. There are nineteen groups of these birds: eighteen were successfully hunted with camera, with field-glasses, and when necessary for identification, with the shotgun. The journey occupied seventeen months, extended over twenty countries, and resulted in a rare abundance of material, both literary—concerning the life histories of birds—and pictorial, photographs and sketches. The journey extended over 52,000 miles; it ended in the great museums of London, of Tring, of Paris, and of Berlin, for the purpose of studying the type collections. Thus the order of the work was from nature to the museum and to man, rather than from man and the museum to nature.

"The *Monograph* covers the blood partridges, the tragopans, the impeyans, the gold and silver pheasants, the peacocks, the jungle fowl, and the history of the ancestry of our domestic fowls. It has important bearings on the Darwinian theories of protective coloration and of sexual selection, and on the De Vries theory of mutation. The full-grown male and female characters, the changes of plumage from chick to adult, the songs, courtships, battles, nests, and eggs of nearly one hundred species are included and systematically described. The illustrations are by leading American and British artists. The haunts of the pheasants are shown in the author's photographs ranging from the slopes of the Himalayan snow-peaks, 16,000 feet above the sea, to the tropical seashores of Java."

To the four great murals by Charles R. Knight in the hall of the Age of Man at the American Museum has now been added a fifth, representing the Pleistocene life of northeastern North America, with its characteristic giant beaver, deer, moose, and tapir, the remains of which are found along with those of the mastodon in the peat bogs and later cave deposits of the North Atlantic States. A sixth mural painting by Mr. Knight, above the western archway of the hall, represents the Crô-Magnon race of man, the artist of the prehistoric cave paintings and sculptures of France and Spain and the forerunner in western Europe of the higher modern types of man among whom civilization arose.

Dr. Pliny E. Goddard, curator of ethnology in the American Museum, has been elected a fellow of the American Academy of Arts and Sciences.

The seventy-second meeting of the American Association for the Advancement of Science met in St. Louis December 29 to January 3 under the presidency of Dr. Simon Flexner. The retiring president, Professor John M. Coulter, delivered his address on the "Evolution of Botanical Research" and President Flexner gave a lecture, complimentary to the members of the association and affiliated societies and the citizens of St. Louis, on "Present Problems in Medical Research." The Association recommended, among other things, that in connection with the Carnegie Endowment for International Peace, the British, French, and Italian equivalents of the American Association be invited to send delegates to the meeting to be held next year in Chicago. The Association also indorsed and commended the general purposes of the Save the Redwoods League. Dr. L. O. Howard, chief of the United States Bureau of Entomology, was elected president for the ensuing year.

On Roosevelt Day, October 27, a number of lecture reminiscences were delivered at the American Museum in conjunction with the National Association of Audubon Societies. Addresses on various aspects of Roosevelt's interests in natural history were delivered by President Henry Fairfield Osborn, of the American Museum, Mr. T. Gilbert Pearson, secretary of the National Association of Audubon Societies, Dr. Frank M. Chapman, curator of ornithology in the American Museum, Mr. George K. Cherrie, representative of the American Museum on the Roosevelt Expedition to South America, Mr. Carl E. Akeley, and Mr. Ernest Thompson Seton.

The New York *Times*' "Review of Books" reports the activity of John Burroughs in the memorial exercises in honor of Theodore Roosevelt. He journeyed from his home to Garden City, Long Island, to plant a "Roosevelt tree" in the gardens of the Country Life Press, selecting a sugar maple and setting it near the evergreen tree which John Muir planted several years ago. Mr. Burroughs is spending the winter in southern California.

Through the courtesy of Miss Josephine M. Stricker, who acted as Theodore Roosevelt's secretary during the years 1916 to 1919, Natural History has become acquainted with Roosevelt's early refusal and final acquiescence to Sigurd Neandross' request—seconded by Mr. Anthony Fiala—for sittings for a portrait bust (reproduced as frontispiece, page 510). Unfortunately the bust was never completed because of Roosevelt's sickness; in fact, the sculpture is so true to life in certain views as it stands, that it very perceptibly portrays the low state of health and somewhat troubled condition of mind of the great American in the last year of his life and the fourth of the heart-rending years of the war.

Mr. Laurence V. Coleman has returned to the American Museum as chief of the department of preparation. Since Mr. Coleman's connection with the department of public health of the American Museum in 1915–16 he has been studying zoölogy at Yale, Harvard, and Woods Hole and has given nine months' service in the United States Army as chemist.

Since the last issue of Natural History the following persons have been elected members of the American Musum:

Patrons, Mrs. David J. Kelley and Mr. W. B. Dickerman.

Life Members, Mesdames H. Roswell Bates, Carlos de Heredia, Bella C. Landauer, Jay C. Morse, J. D. Rockefeller, Jr., Gardiner Sherman, Thaw, Misses Charlotte L. Andrews, Theodora Wilbour, Gen. Thomas L. Watson, Col. S. Herbert Wolfe, Major Hunter S. Marston, Lieut. Frederick Trubee Davison, Dr. Felipe Garcia Cañizares, The Hon. Julien Stevens Ulman, Messrs. A. M. Anderson, John Aspinwall, Frederic Barnard, E. D. Church, Edgar B. Davis, Harry Vallette Day, D. George Dery, Clarence Dillon, Irénée du Pont, Eugene G. Foster, Austen G. Fox, Walter D. Gelshenen, Augustus Hemenway, Walter Hinchman, Alfred O. Hoyt, Elias M. Johnson, Felix E. Kahn, Theo. N. Vail Marsters, Wm. Maxwell, Dunlevy Milbank, Francis L. Mitchell, E. Virgil Neal, Frank G. Ormsby, C. P. Perin, Carl H. Pforzheimer, F. L. Rodewald, H. E. Sargent, Walter Seligman, Stuart C. Squier, Stevenson Taylor, Inglis M. Uppercu, Theo. N. Vail, C. Blaine Warner, Blair S. Williams, Emil Winter, and Samuel Zemurray.

Sustaining Members, Mrs. J. F. D. Lanier, Miss Anita Bliss, Messrs. John V. Bacot, Jr., Francis D. Bartow, Edward H. Clark, J. S. Douglas, Laurence H. Hendricks, M. L. Morgenthau, Clarence M. Roof, E. C. Smith, and Casimir I. Stralem.

Annual Members, Mesdames T. R. Almond, F. Huntington Babcock, Jacques Ballin, William T. Blodgett, George G. Bourne, M. T. Campbell, O. B. Coates, Sturgis Coffin, Clark Davis, George B. de Long, Fairman R. Dick, Ruger Donoho, Chas. Douglass, George W. Fleming, Anson R. Flower, A. V. Fraser, Robert A. Gardiner, Marion B. B. Langzettel, Frederic E. Lewis, Frances B. Mason, Junius S. Morgan, James Moses, J. O. H. Pitney, J. Ernest Richards, H. Schweitzer, Frederic Shonnard, A. Ritter Shumway, Henry Sillcocks, H. G. Simon, Roswell Skeel, Jr., Gerda Stein, William E. S. Strong, Cornelius Tiers, Richard Tjader, R. A. Walker, Misses Ellen Louise Adee, Katherine M. Barnes, Annie W. Bond, Emily Buch, Eleänore Cross, Anna S. Götberg, Avah W. Hughes, Mary Bernice Jenkins, Hope Lewis, Alice R. Peters, Isabel M. Peters, Caroline M. Platt, Clara A. Reed, Alice Low Sand, Belle Thomson, Alice Wilson Wilcox, Major H. P. Erskine, Major John W. Loveland, Capt. A. P. Simmonds, Lieut. Herbert Schiff, U.S.N.R.F., The Rev. Cyrus Townsend Brady, The Hon. George A. Carden, Doctors Lawrason Brown, Pablo F. Calma, Henry H. Covell, Annie S. Daniel, Henry E. Hale, Marius E. Johnston, Charles C. Lieb, Geo. M. MacKee, Marshall William McDuffie, John P. Munn, John H. Nolan, J. H. O'Connell, G. W. Richardson, Wm. Benham Snow, Walter R. Steiner, Malcolm H. Tallman, Faneuil Suydam Weisse, Messrs. Wm. Crittenden Adams, Paul W. Alexander, J. Roy Allen, Philip Allen, Morris Ampur, Alexander L. Anderson, Charles Lee Andrews, George R. Baker, Chris Bambach, Louis H. Barker, Isidor Baumgart, Wm. N. Beach, W. Gedney Beatty, James H. Benedict, Edwin H. Blashfield, Moses D. Blitzer, George T. Bowdoin, Lawrence J. Brengle, Henry Morgan Brookfield, C. Fred Buechner, Joseph E. Bulkley, Harry I. Caesar, Arthur L. Carns, John Jay Chapman, C. T. Chenevert, Louis R. Cheney, Myron H. Clark, William Clark, Lathrop Colgate, C. H. Conner, J. C. Cottrell, E. H. Crandall, Richard Cronin, Anton Cypra, Geo. C. Dempsey, Charles H. Ditson, Frederick G. Dodd, H. Yale Dolan, F. L. DuBosque, P. D. Dwight, John H. Eden, Jr., Franklin M. Elms, Charles Farber, Samuel H. Fisher, P. H. B. Frelinghuysen, Melville B. Fuller, Jacob Meyer Gidding, George McMurtrie Godley, Gustav Goodmann, Fred W. Gordon, W. C. Gotshall, James S. Gross, George C. Haigh, Alexander J. Hammerslough, William B. Hardin, Thos. R. Hartley, Carroll Hayes, J. F. Heine, Andrew H. Hershey, Robert Carmer Hill, Julian Hinckley, Harold K. Hochschild, Hal Hodes, Charles L. Hoffman, W. Roger Hunt, Courtney Hyde, Stanley M. Isaacs, Frederick D. Ives, John Percival Jefferson, Percy H. Jennings, Francis C. Jones, Otto Kahn, Joseph F. Keller, John Kirkpatrick, Charles Klingenstein, J. C. Kraemer, Jr., Julius G. Kugelman, Wm. B. Larkin, George Bacon Lester, Richard Lounsbery, Christopher M. Lowther, George Lowther, Israel Ludlow, Samuel Lustbader, Jr., W. J. Turner Lynch, Arthur C. Mack, Kenneth K. Mackenzie, Bernhard Marcuse, Francis R. Masters, Henry Forbes McCreery, Robert McKelvy, Thos. P. McKenna, Andrew D. Meloy, J. Edward Meyer, Emanuel Miller, Frederic P. Moore, Geo. T. Mortimer, S. L. Munson, John G. Neeser, Isidore Neugass, Walter M. Nones, Wm. P. Northrup, Gill N. Oakes, Julius Oppenheimer, Raymond Orteig, Edward S. Paine, Wainwright Parish, Hubert Templeton Parson, Lincoln R. Peabody, F. Curtis Perkins, Jr., L. H. Perlman, John J. Phelan, Livingston Platt, B. F. Quackinbush, Evan Randolph, Robert R. Reed, Henry R. Reischmann, Thos. A. Reynolds, William L. Rich, Jr., Charles A. Richards, Kingman Nott Robins, Edwin M. Rogers, Gustavus A. Rogers, Clarence G. Rothschild, William A. Sanborn, Carl Schaetzer, Jack W. Schiffer, William D. Scholle, J. Schüllinger, Alfred F. Seligsberg, J. Nelson Shreve, William R. Sidenberg, Theo. A. Simon, C. Harold Smith, Alfred T. Stanley, Fred M. Stein, Glenn Stewart, Philip B. Stewart, Frederick A. Stokes, Alfred W. Stone, Arthur Hays Sulzberger, Robert Egerton Swartwout, Daniel G. Tenney, Ambrose G. Todd, J. M. Townley, J. Henry Townsend, John C. Travis, Gardiner Trowbridge, Kinsley Twining, Albert Ulmann, Leo Weill, Bulkeley Wells, John C. Wetmore, Frank Whitney, William Wiese, James D. Williams, Laidlaw Williams, H. A. Wilson, Lee J. Wolfe, Otis F. Wood, Henry R. Worthington, and Henry Zuckerman.

Associate Members. Mesdames J. Gilbert Burton, T. A. Janvier, A. G. Langford, John W. Phelps, A. P. Taylor, Misses Eliza Frances Andrews, Betsey Bean, Mary A. Booth, Rosamond P. Coffin, Caroline J. Hitchcock, Mary S. Holmes, Elizabeth Madeira, Agnes McDonell, Louise Klein Miller, Clara A. Pease, Ruth L. Phillips, Caroline Gray Soule, Cleona C. Sproul, Elisabeth W. Stone, E. Grace White, The Hon. Charles H. Allen, The Hon. Edwin F. Lyford, The Hon. Chase S. Osborn, Professors O. M. Ball, Geo. E. Beyer, Frederic T. Bioletti, J. H. Bretz, George Alexander Buist, Webster Chester, T. D. A. Cockerell, Charles Wright Dodge, Elon Howard Eaton, Simon H. Gage, George E. Hale, Gilbert D. Harris, Thomas M. Hills, Jas. S. Hine, N. L. Huff, J. Gladden Hutton, A. G. Leonard, Earle G. Linsley, Homer P. Little, Hansford M. MacCurdy, Shirley P. Miller, Frank S. Mills, C. A. Mooers, Henry F. Nachtrieb, William Peterson, Charles Schuchert, Mary A. Willcox, Ira A. Williams, Doctors F. Bascom, R. Bennett Bean, Frederick Bentley, Louis B. Bishop, J. Chester Bradley, J. Braunnagel, Edward C. Briggs, H. S. Brode, Chas. C. Browning, Luther Burbank, Herman Burgin, C. E. Calm, W. C. Coker, Joseph D. Condit, R. D. Crawford, Whitman Cross, Charles A. Dewey, Chas. R. Drake, Charles Redway Dryer, George C. Embody, Justus Watson Folsom, Donald J. Frick, Melvin Randolph Gilmore, U. S. Grant, Leland Griggs, Philip B. Hadley, J. Culver Hartzell, William Frederick Howat, George David Hubbard, Ivar Janson, E. E. Just, J. H. Kellogg, Abram T. Kerr, Benjamin F. Kingsbury, Adolph Koenig, W. J. G. Land, Frank R. Lillie, James W. Lowber, Clara S. Ludlow, Marcus W. Lyon, Jr., T. H. McHatton, Edmund B. Montgomery, Robert Orton Moody, Susan P. Nichols, J. Pease Norton, Henry Leslie Osborn, Frederick J. Pack, G. H. Parker, Edith M. Patch, J. T. Patterson, A. S. Pearse, Raymond J. Pool, H. D. Reed, Albert M. Reese, Edward Reynolds, DeLancey Rochester, Raymond C. Rush, M. Charlotte Schaeffer, Adeline F. Schively, Mary Alice Schively, Solon Shedd, Hervey Woodburn Shimer, Henry Skinner, Charles D. Smith, F. D. Snyder, Clinton R. Stauffer, Bernard C. Steiner, P. E. Stuart, Joe H. Todd, Chas. Edward Tucker, Henry E. Utter, Elda R. Walker, Stuart Weller, R. Wernigk, Charles Branch Wilson, J. Howard Wilson, Messrs. Billy Andrews, Orla L. Ayrs, Felix Babbage, Geo. B. Badger, J. L. Bell, Arthur Barneveld Bibbins, Frank S. Bigler, E. L. Blackshear, Edgar C. Bradley, Edwin T. Brewster, Wiley Britton, Fred E. Brooks, Ernest B. Brown, Walter H. Bucher, Stewart H. Burnham, Verdi Burtch, Kermit Christensen, W. A. Clark, Jr., Ramon Gandia Córdova, Charles H. Cramer, Norman Criddle, Marcus Hele Dall, Henry E. Davies, Samuel Hoffman Derickson, E. T. Dumble, Willard A. Eliot, H. G. Faithorn, Edward A. Featherstone, Wm. L. W. Field, Arthur H. Fleming, Freeman A. Ford, Mark Francis, L. S. Frierson, T. E. Gibbon, W. W. Grant, Henry Waldo Greenough, John W. Hancock, T. L. Hankinson, E. C. Harder, George Harrington, Norvin Trent Harris, Kenneth L. Hartshorn, Herbert M. W. Haven, Morgan Hebard, Geo. A. Hero, J. P. Herring, Richard Charles Hills, Howard A. Howe, Richard Ledyard Hubbard, Carl Hyne, Walter F. Jahncke, William Kelly, Henry Kerr, Warren Knaus, Edward Q. Knight, George Langford, Richard K. LeBlond, Frank Leverett, J. T. Lloyd, Carl F. Lomb, Edgar Odell Lovett, Geo. E. Marsh, M. C. Marsh, Edwin J. Marshall, John W. Marshall, Geo. C. Matson, S. W. McCallie, Hiram Dryer McCaskey, Wm. C. Mills, Warner J. Morse, W. D. Murphy, Arthur H. Norton, George E. Osterhout, Wm. Parfitt, D. C. Parman, George H. Perkins, John W. Phillips, Laurence E. Pope, Lewis Radcliffe, J. B. Railsback, L. C. Read, James A. G. Rehn, G. Brinton Roberts, Joseph M. Rogers, John G. Rothermel, John Hall Sage, Hubert Schmidt, Charles Schuneman, Frederick E. Sears, C. W. Shannon, Charles Cutler Sharp, C. A. Sharpe, Henry S. Sharpe, Delavan Smith, Charles H. Sternberg, George R. Stetson, Frank Stone, Lucius S. Storrs, Louis N. Stott, P. A. Tetrault, Abram Owen Thomas, Howard V. Thomas, J. K. Urmston, L. R. Waldron, Albert P. Weiss, Wm. D. Wheelwright, B. F. Whipple, Harold O. Whitnall, E. B. Williamson, Herrick E. Wilson, Chas. D. Woods, John S. Wright, and Carl Zapffe.