IN TWO SECTIONS—PART II

NATURAL HISTORY

THE JOURNAL OF THE AMERICAN MUSEUM

VOL. XIX – JANUARY, 1919 – NUMBER 1

EDITED BY
MARY CYNTHIA DICKERSON

INDEX FOR VOLUME XVIII

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

Beginning with 1919 the AMERICAN MUSEUM JOURNAL will be known as NATURAL HISTORY. As the Index for 1918 represents Part II of the January, 1919, NATURAL HISTORY, its title page conforms with the new name of the JOURNAL.

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

FREE TO MEMBERS OF
THE AMERICAN MUSEUM
OF NATURAL HISTORY

CONTENTS OF VOLUME XVIII

December

ILLUSTRATIONS

INDEX OF VOLUME XVIII

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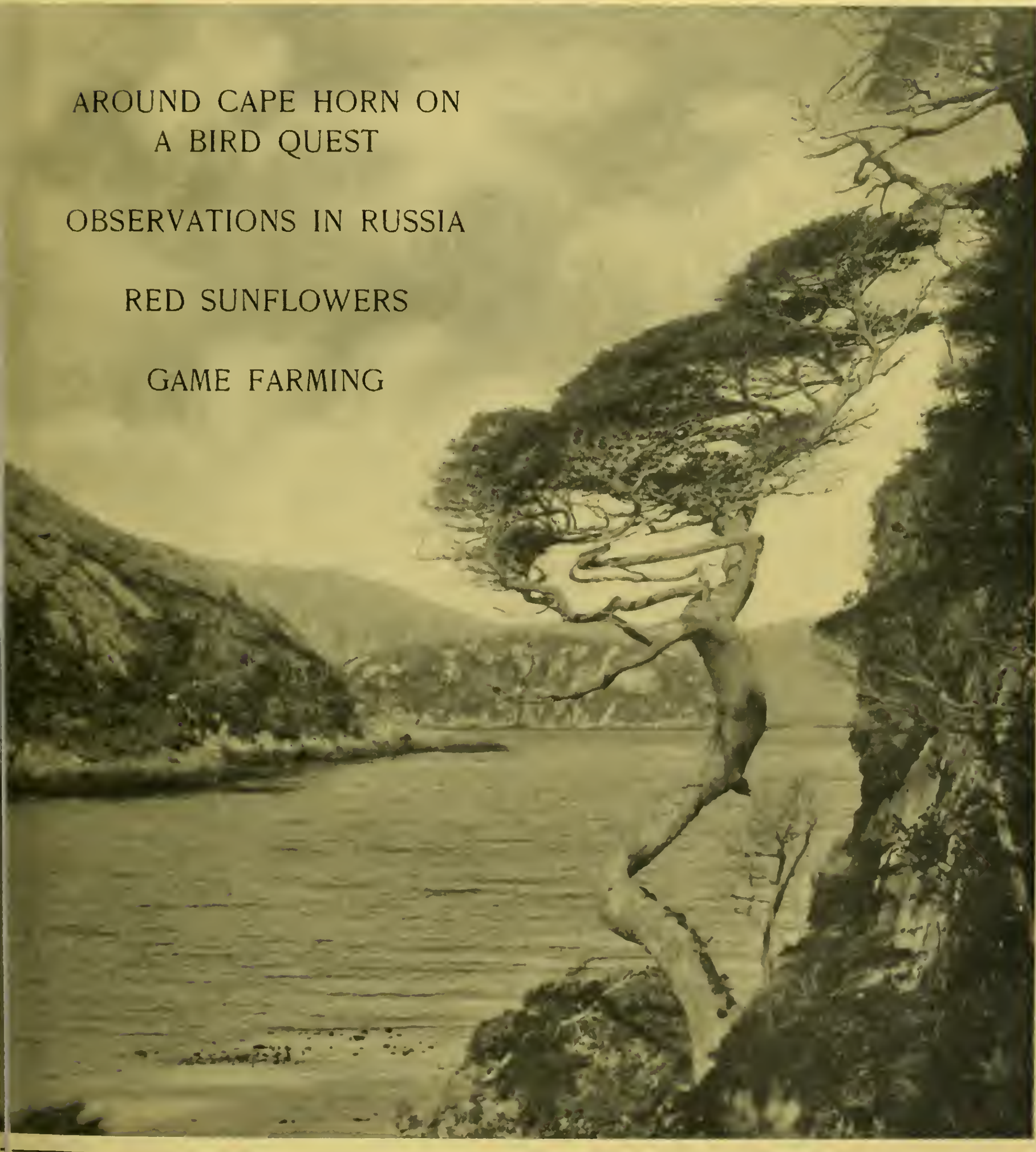
THE AMERICAN MUSEUM JOURNAL



AROUND CAPE HORN ON A BIRD QUEST

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THE AMERICAN MUSEUM JOURNAL

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

January, 1918

Volume XVIII, Number 1

THE AMERICAN MUSEUM OF NATURAL HISTORY

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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 members are now enrolled who are thus supporting the work of the Museum. The various classes of membership are:

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The American Museum Journal, 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 One Dollar and Fifty Cents a year. The Journal is sent free to all classes of members. 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, have been issued by members of the scientific staff and those utilizing the Museum collections. A detailed list of these publications will be found in the Appendix to the Journal. Price lists and full information may be obtained by addressing the Librarian of the Museum.

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The American Museum Journal

CONTENTS FOR JANUARY

MARY CYNTHIA DICKERSON, *Editor*

Subscriptions should be addressed to the AMERICAN MUSEUM JOURNAL, 77th St. and Central Park West, New York City.

The Journal is sent free to all members of the American Museum.

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

MR. ROLLO H. BECK

Wide experience and much practical knowledge, coupled with a boundless enthusiasm for the work, have made Mr. Beck one of the most successful bird collectors in a region where such collecting is accomplished only with the greatest difficulty and even danger. Through his efforts on the Brewster-Sanford Expedition to South America, there is now deposited in the American Museum the most complete representation of Tubinares in the world

THE AMERICAN MUSEUM JOURNAL

VOLUME XVIII | JANUARY, 1918 | NUMBER 1

During the winter season, traveling through Smyth's Channel, which extends from the Strait of Magellan along the southern coast of Chile, one sees an ever shifting panorama of distant peaks and white-garbed islands, with snow-encased fjords leading off to one knows not where

Narrative of a Bird Quest in the Vicinity of Cape Horn[1]

By ROLLO H. BECK

WHEN we were leaving San Francisco, California, in December, 1912, for a two years' collecting trip along the coasts of South America, rounding Cape Horn was regarded as a rather remote possibility; but in December, 1914, when we enjoyed our Christmas dinner only thirty miles from Cape Horn, the same possibility loomed large before us. The disturbance in Europe contributed in no small measure to our passing the summer months in and about the region so dreaded by sailors—for our plans had been laid to visit the Falkland Islands that season.

Perturbed conditions, evident before we attempted to land from the steamer in the Falklands, and which were later settled in the Falkland Island battle, made us decide to try Cape Horn for a time. I had journeyed down along the west coast through Smyth's Channel and other inland waters, and up through the Strait of Magellan in the dead of winter, passing the months of September and October at Mar del Plata, at the mouth of the Rio Plate, collecting ocean birds while waiting for the summer time to strike the southern latitudes. By the middle of November, when Punta Arenas had begun to put

[1] Article and illustrations copyrighted, 1918, by Rollo H. Beck

on spring garments. I readily obtained the best sealing cutter Magellan Strait boasted, as the war had made sealing unprofitable. This was a small twelve-ton boat manned by three men and a cook. It had a small cabin that accommodated the collector and his wife, while the four sailors bunked forward close by the stove, which was fed with wood chopped as we went along. Having been accustomed to drying wood thoroughly in California before burning it, I imagined we should need coal about Cape Horn where rain or snow thoroughly soaks all wood lying on the ground. The captain, however, took but a sack or two for emergencies, relying on freshly chopped wood most of the time, and I was greatly surprised to see how readily the newly felled trees burned.

We left Punta Arenas on November 25, and were not two hours out before a great flock of birds was sighted, fishing in the middle of the strait. We changed our course and ran out to them, but found they were dominican gulls rather than the hoped for shearwaters. It was the largest flock of gulls I had ever seen, containing several thousand birds, and resembled at a distance the great hordes of sooty shearwaters that are seen at Monterey, California, in the summer and fall. Swinging back on our course again, we headed for Point Isidro some fifty miles down the strait, reaching it about four o'clock, and anchored for the night. An old Norwegian, whom we dubbed "Quién sabe" owing to his frequent repetition of that questioning phrase, was the sole warder of the defunct whaling station located in the cove. In former years whaling from this point had been a profitable occupation, many whales being taken in Magellan Strait. But they have become scarce lately, and in our two months' trip only three whales were seen, these being in Beagle Channel a short distance south of the strait. We anticipated a couple of hours of rough weather crossing the strait, as the prevailing westerly winds sweep strongly up the channel from the western entrance to near Point Isidro where the strait bends northward. We enjoyed good weather, however, and after crossing, worked with a light wind and the tide as far as King Island in Cockburn Channel. The close view of Mount Sarmiento, the snow-covered peak visible in clear weather from Punta Arenas, was enjoyed for hours as we passed it, the usual foggy covering being absent in the morning.

After spending a day at King Island until a head wind subsided, we started out again and succeeded in getting into the protected waters just beyond Brecknock Pass. This was a dreaded spot, for the ocean swells roll up into the channel, and some years before, the captain had been capsized here and all his companions drowned, a sudden squall overturning their boat. We anchored in a small harbor in the lee of London Island, working close in to the edge of a kelp patch so that the sudden williwaws or gusty gales sweeping down off the rocky heights could not disturb us. Several diving petrels came into the bay from the sound during the afternoon and I obtained a number, shooting the most of them during a thick snowstorm that raged for an hour. These little birds, though belonging to the petrel family, resemble in their forms, flight, and feeding habits the northern auklets rather than any of the other petrels, and I was interested to find in Peru a closely related species unable to fly while molting the wing feathers, being in that particular also like the auklets. Going ashore at London Island and climbing over the granite rocks toward the south, a pretty lake was discovered lying in a small valley, and as we were walking along the shore, one of the brown-breasted plovers that had been so common the preceding winter at Ancud, a

LAUNCHING FISHING BOATS AT MAR DEL PLATA, ARGENTINA

An interesting sight in summer at Mar del Plata is the daily launching of the fishing boats. On account of the shallow water along the coast, it is unsafe to leave the boats anchored in the bay, and all are taken ashore at night, being hauled up on the beach by horses and returned to the water in the same way in the morning thousand or more miles to the northward, suddenly fluttered into view, revealing a handsome set of eggs tucked away under a tuft of short grass. Birds were very scarce; occasionally a small flycatcher would be seen or heard, or a robin would make known his whereabouts, and in the stunted trees that found shelter in little pockets or on the lee side of towering cliffs, the tiny creepers could be heard. While the barren rocks brought to mind similar spots in the Aleutian Islands of Alaska, the cheery song of the snowflake or *Leucosticte* found no counterpart here.

Leaving this inhospitable anchorage the morning of December 2, we sailed out into Whaleboat Sound with a fair wind, and through rain and snow squalls reached the eastern end of Grand Island where we anchored again. The next morning at half past five we got under way and spent the forenoon sailing slowly along until an inviting cove at Timbales Island, with a snowy white kelp goose standing on the outermost point of rocks, induced us again to drop anchor and go ashore. This part of the sound was studded with little islands where the presence of steamer ducks and kelp geese gave promise of nests, although two or three pairs of each were seen with broods of downy young. Shortly before anchoring, we saw the wreck of an Argentine steamer, the captain of which had selected the wrong channel between two of the numerous islands and had come to grief on an uncharted reef. Timbales Island interested us greatly, and we obtained fine sets of eggs and photographs of both kelp geese and steamer ducks. The sailors discovered the goose's nest a couple of miles from the

The eggs of the kelp goose, usually five or six in number, are, as a rule, stowed away in a clump of grass close to the beach. (Note the nest at the feet of the feminine figure.) This goose lives largely on bits of kelp and other salt water vegetation and is eaten only by the Indians. It is much tamer than the upland goose, a few of which are also found on the larger southern islands. A close view of the nest is shown on the opposite page

One of the land birds of the Cape Horn region is a small, dark-colored, wrenlike whistler, called by the natives *patra* in imitation of its note. Although it is heard constantly along the bushy shores, the bird seldom is visible. A single nest was discovered on London Island, and Mrs. Beck may be seen taking a peek at its contents

ship. Before getting back to the vessel we had to endure a soaking rain for an hour, but we had learned to carry our rain coats with us when intending to remain away from the boat for any length of time, so we suffered little

When the eggs of the kelp goose are first laid, little down is in evidence in the nest, but gradually more and more is plucked by the sitting bird from her breast until finally, when the eggs are hatched and the young geese leave the nest, a great wad of soft feathers remains to be blown away by the wind from rain squalls. After leaving Timbales Island we sailed nearly south for twenty-five miles and swung around into Christmas Sound, an island-dotted channel which separates Hoste Island from several small islands bordering the southern ocean. We anchored for the night halfway down the sound, and when we sailed again a day later, we headed for Ildefonso Island which lies about twenty miles out in the open ocean to the southward. After getting outside the sound four or five miles, the breeze began to increase, and the captain turned back to anchor in a secluded cove in Trefius Bay, which forms the southern entrance to Christmas Sound.

Steamer ducks are often surprised asleep on some jutting rock in the quiet channels of south Chilean waters

Ildefonso Island has no anchorage, being merely a long narrow rock sticking up a few hundred feet above the water, and as its shore line is swept continually by the heavy seas that roll up from the westward, landing is possible only on calm days, and these are of rare occurrence. The island was plainly visible from Trefius Bay, but although we anchored on the seventh, it was not until the seventeenth that the rain and snow squalls gave place to a sunny day. While awaiting the good weather, we rowed about among the islets in the bay. On one a flock of kelp geese was stopping while they molted their wing feathers. It was a mixed flock of males and females, and I noted that while these nonbreeding birds were unable to fly, several pairs of adult geese with young could fly. A couple of weeks later, near Cape Horn we saw another small flock of geese molting, but on the entire

The nest of the steamer duck is cleverly hidden under a stump or dense bush a few yards back from the beach, and the newly hatched young follow their parents into the cold waters of the sound, seemingly indifferent to temperature changes trip of two months I do not remember seeing any adults, while accompanied by young, which could not fly when pressed. On one of the small islets we found a skua's nest with two eggs ready to hatch. The nest was on the open, grassy top, entirely exposed to the driving hail storms that swept over at frequent intervals night and day, but the birds, being clothed with coarse heavy feathers, seemed not to mind. When we first reached the ocean side of the islands the beautiful slender-billed fulmars were common, but by the time we had left Ildefonso Island behind us the fulmars had passed to the southward toward their breeding grounds in the South Shetlands, several hundred miles south of Cape Horn.

A strange feature of the landscape at the eastern end of Caroline Island, where we were anchored, was the tufts of earth sticking up on the lee sides of the great granite boulders. The wind, sweeping across the island, strikes a moss-covered rock, and perhaps, in some extra heavy gale, loosens the tightly clinging moss at one edge. Succeeding winds tear away bits of the decayed roots and soil which have gathered, until finally the rock is exposed, and then it is merely a matter of time until the windward face of the rock is swept clean. But on the leeward side of large rocks the wind has much less force, and the roots hold the matter together so firmly that a soft piece of vegetation and earth will be sticking up, while surrounding it is a solid barren rock.

The weather looked clearing on the sixteenth and at half past one on the morning of the seventeenth, as the sky began to lighten, we towed out into the open sea again. A dead calm prevailed until noon, but at nine o'clock I put out in the boat and rowed along the eastern shore of the bay where Hoste Island juts out in high perpendicular cliffs. Hundreds of the white-breasted king shags were nesting on the ledges, with pendant-like bunches of tussac grass hanging from their nests, and on a small unclimbable rock near them I saw my first colony of the handsome red-billed, bluish-colored Scoresby gulls nesting. A light breeze sprang up at noon and we stood out toward Ildefonso where I hoped to find the yellow-nosed albatross nesting. That was the particular desideratum of our trip. In Punta Arenas the captain had assured me Diego Ramirez Island, seventy-five miles to the southward, where the birds were supposed to nest, could be reached in our small boat, but after seeing the sudden storms that sprang up without an hour's warning, we decided Ildefonso was quite far enough from shelter to satisfy us, and he thought it probable some of the birds nested there. Our light breeze died down toward evening and we stood back in the direction of land, heading out again at midnight.

At three in the morning the captain roused me out in foggy, drizzly weather, announcing the nearness of land. As he expected a change in the wind he wanted me to hasten ashore, but I held off until five o'clock when, with camera loaded, three of us dropped the whaleboat overboard and pulled in along the rocks. Being oldtime sealers, the two sailors carried rifles, expecting to find fur seals on the rocks. We did see a dozen or so at the entrance to a cave and shot a couple, but the expected herd was not there. Black-browed albatrosses by the dozen sat on the steep sides and on top of the island, or sailed over us, some alighting on the water and others sweeping over and then back again to their nests. We rowed a mile or two until a little ledge gave us a footing to climb the slippery penguin trail to where some of the albatrosses were nesting. The nests, containing newly hatched young, were built up of mud picked up near at hand, and reminded me at once of flamingo nests. Close by and under the albatross nests rockhopper and jackass penguins had nests with half-grown young, and I was busy with the cameras for an

CHRISTMAS SOUND, ONE HUNDRED AND TWENTY MILES FROM CAPE HORN

A climb of a thousand feet in the vicinity of southern Chile spreads before one a waste of waters dotted with rugged wind-swept islands, against a background of desolate snow-capped mountains. Hoste Island lies at the left. In the distance, Christmas Sound leads through Talbot Passage into the Antarctic

ALBATROSS NESTS ON ILDEFONSO ISLAND

The black-browed albatross builds nests elevated several inches above the ground, thereby making it possible to keep the occupants spotlessly clean, which would not be the case were the nests placed in hollows after the manner of albatross nests in tropical islands. The birds are very tame, usually remaining on the nests until forcibly removed

PENGUIN TRAILS

Where the penguins have traveled back and forth from the water to the rookery generation after generation for long passages of time, marks of their claws may be seen on the steep face of the rock among the lines caused by natural erosion

YAHGAN INDIAN CAMP

A slender wisp of smoke led us to this camp around the point of an island in Beagle Channel. Although a heavy rain had been falling for hours, a cheerful fire was burning inside the wigwam, and in a five-gallon can over the fire several young shags were cooking for breakfast. We saw many deserted camp sites; this was the only occupied one observed in two months' traveling through the southern channels hour or two, tramping through the mud and slush searching for the best spots from which to photograph them. It was a surprise to see and hear several creepers in ragged plumage in the long tussac grass, as not a bush or tree was in sight, and they are birds of the forest rather than of the open. Perhaps an abundance of flies about the rookeries attracts them. A drizzly fog hanging low over the island gave promise of a change in wind, and after taking photographs and deciding that the yellow-nosed albatrosses were not present, we returned to the sloop which was standing on and off near shore.

We ran back toward Hoste Island, passing in between Morton and Henderson islands and close to a little island where a copper mine had been worked some years before, then up through a tortuous channel, finally anchoring under the Diadem Mountain, which stretches up about three thousand feet. Mrs. Beck and I climbed the mountain-side from the thick grass and mossy tundra along the beach, to a small lake where great cakes of ice were floating in the cold water. This was probably two thousand feet up and was surrounded by snow-covered mountains. A flock of dominican gulls was standing on a snow-covered islet in the lake, and some were bathing in the icy water. The overflow water from the lake poured down a rocky cascade and went tumbling over high falls to join the salt water below. Pretty white verbena-like flowers were blossoming on the steep hillside and adding their bit to make the climb quite worth while.

The next day, soon after lunch, we were surprised to see a small sailboat appear around a headland, and as it approached, our cook recognized the steersman as a former friend from Ushuaia. The sloop contained but two individuals, the young man acting as captain and an Indian boy as helper. They had three dogs with them and about fifty otter skins which they were taking to Punta Arenas to sell. After making some inquiries about the course and telling us they intended to try for fur seals on an outer rock some miles south, they vanished around a point — and have never been heard from since. We made particular inquiries six months later in Ushuaia and Punta Arenas, but their foolhardiness had undoubtedly brought its certain reward.

We moved a few miles down toward False Cape Horn the next day and from a rocky point where a colony of terns was nesting we secured a bucketful of eggs to eat. December 22 began with a light breeze and, as False Cape Horn was only twenty-five miles away, we hoisted anchor at four in the morning and headed for it. Getting away from the protection of the small islands, we could see the dark heavy clouds piling up over the top of Hoste Island behind us. This was a sure presage of storm, but our breeze freshening, we hoped to get around the cape before it struck us. Just before reaching the cape a rain squall hit us and with it wind. The sea roughened suddenly, and as we ran before the squall the boom hammered the waves as they swept past. Fortunately we were a few miles to windward, and it took but a short time to swing round the cape and haul up on the lee side where the fine anchorage at Lort Bay protected us from the bad weather. Christmas day began sunnily, and we went ashore for a couple of hours to where an old Indian rancho, as the wigwam frames are called, was standing as a reminder of a fast vanishing race. Wild celery grew in abundance about the site, and mussel shells showed through the rank vegetation growing everywhere. We left on the twenty-sixth for Hermite Island from which we expected to round the Horn. Anchoring at the east end and spending a couple of days there, we took pictures of Cape Horn from the top of Hermite Island in case our attempt at rounding the Horn proved futile.

This article will be concluded in the next issue of the JOURNAL.

SCENES FROM THE VICINITY OF CAPE HORN[1]

BY ROLLO H. BECK

Duotones from photographs taken on the Brewster-Sanford Expedition for the study of pelagic species of birds in the southern Pacific. The expedition remained one year in the Cape Horn region and visited remote islands where albatrosses, fulmars, shearwaters, and petrels, deserting their home on the open sea, resort to the land to nest

BEACHING FISHING BOATS AT MAR DEL PLATA, ARGENTINA

When the fishing boats return with the day's catch, they come into port at full speed and drive up on the beach as far as possible. They are then drawn still farther out of the water by horses that pull sideways with a saddle instead of straight ahead with a collar as is customary elsewhere in the world

[1] Illustrations and text, together with the preceding article, copyrighted, 1918, by Rollo H. Beck

SKATING IN JULY AT PUNTA ARENAS

While many of the inhabitants of New York are seeking cool spots on mountain tops or roof gardens, dwellers in Punta Arenas, the most southern town in the world, are enjoying the short afternoons skating over the smooth ice which covers the pond on the town common

A BEAGLE CHANNEL GLACIER

There are several glaciers to be seen during the trip through Beagle Channel. While not so large as some of the glaciers in southern Alaska, they are perhaps more attractive on that account. The rock-bound cañons down which the glaciers flow are at times devoid of vegetation and present a scene of utter desolation. Clouds floating along from the westward over the higher peaks are forerunners of a squall which usually follows sunny weather

DOMINICAN GULLS IN THE STRAIT OF MAGELLAN

This great flock containing thousands of gulls was seen fishing in the Strait of Magellan November 22, 1914. While one sometimes sees a few hundred gulls about the wharves and steamers in American harbors, flocks of this size are extremely rare anywhere

FIFTY MILES WEST OF CAPE HORN

The rugged nature of the islands bordering on the southern ocean may be seen in this view of Caroline Island. The bushy-topped trees with barren trunks are characteristic of these storm-swept regions, where all forms of life have a never ceasing struggle for existence

VIEW OF CAPE HORN FROM HERMITE ISLAND

On account of its configuration, Cape Horn looks very much the same whether viewed from the east or from the west. The photograph here given, taken on a clear day, gives a view from Hermite Island, fifteen miles northwest of Horn Island. The cape is on Horn Island partly hidden in the far center background. Chanticleer Island is seen on the right, while Hall Island is the island at the left which conceals the major part of Horn Island.

AT HOME ON THE BOSOM OF THE DEEP

The Cape pigeon of the Southern Hemisphere is as well known to seafarers as is the wandering albatross. From Buenos Aires or Valparaiso to Cape Horn the Cape pigeon in wintor time nearly always is present astern of a vessel. This one is just leaving the water to resume its tireless flight. These birds do not nest about Cape Horn, but go farther south into the colder regions of the Antarctic to rear their young

SELKIRK'S CAVE ON THE ISLAND OF JUAN FERNANDEZ

Four hundred miles off the southern coast of Chile lies the island on which a Scotchman, Alexander Selkirk, passed four years of solitary existence. It is six by eighteen miles in extent, of about three thousand feet elevation, steep, and generally desolate in appearance. At the highest point, known as Selkirk's Lookout, a bronze tablet commemorating Selkirk's sojourn there has been erected. Although it was doubtless this adventure of the mariner Selkirk which inspired De Foe's tale of "Robinson Crusoe," the original title of the story, which on account of its length is abridged in modern reprints, indicates that Crusoe's island was not in the Pacific, but on the northern coast of South America, near the mouth of the Orinoco River

Indian Corn as a World Food[1]

By CLARK WISSLER

FOOD and fuel are the two subjects uppermost in the public mind. Starvation and privation have not come within the experience of the people of the United States except as individual or local calamities. In fact, we have come to look upon famines as primitive phenomena, due to improvident and undirected social activities. Thus, when we read that whole tribes of Eskimo perish from food shortage we shrug our shoulders and say that this is due to their low state of culture, a form of existence that takes no thought of tomorrow. Yet, the facts are that the Eskimo has worked out a scheme of life that under normal conditions provides him with plenty and comfort at all seasons of the year: it is only when his group gets too large for the resources of the country in which he lives that calamities come. But such disasters are not peculiar to the Eskimo: the literature of the American native, north and south, furnishes many examples of what may be formulated as a principle, that is, when a people work out a method of supporting themselves in a given locality, they tend to increase in numbers until a point is reached where the demand is greater than the supply. Whenever this point is reached, only the most drastic efforts can prevent a calamity.

The fuel and food shortage which now confronts us is a warning that our rapidly expanding population and the massing of families in great manufacturing and trade centers are reaching a point where the long established methods of food production and distribution will no longer suffice. The pages of history and anthropological literature show us exactly what will happen if we do not

Hidatsa digging stick, rake, and hoe, the first a heavy ash pole hardened and sharpened by fire, and the rake a deer antler, or willow shoots cleverly bent at the ends to form teeth

[1] The illustrations accompanying this article are from *Corn Among the Indians of the Upper Missouri* by George F. Will and George E. Hyde, published by the William Harvey Miner Co., Inc., St. Louis, 1917. Mr. Will is energetically propagating many varieties of Indian corn with a view to their introduction into the higher latitudes of the United States and Canada. Samples of the varieties of corn shown here, together with native farming tools, are on exhibition in the Plains Indian hall

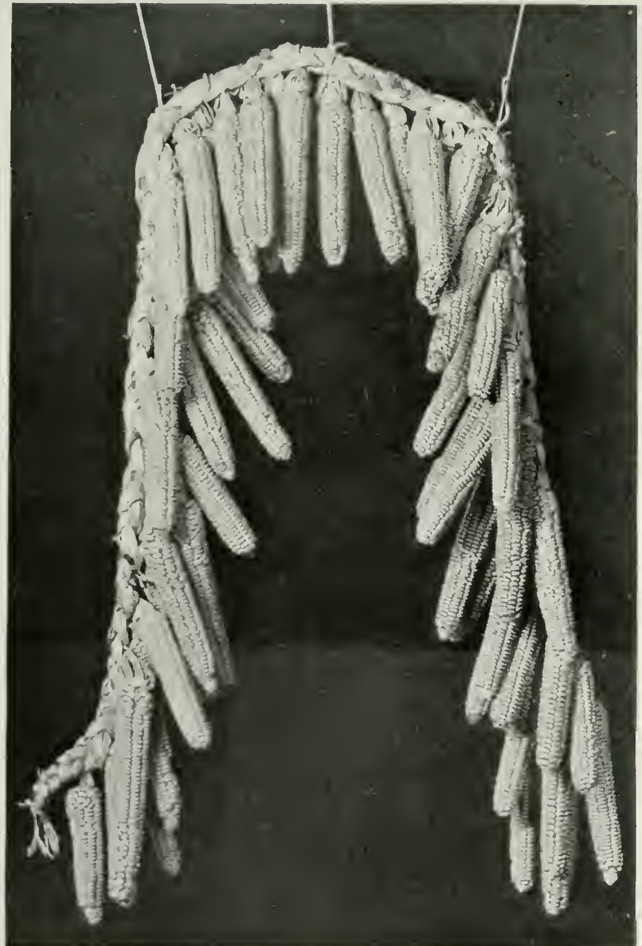
at once set in motion the social machinery to meet the new conditions of the future. In short, food shortage and ultimate famine are not the characteristics of primitive life, but the results of natural laws governing the history of all social groups, high or low.

It has been suggested that we rely more and more upon cultivated food plants. One cannot help applauding the spirit with which our people rallied to the fields and gardens last spring to do each his mite in increasing our dwindling surplus. But there is also another direction in which great gains can be made. When Columbus found America he discovered some new foods destined to take the most important places in the dietary of the world. I say discovered, but in reality, he plagiarized or simply appropriated them, for the discoveries had been made by the ancestors of the American Indians many centuries before Columbus was born. When we are reminded that more than thirty of the world's important food plants were already in cultivation here in 1492, we can form some realization of our cultural obligations to the aboriginal American race. Of these foods none take so high a place as Indian corn. In addition to being one of the best of the world's foods, it is the one cultivated plant that seems most at home in our country. It is the greatest cultural triumph of the American race and its origination makes a strong claim to the highest place in the world's great deeds of culture.

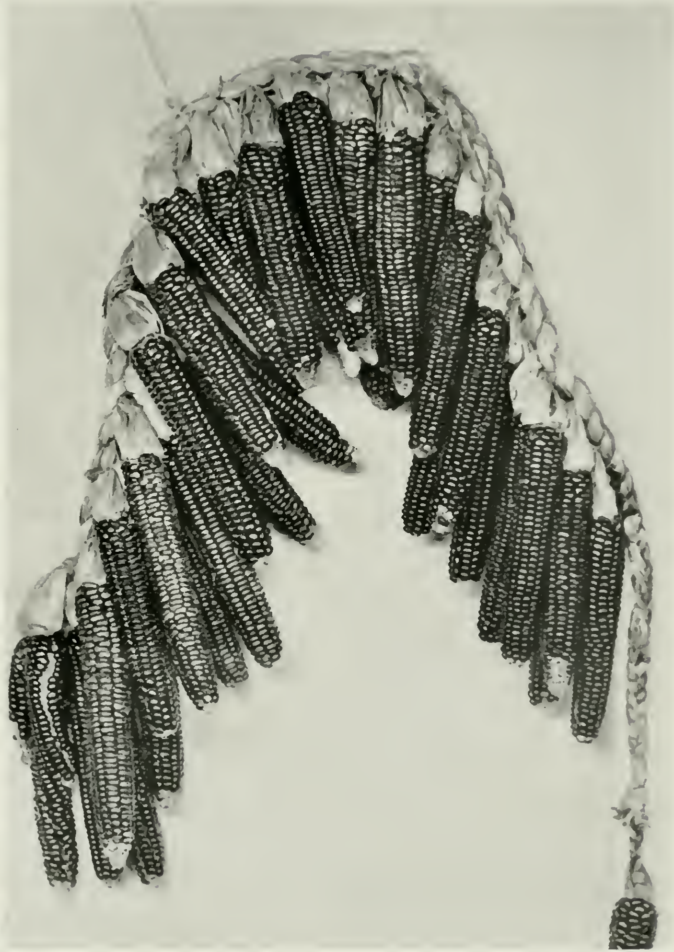
It is therefore most timely that there are now appearing some excellent books upon this important plant. Among these books is one deserving especial mention, *Corn Among the Indians of the Upper Missouri*, which reviews the early writings upon the subject and gives some account of the known varieties of corn cultivated by the Indians in North and South Dakota. In the main, this book deals with one tribe, the Mandan.

The Indian tribes of both South and North America cultivated corn in about every region where it could be raised by their methods. In other words, corn occupied about as large a place in the culture of the Indians as it does in our own. Long before the day of Christopher Columbus some Indian genius began to tame the wild ancestor of maize, a process which was carried ultimately to such a pass that there is still some doubt as to the identity of the parent plant. Virtually all the known varieties of corn also had been developed before 1492. In fact, as corn is cultivated today on our farms, the methods used are essentially the same as those devised by the untutored Indians of prehistoric days. It behooves us then, we who have so thoroughly and grossly assimilated this great cultural corn-complex, greatly to intensify and improve upon it, that it may take its place in the great super-complex of culture traits that must be evolved if our expanding population is to survive.

The problem that confronts us is as old as man: can we devise new methods of feeding, clothing, and warming ourselves that are workable on the scale required by our ever increasing population? It is plain that when Columbus landed on these shores many parts of the continent were supporting as many Indians as could be maintained in a seminomadic form of culture. In other words, the aborigine had about reached the limit of expansion until he devised new ways of living, for the inexorable law of supply and demand checked his growth—if too many people came into existence, there was a famine. Although we live under far different conditions and on a widely divergent plane from that of the Indian, we must give some consideration to the teachings of culture history: that is, there will come a time when the present methods of food production and distribution will be inadequate.



From *Corn Among the Indians of the Upper Missouri*

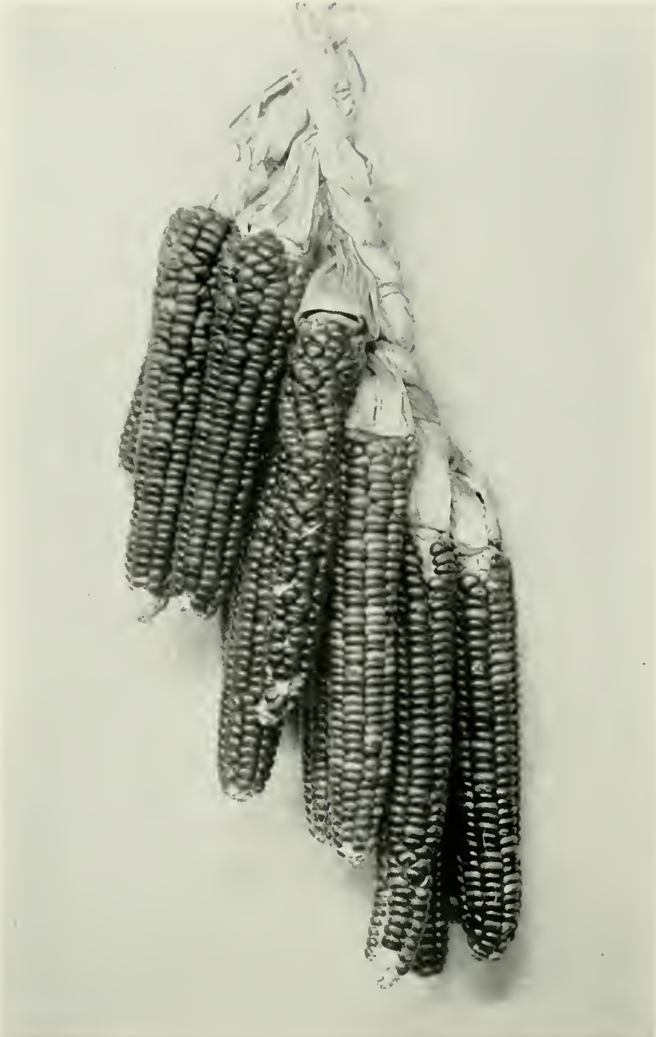


From *Corn Among the Indians of the Upper Missouri*

SOFT WHITE AND SOFT RED CORN OF THE MANDANS

The ripe corn harvest, which took place early in October with the Upper Missouri tribes, lasted about ten days, during which time the ears were gathered, thrown into piles, and husked by the women and young men. Then the large ears were braided in the field by the women, fifty-four or fifty-five ears to each braid. These ropes of corn—one of which in trade was reckoned as the equivalent of a tanned buffalo robe—were hung on scaffolds to dry, their variegated hues lending a festive appearance to the village

From *Corn Among the Indians of the Upper Missouri*



From *Corn Among the Indians of the Upper Missouri*

MANDAN BLACK AND MANDAN BLUE CORN

Upper Missouri Indian corn is bushy in appearance, the ears—from eight to ten inches long—often emerging from the ground on a short stalk. It is hardy, adapting itself to varying conditions of moisture and drought, as well as to frosts. The period from planting to maturity is about sixty days in favorable years, and seldom more than seventy days. White, yellow, red, black, blue, and spotted varieties occur. By breeding and crossing these native species it is hoped that hardier and heavier yielding varieties for the Northwest may be produced in abundance

From *Corn Among the Indians of the Upper Missouri*

From *Corn Among the Indians of the Upper Missouri*

MANDAN BLUE AND WHITE SPOTTED AND SOFT YELLOW CORN

Early settlers in America were glad to take the Indian's native food product, maize, and to learn from him the methods of growing and handling the crop. They did not, however, always realize that each new region occupied presented different conditions of soil and climate, which must be met by a study of the ways and means used by those who had been growing corn in that particular section often for three hundred years and had learned from hard experience what varieties to plant. These are two of the thirteen varieties said to have been grown by the Mandans in early times in the Upper Missouri area

ONE OF THE MOST BEAUTIFUL CHURCHES IN THE KREMLIN AT MOSCOW

The chief interest of Moscow is centered in the Kremlin, both for its historical associations and for its churches with their semibarbaric splendor and curious architecture. In one of these churches all the Russian monarchs since Ivan IV have been crowned, in another they have been buried. The dusky interiors are adorned with numerous icons of great antiquity, covered with gems and precious metals. The great Russian Church has reformed and liberalized itself since the Revolution without losing its fervent religious faith and sense of national solidarity

The women's battalion, Petrograd. These women soldiers fought gallantly for their country last summer at many points on the battle front

Public Health Problems in Russia

By C.-E. A. WINSLOW

Curator of Public Health, American Museum of Natural History; Professor of Public Health, Yale University; Member of American Red Cross Mission to Russia

THE American Red Cross Mission to Russia (Dr. Frank Billings of Chicago, Chairman) left the United States at the end of June to offer aid, on behalf of the American people, in the military and civilian relief problems of our Russian allies. The trip was made by Canadian Pacific steamer to Yokohama, across Japan by rail, from Tsuruga to Vladivostock by Russian Volunteer Fleet steamer, and across the Trans-Siberian Railroad by the one-time Imperial train, which had brought the Root party out and was held for our accommodation. The dining car on this train was the one in which the Czar handed his abdication to the representatives of the Russian people, four months before.

We found Siberia a beautiful country and potentially a rich and prosperous one, a larger edition of our own Northwest. Russia as a whole was surprisingly peaceful and orderly, considering the crisis through which it was passing. Police power had virtually ceased to exist since the Revolution, yet I did not hear anywhere so much as a voice raised in anger. Bread lines, meat lines, milk lines, tobacco lines, calico lines, were to be seen on almost every street, and in some of them the people slept all night upon the doorsteps or the pavement in order to hold their places for the morning; but I saw nowhere anything but patience and courtesy, no single attempt to push ahead and gain an unfair advantage.

The lack of bitterness or wanton damage with which the Revolution was consummated struck us as another evidence of the self-control and common sense of the Russian people. The jails and the secret service archives had been burnt but otherwise Petrograd and Moscow were unharmed. Great Catherine's statue on the Nevski had been hallowed to new uses by the simple process of thrusting the red flag of the Revolution into her hand alongside the imperial scepter; and in the palaces, now used for government bureaus, the pictures of the late royal family were covered neatly with brown paper.

Illustrations from photographs by the Author

Political control, while we were in Petrograd, was in the hands of the last Kerensky cabinet, which was socialist, as three fourths of Russia is socialist, but which stood for a gradual working out of the socialistic program and for a vigorous prosecution of the war. The Cadet party, which includes such men as Miliukoff, Lvoff, and others to whom we have looked in the past as leaders of liberal Russia, was the chief opposition party, demanding a sterner discipline than Kerensky deemed attainable, and aiming at securing the fruit of the political revolution with as little disturbance of the social order as possible. On the other side, criticizing the Kerensky *régime* from a precisely opposite standpoint, as despotic and bourgeois, was the then smaller minority of the Bolsheviki.

Russia had passed through three years of terrific military strain. She had had two million men killed and four million sick and wounded, while two million and a half more were prisoners in the hands of the Central Powers. Yet she was maintaining an army of three million on the front last summer.

The medical care of the army was in the hands of four great relief organizations, the Sanitary Department of the Army, the Russian Red Cross, the Union of Zemstvos, and the Union of Towns. We found these organizations provided with admirable factories and large storehouses in Petrograd and Moscow, and the hospitals and system of handling the wounded at the front and behind were, in the main, worthy of high praise. The gigantic scope of the work is indicated by the fact that 200,000 hospital beds had been provided for the care of sick and wounded Russian soldiers. The technical staff, both surgical and sanitary, was of high grade, and supplies were in general adequate. Some things, however, were lacking and could not be obtained in Russia,—motor ambulances, certain serums and vaccines, certain drugs, rubber goods and the like. Our first duty seemed to be to supply these specific needs; and at our request the four organizations named above formed a joint

Typical group of Russian soldiers at a Siberian railroad station.—It is these peasant soldiers, ten million strong, who will determine the ultimate future of Russia committee to meet with our representatives and prepare specifications of the articles most urgently needed. An American Red Cross bureau was established in Petrograd with a storehouse in Moscow to deal with these needs as they should arise: and the first shipment of supplies under this plan left America in August last.

On the civilian side, we found excellent departments of health in the larger cities, with laboratories and statistical bureaus of the most approved type and good organizations for the control of communicable diseases. Antituberculosis work is not, however, developed as in England and America, and systematic public health education along modern lines has scarcely been begun.

Statue of Great Catherine, on the Nevski, with the red flag of the Revolution placed in her hand alongside the imperial scepter

The greatest health problem of Russia is infant mortality. The death rate among young children is enormous, both in city and country, one baby out of every four dying in the first year of life (as compared with one in ten in New York City). The rates are highest in those provinces with the purest Russian population. It is not the lack of breast feeding which is at fault but the almost universal habit of giving the baby all sorts of other foods as well. The remedy, as everywhere, is education of the mother in the principles of infant care, and in the large cities excellent beginnings have been made along this line. I have never seen anything finer than the Infant Welfare Station at the Morosov Hospital in Moscow or the Museum of the Patronage for Motherhood and Childhood at Petrograd. After the war, however, the work now being done must be multiplied a hundredfold.

The most interesting feature of public health work in Russia is the system of Zemstvo medicine which has brought the blessings of medical care to a large proportion of the people throughout the vast areas of the scattered rural population. The representative rural assemblies have recognized the medical care of the peasant population as a fundamental duty of the state, and have provided in most of the provinces of European Russia medical districts with small hospitals (from 4 to 20 beds) which furnish free medical care to all who come. There are, of course, even now far too few physicians to care adequately for the rural population; but when it is remembered that before the Zemstvos began their work the peasant never saw a qualified physi-

Typical Siberian house and peasant cart.—Siberia is a larger edition of our own Northwest, and is a beautiful and potentially prosperous country. We found Russia as a whole surprisingly peaceful and orderly in view of existing conditions

Milk line outside the market in Petrograd.—Milk is particularly needed in Petrograd, the total supply being only about one tenth of the amount actually required. People sometimes sleep all night on the pavement in order to hold their places in line

This palace was the home of a famous dancer before the Revolution, and later the headquarters of Lenine, leader of the Bolsheviki cian except at some official investigation, the supply of even one physician to every 23,000 population seems a remarkable achievement.

It is curious to note that while with us public health officials after establishing the organization of purely preventive and sanitary work are beginning to expand along more medical lines in the direction of school clinics, infant welfare clinics, tuberculosis clinics, and the like, the course of historical development has been precisely the opposite in Russia. There, the socialization of medicine came first and the Zemstvo organizations, originally created for medical care, are now, in the more progressive provinces, expanding along

A Petrograd prison which was burned and gutted during the Revolution.—Except to the prisons and the secret archives, almost no damage was done in this remarkable awakening of the people

Group of Mongolian cowboys in Manchuria.—The costume and the pose of the Asiatic "bad men" strikingly recall old days on our Western Plains, except for the fact that some of these horsemen have queues as thick as one's arm

Camels in Peking, where members of the American Mission spent a few days on the return trip

Flood in the streets of Tientsin.—Members of the Mission stopped at Tientsin on the way home and were able to interest the American Red Cross at Washington in the relief problem created by the recent floods which covered 15,000 square miles of territory the lines of sanitation and the prevention of disease.

We found no strictly sanitary or medical civilian problems which were so urgent as to demand aid from America during the present crisis. The feeding of the population, and particularly of the children, in the large cities will, however, require energetic efforts if starvation and demoralizing disorder are to be avoided during the coming winter. Russia has food enough for her needs as a whole, but peasant hoarding and deficient transportation facilities prevent its effective distribution. Milk is particularly needed in Petrograd where the use of this essential food for children was limited even in August to babies under three, and where the total supply was only about one tenth of that needed according to accepted dietary standards.

In connection with this problem we worked in coöperation with the Ministry of Social Help in the preparation of plans for fourteen district feeding points in Petrograd with night refuges for the homeless. The Ministry estimated that 100,000 children would be in need of food and 5000 absolutely destitute. Here, as in the case of military relief, it was the aim of the American Red Cross to supply those things which could not be obtained by the Russians themselves,—in this case milk,—and a million pounds of condensed milk left the United States in October for the use of the children of Petrograd.

It is of course possible—but not, I think, probable—that the crisis created by the formation of the present Bolshevick government may put an end to the coöperation between America and Russia which began last summer with so much promise. Even the Bolsheviki do not dare openly to advocate a separate peace with Germany; but their policies would be likely to lead to such a result, and if Russia should definitely abandon the war the energies of America must perhaps be applied elsewhere. Petrograd is not Russia, however, and the Bolsheviki are not the Russian people. The real Russia is shaken but not shattered by three years of war, disorganized but not demoralized by nine months of revolution. In these trying days we may remember the Russia that built up the Zemstvos, the Russia that conducted an almost bloodless revolution and maintained a surprising degree of order without legally constituted authority during the ensuing months, the Russia that through the Ministries of Social Help and Education and many other agencies is planning for a new and solid future. We may think of the great mass of the peasantry, conservative and law abiding, who will find voice for the first time in the Constituent Assembly this winter, of the great Russian Church which has reformed and liberalized itself since the Revolution without losing its fervent religious faith and sense of national solidarity, of the Chevaliers of St. George and the Battalions of Death, pledged never to surrender nor to cease fighting until the German beast is chained, of the women of Russia who are not only doing more than their share of the physical labor and the thoughtful planning of the new Republic but actually have been fighting her battles at the front with gallantry and devotion.

It is this Russia which looks to America for aid. Major Stanley Washburn has said that as long as one division of Russian troops keeps up the fight against Germany we should be behind that division a million strong. If that continues to be the spirit of America, Russia will win through and will come out of the struggle strong and liberal, an effective bulwark against Prussianism after the war and a sure guarantee of peace and justice in the Far East.

VARIATION OF THE COMMON SUNFLOWER ***H. ANNUUS***

A form selected from the group with light-tipped rays, obtained in 1916. The dark color is chestnut-red. Mrs. McClintock, of the University of Chicago, named it "Halo"

Sunflower garden at Boulder, where the red sunflowers were developed. Mrs. Cockerell is half hidden among her plants

The Story of the Red Sunflower

By T. D. A. COCKERELL

Professor of Zoölogy, University of Colorado

THE original red sunflower was found by Mrs. Cockerell close to our house in Boulder, Colorado. Among many wild sunflowers growing by the roadside was a single individual in which the rays were suffused with chestnut-red. It was at once recognized that here was an opportunity for the production of a new horticultural type, as well as for scientific investigation. The plant was dug up and removed to the garden, where it continued to bloom until the end of the season. The sunflower being an annual, and at the same time infertile with its own pollen, the only possible way to preserve the new variety was by crossing with the more ordinary sorts. This was done, and in the following year many plants with reddened rays were produced. These could now be crossed on one another, and a permanently red strain obtained. Today the red sunflower may be found in gardens in Europe and America, and even in Australia, New Zealand, and South Africa, all the plants being descendants of the single wild sport which appeared at Boulder in 1910.

The current manuals of botany, at least in America, pay very little attention to variation. In the new edition of Dr. Britton's *Illustrated Flora* descriptions of varieties have been omitted altogether. This may be necessary in a work of such scope, where only the briefest outline of the flora is possible. Anything like a full treatment of varieties would double the size of the volumes, with necessarily a corresponding increase in cost. Nevertheless, we must some day have a work on American

Helianthus annuus, collarette variety, parallel to the well-known collarette dahlia. The first collarettes were obtained in 1915, and are figured in *Gardener's Chronicle* (London), Nov. 6, 1915, and the *Journal of Heredity*, Sept., 1916. The present figure shows an improved form, obtained by crossing the original collarette on a chestnut-red form with light bases of rays

Plant of 1916 crop, extracted from red doubles, but showing no trace of the "double" feature. The numerous long flat rays are in striking contrast with the sunflower on the right of page 43. Sunflowers vary not only in the shape of the rays but also in their position. They may be level with the disk, or directed more or less forward, or else backward as if drooping

A variety marked nearly as in frontispiece, but the rays much more obtuse. There is also a light ring around the disc. This was chestnut red, very bright and distinct; grown in 1916 from seed received from Messrs. Sutton and Sons, of Reading, England. The form is derived from our original cultures, but has been bred and selected by Sutton

TWO TEXAS SPECIES-HYBRIDS

Helianthus annuus × cucumerifolius displays a characteristic color pattern similar to that of the hybrid with *petiolaris*. This figure has been published in *The Garden Magazine*, July, 1914, p. 332

Helianthus annuus × argophyllus shows the silvery *argophyllus* foliage and bud. This particular specimen has vinous colors on a rather buffy ground, and is a second generation cross, *Helianthus* (*argophyllus × annuus vinosus*) × *annuus vinosus*

SUNFLOWER ARISTOCRATS

A semidouble with long curled rays, obtained in 1915. The so-called double sunflowers are those in which the disc-florets have taken on ligulate features, paralleling the condition normal in the dandelion

Wine-red sunflowers; they were in a dull blue vase, the combination of colors being especially lovely. A spray of *Gypsophila* (baby's breath) has been added

WITH HIGH DECORATIVE VALUE FOR THE HOME

Helianthus annuus variety *bifidus* (*Torreya*, Jan., 1915, p. 13). A form with cleft rays; this one grown at Boulder in 1915. Another form (variety *trifidus*) has the rays with three (rarely four) points

Red sunflowers of the 1915 crop, showing the form with twisted and curled rays; a very attractive type. Such forms can be obtained both in the chestnut-red and the vinous colors

"LITTLE WONDER"—A RED SUNFLOWER

A pretty vinous form obtained in 1917; named by Mrs. Cockerell. The heads are rather small and the bases of the rays are a lively lemon-yellow botany treating the subject with that fullness of detail which is not uncommon in modern European floras. Only by close attention to the phenomena of variation can we expect to understand the evolution of plant species, and at the same time to develop those new horticultural forms which may add so much to the wealth and beauty of farms and gardens.

We sometimes hear of the "creation" of new kinds of plants by the breeder. The plant breeder can utilize only what nature provides. In the first instance he must search for materials to serve his purposes,—for plants possessing the characters he desires to impart to his new horticultural forms. In the case of the red sunflower, the variation was so conspicuous and remarkable as to arrest the attention at once; yet even so, the chances of the plant being saved were rather slight. It is perhaps no exaggeration to say that a thousand red sunflowers might bloom in as many American towns, without anyone thinking it worth while to save the seed and carry on breeding experiments. When we come to valuable new varieties of less conspicuous plants, such as wheat or oats, the present chances for isolation and preservation are infinitesimal. Not even the professional botanist is, as a rule, trained to observe minute differences: he often actually prides himself on ignoring everything below the grade of a species. Yet these small differences may carry the potentiality of an increase in yield sufficient to feed thousands of people, or of some new form of beauty to gladden the eyes of garden lovers in two continents. Thus it would doubtless be a paying proposition for this country to employ a number of skilled botanists to make a minute study of the variations of plants, and set their observations forth in a series of cheap volumes which would stimulate a far wider and more intelligent interest in the subject.

Although in one sense the breeder creates nothing, yet he does virtually create in the sense that the new combinations he produces are in effect and to all practical purposes actual novelties. This may be illustrated by the history of the wine-red sunflower. If we take rays of the chestnut-red variety and soak them in acidulated alcohol, we get a solution which is not chestnut-red but wine-red. The red color is in

Helianthus annuus variety *primulinus*, the pale yellow type used in the first cross to obtain the wine-red (variety *vinosus*) form. The primrose variety was introduced to horticulture by Messrs. Sutton and Sons, of England, in 1889, it having occurred as a sport among the ordinary orange plants a few seasons previously. The plant here figured is an improved form, with two rows of rays, recalling the star dahlias. Sunflowers with additional rows of rays have been known for a long time, however, as is shown by Vandyke (1599–1641) in his portrait of himself, now in the collection of the Duke of Westminster fact due to a carmine pigment dissolved in the sap; it appears chestnut because on an orange background. Knowing this, the problem was to get it on to another background, in order to bring out the wine-red color. We should have preferred white, but no white-rayed sunflowers are known. The nearest approximation is a very pale yellow, which we have found as a wild sport, but which has also been long in cultivation. In England it is called the primrose sunflower, because the color is like that of an English primrose. Crossing the full red sunflower with the primrose variety, we got, as expected, offspring like the red parent. These were raised in the greenhouse during the winter, to save a year, and were crossed with one another. Their offspring included chestnut-red, plain orange, primrose, and the expected wine-red, which is simply red on a primrose background. All this appeared, not only as expected, but nearly in the proportions which were deduced on theoretical grounds. Thus we had the following:

	Obtained	Expected according to theory
Chestnut-red	71	69
Wine-red	25	23
Orange	19	23
Primrose	8	8

Species-hybrid *Helianthus annuus* (red) × *petiolaris*, the latter being the seed parent. Grown in Boulder in 1917. The *H. petiolaris* parent was raised from seed collected in Oklahoma

The wine-red, thus obtained according to definite rules of breeding, was an entirely new color variety, yet its qualities existed separately in its grandparents. Just how it all works out, we will not attempt to explain in this article, but it is in accordance with the laws discovered by Gregor Mendel many years ago, and fully set forth in many recent works as "Mendelism."

It is often supposed that when a breeder desires to produce new plants, he has only to cross different species possessing desirable characters. The chances of success in doing this vary very much according to the kinds of plants used. Among the hothouse orchids, hybrids between different genera are common, and as they can be propagated by division, they are capable of being increased without losing their characters. Annual sunflowers, which are propagated by seed, offer much greater difficulties. The annual species so far experimented with readily cross, and produce fertile seed. This seed gives rise to hybrid plants, which are themselves so nearly sterile that they cannot be offered horticulturally. On the other hand, all the varieties of the common sunflower, *Helianthus annuus*, seem to cross without any impairment of fertility. Even the great so-called Russian sunflower produces quite fertile hybrids with the prairie sunflower, which some botanists have regarded as a distinct species. Nevertheless, even where there is abundant or sufficient fertility, complex crosses break up into a number of different types when propagated by seed, and are capable of being extracted pure only after labor extending over several years. This is why apples cannot be propagated successfully by seed, although the varieties are readily preserved and spread through grafting. Dahlias, which can be propagated vegetatively by means of tubers, possess many constant varieties, although these same varieties would rarely come true from seed. Could we increase the annual sunflower in the same manner as the dahlia, we should now have about fifty distinct and recognizable horticultural forms, any or all of which could be placed on the market. Three species-hybrids are illustrated, the *annuus* parent being in each case a red variety. On page 41 the right-hand figure shows an *annuus* × *argophyllus* cross, *H. argophyllus* being a robust plant from Texas, remarkable for its white silky pubescence. The hybrid shows the silky character distinctly, and is a very pretty thing. The *H. annuus* × *argophyllus* hybrid was independently produced by Sazyperow in Russia, in this case with the object of obtaining a plant resistant to rust and other diseases. The left-hand figure on the same page represents the cross *H. annuus* × *cucumerifolius*, the latter being also a species from Texas, but small and branched. The *H. cucumerifolius* used were cultivated forms. A similar cross, except that the *annuus* used was not red, had been made previously in Europe. *H. annuus* × *petiolaris*, new in 1917, is shown on page 16. It is a beautiful plant, much branched and with numerous heads. It remains in full flower later than the common sunflower.

The remaining figures show different variations of the *H. annuus* type, some peculiar for the form of the rays, others for the color and markings. Marking factors, which control the distribution of the colors, are independent of the color factors, and may be inherited through plants which have no red in the rays at all. Thus, although *H. petiolaris* is without red, it has a very distinct pattern or marking factor, which appears in the hybrids with the red *annuus* as a red ring at the bases of the rays.

Sunflowers are cultivated very easily, and anyone may experiment with them. When carrying on breeding experiments, it is necessary to put bags on the flower heads before the flowers open, and carry the pollen to the flowers by hand, repeating the operation several times on each head. If this is not done, bees bring pollen to the flowers, and it is impossible to tell which varieties the pollen parents belong to. In Colorado, at least, we find it necessary to bag the heads at the seeding stage also, to protect them from the birds.

All the work in breeding sunflowers has been done by my wife, who has devoted her summers to it for a number of years past.

Nature's Magic

REDISCOVERY OF A REMARKABLE WOOD, FIRST KNOWN IN THE SIXTEENTH CENTURY, WHICH PRODUCES WITH WATER A BEAUTIFUL OPALESCENCE NOT YET EXPLAINED BY SCIENCE[1]

By WILLIAM E. SAFFORD

Economic Botanist, United States Department of Agriculture

IN a vellum covered book printed in Seville in 1574 there is an account of a strange wood which had the effect of imparting to water a blue color. This wood was carried to Europe from New Spain in great quantities, and it was supposed to be efficacious for certain diseases of the kidneys and liver. So great was the demand for it that it was often counterfeited, and many kinds of wood were offered for sale under its name; but the attempted fraud could be detected easily, for, as the author warns the public, the wood must make the water blue, and "if it does not make it blue it is not the true kind; for they are now bringing a wood that makes the water yellow, and this is not the one which is efficacious, but that which makes the water blue; for the kind that will make it blue is the true wood."[2]

A wood possessing such rare qualities could not fail to attract the attention of the world and induce scientific research as to the source of its mysterious powers. There was, however, considerable confusion regarding the identity of *lignum nephriticum*, as this wood was called in Europe, and its true origin remained unknown for centuries. Pieces carried to Spain were apparently taken from large trees, yet Francisco Hernández, who was sent by Philip II to study the resources of Mexico, and who returned about the time the above account was published, was able to obtain specimens of only a small tree or shrub, called by the Aztecs *coatl* or *coatli* (snake water). He described this as having pinnately compound leaves like those of a chick-pea, but smaller, and spikes of small longish flowers; but he gave no illustration of it. His somewhat confused account was translated into Spanish from the Latin in 1615 by Fray Francisco Ximénez, who, however, did nothing to clear up its vagueness.

About thirty years later a celebrated German Jesuit living in Rome had his attention called to the peculiar qualities of this wood on being presented with a cup made of it by the procurator of the Society of Jesus of Mexico. This cup he afterward sent to his Sacred Majesty, the Emperor, as something rare and little known. In his account published in 1646[3] he described cups made from the wood, the source of which was unknown to him, stating that they turned the water not only blue but all kinds of colors. He says:

"The wood of the tree thus described, when made into a cup, tinges water when poured into it at first a deep blue, the color of a Bugloss flower; and the longer the water stands in it the deeper the color it assumes. If then the water is poured into a glass globe and held against the light, no vestige of the blue water will be seen, but it will appear to observers like pure clean spring water, limpid and clear. But if you move this glass phial toward a more shady place the liquid will assume a most delightful greenness, and if to a still more

[2] Monardes, *Historia medicinal de las cosas que se traen de nuestras Indias Occidentales que sirven en medicina*, pp. 24, 58a, 59; 1574.

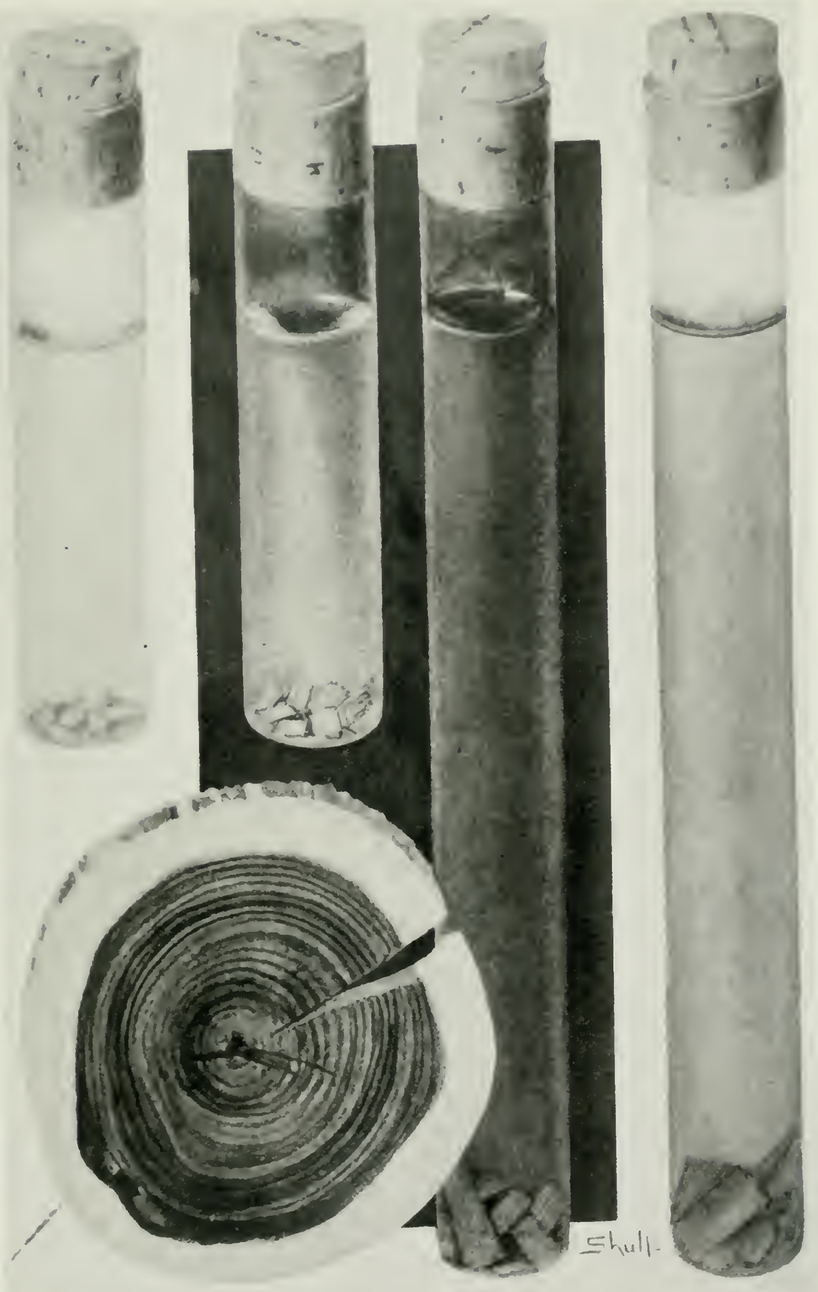
[3] Kercherius, Athanasius, *Ars Magna Lucis et Umbrae*, p. 77, 1646.

[1] Published with the permission of the Secretary of Agriculture

Courtesy of the Smithsonian Institution

CUP CARVED FROM THE WOOD OF THE NARRA TREE

A mysterious chemical property which resides in this cup made from the wood of the Philippine *Lignum nephriticum* or *narra* transforms water into a liquid of the deepest blue, and this, when held against the light (as in the flask), shines with opalescent hues of fiery yellow, bright red, glowing purple, and sea green; in the rays of an arc light the liquid may shine with a blue light of sufficient intensity to illumine the faces of those standing near by. In the sixteenth and seventeenth centuries these cups were gifts for emperors and kings, and marvelous cures were attributed to the water allowed to stand in them. The phenomena have been the subject of many researches by famous chemists and physicists, yet even today the mystery is unsolved



Courtesy of the Smithsonian Institution

INFUSIONS OF THE MAGIC WOOD OF MEXICO

A section (lower corner) of the magic wood (*Eysenhardtia polystachya*) shows dark heartwood surrounded by white sapwood. The four tubes contain water with a few chips of the magic wood at the bottom of each. The colors from left to right are light greenish yellow, light opalescent blue, dark peacock blue, and brilliant orange yellow. The white sapwood is in the smaller phials. It tinges water only slightly at first, but when left over night, the infusion becomes a greenish yellow and glows with a decided fluorescence. Chips of the heartwood are in the large phials. They tinge water deep orange yellow which, held in front of a dark background, displays beautiful peacock colors shady place, a reddish color; and thus it will change color in a marvelous way according to the nature of its background. In the dark, however, or in an opaque vase, it will once more assume its blue color."

Although he says frankly that he does not understand the phenomena, the learned philosopher, true to his boast that there was no problem in nature he could not solve, ends by asserting that his experiments have shown him the cause, which he will later publish. This, however, he never did.

Not long after, another such cup was described by a botanist[1] who received it under the name *palum indianum*. This ingeniously made cup, almost a span in diameter and of uncommon beauty, resulting from the variegated lines adorning it, was accompanied by sawdust or shavings of the same wood, of a reddish color and of no manifest taste. When water was poured into the cup and the sawdust macerated in it, the water in a short time became tinged with blue and yellow, and when held up against the light displayed beautiful opalescent hues, giving forth reflections of fiery yellow, bright red, glowing purple, and sea green, wonderful to behold. After quoting from the earliest account of *lignum nephriticum*, the author notes that the great botanist Cæsalpinius believed the wood to be a species of ash.

It was not until 1663 that the color phenomena exhibited by the extract of *lignum nephriticum* were first investigated in a truly scientific manner.[2] The account given mentions all phases of the fluorescence, as well as the medicinal properties claimed for the infusion. The author calls attention to the fact that the wood described by the learned Jesuit previously cited was called "white Mexican wood," whereas that used in his experiments was of a darker color. He does not find exactly the same variations in color as those named by the Jesuit, but owns that a greater variety appeared when the infusion was held in a partly darkened room than when placed in full light. He discovered also that if spirits of vinegar were dropped into the liquid it lost its blue color, but not its yellow, and that the addition of salts of tartar would restore the blue.

Many writers sought to identify the wood in the centuries following its discovery, but the results obtained were very conflicting. Experiments with a piece of wood labeled *"cuatl"* in the Mexican exhibit at the Paris Exposition led to the belief that the *lignum nephriticum* of early writers was *Eysenhardtia amorphoides*. It was assumed that both the wood of the white cup which yielded an infusion colorless as spring water, and that of the reddish cup made of *palum indianum*, were identical with the dark-colored wood used in the scientific experiments just mentioned. This would mean that the great logs described as "larger than very large trees" were those of Eysenhardtia—an erroneous conclusion, since it is certain that this genus includes only shrubs and very small trees. On the other hand, after an equally exhaustive research, one author confidently asserted[3] that the source of the magic wood was not Eysenhardtia at all but a Mexican tree belonging to the genus Pterocarpus. If the statement regarding the great size of logs of this wood conflicts with the possibility of its being identified with an Eysenhardtia, so does the description of its small pinnately compound or rue-like leaves preclude the possibility that the plant described could be a Pterocarpus, in

[1] Bauhin, Johan, *Historia Plantarum*, 1650.

[2] Hon. Robert Boyle, *Experiments and Considerations Touching Colours*, p. 203, 1664, a Latin translation of which (1667), and also a summary of the results of Boyle's studies in Richard Boulton's edition of Boyle's works (1700), are in the library of the Surgeon General of the Army at Washington.

[3] See Möller, Hans-Jacob, *Lignum nephriticum*. Berichte der Deutschen Pharmaz. Gesellsch. 23:88–154. Copenhagen, 1913.

Courtesy of the Smithsonian Institution

LEAF AND FRUIT OF THE MAGIC WOOD FROM LUZON

This species of *lignum nephriticum* is a large forest tree with drooping branches, and trunk often provided with broad buttresses. The leaves, from eight to ten inches long, are composed of from five to nine usually alternate leaflets averaging three inches in length and two inches in width. The flowers are yellow. A membranous wing surrounds the large one-seeded pod which the leaflets are not in the least like those mentioned by this investigator.

The explanation of these incongruities is quite simple. Beyond doubt, two distinct woods have been called *lignum nephriticum:* the diminutive *Eysenhardtia polystachya* and *Pterocarpus indicus*, a giant tree of the Philippine Archipelago and adjacent islands. The first of these agrees perfectly with the description of a plant with tiny leaflets and spikes of small longish flowers, while the second conforms to the account of the great logs larger than very large trees. Moreover, the wood of Eysenhardtia is so very like lignum-vitæ that Dragendorff,[1] in the absence of leaves and flowers, may well be excused for referring it to a species of that tree: and, judging from its color and texture, it seems very certain that it was the wood with which the first scientific experiments were performed. Both the red *palum indianum* and the white wood from which the famous Jesuit's cup was made may be included in the second species, for all accounts agree that of its wood there are two varieties, one pale-colored, the other reddish. In the Philippines, where the tree is commonly called *narra* or *naga*, the pale variety, which yields a fluorescence in a very marked manner, is called "female" and the red variety, possessing this characteristic in a less degree, is called "male" *narra*.

In connection with his work on the economic botany of Mexico, the writer has for years been seeking the source of *lignum nephriticum*. Among other woods examined for the blue fluorescence characterizing this were specimens of branches of *Eysenhardtia polystachya* collected by him in 1907 in the vicinity of Aguascalientes, the infusion of which gave no evidence of fluorescence in ordinary sunlight. From this fact and from the circumstance that all samples seen were either of shrubs or trees too small to yield wood for the manufacture of bowls or cups, the writer was inclined to agree with the opinion that *Eysenhardtia* must be discarded as a possible source of the magic wood. In July, 1914, however, specimens of a medicinal wood from Mexico were received for identification, accompanied by herbarium material from the same tree. This proved to be *Eysenhardtia polystachya*, known by the modern Mexicans in many localities as *palo dulce*, or "sweet wood." Its collector had not noticed anything peculiar about the color of its infusion, but dwelt upon its efficacy as a cure for certain diseases of fowls. The wood was a section of a tree trunk, which, when deprived of its bark, was 7 cm. in diameter. Unlike all other specimens of this wood seen by the writer, it consisted chiefly of dense straight-grained dark brown heartwood, very much like lignum-vitæ in appearance, surrounded by a ring of brownish white sapwood from 5 to 8 mm. thick.

A few small chips of the heartwood in ordinary tap water tinged the latter a golden yellow, which soon deepened to orange and appeared like amber when held between the eye and the window. When the glass was held against a dark background the liquid glowed with a beautiful peacock fluorescence very much like that seen in quinine. Placed partly in a sunbeam, half of the liquid appeared yellow and the other half blue: and when the sunlight was focused upon it by the lens of a common reading glass, the vial seemed to be filled with radiant gold penetrated by a shaft of pure cobalt.

There was no longer any doubt as to the identity of the wood. This could be only the Mexican *lignum nephriticum* of previous experiments, and it was undoubtedly the wood of *Eysenhardtia polystachya*, a tree with small pinnately compound leaves and with spikes of small flowers which, although originally white, had turned yellowish in drying,

[1] Dragendorff, *Heilpflanzen* (p. 345), 1898.

corresponding well with Hernández's description of the *coatl* of the Aztecs.

Chips of the sapwood tinged tap water only slightly at first, but when left over night the infusion deepened to a greenish yellow and glowed with a decided fluorescence. With distilled water neither the sapwood nor the heartwood produced fluorescence as seen by ordinary sunlight; but this phenomenon was distinctly visible when these infusions were held in the ultra-violet rays of a fluorescence lamp; and it was also displayed in ordinary daylight, when a small amount of carbonate of sodium or other alkali was added to infusions of the wood in distilled water. By boiling chips in tap water for several hours, a deep amber-colored extract was obtained, not unlike Madeira wine in color. When this extract was placed before a window it appeared to be outlined by a deep blue marginal ring, and when held away from the light, or when the light fell upon it obliquely, the fluorescence of the liquid gave it an opalescence not unlike that of certain mineral oils. A drop of the extract in a glass of water caused the whole glass to glow with fluorescence when held in the rays of the sun admitted through a hole in a screen. By ordinary electric light the infusion failed to show the phenomena; but when held in the rays of an arc light the liquid shone with an intense blue light which illumined the faces of those standing near by.

The genus Eysenhardtia is confined to America. Its range extends from Texas and Arizona on the north to Guatemala on the south. On the elevated plateau of northern Mexico it usually grows as a shrub about two meters high, in southern Mexico as a tree from six to eight meters high, yielding wood which is valuable for cabinet purposes.[1]

That the cups described by early writers could not have been made from the dark-colored wood used in the later scientific experiments is evident; and, moreover, a search throughout Mexico has failed to reveal even a tradition of such cups. In a history of the Philippines, however, written in 1751, but remaining unpublished until 1892, a description is given of similar cups made in southern Luzon, and these are identified by the author with the long sought for cups so popular in Spain in the sixteenth and seventeenth centuries. They were made from the wood of the *narra* or *naga* (*Pterocarpus indicus*), a giant tree of the Philippine forests. The history of these cups is closely associated with the Jesuits, who concerned themselves wherever they went not only with making converts but with investigations in many fields of research. Father Camellus (George Joseph Kamel), whose name is immortalized in the lovely *Camellia*, described the tree and its wood in 1701 and called attention to the sea-blue color of its infusion.[2] Father Delgado tells of cups made of it in southern Luzon and identifies them with similar cups which he had seen at Cadiz when a child, about the year 1700. After describing the boards made from the trunk of the tree, so wide that a single one "sufficeth for making a door or a table," and praising the durability of the wood, he speaks of its medicinal virtues and adds that the cups are much esteemed in Europe where they are regarded as a gift worthy of a prince.[3]

The cups were indeed presented to princes, and there can be but little doubt that those already mentioned were of Philippine and not of Mexican origin; for it must be remembered that

[1] It is probably this wood which Padre Bernabé Cobo, in his *Historia del Nuevo Mundo* (1653), described as the *arbol de la inmortalidad*; and, as the wood resembles lignum-vitæ, it is possible that the latter suggested the name which Cobo applied to it and led to its incorrect identification by Dragendorff.

[2] Lignum ex subfusco rufescens, aquam in qua maceratur colore inficiens cymatili. Camellus, G. J., Descr. Fruct. & Arb. Luzonis ad Jac. Petiverium, Pharmac. Londinens. missae, anno 1701, in Raiius, Joan., *Hist. Plant.*, vol. 3, append. p. 79. 1704.

[3] Delgado, J. J., *Hist. gen. de las Islas del Poniente, llamadas Filipinas*, p. 415. 1892.

long after the discovery of America the only means of communication between the Philippines and Spain was by way of Mexico, and many products of the "Indies" attributed to New Spain were really of Philippine or East Indian origin. The *lignum nephriticum* of Mexico and that of the Philippines, although very different in grain and color, yield fluorescent infusions and extracts so closely similar that they can scarcely be distinguished. The Mexican wood resembles lignum-vitæ, the Philippine is somewhat like Spanish cedar or teak. The heartwood of the former, which is extremely compact and heavily lignified, is impregnated with a peculiar substance which can be called neither a resin nor a gum. Since this substance is not found in the wood of the Pterocarpus, it will be seen that it is not the cause of the fluorescence, which exists almost equally in the two woods. Moreover, the resin-like matter is insoluble in water, while that which causes the fluorescence is freely soluble even in cold water. Neither does this mysterious power reside in the red bodies which give color to the Pterocarpus wood.

The fact remains, therefore, that notwithstanding all the painstaking research which *lignum nephriticum* has induced, the most interesting problem regarding it is yet unsolved—the nature of the substance which causes the beautiful color phenomena produced by the wood. Renowned throughout Europe in the sixteenth and seventeenth centuries for its medicinal properties, as well as for this wonderful fluorescent quality, the magic woods have been traced to their homes in the Philippines and in Mexico and fully identified, in spite of confusing and conflicting evidence as to their identity. But that which the learned Jesuit two hundred and seventy years ago promised to reveal has continued to elude all investigators down to the present time.

Courtesy of the Smithsonian Institution

The sweetly aromatic Mexican *lignum nephriticum* (*Eysenhardtia polystachya*) sometimes occurs as a stunted bush with very small leaflets, sometimes as a spreading shrub with straight stem and recurved branches, and sometimes as a slender tree. The small, white, fragrant flowers turn yellow in drying

Game Farming for Pleasure or Profit

By HERBERT K. JOB

Of The National Association of Audubon Societies

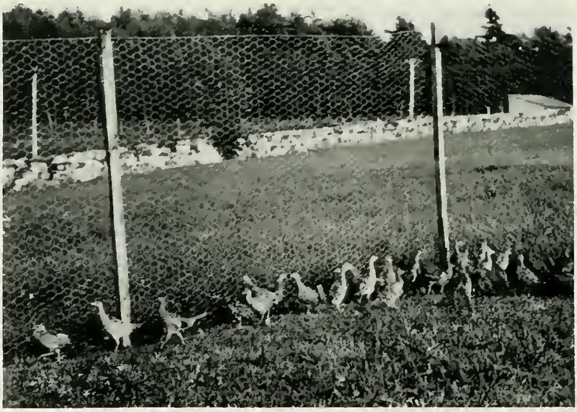
DURING the last few years a remarkable tide of interest in the subject of game farming has arisen all over the country. Just previous to this was a period of experimentation, and of skepticism on the part of many as to the practicability of the work—comparable to a similar period in the history of aviation. Now that successful demonstration has been made by many persons, game-farming enterprises are starting up all over the United States and Canada. While efforts with some species of game are still in the experimental stage, enough success has been attained with various important species to make propagation of game clearly worth while.

Aside from any financial profit, there is a distinct fascination which leads many to undertake such work. There is a widespread interest in wild birds, an enjoyment of their very presence, especially of kinds of any considerable size or which have become scarce. The hunting instinct, of pursuit and acquisition, is also very keen in many people. Actually to be able to produce charming wild bird life, especially such as is connected by association with exhilarating sports afield, to watch the birds grow up, to have them thus readily accessible in the open, with superior opportunity to study and observe wild traits, are most enjoyable.

The propagation of wild game is destined, furthermore, to become one of the most important factors in saving and restoring valuable species which the growth of "civilization" inevitably would render extinct. It is most important that legislation should encourage and promote the propagation of game, not obstruct it. We are just emerging from a period when progress clearly has been retarded by well-meant but shortsighted efforts to save it. A hunter pays a dollar for a license and kills, say, a hundred birds. It has been lawful to have many dead ones, but a crime to be caught with *one* alive and unwounded! Our domestic poultry was originally a wild species—very wild—with restricted range. Thanks to "game farming" it is now the most abundant and useful species on earth. Had it been "protected" as we have been protecting our game, there probably would not be one left on earth today. European countries are far ahead of us in these matters. It is estimated, for instance, that the pheasant population of England is double that of the human, the result of just a few decades of broadminded legislation, allowing people to hold, breed, and sell game that they had raised. Happily, we are emerging rapidly as a nation from our recent darkness, and state after state is passing more liberal laws.

The propagation of wild game requires careful attention to details, especially to matters of sanitation, as wild species are very susceptible to diseases of uncleanliness. No one is qualified to undertake it who has not a deep interest in the birds themselves. Always begin on a small scale, and learn the technique by first-hand experience. It would be the height of folly to lay out plans on paper and plunge into any great game-farm project. Game farming had better begin as an adjunct to other diversified farming, and make a gradual and healthy increase.

In making a beginning it is usual to start with a few ring-necked pheasants for a "try-out." These are easily obtained, are hardy, less liable to disease than some, and every dealer can furnish booklets showing how to proceed. Further, pheasant raising is considered the most lucrative branch of game breeding at present, even though many are going into it. The birds are light eaters, of good size, very prolific, and both birds and eggs bring excellent prices, with wide demand for them. The common ring-necked pheasant is the best all-round species for market and for stocking game preserves. Many other kinds are reared also, more particularly for ornamental purposes, being rather less hardy, but bringing fancy prices. Of these the best known are the golden, silver, Manchurian, Reeves', and Lady Amherst's pheasants. Beginners had better learn with ring-necks before trying these.



Ring-necked pheasants, being easily obtained, hardy, and less liable to disease than other wild fowl, are usually chosen by the beginner in wild game farming. This flock is on the farm of John Heywood, Gardner, Massachusetts

The breeding and rearing of quails of several kinds, now has been made entirely practicable, although the commercial side has not been thoroughly worked out. Young quails are delightful to handle, and the actual rearing of them on a small scale is considered by some to be more easily accomplished than the rearing of even pheasants, as they stay with the hen and run with her for shelter to the coop during showers, whereas the young pheasants often merely squat in the grass, and, further, the quails stay better in one locality when grown up. The stock in confinement, however, cannot be crowded as much as pheasants without danger from epidemic diseases. Also finer wire, which at present is very costly, is required for quail pens.

The California quail (note that the brood is under the care of a bantam hen) is a beautiful bird with a glossy black plume-like crest. It takes kindly to civilization, and the young are delightful to handle. The brood here shown was raised at the Experiment Station, Amston, Connecticut

To raise pheasants, we may begin in either of two ways. We may buy eggs from a game farm and set them under hens, or we may buy, in late fall or early winter, adult breeding stock, usually one male to four or five females. If the second method is followed, the pheasants, with wings clipped, should be kept in a wire enclosure, sheltered on north and west, and containing simple board and brush shelters under which the birds can take refuge from storms. Outdoor cold does not trouble them when thus cared for. About the middle of March they should be removed to breeding quarters. For these a separate small enclosure should be provided for each breeding unit of a cock and four or five hens. Each of these pens should be about fourteen feet square, bottomless and portable, with two-inch mesh wire, but boarded up two feet from the ground. There should be board shelters from storm, and brush heaps under which nests may be concealed. Pheasants are fed mostly on ordinary small grain, such as "scratch-feed," and any convenient "green-stuff," with a little rich laying-mash in spring. In northern districts laying begins about the middle of April.

The young when first hatched must be kept carefully shut in with the hen, or they will escape and get lost. After one day, hen and brood are removed to a fresh coop, fed and confined for another day, then for two days allowed to run out through slats into a very small yard. After this they are allowed to run at will, the hen being shut in the coop when there are a number of other broods, to prevent mixing and fighting of hen mothers. Otherwise the hen could range with them. By this time they know the call of the hen and stay with her. Coops had better be from fifty to sixty feet apart, in a grassy field or pasture. There need be no fence if cats, dogs, and vermin do not attack them. Preliminary trapping of vermin is important. For any considerable game farming, however, it is better to have at least two fields surrounded by wire fences, seven or eight feet high, over which animals will not jump, and over which the young sel-

The bluish gray scaled quail (note its conspicuous white-tipped crest) has been bred and wintered in northern Connecticut by Senator McLean, whereas it is native to a warmer home in the southwestern United States and in Mexico

United States Senator George P. McLean, who is the man that introduced before Congress the Weeks-McLean Migratory Bird Law passed in 1913, has raised ruffed grouse on his estate at Simsbury, Connecticut dom try to fly until they are well grown, when they learn the way back and forth, getting range and natural food outside, but returning to the enclosure at feeding time. When fully fledged they can be caught readily in traps and disposed of as desired.

Quails are managed in the same general way as pheasants, with modifications due to the fact that the species is monogamous. The common bobwhite breeds best when separated arbitrarily into pairs, about the first of April, and each pair placed in a small, separate enclosure about eight by four feet in size, with a thick brush heap at each end and a little board shelter for storms. Each hen usually lays from twenty to forty eggs a season, sometimes more. She will seldom incubate her own eggs in captivity, and it is best to rear the young with bantams. The eggs are so small and fragile that large hens would surely crush them. For the first week after the hatching treat the young quails like pheasants, then release the hen and let her roam with the brood, as they are by that time strong enough to follow.

Other kinds of quail which can be raised are the California, Gambel's, scaled or "blue," and mountain species. All but the last are southern forms, but all can stand cold under restraint, certainly when fed and sheltered from storms, and probably, with some care, could be acclimated to conditions of medium severity, as scaled quails from Mexico have been bred and wintered free in northern Connecticut, by United States Senator George P. McLean,—although one storm took heavy toll of them. Of the scaled and mountain quails the sexes resemble each other and cannot with certainty be segregated, but fortunately all these four species breed when put together, each kind by itself, in a larger enclosure.

The common partridge or ruffed grouse, which is very hardy and might be supposed to be one of the easiest to breed, is in reality one of the most difficult, owing to peculiar traits, especially the pugnacity of the male. They are raised in confinement in small numbers, but it requires a separate large wire enclosure for each pair, making the cost prohibitive as a business proposition. Experiments, however, are under way, and some solution may yet be found. There are other kinds of grouse yet to be made subjects of careful study, notably the "prairie chickens" of the West. Likewise there is an extensive field with many foreign species of gallinaceous birds.

Our native wild turkey is beginning to be bred successfully under restraint. This undertaking requires a considerable tract of field and woodland enclosed with high wire fencing. Like the domestic variety, the wild form is sensitive to diseases of captivity, and the young have to be managed very carefully. Most of the stock sold as "wild" turkeys are only domestic ones or crosses. The domestic bird has a white or light buffy tip to the tail and the same light edging to the feathers of the rump, whereas these corresponding feathers of the true eastern form are dark rusty brown and reddish brown or maroon respectively.

The breeding of wild waterfowl is a most fascinating pursuit, especially the breeding of wild ducks, and also of some geese and swans. The main requisite is a small pond, preferably marshy. An acre or two is an ideal size, although for fewer birds one much

Mallard eggs hatching at Clove Valley Club, near Verbank, New York

Lunch time on the F. B. Dusette Ranch at Bad Axe, Michigan, which calls together a throng of two thousand wild mallards eager to be fed. The mallard, by far the easiest duck to raise, has become very prolific through long breeding in captivity

smaller will do. This should be enclosed with a wire fence six or seven feet high, one-inch mesh at the bottom for about three feet up, the rest ordinary poultry size. An equal area of land should be enclosed with the pond, preferably marsh, swamp, and field, with plenty of rank growth to hide nests. The mallard is by far the easiest to raise, and is produced on game farms in great numbers. Through long breeding in captivity it has become very prolific, and in this respect it is in a class by itself. The tendency of long confinement is to increase the size of the bird and lessen the power of flight, and in buying stock one must be on his guard, if he desires to have true wild ducks and not domestic fowl.

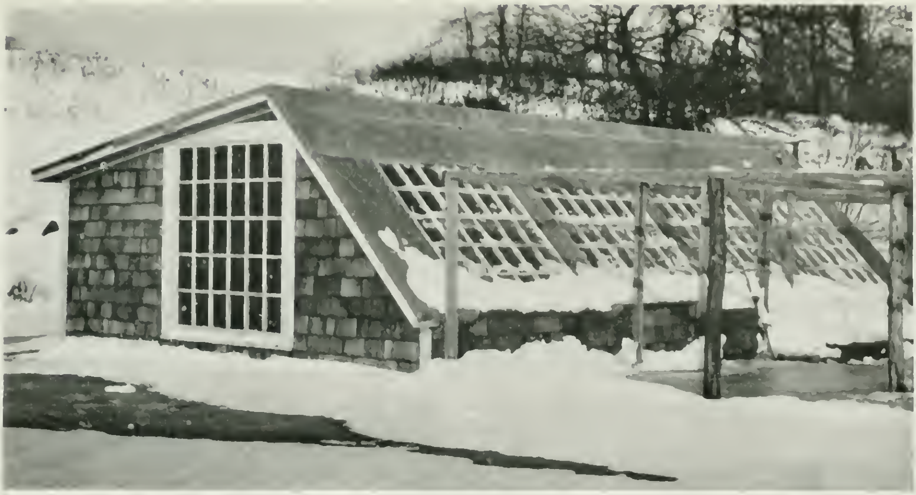
The wood duck, our most beautiful

Given a small pond surrounded by an equal area of marshy land having a rank growth to hide the nests, the breeding of wild ducks will be found not only a profitable but a very fascinating pursuit. This band of young canvasbacks was raised in Manitoba by Herbert K. Job wild native waterfowl, is a charming species to breed. Although not prolific like the mallard, it will breed every year, and produce two layings if properly managed. As with other wild ducks in captivity, to hold them in open enclosures for breeding the stock should be pinioned. This species in the wild state nests in hollow trees, but in captivity uses nesting-boxes on posts, with a cleated board walk leading up to the five-inch hole in the side. Small nail kegs answer very well, or any ordinary box. The posts are set out in shallow water preferably, or else on shore amid shelter of shrubbery. When the laying is complete, the eggs should be taken at once and hatched under a common hen, one of fairly light weight being best. The duck will probably lay another set, which she may be allowed to hatch and raise, provided the pond is free from large fish, frogs, turtles, or snakes, and there are not many other ducks. Wood ducks are in great demand as breeding stock, and bring from $10 to $20 a pair, so that their propagation is quite profitable. Until recent years most of the stock used in this country was raised in Holland.

Wild ducks' eggs also hatch quite well in incubators, if given all possible moisture, and the young can be raised in brooders, although it is easier and less exacting work to employ hens. In the latter case the hens are kept shut in the coop, and the young allowed to run in and out through slats, confining them to a wired yard on grass, and moving them to a new spot now and then. The coop should be kept very clean, and fresh sand frequently spread over the bottom.

Of course there are many other kinds of wild ducks, but the work of breeding them in this country, especially our native kinds, is still in its infancy. The main hindrance is that wild captured ducks are loath to produce eggs at first. If kept in a suitable pond where they are not disturbed, and where there is plenty of cover, although they do not lay the first year, they probably will begin the second season, and do still better the third. The young should be reared by hens, and will be tamer and more ready to breed than their parents. This is the way to build up breeding stocks and solve this problem with various native species hitherto largely un-

A band of wild Canada geese raised by W. R. Truman, of Marshall, Illinois, demonstrates the great possibilities in domestication of wild fowl. Geese and swans are hardy birds, requiring little care, yet not many instances are known of their being bred in captivity



The Amston Experiment Station, in Connecticut, has solved the serious problem of wintering wild ducks. A simple structure, 16 by 24 feet, is built on posts set out in the pond. It is boarded down into the water to within less than a foot of the bottom of the pond and from there down is shut in with wire attached to a board sunk into the mud

tried. Such hand-reared stocks will prove very valuable, and already are in great demand at special prices. Those who produce them first will obtain the greater rewards.

Geese and swans raise their own young. The various species are hardy and mostly take care of themselves, except that one must feed them a little grain. They are very pugnacious dur-

The house faces south, with large windows in front and on the west. In the sunny swimming pool, which occupies two thirds of the interior, the water never freezes, although there is no artificial heat and the outside temperature may drop far below zero ing breeding time, and each pair must have a considerable area entirely to itself. The common native wild Canada goose breeds readily in captivity, but thus far there have been very few instances of other species of American wild geese breeding in captivity. The same is true of our wild swans. There is here a large field for experimental research.

Practical propagation of upland game birds and wild waterfowl by the public is now an accomplished fact, and is one of the most fascinating modern developments of popular study of wild birds. It is a real delight to see one's own broods of pheasants or quails feeding on the lawn or in the pasture, or one's own wild ducks swimming trustfully to their protector on the pond shore asking for food,—the same wild game species, it may be, that one has hunted in glorious bygone days afield. I speak from happy experience, as can many others, and I advise lovers of the great outdoors and its wild denizens to try for themselves this new intimate relationship with wild bird life.[1]

[1] Realizing that "game farming" is proving one of the very best means of interesting the public in wild bird life, its conservation and increase, the National Association of Audubon Societies more than three years ago founded its "Department of Applied Ornithology," in charge of the writer, the purpose of which is to interest and instruct the public in practical measures to increase wild bird life. These measures include attracting, feeding, and protecting wild birds in general, and the direct propagation of those kinds amenable to such measures. Besides employing various lines of instruction, such as publications, inspections, correspondence, lectures, photographs, and motion pictures of wild bird life, the department has been enabled to secure and conduct a demonstration and experiment station in applied ornithology, which includes, among other branches, "game farming." This is at Amston, Connecticut, and is the property of Mr. Charles M. Ams, of New York City, who has placed it at our disposal, with generous aid in various ways. The tract embraces about three square miles of beautiful diversified country abounding in bird life, and is the natural haunt of a good variety of wild game. It includes a picturesque wooded lake more than a mile long, which wild fowl frequent, and also other smaller ponds. Here we have begun various lines of bird work, including the breeding of several kinds of game birds and of wild ducks. In a fenced pond and swamp, an enclosure of several acres, are kept fifteen species of wild ducks for propagation experiments, including a fine stock of canvasbacks.

The problem of wintering wild ducks in cold latitudes has always been a serious one, and this experiment station has already hit upon a method which furnishes a real solution. This is an aquatic house built on posts out from the shore of the pond. It is a simple structure, twenty-four by sixteen feet, boarded down into the water to within less than a foot of the bottom of the pond, thence with wire to a board sunk into the mud. It faces south, with four large frame windows in front and one on the west side. Within, two thirds of the area is a swimming pool, the remainder a dry platform, on which the ducks come out to feed and rest. The sunshine pours in so effectively that the water never freezes although there is no artificial heat, and outside in midwinter the ice freezes two feet thick, with the mercury at times fifteen degrees below zero. The deep-water or diving ducks always have been the especial problem. If kept out of water during winter their feet are apt to freeze, and become sore and lame, as these birds are not well adapted to much walking. The new plan winters them and every other species in the most comfortable fashion. Even the most tender species, such as the blue-winged teal, thrive under it. I consider it very much better than to try to make the ducks live outdoors all winter in a little air hole in the ice which they keep open by swimming around all the time, getting frozen in during severe spells and needing to be chopped out in the morning, often with vitality greatly reduced by spring, making them unfit to breed. By this new plan they come through in splendid condition.

The department, during the summer, while the breeding and rearing are under way, gives instruction in practical details of propagation of game birds and wild waterfowl, and of attracting wild birds, and all persons who are interested in such matters and desire to learn are welcome to come to the game farm at Amston. It is planned during the coming season to hold regular summer school sessions. The tract has just been made a State Game Preserve and Sanctuary, one of the largest in Connecticut. All the propagation or "game farming," and the more important features connected with it, are within easy walking distance of Amston railway station, which is on the Air Line Division of the New Haven Railroad, between New Haven and Willimantic, ten miles from the latter. Those who desire it will be well cared for at the Amston Inn. The National Association of Audubon Societies has a residence at headquarters, called the "Audubon House," where visitors are received, and where are collections of pictures, and of mounted birds, also books and publications relating to bird life. The writer will gladly answer inquiries addressed to the New York office of the Association, 1974 Broadway, or to his home at West Haven, Connecticut.—The Author.

Mr. Roy Chapman Andrews, leader of the recent Asiatic Zoölogical Expedition sent to Yunnan, China, by the American Museum, and author of *Whale Hunting with Gun and Camera*, a popular narrative covering his previous expeditions to all parts of the world in a study of whales

Giant Mammals of the Sea

REVIEW OF A NEW BOOK ON WHALE HUNTING[1]

THE readers of the JOURNAL know Mr. Roy C. Andrews from the accounts of his expeditions to Korea, Japan, and recently to China, as well as by the interesting descriptions, accompanied by equally interesting pictures, of his adventures in search of whales.

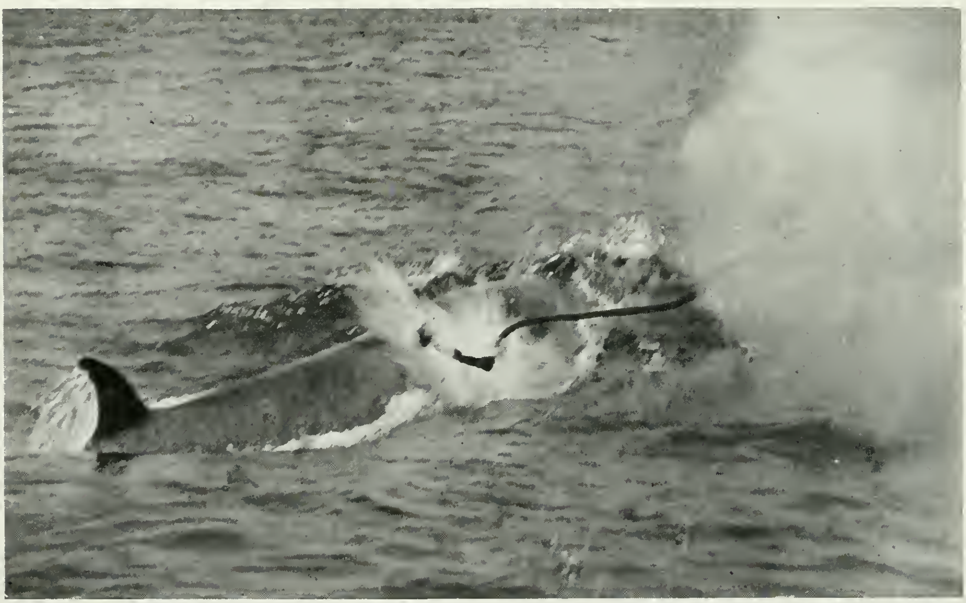
When Mr. Andrews started on his last trip to the Orient he left in the hands of the printer a book setting forth his experiences with whales, which shortly after appeared under the title of *Whale Hunting with Gun and Camera*, Mr. Andrews being equally adept with either weapon.

The observations were made during the course of expeditions carried on over a period of several years with the intent of obtaining for the American Museum of Natural History an unrivaled series of whales whose skeletons and counterfeit presentments in the way of reproductions should be gath-

[1] *Whale Hunting with Gun and Camera*, by Roy Chapman Andrews. D. Appleton and Company, New York, 1916, pp. 321, illustrations from photographs by the Author.

Courtesy of D. Appleton and Company

To capture a whale with either gun or camera requires a quick eye and a steady hand. This photograph, in which appear the back of the whale on the surface of the water, the harpoon and line and the black smoke from the discharge of the gun, shows that the click of the camera and the crash of the gun were almost simultaneous



Courtesy of D. Appleton and Company

As the huge gray form rises from the water with clouds of vapor spouting from the open blowholes, the excitement is intense. The gunner, standing by the photographer with his harpoon gun ready, cries, "I shoot, I shoot!" His words are drowned in the roar, as camera and gun act in unison ered into a great hall of marine life. Mr. Andrews did his part; the material has been brought together, but, alas, it rests in great crates and dark storage rooms awaiting the coming of more peaceful and prosperous days when these leviathans shall be gathered together for the edification of the public. Meanwhile we have his book to keep up our interest in the subject.

In this book Mr. Andrews takes us from Long Island to the Pacific coast and Japan, with side excursions to Alaska, Bering Sea, and the St. Lawrence, but most of his studies were pretty evenly divided between Vancouver and Oshima.

Mr. Andrews has participated in many a whale hunt; he was almost "in at the death" of one of the last whales taken at Amagansett where whaling is, or was until the whales gave out, carried on exactly as it was at its birthplace on the Basque coast a thousand years ago. And yet we call this a progressive age.

We are told how whales feed and play, how they care for and nurse their young, of their enemies and diseases. We are shown many phases of the capture of whales by modern methods; learn how they are pursued, killed and utilized, turned into oil and fertilizer or, as in Japan, sent to market to furnish food for thousands—as is beginning to be done here. And if, as a rule, the business-like methods of modern whaling lack the excitement and danger incident to the capture of the sperm whale,—which, by the way is still pursued and killed just as it was a century ago,—there are yet occasions when whaling by modern methods is sufficiently strenuous for the ordinary individual. Such an incident was the chase and capture of a great blue whale, which lasted from sunrise to sunset; twice the whale was struck and twice he escaped, once by the breaking of the line which stands a strain of twenty tons, and when he was finally killed by a third shot, the steamer was 130 miles from home.

If excitement is usually lacking, there is plenty of hard work and discomfort, but as a matter of compensation, it is now possible to study whales as never before, to photograph, measure, and examine them at leisure, so that although the whales are rapidly disappearing, we are getting to know more and more about them.

Mr. Andrews' book is rounded out by chapters on old-time whaling, in which we are told how the sperm whale, the fiercest fighter of his race, was hunted during what may be termed the golden—in some cases most literally golden—age of the whaling industry, and how the great but clumsy bowhead was chased from Spitzbergen to Greenland and Bering Sea and then all but blotted out of existence, and how his cousin, the right whale, which was driven from Spain and Nantucket into the far north, has become a name only over most of his former range.

The smaller whales and porpoises are not forgotten, and we read how the bottlenose whales are taken in the North Sea and the porpoises off Hatteras, how the Indians chase the white whale in the St. Lawrence, and how the stupid blackfish are rounded up and driven ashore on the Faroes and Cape Cod. All these things, and many more, we are told in *Whale Hunting with Gun and Camera*, supplemented by many pictures of whales and whaling methods.

With the exception of the few chapters noted, this book is the record of personal experiences, and Mr. Andrews may say with Æneas—"all of which I saw and a great part of which I was." And it is only fair to Mr. Andrews to add that he tells his adventures more modestly than did Æneas, who made more of a to-do and got into more mischief during a cruise over a small part of the Mediterranean than Slocum did in circumnavigating the globe in a twenty-ton sloop.—F. A. Lucas.

Favorite Food Fishes

THE NEW YORK MARKET SUPPLIED FROM INLAND AND OCEANIC WATERS, NORTHERN AND SOUTHERN ATLANTIC SHORE FISHERIES, AND VERY CONSIDERABLY FROM THE PACIFIC

By JOHN T. NICHOLS

TO rank as one of the most desirable fish in a big market like that of New York City, a species must have other things in its favor than mere excellence of flesh. To begin with, the number of first-choice fishes is limited by the number of fish names the average consumer finds it worth while to hold in his memory. There is little demand for an unknown article. This number varies from about ten to twenty. The first ten in the New York market are something like the following: shad, salmon, smelt, Spanish mackerel, bluefish, striped bass, kingfish, cod, halibut, and "sole."

The first six in the list justly earn their preëminence, each having qualities which particularly appeal to certain palates. The position of the salmon doubtless is made still more secure by its long sporting career, and the general difficulty the populace has experienced in obtaining it in the past. At times and places where it has been very abundant in the market it promptly has lost favor. Spanish mackerel, bluefish, and striped bass at times are caught locally as game fishes. The bluefish especially has a local reputation as a game fish, which helps its sale for the table. There was a time when the bluefish was not well known hereabouts and there was no sale for it.

The kingfish is a very delicious little fish which was more abundant near New York City at one time than it is now, and more extensively angled for. This unquestionably helped to bring it to the fore, as did also its regal name. Various species of fishes in different parts of the world go by the name kingfish, and these, so far as I am aware, are always esteemed as food. The kingfish in this vicinity is a small species allied to the weakfish and drum. The kingfish of Florida is a large mackerel not only sought for sport but also holding a high place on bills of fare in the South. New York imports a large quantity of this fish. In New York, however, the name kingfish is preoccupied, and the southern fish therefore is marketed as sering, becoming one of the less desirable and cheaper fishes. A delicious fish the size of a smelt is called kingfish, or to be more exact, *pez-el-rey*, in Argentina. Some years ago, I remember, a ship northbound from that part of the world brought some of these southern fish on ice to the New York market, whence one of them came into the hands of the American Museum of Natural History. The Museum had at first no inkling as to its place of origin and was inclined to consider it a species new to science, as it certainly differed from any fish caught locally and even from those species which might have been imported from the Pacific coast.

Cod and halibut are northern fishes which were obtainable in large quantities by early English fishermen. Their appreciation is traditional with the Anglo-Saxon race, which accounts in part for the high esteem in which they are held. They belong to that group of fishes whose general southern limit lies about in the vicinity of Cape Cod. It is natural, therefore, to find them occupying an even more important place in the market of Boston than in New York.

The name "sole" has an important place on bills of fare, doubtless due to the justly earned reputation of an abundant and delicious European species of the name. The writer has never seen true sole served on this side of the Atlantic, however, save on an ocean steamer lying in New York harbor. The demand for "filet of sole" is filled very largely by flounders of various species, excellent fish to be sure but not notable above many others. Of late years a particular species of flounder has appeared in the market which through usage is acquiring a right to the name "sole," or "lemon sole." This is a deep-water form (*Glyptocephalus*) which has been brought to the notice of the trade by the United States Bureau of Fisheries. The only common fish found on our coast which might, from the point of view of science, have a right to the name is virtually worthless for food, small with very rough scales so that it can scarcely be drawn through the hand tail first. It is said that if a hog should attempt to eat one of these fishes tail first, he would be choked by it; in some localities it goes by the name of "hog choker." While we are discussing the subject of flounders and soles it is appropriate to mention a small species known as sundial or sand flounder which is rather common locally on sandy bottoms. This fish is really one of the most delicious found in the sea but probably never will rank high in the market because it is not obtainable in sufficient quantity to become known. Furthermore, its flesh is transparent, so that if the fish be held to the light the shadow of an opaque object may be seen readily through it, which gives the impression of its being very mean and poor. The European turbot, of which it is the closest American relative, shares in this translucency of flesh to some extent.

The second ten fishes for which there is great demand in the New York market comprise something like the following: whitefish, mackerel, butterfish, pompano, sea bass, red snapper, porgy, sheepshead, weakfish, and sea trout. Weakfish, sea bass, and butterfish are obtainable in large quantities in local waters. Weakfish, sea bass, porgy, and sheepshead are objects of pursuit by the local fraternity of salt-water anglers. Red snappers and pompano are among the most excellent southern food fishes which may be shipped in good condition and considerable quantity to the New York market. The whitefish is perhaps the most important fresh-water species taken in our inland fisheries; it is allied to salmon and trout. Sea trout is the southern representative of our weakfish, and is somewhat better flavored. Doubtless its name of trout—to which, by the way, it has not the least ichthyological right—aids its sale here, trout being a familiar English household word. The mackerel, like the cod and the halibut, is a traditional food of English-speaking peoples, and even salt mackerel has a large sale, although to the writer's mind it is one of the least enjoyable forms of nourishment purchasable. Whitefish has very delicate white meat and is most delicious broiled. Also, a fine large good-conditioned red snapper baked is unsurpassed.

Availability of a steady supply of any species is one of the requisites for its proper appreciation in the market. The eastern salmon supply is very largely exhausted, but fresh salmon are brought on ice from the Pacific coast. Through the winter these are mostly steelheads. In spring the Chinook salmon is running in the Columbia and other Pacific rivers and about a week later makes its appearance in the New York market. The cold-storage salmon here is very largely the silver salmon, a western fish that runs later in the season than the Chinook and that can be caught in quantities when Pacific Slope rivers are low. These fish when taken are approaching the spawning period and therefore in poorer flesh than the other species; cold storage does not improve their quality, and the fresh fish when it comes into the market, although more expensive, is well worth the difference.

During periods of the year when the bluefish is not taken in the latitude of New York it is imported from points farther south. Through the winter a large amount of Spanish mackerel is shipped north from Florida. It is properly cleaned and packed there, and in excellent condition when it appears on our tables. Cod and halibut reach us from the north, being taken off the shores of New England and on the offshore and Newfoundland banks, although of late years I believe the latter species especially has decreased in the Atlantic, and a good deal of it comes from our Northwest Coast.

The market in a metropolis like New York is in part controlled by foreign elements in the population that have brought from their home countries the taste for special kinds of fish. Thus we find that there is a large sale of skates to French people living here, the skate being an important market fish on the northern coast of France, and highly esteemed.

As to the food excellence of any kind of fish, the condition in which it is marketed plays as important a part as does the species. Certain fish dealers of intelligence become very expert in judging the intrinsic merit of the wares they handle. If one can select such a reliable dealer who has been proved a good judge of fish, and will give him latitude in the species furnished, a greater variety probably can be used, without danger of making a mistake, than would be practicable to purchase in any other way. Probably about a hundred species worthy of trial occur each year in the New York market, which has a geographical position rendering it accessible to a greater variety of good fresh food fishes than any other world market with which I am familiar.

Occasionally delicious food fishes not ordinarily common in the vicinity of New York become abundant and are taken in large numbers. A case in mind is that of the croaker, a very excellent pan fish which was abundant during the past summer. Under existing conditions this catch of croakers was wasted. There should be some way of "taking up such slack" in the market possibilities.

Certain notable fishes are especially worthy of introduction into the market either because of their special excellence or, if of an inferior grade because they can furnish a cheaper supply of fresh and wholesome fish. From time to time the United States Bureau of Fisheries institutes more or less successful campaigns for the introduction of such species. A recent attempt of this nature to introduce the tilefish seems to have been one of the more successful, perhaps because tilefish has an attractive and striking appearance and a distinctive and easy name.

On the Pacific coast many smeltlike fishes of great delicacy of flavor are taken in large numbers. There probably is no reason why the people of New York should not have regularly the benefit of this supply, but we are not aware that these species have been brought to our market to any considerable extent. A fish common on the Pacific coast is the black cod (*Anoplopoma fimbria*) of very distinctive and agreeable flavor. I find that one of the things I look forward to with great pleasure in a visit to Seattle, is the opportunity to order a portion of this fish in one of the restaurants there where it is very largely used. A few years ago I learned that black cod was being shipped east after having been cured in a special manner—in just what manner I never discovered—and that it was being served regularly in one of the downtown luncheon clubs. It was thereafter my custom to visit that club as frequently as I could to enjoy this delicacy of the Northwest. Unfortunately the discovery was made presently by pure food agitators that the preparation of the product entailed giving it a somewhat artificial color, which was not allowed, and the supply was shut off.

There should be a greater utilization of shark for food, many species having flesh which is nutritious, palatable, and not at all tough. That they are not eaten more in this vicinity seems largely due to prejudice. They should be obtainable in sufficient quantity and with sufficient readiness to be salable at a reasonable figure. Furthermore, if the destruction of shark were put on a commercial utilization basis, the supply of other food fishes, upon which sharks prey, would be augmented.

Roughly, for commercial purposes, the fishes of the world may be divided into four categories. Those of the north occur at various depths, often in vast schools, and are frequently taken on offshore banks. In general they are firm of flesh and excellent as food. The fish of temperate latitudes are found characteristically near sandy shores. This group contains a great variety of delicious species. Then there are fishes of the tropics, found about coral reefs, or in deeper water. Difficulty of obtaining any one variety of tropical fishes in great quantity, and special problems in marketing them, probably preclude their export, although in many places they form an important factor of local food supply, and should do so in others. Finally there are fishes of fresh waters.

New York is almost unique in its accessibility to a fish supply from the first two and more important groups. Our hot summers raise the temperature of the inshore sea water to the neighborhood of seventy degrees Fahrenheit, and bring fishes of the second group north into our bays. The bleak northwesters of winter bring the cod down to us from behind Cape Cod. Local familiarity thus obtained with both northern and southern species introduces them to the market, and at any time of year they are readily imported from a little farther north or south along our coast. At the same time transportation facilities from the west enable New York to obtain fish readily from the extensive inland lakes and rivers, and even to tap the unrelated fishery resources of the distant Pacific.

Doubtless the fish supply of New York,

and indeed of America, is capable of great expansion, but in turning to fish as a war food we should not lose sight of certain problems involved. Whereas some species have been overlooked, others already are utilized to such an extent that they cannot recuperate from the inroads made upon them. In increasing our consumption of these we are still further eating up our capital. Then not only does the price of fish rise in sympathy with that of other commodities in response to economic laws, but, furthermore, labor is involved in obtaining fish just as in raising cattle or potatoes, and it is primarily the shortage of labor which is bringing hunger home to us.

Museum Notes

Since the last issue of the Journal the following persons have become members of the American Museum:

Patron, Mr. George G. Haven.

Life Members, Mrs. James J. Goodwin, The Rev. Harry R. Caldwell, Professor C. R. Kellogg, Dr. William Diller Matthew, Messrs. Thomas Barbour, Eph. A. Karelsen, George Mercer, Charles A. Schieren, and Adolfo Stahl.

Sustaining Member, Mr. C. H. Tenney.

Annual Members, Mesdames Sylvan Bier, J. M. Cohn, John Howells, Max Kops, G. Langmann, Lucius K. Wilmerding, Frank S. Witherbee, Misses Florence Dean, Virginia S. Loewenstein, Messrs. James Abbott, George J. Baldwin, Felice Bava, A. C. Bechstein, Joseph P. Bickerton, Jr., Roy Curtiss, Benedict Ernstein, B. M. Ewing, Dudley B. Fay, E. Roland Harriman, Henry Lambelet, Isidore H. Lehman, John B. Lunger, Max L. Masius, J. Doull Miller, William W. Miller, Louis H. Moos, Beverly Arden Norris, Benjamin Patterson, William Renult, Harold A. Rosenbaum, Morris Rossin, Raymond W. Storm, Thomas W. Streeter, Myron C. Taylor, B. B. Thayer, Robert Van Iderstine, C. Palmer Woodbury, The Rev. Wm. Brewster Humphrey.

Associate Members, Captain Henry Rowan Lemley, Messrs. George Whitefield Davis, Albert Douglas, Charles C. Glover, Robert J. McKay, Charles Lester Marlatt, Walter S. Mitchell, H. A. Nebb, F. Curtis Perkins, Jr., Henry Clifford Stuart, J. M. Tate, Jr., James Todd, Edgar J. Uihlein, Harry H. Willock, John Woodwell, The Hon. Willis Van Devanter.

The sudden death, on December 19, of Mr. L. P. Gratacap, curator of mineralogy and of mollusca, was a great shock to his many friends in the American Museum, where on that very day he had been at his desk. Mr. Gratacap has been identified with the American Museum of Natural History since October 4, 1876, when the collections were still housed in the old Arsenal Building. Since the death of Professor R. P. Whitfield, in 1878, he has been dean of the scientific staff, having been in the service more than forty years. During this period he has held successively the positions of assistant curator of mineralogy, assistant curator of geology, curator of mineralogy and conchology, and curator of mollusca, the last of these since 1909, when he was placed in entire charge of the mineralogical and conchological collections.[1] The funeral services were held in Trinity Church, New York City, where the American Museum was represented by the many members of the staff who were his personal friends.

The death is announced of Mr. Augustus R. Strader, head carpenter at the American Museum of Natural History. Mr. Strader has been actively employed in this institution for eighteen years. The members of his department as well as his many friends throughout the building mourn his loss.

The Executive Committee of the American Museum at a recent meeting confirmed the succession of Mr. George G. Haven to the patronship of his father through the endorsement of his patronship certificate. The Rev. Harry R. Caldwell was elected to life membership in appreciation not only of his gift to the Museum of a collection from China of about 8000 insects, but also of his assistance to the Asiatic Zoölogical Expedition during its recent work in Yunnan. Professor C. R. Kellogg was made a life member

[1] The Journal will publish a biographical sketch of Mr. Gratacap in a later issue.

in acknowledgment of his invaluable aid to the Asiatic Zoölogical Expedition and his continued interest in the development of the American Museum. Dr. William Diller Matthew also was elected to life membership in recognition of his many services to the Museum and of his scholastic attainments.

The American Museum has offered to the National War Work Council of the Young Men's Christian Association the choice of any of its thousands of miscellaneous lantern slides which may be found suitable for the entertainment of soldiers in camp, either in this country or abroad. A cable received from France by the War Work Council asked for as many colored slides as possible, with a range of subjects embracing architecture, art, science, war, and the scenery of various countries. The Museum is preparing also a series of lectures to be circulated among the camps. Four of these now in course of preparation are: "Hunting Elephants and Other Big Game in Africa," by Carl E. Akeley; "Whale Hunting with Gun and Camera," by Roy C. Andrews; "Down the River of Doubt with Colonel Roosevelt," by George K. Cherrie, and "Bird Life on an Antarctic Island," by Robert Cushman Murphy. The manuscript of each lecture will be accompanied by about one hundred slides. The lecture, prepared in the first person, may be read before the soldiers with the same effect as if given at first hand. Another plan of the American Museum for providing relaxation and recreation for the soldiers, is the loan of some of the best of its motion picture films, such as the Crocker Land material and the travel films of Japan and China taken by Roy C. Andrews. These will be so fully titled and captioned that they will be self-explanatory.

Many copies of the American Museum Journal are now being distributed to the libraries of forty-five army and navy camps.

At a recent meeting of the New York Academy of Sciences the following members of the American Museum scientific staff were elected Fellows in the Society: Dr. Thomas G. Hull, of the department of public health, Dr. F. E. Lutz, associate curator of invertebrate zoölogy, and Mr. Barrington Moore, associate curator in woods and forestry. Dr. C. C. Mook, who is engaged on special research work in the department of vertebrate palæontology, was also elected Fellow.

Mr. C. William Beebe, curator of birds in the New York Zoölogical Park, has returned from the Tropical Research Station established last year in British Guiana by the New York Zoölogical Society. While the intention of Mr. Beebe's short trip was principally to salvage books and instruments until after the war, and to seek rest from an airplane accident, yet opportunity was found for a month of investigation. Several thousand specimens, ranging from mammals to insects, were collected, and more than eighty-five representatives of various groups were brought back alive. Among these were a young tapir, an imperial Amazon parrot, and a silky anteater (*Cyclopes didactylus*), the latter species brought north for the first time. More than ninety paintings and sketches of zoölogical subjects were obtained by the director's assistant, Mr. John Tee Van, and by Miss Isabel Cooper. The list of known birds of Bartica District was increased to more than four hundred species.

Mr. Leslie Spier has returned from a journey to Zuñi, Arizona, undertaken the latter part of October to continue archæological investigations begun in the summer of 1916. His researches indicate that the Zuñi at one time disappeared from the Zuñi Valley, to return later. Just where they went during the period of their absence from the valley is the object of the present investigation. As no trace of their wanderings had been discovered in the north and east by former expeditions, Mr. Spier confined his explorations to the western and southern parts of the territory.

The department of anthropology of the American Museum has installed a new exhibit of rare Indian baskets in the Southwest hall of the Museum. There are Mission baskets worth almost their weight in gold. These are made of the stems of California grass sewed together with juncus reed, or the shoots of the sumac, in their natural colors. The reed imparts mottled variations of yellow, brown, and green. The black shades are produced by dyeing the juncus stems with elder. These colors are arranged in horizontal bands of simple and artistic geometric designs. Soft-toned Tlingit basketry of the Northwest shows the great skill of the Tlingit Indians in the selection and blending of colors.

The model which has been made of the *Manta* or "devilfish" captured in Florida for the American Museum some time ago by Mr. Russell J. Coles, has been worked into final form in the department of preparation and will soon be on public view. Many mechanical difficulties had to be overcome to produce a thoroughly satisfactory exhibition specimen of this great diamond-shaped ray, which is more than eighteen feet across. The completed model, however, will be not only the first of its kind to be placed on exhibition in any museum, but also of an excellence which must remain unsurpassed for years. *Manta*, meaning "blanket," first applied to this sea monster by Spanish-speaking peoples on account of its great breadth, is in many respects more desirable than the English name "devilfish," to which the giant octopus has prior claim.

The library of the American Museum of Natural History reports an exchange relationship with the Straits Branch of the Royal Asiatic Society. With the establishment of the exchange, the library has acquired a complete file of the valuable *Journal* of this society, treating of the natural history and anthropology of the general locality of the Malay States. The field is one which has been long in need of material, and the Library is particularly glad that, in spite of the war, the exchange has been established at this time. Another recent accession is *Traité Élémentaire d'Entomologie* by Maurice Girard, volumes 1–3 and atlas, published in Paris 1873–1885.

The American Museum has purchased from Mr. Charles L. Romaine one hundred and fifty prehistoric pottery vessels from the shore of Charco Azul, David, Province of Chiriqui, Panama.

Among the semi-annual additions to the collections of the department of mineralogy are a number of very interesting specimens, notable for size, scientific interest, or beauty. Worthy of mention are: a large group of translucent brown barite crystals, from Cumberland, England; a very beautiful intercrystallization of white quartz and amethystine fluorite from Durham, England; a singular tubular group of smithsonite from New Mexico; crystals of wavellite; a broad crystallized plate of sphalerite from Colorado; a remarkable honey-colored crystal of scheelite (calcium tungstate), being a pyramid of unusual size, from Sonora, Mexico; a striking specimen of calamine from Leadville, Colorado, formed of gray-white blades of the mineral in a mass of shining spheres; a deep orange ball of diadochite; two mammoth crystals of betafite from Madagascar; and many others. The most remarkable addition to the collection has been the large lump of native antimony, weighing ninety pounds, and which so far as our knowledge goes is unique. It was taken from Kern County, California. It is hoped that the department will be permitted in the near future to begin an installation of artificial mineral crystallizations, such as are formed in the arts. A small beginning has already been made, and chalcanthite, alunite, gypsum, and borax, all synthetic productions, fine in color and perfect in crystallization, have been purchased.

Dr. Herman K. Haeberlin, who visited the state of Washington in pursuance of ethnological work on a Columbia fellowship, gathered for the American Museum a considerable collection of specimens from the fast disappearing Indian tribes of that state. Baskets, bows and arrows, beaded skin garments, gambling sticks, and ceremonial objects are among the articles received by the department of anthropology. A unique piece is a blanket of mountain goat's wool from the Tulalip Reservation.

A painting of a herd of buffalo, with Pike's Peak in the background, by Titian Ramsay Peale (an account of whose career and works appeared in the March, 1917, number of the Journal), is a recent accession of the Museum through the generosity of Mr. John M. Hoffmire, of Newark, N. J., and Mr. Charles W. MacMullen, of New York City, nephews of Mr. Peale. The picture was painted in 1854 from a sketch made by the artist in 1819, when he was naturalist on Long's expedition to the Rocky Mountains. It is the largest of his paintings, and is of interest as representing what is perhaps the earliest sketch of Pike's Peak.

A handbook of Peruvian art, prepared by Mr. Charles W. Mead, has been in greater demand by the public since its recent issue than any other handbook of the American Museum except the one on butterflies. The pamphlet contains five plates illustrating the fish, bird, puma, human, and mythological designs to be found on Peruvian pottery and textiles. A full explanation of each of these designs is given in the text.

Relief maps, models, and photographs of the Catskill Mountain water-supply system for New York City may be seen on the fourth floor of the American Museum. The city of New York uses 615,000,000 gallons of water daily, and with the population increasing at the rate of 157,000 a year and needing 100 gallons of water for each person, it is evident that the water supply is an important problem. By the completion of the Ashokan reservoir, the first of the artificial storage lakes in the Catskill Mountains, 250,000,000 gallons daily have been added to the permanent water resources which can be depended upon by the city in the most prolonged series of dry years likely to occur. The great engineering project of bringing the water from the Catskills to New York City was begun in 1907. The system ranks among the greatest of waterworks, ancient or modern, and for magnitude, cost, and complexity of physical problems, stands with the great canals and railroad systems of the world. The part now completed constitutes three quarters of the whole and embraces the Ashokan reservoir, an artificial lake twelve miles long, the Catskill aqueduct, extending ninety-two miles from this reservoir to the city's northern boundary and thirty-five miles within the city's limits, including the branch to the borough of Queens, Kensico storage reservoir near White Plains, Hill View equalizing reservoir at the city line, and Silver Lake terminal reservoir on Staten Island. The water of the new system flows from gathering grounds much higher than the city, force of gravity alone providing sufficient pressure. This is one of its great advantages, as the necessity for costly pumping is obviated. The large aqueduct through which the water flows is of sufficient capacity to deliver 600,000,000 gallons daily. Kensico reservoir, of which a model is shown, offers provision for storing a large quantity of water near the city. From the Ashokan reservoir the water, at the average velocity, takes almost three days to travel to the Silver Lake terminal on Staten Island, during which journey it flows along many a steep hillside, crosses several broad plains, pierces mountains, descends beneath rivers and wide deep valleys, traverses the boroughs of the Bronx, Manhattan, and Brooklyn, and crosses the narrows of New York Harbor.

To emphasize the features of Dr. Clark Wissler's new publication, *The American Indian*, a special two-case exhibit has been installed on the main floor of the American Museum near the west assembly hall. The display is designed to portray the somatic or bodily characters of the American Indian, and to show his relation not only to mankind in general, but more particularly to the Asiatic mongoloids. This is done by means of life masks, skulls, hair samples, photographs, and charts. The subject matter of the labels is taken from Dr. Wissler's book, which forms the nucleus of the exhibit.

The American Anthropological Association and the American Folk-Lore Society met in joint convention at Philadelphia December 27–29. The sessions were held in the auditorium of the University Museum. Professor A. L. Kroeber, now of the American Museum scientific staff, presided. The anthropological department of the American Museum was further represented by Dr. Clark Wissler, Dr. P. E. Goddard, and Mr. N. C. Nelson. A dinner was given on the evening of December 27 in honor of Dr. Wissler, in appreciation of his recent publication, *The American Indian*. This book was the theme of the after dinner discussion, which Dr. A. H. Goldenweiser opened by giving a brief analytical summary of the work.

Mr. Harry Piers, curator of the Provincial Museum at Halifax, reports that the specimens and labels of the Museum apparently came through the recent disaster in that city in far better condition than could have been expected. Windows were blown in and the glass of cases was smashed, water pipes burst, and snow drove disastrously in at one end of the building. Mr. Piers calls attention to their good fortune in having used waterproof ink for labels. The cases were boarded over soon after the explosion in order to make them available as tables for Red Cross relief supplies, thus preventing a very careful examination of the damage to date.

That the December number of the Journal did not reach subscribers by the middle of the month was due to its detention in the New York Post Office, pending investigation of an alleged violation of post office requirements. A telegram from Washington finally released the issue.

Through the courtesy of the United States Bureau of Fisheries there has been added to the exhibits of the shell hall of the American Museum a full series of photographic enlargements illustrating the button industry—from the work of the pearl mussel fisheries of the Mississippi River to the finished buttons. The pictures show mussel dredges of various types at work; the shellers' camp; transportation of the shells by scow to the button factories; and scenes within the factories. From the shells are cut the "blanks," the foundations of buttons. The finishing process includes grinding to obtain an even surface, turning to form the button and depress its center, drilling the holes, polishing in kegs of chemicals to give luster, washing, sorting, and packing. Some factories have been known to reach an output of one hundred and forty-four thousand buttons a day. Button manufacture from shells began in the United States about 1890, and rapidly increased in scope owing to the high tariff on imported buttons. The fishing season for the mussel (*Naiades*) was formerly restricted to August and December but is now continued throughout the year.

There has also been installed in the hall of shells an extensive series of objects showing the commercial uses of shells and how they are employed by Japanese craftsmen in the construction of toys, utensils, jewelry, charms, and ornaments of great delicacy and beauty. Included with this collection are gay shell baskets from the Bahama Islands, and others in which shells are combined into flowers, made for the tourist trade by the Seri Indian women of Lower California.

The rare red ground monkey (*Erythrocebus whitei*) of Africa is the subject of a new habitat group in the American Museum. This species is shy and has habits of watchfulness and great activity which make its capture very difficult. Native hunters seldom get a chance to kill it. They therefore attribute to it the power of rendering itself invisible, and the Azande believe that the skull of the red monkey imparts this power to the fortunate possessor, who thereby is enabled to approach and slay his enemies unseen. The large baboon (*Papio doguera*) shown in the center of the new group is one of nineteen species found in Africa. This particular species ranges from the plains and forests of Uganda westward through the Congo Basin and is here displayed in connection with the red monkey because the two species live in harmony, having similar feeding habits. Like the red monkey, it is a swift runner and very difficult to catch. Most of the animals of this group were collected personally by Mr. Jenness Richardson, working under the direction of Dr. William S. Rainsford, who headed an exploring expedition to Central Africa in 1912–13. The mounting was done by Mr. Frederick Blaschke, a preparator of the Museum, and the background was painted by Mr. Albert Operti.

A second monkey group is completed. This shows the spider monkey, likewise a rare species. Spider monkeys are dark brown, with small bodies and long slender legs, appearing, when seen at a distance in a tropical jungle, like huge spiders. They are sluggish in movement, timid, good-natured, and very quiet. They have no thumb, but make up for this deficiency by having a prehensile tail which serves the purpose of an additional hand. The variety shown in the group is found throughout the greater part of Guatemala and northward, east of the mountains, through the state of Vera Cruz, Mexico. The group is the joint work of Messrs. Frederick Blaschke and William B. Peters. These two groups, representing the Old World and the New, mark progress in the making over of the hall of Primates.

The report on the collection of lizards, made by the American Museum Congo Expedition during its six years' stay in Africa, is nearing completion. This collection of fifteen hundred lizards is the largest ever brought from Africa by a single expedition, although collections from the richer lacertilian fauna of South Africa and from the West African islands have exceeded it in number of species. In the 18 genera and 44 species recorded, all of the central African families of lizards are represented, with the exception of the Amphisbænidæ. Nine forms are described as new, of which three are geckos, three lacertids, and two chameleons. Three others of the species have each been known previously from a single type specimen, and an additional ten are rare in collections. The large series of the Scincidæ, making possible a careful delimitation of the species in that group, and the great extensions of the range of many species probably are of even greater value and interest than the new forms. Among the turtles and crocodiles collected in the Ituri the most interesting is a new genus of crocodile, related to the west African *Osteolæmus*. The work is in the hands of Mr. Karl P. Schmidt, research assistant in herpetology in the American Museum.

PROFESSOR A. L. KROEBER, of the University of California, has come to the American Museum of Natural History as associate curator in the department of anthropology. Professor Kroeber will be with the Museum for six months, exchanging with Dr. Robert H. Lowie, who is now on leave of absence at the University of California.

THAT there is an abundance of material in our Museums from which to supply an indefinite number of artistic textile patterns is becoming more and more evident since manufacturers no longer are able to send artists abroad for designs and are forced to use the resources at command in America. The recent exhibit in the west assembly hall of the Museum fully demonstrated this fact by the number and variety of designs. Work was sent to the Museum from the public schools of Paterson, N. J., and of New York City, from Pratt Institute, Brooklyn, Teachers College of Columbia University, Hunter College, and the Art Department of the Young Women's Christian Association.

AN exhibit of clothing, to which the attention of the costume industry is being especially invited, has been arranged in the Philippine hall of the American Museum for the two weeks from January 3 to 17. About one hundred and fifty handsomely beaded and embroidered garments from the Chinese, Burmese, African, Mexican, Philippine, and American Indian collections are displayed, with a view to demonstrating the artistic possibilities which lie in these products of primitive peoples.

NOTWITHSTANDING the fact that a spider web is so fine and delicate that unless covered with dust or sparkling with dew it is almost invisible, the Museum is now displaying a series of these webs, twelve in number, so mounted on dark backgrounds as to be plainly visible. The spiral construction, widening gradually from the center outward, is easily traced. The webs are accompanied by colored plates of the spiders which spun them. Some spiders live in the web they spin; others spend only the nights there, hiding during the day in retreats often some distance away, with a single thread leading to the web. One of the larger spiders, *Aranea trifolium*, for instance, spins a thread from the center of its web to a tent made of leaves and silk. Sitting in this tent, the spider holds the thread in such a way that it knows when the web is shaken by its insect prey.

A NEW canned fish product, known as grayfish, is on the market and is recommended by the United States Bureau of Fisheries. Analyses have shown that the grayfish contains three times the amount of ammonia nitrogen found in an ordinary food fish, and unless this is eliminated in preparing it for the table, the fish is likely to fall short of proper appreciation. This substance can be removed easily by soaking or cooking the fish in vinegar and water before it is finally made ready. In any event, grayfish should be cooked thoroughly after being taken from the can. Also, it seems that this fish lacks the proper amount of oil. The oil very probably is contained in the liver, which of course is not canned. The fish, therefore, is more palatable when cooked with some fat, such as olive oil, butter, or cream. It may not seem worth while to take so much trouble in the preparation of a new product—which brings to mind the fact that for a time after the potato was introduced into the Old World it was little thought of as a food plant, because people were ignorant of how properly to utilize it.

DR. W. L. HILDBURGH has presented to the American Museum a very carefully selected collection of archæological objects from New York State, containing some fine Iroquois pots and pipes. This gift makes the exhibition and study collections for New York adequately represented in the Museum. Dr. Hildburgh has resided for a number of years in England and has made a large place for himself among English anthropologists.

DR. T. MITCHELL PRUDDEN, who has spent many years in the study of the small ruins of southern Colorado, has presented to the American Museum a collection of pottery and other objects acquired during the course of his work. The specimens are accompanied by two models representing the exterior and interior of the small dwellings whose exact relationship to the larger pueblos and cliff dwellings of the Southwest is not yet evident.

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 1916:

Visitors at the Museum	847,675
Attendance at Lectures	96,353
Lantern Slides Sent out for Use in Schools	38,912
School Children Reached by Nature Study Collections	1,118,000

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 the JOURNAL. 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.

The various Classes of Resident Membership are as follows:

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

They have the following privileges:

An Annual Pass admitting to the Members' Room
Complimentary tickets admitting to the Members' Room for distribution to their friends
Services of the Instructor for guidance through the Museum
Two course tickets to Spring Lectures
Two course tickets to Autumn Lectures
Current numbers of all Guide Leaflets on request
Complimentary copies of the AMERICAN MUSEUM JOURNAL

Associate Membership

In order that those not living in New York City may associate with the Museum and its work, the class of Associate Members was established in 1916. These Members have the following privileges:

Current issues of the AMERICAN MUSEUM JOURNAL—a popular illustrated magazine of science, travel, exploration, and discovery, published monthly from October to May (eight numbers annually), the volume beginning in January

A complimentary copy of the President's Annual Report, giving a complete list of all Members

An Annual Pass admitting to the Members' Room. This large tower room on the third floor of the building, open every day in the year, is given over exclusively to Members, and is equipped with every comfort for rest, reading, and correspondence

Two complimentary tickets admitting to the Members' Room for distribution by Members to their friends

The services of an Instructor for guidance when visiting the Museum

All classes of Members receive the AMERICAN MUSEUM JOURNAL, which is a magazine issued primarily to keep members in touch with the activities of the Museum as depicted by pen and camera; also to furnish Members with reliable information of the most recent developments in the field of natural science. It takes the reader into every part of the world with great explorers; it contains authoritative and popular articles by men who are actually doing the work of exploration and research, and articles of current interest by men who are distinguished among scientists of the day. It takes the reader behind the scenes in the Museum to see sculptors and preparators modeling some jungle beast or creating a panorama of animal life. It shows how the results of these discoveries and labors are presented to the million public school children through the Museum Extension System. In brief it is a medium for the dissemination of the idea to

which the Museum itself is dedicated—namely, that without deepening appreciation of nature, no people can attain to the highest grades of knowledge and worth.

Publications of the Museum

The Scientific Publications of the Museum comprise the *Memoirs, Bulletin* and *Anthropological Papers*, the *Memoirs* and *Bulletin* edited by Frank E. Lutz, the *Anthropological Papers* by Clark Wissler. These publications cover the field and laboratory researches of the institution.

The Popular Scientific Publications of the Museum comprise the *Handbooks, Leaflets*, and *General Guide*, edited by Frederic A. Lucas, and the JOURNAL, edited by Mary Cynthia Dickerson.

POPULAR SCIENTIFIC PUBLICATIONS

HANDBOOKS

NORTH AMERICAN INDIANS OF THE PLAINS
By Clark Wissler, Ph.D. — Paper, 25 cents; cloth, 50 cents

INDIANS OF THE SOUTHWEST
By Pliny Earle Goddard, Ph.D. — Paper, 25 cents; cloth, 50 cents

ANIMALS OF THE PAST
By Frederic A. Lucas, Sc.D. — Paper, 35 cents

DINOSAURS
By W. D. Matthew, Ph.D. — Price, 25 cents

TEACHERS' HANDBOOK, PART I, THE NORTH AMERICAN INDIAN COLLECTION
By Ann E. Thomas, Ph.B. — Price, 10 cents

TREES AND FORESTRY
By Mary Cynthia Dickerson
A new edition in course of preparation.

HEALTH IN WAR AND PEACE
By C-E. A. Winslow, M.S., M.A. — Price, 25 cents

ANCIENT CIVILIZATIONS OF MEXICO AND CENTRAL AMERICA
By Herbert J. Spinden, Ph.D. — Cloth. Price, 75 cents

ILLUSTRATED GUIDE LEAFLETS

THE COLLECTION OF MINERALS
By Louis P. Gratacap, A.M. — Price, 5 cents

NORTH AMERICAN RUMINANTS
By J. A. Allen, Ph.D. — Price, 10 cents

THE ANCIENT BASKET MAKERS OF SOUTHEASTERN UTAH
By George H. Pepper — Price, 10 cents

THE MUSICAL INSTRUMENTS OF THE INCAS
By Charles W. Mead — Price, 10 cents

THE SAGINAW VALLEY COLLECTION
By Harlan I. Smith — Price, 10 cents

PERUVIAN MUMMIES
By Charles W. Mead — Price, 10 cents

THE METEORITES IN THE FOYER OF THE AMERICAN MUSEUM OF NATURAL HISTORY
By Edmund Otis Hovey, Ph.D. — Price, 10 cents

PERUVIAN ART
By Charles W. Mead — Price, 10 cents

POPULAR BOOKS [1]

Based on Explorations, Collections, and Researches of the American Museum of Natural History [2]

AUTOBIOGRAPHICAL NOTES AND A BIBLIOGRAPHY OF SCIENTIFIC PUBLICATIONS OF JOEL ASAPH ALLEN. *American Museum of Natural History*, 1916.
Cloth, $2.50; Paper, $2.00

WHALE HUNTING WITH GUN AND CAMERA, ROY CHAPMAN ANDREWS. A naturalist's account of the modern shore whaling industry, of whales and their habits, and of hunting experiences in various parts of the world. *D. Appleton & Co.*, 1916. Cloth, $2.50

CAMPS AND TRAILS IN CHINA, ROY CHAPMAN ANDREWS AND YVETTE BORUP ANDREWS. An account of the American Museum's Asiatic Zoölogical Expedition, 1916–17. Sixty-five illustrations. *D. Appleton & Co.* (In preparation.) Cloth, $3.00

THE WARBLERS OF NORTH AMERICA, F. M. CHAPMAN. With 24 full-page colored plates, illustrating every species, from drawings by Louis Agassiz Fuertes and Bruce Horsfall, and halftones of nests and eggs. *D. Appleton & Co.*, 1907. Cloth, $3.00

CAMPS AND CRUISES OF AN ORNITHOLOGIST, F. M. CHAPMAN. With 250 photographs from nature by the author. *D. Appleton & Co.*, 1908. Cloth, $3.00

COLOR KEY TO NORTH AMERICAN BIRDS, F. M. CHAPMAN. With bibliographical appendix, and upward of 800 drawings by Chester A. Reed. Revised edition. *D. Appleton & Co.*, 1912.
Cloth, $2.50

HANDBOOK OF BIRDS OF EASTERN NORTH AMERICA, F. M. CHAPMAN. With introductory chapters on the study of birds in nature; full-page plates in colors and black and white by Louis Agassiz Fuertes, and text cuts by Tappan Adney and Ernest Thompson Seton. Revised edition. *D. Appleton & Co.*, 1912. Cloth, $3.50

BIRD LIFE, F. M. CHAPMAN. A guide to the study of our common birds. *D. Appleton & Co.*, 1912. Cloth, $2.00

TRAVELS OF BIRDS, F. M. CHAPMAN. Our birds and their journeys to strange lands. *D. Appleton & Co.*, 1916. $ .40

HITHERTO UNPUBLISHED PLATES OF TERTIARY MAMMALIA AND PERMIAN VERTEBRATA, EDWARD DRINKER COPE AND WILLIAM DILLER MATTHEW. Published and distributed with the coöperation of the United States Geological Survey. *American Museum of Natural History*, 1915. Cloth, $5.00; Paper, $4.25

DOCTRINE OF EVOLUTION, ITS BASIS AND SCOPE, HENRY E. CRAMPTON. *Columbia University Press*, 1911. Cloth, $1.50

STUDIES ON THE VARIATION, DISTRIBUTION, AND EVOLUTION OF THE GENUS PARTULA, THE SPECIES INHABITING TAHITI, HENRY E. CRAMPTON. *Carnegie Institution of Washington*, 1916.
$15.00

A BIBLIOGRAPHY OF FISHES, BASHFORD DEAN. Enlarged and edited by Charles Rochester Eastman. 2 vols. Publications grouped under names of authors; Vol. I, A–K; Vol. II, L–Z. *American Museum of Natural History*. Vol. I, 1916. Vol. II, 1917.
Paper, per vol., $5.50

THE FROG BOOK, MARY C. DICKERSON. North American toads and frogs with a study of the habits and life histories of those of the northeastern states, with more than 300 photographs from life by the author. *Doubleday, Page & Co.*, 1906. Cloth, $4.00

A REVIEW OF THE PRIMATES, DANIEL GIRAUD ELLIOT. 3 vols. Vol. I, Lemuroidea, Anthropoidea; Vol. II, Anthropoidea; Vol. III, Anthropoidea. *American Museum of Natural History*, 1913. Paper, $35.00; Cloth, $37.00; Morocco, $60.00

CHECK LIST OF MAMMALS OF THE NORTH AMERICAN CONTINENT, THE WEST INDIES, AND NEIGHBORING SEAS, DANIEL GIRAUD ELLIOT. *American Museum of Natural History*, 1917. Paper, $1.25

GEOLOGY OF THE CITY OF NEW YORK, LOUIS P. GRATACAP. With numerous illustrations and maps. 3rd edition, enlarged. For use in schools, institutes, and classes. *Henry Holt & Co.*, 1909. Cloth, $2.50

POPULAR GUIDE TO MINERALS, LOUIS P. GRATACAP. With chapters on the Bement collection of minerals in the American Museum of Natural History and the development of mineralogy. *D. Van Nostrand Co.*, 1912. Cloth, $3.00

THE ORDERS OF MAMMALS, WILLIAM K. GREGORY. Parts I and II, Author's edition, Bulletin of the American Museum of Natural History, Vol. XXVII, February, 1910. Cloth, $5.00

BOOK OF THE PEARL, GEORGE F. KUNZ AND CHARLES H. STEVENSON. The history, art, science, and industry of the queen of gems. *Century Co.*, 1908.
Cloth, $12.50

[1] In alphabetical order of Authors.
[2] Wholly or in considerable part.

THE CURIOUS LORE OF PRECIOUS STONES, George F. Kunz. A description of their sentiments, folk-lore, superstitions, symbolism, mysticism, and use in medicine, religion, etc. *J. P. Lippincott & Co.*, Philadelphia, 1915. Cloth, $5.00; Morocco, $10.00

MAGIC OF JEWELS AND CHARMS, George F. Kunz. With 90 illustrations in color, doubletone, and line. *J. P. Lippincott & Co.*, Philadelphia, 1915. Net, $5.00; Half Morocco, $10.00

IVORY AND THE ELEPHANT IN ART, ARCHÆOLOGY, AND IN SCIENCE, George F. Kunz. The Belgian Congo edition. *Doubleday, Page & Co.*, 1916. Cloth, $7.50

RINGS FOR THE FINGER FROM THE EARLIEST KNOWN TIMES TO THE PRESENT, George F. Kunz. With full descriptions of the origin, early making, materials, archæology, and history of rings, with 290 illustrations in color, doubletone, and line. *J. P. Lippincott & Co.*, Philadelphia, 1917. Cloth, $6.50

RHYNCHOPHORA OR WEEVILS OF NORTHEASTERN AMERICA, C. W. Leng and W. S. Blatchley. *The Nature Publishing Co.*, Indianapolis, 1916. Cloth, $5.00; Paper, $4.00

CULTURE AND ETHNOLOGY, Robert H. Lowie. Lectures offered by the department of anthropology of the American Museum of Natural History. *Douglas C. McMurtrie*, 1917. Cloth, $1.25

ORGANIC EVOLUTION, Richard Swann Lull. A text-book. *Macmillan Co.*, 1917. Cloth, $3.00

FIELD BOOK OF INSECTS, F. E. Lutz. With especial reference to those of the northeastern United States, aiming to answer common questions. *G. P. Putnam's Sons*, 1917. Cloth, $2.50

AGE OF MAMMALS IN EUROPE, ASIA, AND NORTH AMERICA, Henry Fairfield Osborn. *Macmillan Co.*, 1910. Cloth, $4.00

MEN OF THE OLD STONE AGE, Henry Fairfield Osborn. Their environment, life, and art. Illustrated by Upper Palæolithic artists, and by Charles R. Knight, Erwin S. Christman, and others. 2nd edition. *Charles Scribner's Sons*, 1916. Cloth, $5.00

ORIGIN AND EVOLUTION OF LIFE, Henry Fairfield Osborn. On the theory of action, reaction, and interaction of energy. *Charles Scribner's Sons*, 1917. Cloth, $3.00

PROBLEMS OF AMERICAN GEOLOGY, William North Rice and others. A series of lectures dealing with some of the problems of the Canadian Shield and of the Cordilleras, delivered at Yale University, on the Silliman Foundation, in December, 1913, by William North Rice, Frank D. Adams, Arthur P. Coleman, Charles D. Walcott, Waldemar Lindgren, Frederick L. Ransome, and William D. Matthew. *Yale University Press*, 1915. Cloth, $4.00

THROUGH THE BRAZILIAN WILDERNESS, Theodore Roosevelt. With illustrations from photographs by Kermit Roosevelt and other members of the expedition. *Charles Scribner's Sons*, 1914. Cloth, $3.50

A HISTORY OF LAND MAMMALS IN THE WESTERN HEMISPHERE, William Berryman Scott. Illustrated with 32 plates and more than 100 drawings by Bruce Horsfall. *Macmillan Co.*, 1913. Cloth, $5.00

STEFÁNSSON-ANDERSON ARCTIC EXPEDITION OF THE AMERICAN MUSEUM OF NATURAL HISTORY, Vilhjalmur Stefánsson. Preliminary ethnological report, Anthropological Papers, Vol. XIV, Pt. I. *American Museum of Natural History.* Paper, $3.50

MY LIFE WITH THE ESKIMO, Vilhjalmur Stefánsson. With report of the natural history of the expedition, by Rudolph Martin Anderson. Illustrated. *Macmillan Co.*, 1913. Cloth, $4.00

THE BIG GAME OF AFRICA, Richard Tjader. With many illustrations from photographs by the author. *D. Appleton & Co.*, 1910. Cloth, $3.00

ANTS—THEIR STRUCTURE, DEVELOPMENT, AND BEHAVIOR, William Morton Wheeler. *Columbia University Press*, 1910. Cloth, $5.00

WATER REPTILES OF THE PAST AND PRESENT, Samuel Wendell Williston. *University of Chicago Press*, 1914. Cloth, $3.00

THE AMERICAN INDIAN, Clark Wissler. An introduction to the anthropology of the New World. *Douglas C. McMurtrie*, 1917. Cloth, $3.00

FOSSIL VERTEBRATES IN THE AMERICAN MUSEUM OF NATURAL HISTORY, Department of Vertebrate Palæontology, Vol. V. Articles collected from the American Museum Bulletin of the years 1913–14. Authors: Henry Fairfield Osborn, William D. Matthew, Barnum Brown, Walter Granger, Charles C. Mook, Robert Broom, W. J. Sinclair, Friederich von Huene, R. W. Shufeldt, and Albert Johannsen. *American Museum of Natural History*, 1916. Cloth, $5.00

NATURE LOVERS LIBRARY. Vols. I–III, Birds of America; Vol. IV, Mammals of America; Vol. V, Mammals of Other Lands; Vol. VI, Birds of Other Lands. *University Society, Inc.*, 1917. Cloth, $29.50

The American Museum of Natural History

Scientific Publications

MEMOIRS

VOLUME I.—Zoölogy and Palæontology.

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The American Museum of Natural History

THE AMERICAN MUSEUM JOURNAL

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

February, 1918

VOLUME XVIII, NUMBER 2

THE AMERICAN MUSEUM OF NATURAL HISTORY

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THE AMERICAN MUSEUM JOURNAL

CONTENTS FOR FEBRUARY

MARY CYNTHIA DICKERSON, *Editor*

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

The Journal 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.

Courtesy of Miller-Dunn Company

UNDERSEA AMONG GIANT CORAL

The Dunn diving helmet has been a part of the equipment of the Marine Biological Laboratory of the Carnegie Institution of Washington at the Tortugas, Florida, since 1915, and has been used by Professor W. H. Longley in his submarine exploration work about the coral reefs. He has directed his attention mainly to reef fishes, living several hours among them each day for weeks at a time. This is not Professor Longley in the photograph, but might well be. There is shown the rubber hose reaching to the attendant boat at the surface, also the stream of bubbles of expired air together with the excess of air pumped from above which is escaping under the edge of the hood

—See "On the Use of the Diving Helmet in Submarine Biological Work," page 135

The American Museum Journal

Volume XVIII   FEBRUARY, 1918   Number 2

Haunts and Habits of Tropical Fishes

OBSERVATIONS OF AN EXPLORER, EQUIPPED WITH A DIVING-HOOD, IN THE UNKNOWN WORLD OF CORAL LABYRINTHS AT THE BOTTOM OF THE SEA

By W. H. LONGLEY

(Goucher College, Baltimore, and the Department of Marine Biology, Carnegie Institution of Washington)

FEW parts of the world seem at once so safely accessible and so little known as certain parts lying in water less than twenty feet deep in tropical seas. Tropical reefs and the reef fauna have been described repeatedly, to be sure, by itinerant naturalists; but no one who has not clothed himself in some sort of diving equipment, clambered over and among the corals, and explored as best he might the labyrinth of passages they enclose, and measured his own height against theirs and that of spreading gorgonians, which in surface view seem so slight and graceful, really knows the reef as it is.

The observer at the surface of the water sees what lies below in little more than two dimensions. From his position he fails further to comprehend the conditions under which the reef-population lives, for water appears to him to be essentially colorless crystal, which blurs no outline, and in which to hide would seem impossible. But when, covered by water, he stands upon the bottom, he speedily realizes how imperfect is his knowledge of the ground he may have studied from above until every detail seemed familiar, and how significant are the changes induced by substituting a very dense for a rarer "atmosphere."

Unimagined depth of shadow lies beneath unsuspected ledges inviting examination but no intrusion. What seemed insignificant depressions become veritable chasms, graven by fretful waves upon an ancient shore now sunken far beneath them. Apparent high steps are abrupt walls, almost beyond scaling, if one's effective weight were not so greatly reduced by his diving equipment that trifling irregularities provide ample hold for foot or hand. Profusely branched, gently swaying gorgonians are waist or shoulder-high, and giant heads of coral tower above, their mass in just proportion to their hoary age.

Over all there hangs a veil of mystery. The water is no longer colorless, crystal-clear, and unsubstantial. Darkening with depth, its soft tints are all pervasive. It blurs and softens every outline. Except when the light is strongest and it is itself most free from sediment, it denies one sight of all but the immediate surroundings, and resolves one's world into a diminutive hollow hemisphere, filled with silence, and on all sides fading into nothingness.

One's narrow field, however, if wisely chosen, may teem with life. It is more than probable that long-spined sea urchins, like animated caltrops, infest the place, twiddle their spines sugges-

AT THE BOTTOM IN A TROPICAL SEA

Gorgonia acerosa with expanded polyps in about fifteen feet of water. The large fish in the center of the field occupied what seemed the identical position twenty-four hours after this picture was taken tively if one approaches, or make off at a surprising rate of speed to shady places if disturbed. Yellow, brown, or purple gorgonians, heavy with expanded polyps, stand on every side, with an occasional coiled basket star close wrapped about their branches, where its inertness completely belies its amazing power of motion. Large spiny lobsters, torn between distrust and greed, from under mushroomed heads of coral protrude their antennæ and wave them frantically over proffered food. Hermit crabs with heavy shells sit aloft on purple sea fans. With their spoon-shaped fingers spider crabs, ensconced in safe retreats, grub off the encrusting growth of plants and fill themselves to repletion. Others lie safely buried, to venture abroad only under cover of darkness. But manifold as are the forms and habits of other creatures, and particularly of Crustacea, the fish fauna surpasses all in number of species, vivid coloration, variety of adaptations, and, one might almost say, in personality.

The smaller fishes are an inexhaustible source of entertainment. The tiny, blue-striped *Elacatinus oceanops* may be seen at almost any time creeping over the bodies of larger fishes such as grunts and groupers. Its jerky movement seems a source of minor irritation commonly borne with indifference or an air of hopeless resignation, even when the little fellows slip almost within their host's capacious jaws. The severance of relations between the two usually occurs in stereotyped fashion: the larger grows restless and with a characteristic movement halfway between jump and shrug rids itself of its visitor, which then goes back to its accustomed station near the coral heads, or rests upon their vertical faces.

An interesting habit shared by some blennies and their allies is that of living in cavities, which they discover and occupy, or construct for themselves. Perhaps the extreme example is that of *Fierasfer* which establishes itself in the cloaca of large holothurians. *Gnathypops aurifrons*, on the contrary, prepares its own shelter in sandy places where the substratum is sufficiently compact to make successful tunneling possible. Jaws and gaping mouth are its only intrenching tools, but meet its every need. It is found not uncommonly upon the open reef in little colonies, the formation of which is probably due in part to the discontinuous occurrence of suitable bottom rather than to the social instincts of the fishes themselves.

During the day, if undisturbed, *Gnathypops* may be regularly observed resting nearly motionless in a semivertical position above its burrow. When alarmed it retreats into its hole tail foremost and conceals itself until the disturbance outside has ceased. Then it reappears cautiously, its beady black eyes being so situated that it is able to sweep the horizon with minimum exposure. If nothing happens to renew its alarm, it mounts a little farther until its ventral fins are free, rests for a moment in the mouth of its burrow, and finally rises easily and gracefully to its original position.

Still another of these fishes (as yet unidentified) shows a different variation of the tubicolous instinct. It lives in holes, quite possibly worm tubes, which it discovers ready formed in pieces of dead coral upon the bottom. Its most striking structural feature is the immense dorsal fin, which when raised seems nearly as high as the fish is long. Its most interesting habit is that of protruding its body for about half its length from the chamber it occupies, and then elevating and depressing its great fin rapidly, as if it were wigwagging in piscine code. This impression is heightened when two individuals separated by no great distance stand erect and repeat the performance in alternation.

Displayed by less specialized members of the great complex to which these species belong, one finds a type of reaction from which those just mentioned probably have been derived. There are small blennies, of which *Actaeis moorei* is perhaps an example, which do not seem to have permanent habitations. In an emergency they slip backward into such tiny holes in the coral as may present themselves. In this response there is advantage the exploitation of which seems to have resulted in the use of a greater variety of refuges, their more extensive employment by individuals, and finally in their improvement, or even in their construction, by their occupant.

Of the largest fishes one sees little. Sharks, fortunately for one's peace of mind, are comparatively rare at the Tortugas. Great barracudas, veritable sea wolves, on the contrary, are common, and frequently come swimming about, but are rather shy. Occasionally a jewfish (*Promicrops*) six or seven feet long may come out of hiding with its attendant remoras, scrutinize its strange visitor and withdraw, or one may chance upon a sting ray bedded in the sand with little more than its tail exposed. In that case, if the water has been still for some time, the bottom may be pitted from repeated burials until it has the appearance of having been walked over with snowshoes.

Some fishes so clearly establish themselves at definite places that one may go to the same station day after day, or after an absence of weeks, with almost complete confidence that he will meet well-known individuals within a few minutes at most after his descent. The acquaintance of particular fishes may be cultivated until they do such unheard-of things as eating from one's hand, and permitting one to take liberties with them which would be quite impossible in the beginning. A large Nassau grouper more than twenty inches in length manifested no alarm upon attempted seizure. On the contrary, it would come for food I held in one hand, slipping an indefinite number of times through the fingers of the other or from under the arm with which I attempted to press it to my side. It followed me about when I was studying other fishes, nibbled at outturned pockets, was commonly underfoot when I was seated, and was in general so attentive that without recourse to strategy it could scarcely be coaxed far enough away to have its picture taken.

As one works repeatedly over the same ground, continually extending one's acquaintance, it gradually appears that fishes of different species may establish relations with one another which persist for days. Of such partnerships one of the most interesting I observed was between a red goatfish and a small yellowtail which I saw a number of times hunting for food together. Perhaps, however, it would be more correct to ascribe the initiative in forming the association wholly to the latter, for it seemed to reap all the advantages from the existing arrangement. The former, like others of its kind, went about actively stirring up the sand in search of food, while its satellite stood by, ever on the alert to dash after and snap up the Crustacea routed out by its companion's fluttering barbels.

The variety in the coloration of the fishes is an unfailing source of delight. Whether one looks down upon them through the glassy water, or whether they float into one's field of view through the circumambient haze, they provoke recurrent expressions of admiration. One is thrilled as by the beauty of Aladdin's garden.

To the bewildered gaze of the novice the various forms flit back and forth aimlessly on the whole, and all appear to be doing much the same thing under the same circumstances. No constant difference in behavior is discovered from species to species with which it would seem reasonable that their color might be correlated. As time passes.

FISH PHOTOGRAPHED AT A DEPTH OF ABOUT EIGHT FEET

These nocturnal fishes commonly rest quietly by day about coral heads and among gorgonians. There are present in this instance gray snappers, yellow grunts, yellow goatfish, with a single parrot fish, and a schoolmaster (*Neomaenis apodus*). Their confusion is due in large measure to a barracuda in their immediate neighborhood

This photograph, taken in from seven to eight feet of water, shows many yellow grunts (*Haemulon sciurus*), three of the related species, the sailor's choice (*H. parra*), two gray snappers (*Neomaenis griseus*), and one yellow goatfish (*Upeneus martinicus*)

Nassau grouper (*Epinephelus striatus*) coming to rest beside the body of a "crawfish" (*Panulirus argus*). Equipped with a diving-hood one may walk about freely among the reef creatures and photograph them amid natural surroundings with much less difficulty than might be anticipated

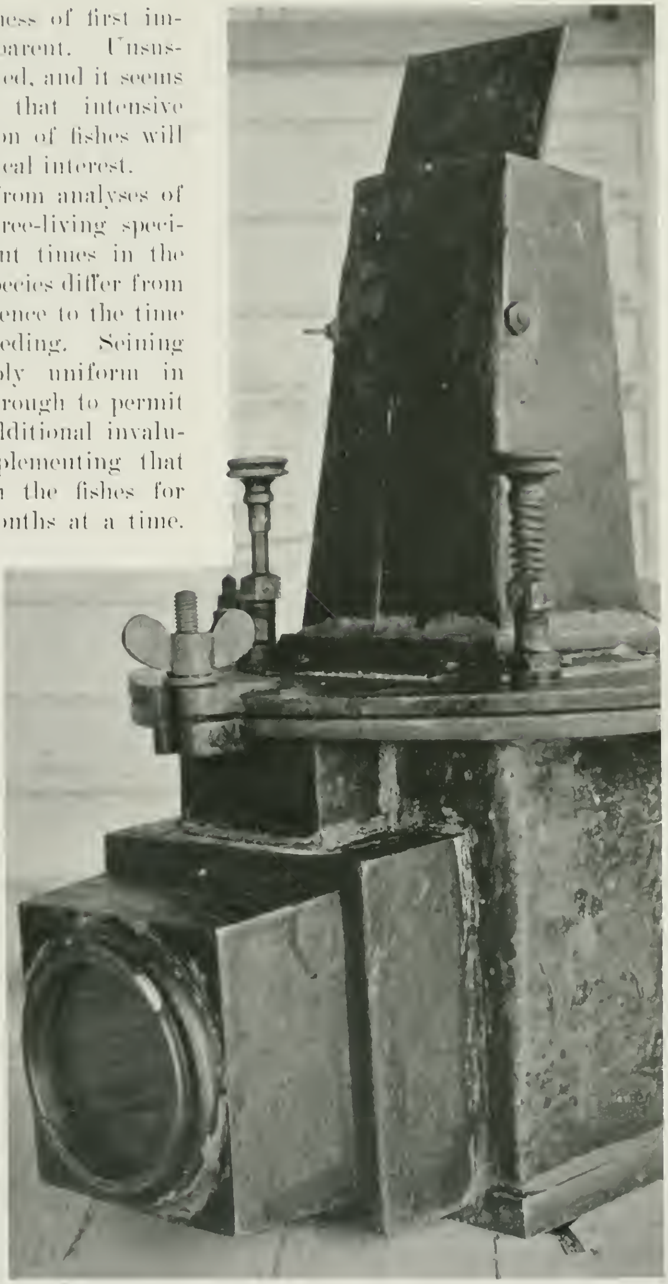
Hogfishes (*Lachnolaimus maximus*) in different color phases, which may replace each other almost instantaneously. Both are feeding on sea urchins broken for them. The lighter colored individual is over clear sandy bottom, the other over broken bottom among corals and gorgonians. The mottled phase is not, however, conditioned solely by the environment, but tends to appear in resting fishes.

It is of much interest that among creatures which justly have been called "chameleons of the sea," changes in color and shade should enable those displaying them to adjust themselves to their normal surroundings, and to assume the dominant colors of their changing environments, as they pass from place to place

This pair, the goatfish ahead, the yellowtail following, foraged together for days in succession. There is a "slippery Dick" (*Iridio bivittatus*) as well as a second goatfish and a parrot fish in the picture. Some of the difficulties encountered by the submarine photographer are well illustrated in this case. On account of absorption of light by the water, one is obliged to use a wide stop in taking snapshots. As a result, to be sharply in focus objects must be all nearly in one plane. Since the fishes are at perfect liberty to come and go, it is often necessary to wait a long time before the desired configuration appears. Taken in about ten feet of water

Porkfishes and tang against a background of massive coral; sea urchin and sea fan out of focus in the foreground however, the unsoundness of first impressions becomes apparent. Unsuspected relations are noted, and it seems increasingly probable that intensive studies of the coloration of fishes will yield results of theoretical interest.

It is demonstrable from analyses of stomach contents of free-living specimens taken at different times in the day, that the various species differ from one another with reference to the time and place of their feeding. Seining upon bottoms tolerably uniform in character and not too rough to permit the operation, gives additional invaluable information supplementing that gained by living with the fishes for hours in succession months at a time. In view of data from these various sources, it is not open to question that the groups of fishes one finds swimming together about the larger masses of coral are of the same heterogeneous nature as the crowds one meets on any busy city thoroughfare; they differ from one another in habit as the people differ in occupation.



Camera container for submarine photography. The mirror projecting in rear view from the top of the focusing hood enables one without bending over to see the doubly reflected image of objects within the field of the camera. The rods with milled heads are for focusing and for releasing the shutter. Both are protected by stuffing boxes. A soft rubber gasket lies between the cover and the body of the box. All other points are permanently sealed by solder or cement. The cubical body of the box is eight inches on the side, and the weight of the whole apparatus in air is about fifty pounds

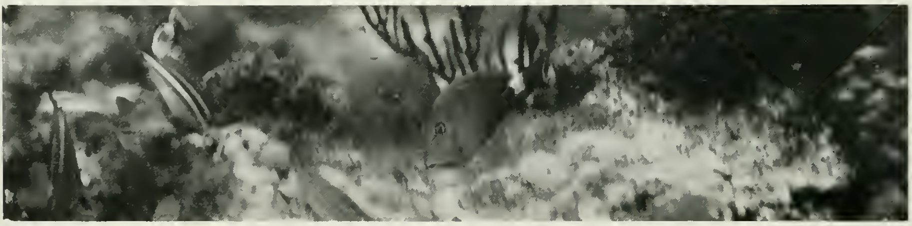
When the fishes are classified by habit, a number of interesting relations are revealed. Variation in color within the different groups is less than in random samples of the same size from the general human population. Particular colors, in other words, are correlated with specific habits. Red, for example, is almost wholly restricted to nocturnal fishes which lie hidden by day. The greens, on the other hand, characterize such species as live upon the green reef-flats, or swim near the surface in open water. The fishes displaying the most vivid color combinations move in the most varied environments. The colors of all, in brief, appear to conform to a rational and simple system of distribution.

The coloration of many of the species is changeable and may be experimentally controlled. Equipped with a diving-hood one may walk about freely and thus lead carnivorous forms from point to point by offering them food. It is possible under such circumstances to evoke their various color phases at will by selecting the spot to which the creatures are led, and, if desired, to observe at closest range each minute effect of their changed environment. The movements of herbivorous forms are not subject to quite such definite control, but one may walk up to browsing schools of tangs or parrot fishes, follow them about, and secure special information with little effort.

All the creatures may be photographed amid perfectly natural and typical surroundings with much less difficulty than might be anticipated. Hence it has been possible to make encouraging progress in an attempt to secure a pictorial record of the phases assumed by a number of species under controlled conditions.

The two pictures of the hogfish give an idea of the extent to which changes which for all practical purposes are instantaneous may modify the appearance of a species. In nature, so far as I have been able to determine positively from personal observation, such changes are solely dependent upon two factors. The first, and perhaps the chief of these, is the color of the environment into which the fishes move. The second is their activity, or lack of it, for, provided they ever display them, banded patterns appear to characterize the resting condition of fishes.

It is of much interest that among creatures which justly have been called "chameleons of the sea," changes in color and shade should enable those displaying the changes to adjust themselves to their normal surroundings, and to assume the dominant colors of their changing environment, as they pass from place to place. It accords completely with the discovery that the colors of those fishes whose pigmentation is essentially stable are correlated with their habits and in general repeat those characterizing the stations they frequent. Since the conspicuousness of these creatures has not been regarded as of an inferior sort, their changeable coloration provides a physiological test of the truth of the Neo-Darwinian hypotheses advanced to explain animal coloration in terms of natural selection. It may be added that if the observations mentioned are correct and representative, it seems impossible that any explanation of the biological significance of the types of coloration in question which assumes that they possess more than minimal conspicuousness can be correct, for what system of coloration could render an animal more *inconspicuous* than one based upon the principles indicated, if to these be added the countershading the fishes almost universally display?



On the American Fuel Famine

By CHARLES P. BERKEY

Professor of Geology, Columbia University

NEVER before has the average citizen of the United States troubled himself seriously with the question of our coal supply, but the fuel shortage of the past few months has raised the question in almost every mind. The popular conception of the cause of the shortage is certain to involve the question of possible exhaustion of the sources of supply, and raise the specter of a permanent fuel famine. It is, on the whole, a very natural inference in these days of turmoil, when for the first time in our experience many of us begin to realize that the whole world is living literally on the verge of starvation, with threatening complete exhaustion of supposedly endless stores of the commonest necessities of life.

Is, then, our coal also about to fail? And are we to be expected to add to our hunger the further suffering that comes from the relentless cold of our American winters? It is in the hope of being able to give a few facts bearing on this question that the following memorandum has been written.

The Real Question

As a matter of fact, the controlling factors in the present fuel shortage have very little relation to the matter of coal resources or reserves. They are almost wholly simple questions of transportation together with the disturbances of an abnormal demand. These are affected somewhat also by labor conditions and the difficulty of adjustment to the extraordinary living and cost conditions of the time. They might be summarized, perhaps, briefly as follows:

(*a*) Inadequate transportation facilities for this commodity, occasioned by extraordinary requirements for other purposes.

(*b*) An unusually severe winter season,

(*c*) An abnormal demand for coal of certain higher grades for shipping and for export, as well as in the industries of our own country, which are now called on for maximum or increased output.

(*d*) Shortage of efficient labor in all sorts of related or contributory work.

(*e*) And the handicap of increased costs of all kinds.

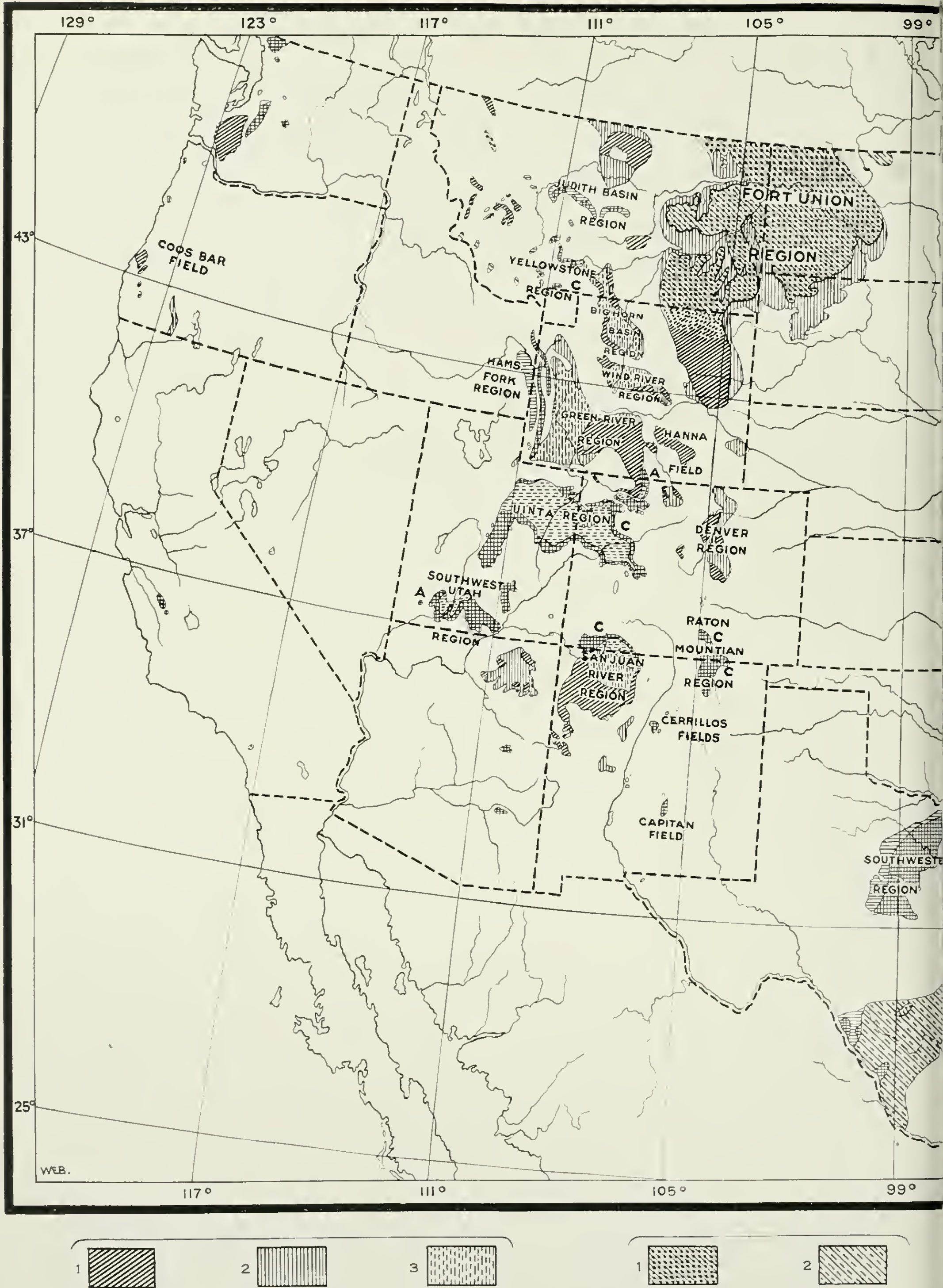
It is not our purpose to discuss these matters. It is only fair to say, however, that there is no real shortage of coal reserves in the ground. America has the most wonderful supply of any country in the world.

The Coal Fields of the United States

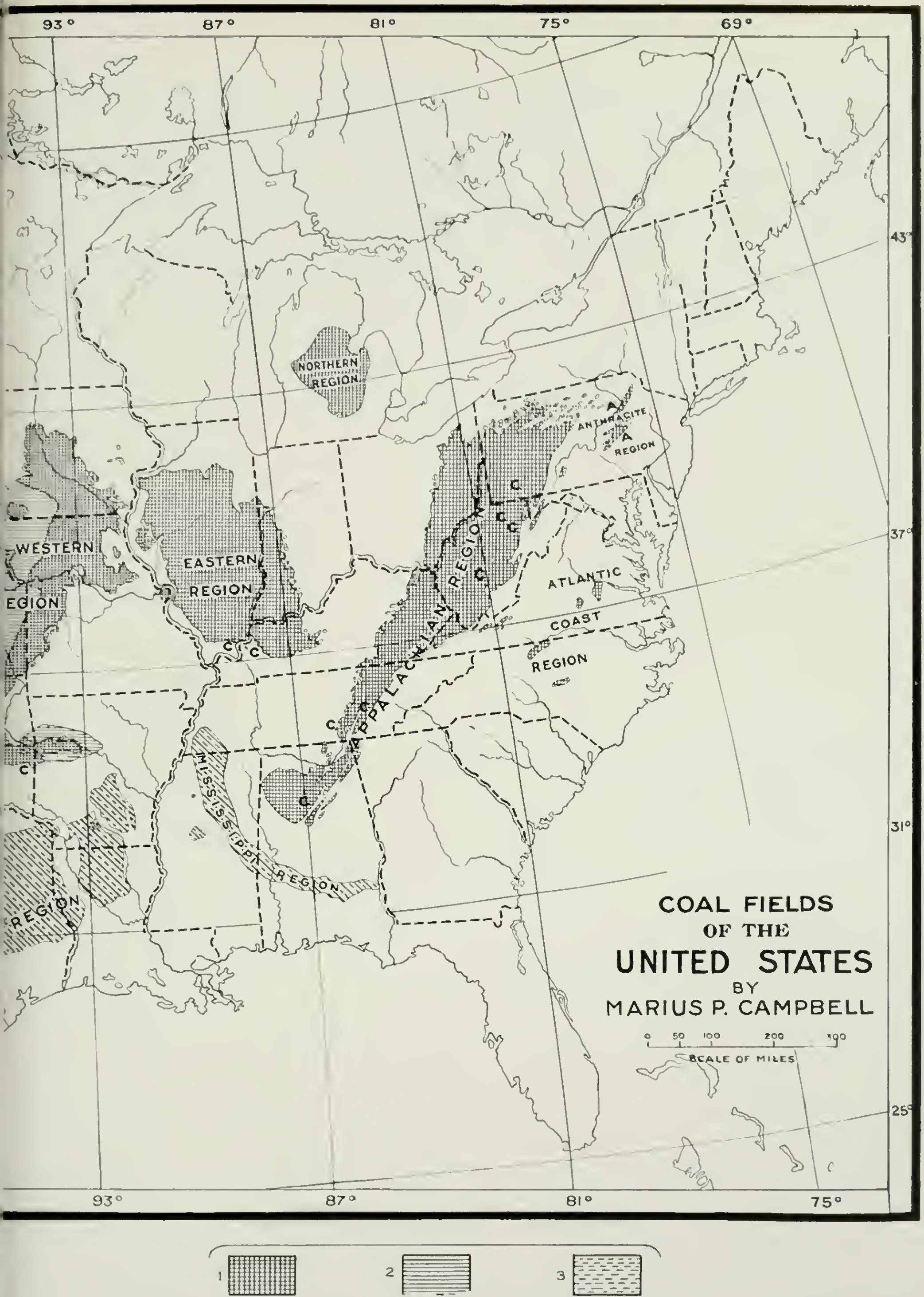
America has all grades of coal in very great abundance as compared with the other countries of the world, but certain grades characterize particular fields and therefore this question assumes regional importance to some degree. For example, *anthracite* is the highest grade of coal, but it is confined almost entirely to four comparatively small fields in eastern Pennsylvania, which furnish the market in that grade, although there are a few very small anthracite occurrences in the Rocky Mountain region that have local use. On the other hand, *lignite*, the lowest grade, is very widely distributed, especially in the Great Plains, Rocky Mountain and Gulf regions, and forms an immense reserve which is drawn upon to very small amount in the present market.

The grades recognized by the United States Geological Survey include:

Anthracite, or "hard coal" (the highest grade of all coals),
Semi-anthracite,
Semibituminous (high grade soft coal),
Bituminous, or "soft coal" (the most



In each case (1) indicates areas containing workable coal beds,
(2) areas that may contain workable coal beds, and
(3) areas probably containing workable coal beds under such heavy cover as not to be available at present



Bituminous and Anthracite Coal

Map adapted from *Coal Resources of the World*—an inquiry made upon the initiative of the XII International Geological Congress, Canada, 1913, with the assistance of Geological Surveys and Mining Geologists of different countries

abundantly produced grade of coal for the industries),
Subbituminous (low grade soft coal),
Lignite (the lowest grade of coal, also called "brown coal").

The differences are based chiefly on the ratio between the fixed carbon and the volatile hydrocarbons as shown upon analysis—anthracite being very high in fixed carbon and lignite very low. The anthracites are coals that have suffered more elaborate metamorphism or transformation than the lower grades. Lignites have been least transformed, often preserving the woody structure of the plant accumulation from which they were derived. The bituminous coals are the common steaming coals and make up the bulk of coal production, but great areas of lignitic and subbituminous coals are known and constitute immense low-grade reserves.

The total production of the different grades of coal in 1915—the last year for which returns in this particular are available—was as follows:

Anthracite, 89,048,500 tons, valued at approximately $184,750,000.
Bituminous and Subbituminous and Lignitic coals of all grades, 442,624,426 tons, valued at $502,037,688.

In 1916 the production and value of anthracite were about the same as given above, but the production of bituminous grades reached the enormous total of 509,162,000 tons and was probably worth at least $600,000,000.

The coal fields of the United States, which are literally distributed from coast to coast, are conveniently referred to under the following general names, with grade of coal and areal extent indicated for comparative purposes:

The Coal Fields of the United States

	Area in sq. miles	Production in 1916, in short tons	Estimated remaining available reserve supply in short tons
THE ANTHRACITE FIELDS	480	88,312,000	16,000,000,000
(1) Eastern Pennsylvania, Colorado, and New Mexico	29	53,445	?
BITUMINOUS FIELDS of the better grade			
(2) Atlantic Coast Triassic Fields (Va., North Carolina)	210	..	199,000,000
(3) Appalachian Fields (Pa., Ohio, Md., Va., W. Va., Ky., Tenn., Ala., and Ga.)	69,755	357,366,000	530,000,000,000
(4) Eastern Interior Fields (Ind., Ill., and western Ky.)	47,000	91,024,000	318,000,000,000
(5) Northern Interior Field (Mich.)	11,000	1,230,000	11,900,000,000
(6) Western Interior Fields (Ia., Neb., Kan., Mo., Ark., Okla., and parts of Texas)	74,900	25,650,000	187,500,000,000
LIGNITIC AND BITUMINOUS FIELDS (chiefly low grade bituminous and lignitic coals)			
(7) Gulf Coast Lignitic Field (Ark. and Tex.)	2,100	1,100,000	20,000,000,000
(8) Great Plains and Rocky Mountain Fields (N. Dak., S. Dak., Mont., Wyo., Ida., Colo., N. Mex., Utah)	126,022	30,041,000	1,969,000,000,000
(9) Pacific Coast Fields (Wash., Ore., Cal.)	1,900	3,025,000	21,800,000,000
(10) Alaska	1,210	?	?

Grand Totals, subdivided on basis of grade

Total original amounts:	
Lignitic coals	986,855,100,000 tons
Subbituminous (low grade)	860,331,100,000 tons
Bituminous	1,314,009,300,000 tons
Semibituminous (high grade)	43,477,800,000 tons
Anthracite	20,721,000,000 tons
	3,225,394,300,000 tons

Total amount used to date, including allowance for waste, about	15,000,000,000 tons
Balance or reserve supply	3,210,394,300,000 tons

The rate of production at the present time is about 600,000,000 tons per year and is increasing. At this rate, and allowing fifty per cent for waste and loss in mining, it would appear that the United States has a reserve good for something like 2000 years. With growing demands, however, from our own industries and the needs of those parts of the world less favored with such supplies, it is to be expected that the rate of production will increase materially for many years and that final exhaustion is well within that time. The anthracite reserves are being depleted at a much faster rate and probably will not last a hundred years. It is worth noting also that the greatest reserves are in the lowest grades.

As a matter of fact, the world can look forward to the grim necessity in the moderately distant future of utilizing other sources of power and heat, or, failing in that, of adjusting their wants to the modified conditions. It is not at all unlikely that many of the industrial establishments now grouped around the great coal fields will abandon these locations and seek tropical and desert regions where there may be hope of harnessing the wind and sun to furnish power, and where the demands for artificial heat for the comfort of their people are not so pressing. Others will doubtless learn to rely upon the water power of our streams, especially our mountain streams, which will in time be harnessed from source to mouth to furnish power. On many coasts the tides may also be utilized in much the same manner.

Thus the reserve forces of the earth loom up in the future industries of the world. Perhaps in those distant times, the present waste places of the earth, such as our deserts, may blossom with many attractions, forced upon them by the exhaustion of less favored regions.

Coal Reserves of Other Countries

It is of equal interest to compare the coal reserves of the different leading countries of the world, but in that case, of course, many questions beyond our present immediate concern are involved. It has to do with the future of many countries in the economic competition of the world, and may in the long run be one of the deciding factors in world-power, if nations are still to strive for such a thing.

If all grades of coal are included, the available reserves of the different continents are roughly as follows:

North America	5,073,431,000,000 tons
Asia . . .	1,279,586,000,000 tons
Europe . .	784,190,000,000 tons
Oceania . .	170,410,000,000 tons
Africa . . .	57,839,000,000 tons
South America	32,097,000,000 tons

If these reserves are classified as to grade, the rankings in the different classes are somewhat modified, Asia leading in reserves of anthracite, but there is no large deviation from the original order given. North America's great reserve in all bituminous grades is the striking thing, and places the United States, which is the country carrying the bulk of these supplies, well in the lead in reserve power from this source for the future.

The total available coal reserves of the United States have been estimated at 3,838,657,000,000 tons;[1] the total for the whole world at 7,397,553,000,000 tons. In other words, the United States owns more than half of the apparent world's supply.

It appears therefore that the present coal famine is a very superficial thing and it is a satisfaction from very many different points of view to find that the United States is so well supplied with reserve fuel.

[1] The figures given above have been compiled from the *Mineral Resources of the United States*, *Mineral Industry* for 1916, and the monograph on *Coal Resources of the World*, published by the International Geological Congress in 1913. These figures are not to be regarded as absolutely accurate to the last ton or dollar but they are found to be serviceable for comparative purposes and they are of the order of magnitude belonging to the various factors of such a problem.

CHARLES R. VAN HISE

President of the University of Wisconsin; trustee of the Carnegie Foundation for the Advancement of Teaching; president of the American Association for the Advancement of Science, 1917. Professor Van Hise is one of the most active and influential of the geologists of the United States in both state and national affairs.

This portrait is from the bronze bust, recently executed by C. S. Pietro for the University of Wisconsin, which was on exhibition for some weeks in Memorial Hall of the American Museum of Natural History

The Coal Situation in the United States

AND THE EARLY HISTORY OF THE WORK OF THE FEDERAL FUEL ADMINISTRATION[1]

"If adequate steps be taken to bring to bear all the potential possibilities of our vast coal and iron resources, in the war of mighty machines driven by the energy of coal, we shall overwhelm the enemy"

By CHARLES R. VAN HISE

President of the University of Wisconsin

OF ALL the countries of the world the United States is the richest known in its coal resources. On October 10 the United States Geological Survey submitted an estimate that the tonnage of bituminous coal in the United States for the year 1917 would be 552,000,000 tons, or 50,000,000 more than in 1916. This is an increase of ten per cent, and as compared with 1915, an increase of about twenty-five per cent. For anthracite the increased production also is estimated at ten per cent as compared with last year.

A survey of the situation made in November, however, indicates that the excess of coal required during the year 1917–18, as compared with the previous year, will be about 100,000,000 tons, thus leaving a gap of 50,000,000 tons between production and requirement.

The great increase in the coal consumption is due mainly to war necessities. Munition plants running twenty-four hours a day require from one third to one half more coal than a year ago. The demands for coal by the government, including the army and navy, have increased by three hundred per cent, or from 2,000,000 to 8,000,000 tons. The public utilities and industries of the country are asking for an increase of coal by one third.

The problem of closing this gap of 50,000,000 tons, between production at the present rate and absolutely necessary consumption, must be met by taking steps to increase the production, by facilitating transportation, and by enforcing the most economical use of available coal. Activities which are unnecessary for the maintenance of military and economic efficiency will have to curtail their supplies as demanded by the necessities of war.

The work of the "Fuel Administration" in the United States during this winter of 1917–18 has been a difficult one. The country is large. Problems of transportation have been many. Labor questions have been difficult of adjustment. What judgment shall be placed upon the work as a whole can be told only in retrospect; and not even then, for we cannot know in the comparisons of various possible methods of procedure, except by supposition, what would have been the difficulties in the untried courses of action.

We start with the fact that about three years ago, in consequence of the war and the revival of industry, there came an increased demand for coal. In 1915 the needs did not require the maximum production of 1913; but the demand during the winter of 1916–17 locally exceeded the available supply, and there resulted hardship and industrial difficulties, especially during the latter part of the winter. With this shortage went rapidly enhancing prices.

[1] From lectures given by President Van Hise at the University of Wisconsin on "Conservation and Regulation in the United States during the World War."

The situation became so acute by June, 1917, that Congress passed a resolution asking the Federal Trade Commission to make an investigation. This Commission found the difficulties to be due more to a lack of cars for transportation and to a shortage of labor than to the incapacity of the mines to produce the necessary amount of coal. The shortage of cars was made even worse by the withdrawal of boats in the Atlantic coast trade from coal transportation, which necessitated shipping coal by rail to the northeastern part of the United States to a greater extent than usual.

Notwithstanding the fact that the estimates made of the amount of coal needed during the year ending June 30, 1917, as compared with the previous year, indicated an increase of about ten per cent, when it came time to make contracts in the early summer of 1917, the prices of coal had increased for large consumers by one hundred to one hundred and fifty per cent, and for small consumers by two hundred to four hundred per cent; indeed, in the early summer of 1917, contracts for many thousands of tons of industrial coal were made for the country contiguous to the interior basins at a rate three to four times that which had been paid the year before.

The fact that coal is basal to all the industry of the country (with the possible exception of agriculture) and its greatly enhancing price, together with the difficulties of transportation, led the Commission to make sweeping recommendations June 19, 1917:

"First, That the production and distribution of coal and coke be conducted through a pool in the hands of a government agency; that the producers of various grades of fuel be paid their full cost of production plus a uniform profit per ton, and

"Second, That the transportation agencies of the United States, both rail and water, be similarly pooled and operated on government account, under the direction of the President, and that all such means of transportation be operated as a unit, the owning corporations being paid a just and fair compensation which would cover normal net profit, upkeep, and betterments."[1]

The coal situation continued to become more and more acute; and during the discussion of the Food Administration bill in Congress, it became so clear that drastic action was necessary regarding fuel, that the Senate inserted a section giving the President the sweeping powers concerning coal[2] suggested by the Commission. He might do either of the things which the commission recommended, or he could make any prices and regulations which he regarded as necessary, even to becoming the exclusive dealer in coal in the United States. This bill became a law on August 10.

The President appointed as Fuel Administrator, Harry A. Garfield, president of Williams College—and thus began the work of the Fuel Administration of the United States.[3]

On August 21, however, and on August 23, before the Fuel Administrator was appointed, the President relieved the general alarm among the people of the country by proclamations fixing the prices of anthracite coal and bituminous coal respectively. The proclamation regarding bituminous coal made $2.00 the basic price in those districts where most cheaply produced—whereas it had leaped to $3.50, to $4.00, to $5.00, and even to $6.00 a ton, sale price at the mines.

These lower prices could not go fully

[1] Report of the Federal Trade Commission on Anthracite and Bituminous Coal, June 20, 1917, Washington, D. C., pp. 20 and 21.

[2] Act of Congress, approved August 10, 1917, entitled "An Act to provide further for the national security and defense by encouraging the production, conserving the supply, and controlling the distribution of food products and fuel."

[3] The organization of the Fuel Administration comprises the organization of the forces at Washington and the organization in the several states. Following the plan of the Food Administration, there has been appointed in each of the states a Federal Fuel Administrator. Through local committees he has complete supervision of local distribution, and in this connection is charged with seeing that the rulings of the President and of the Fuel Administration with relation to prices are observed. The most important duty of the State Fuel Administrators is to see that the supply of fuel in their states is equitably distributed at fair prices.

into effect at once, however, because of previous contracts which had been made, enforcible by law, at much higher figures. But it is extremely probable that, had not this law been passed and the Fuel Administration established, the price of coal for the country would have been at least $2.00 a ton higher than it is, for prices under the competitive plan undoubtedly would have continued to advance. Even at the conservative estimate of $2.00 a ton, the saving on 550,000,000 tons of bituminous coal would be $1,100,000,000.

The prices first fixed have been somewhat modified by the Fuel Administration, acting under presidential approval. In price fixing the Fuel Administration has had the problem to strike the nice balance which will result in the greatest benefit to the people of the United States; a price high enough so that there shall be increased production over that of previous years, but not so high as to place too heavy a burden of cost upon the people. In the case of bituminous coal it is to be noted that the plan has been to fix the price so that each operator shall receive a limited profit. Hence the price is relatively low for coal from the thick seams, easily and cheaply mined, and high for the thin and poor seams from which it is more expensive to mine.

The difficulty of the problem may be illustrated by the very small mine which under ordinary circumstances would not be able to operate. Many of these properties do not even have railroad facilities; these are known as "wagon mines." In consequence of their lack of facilities they cannot produce coal as cheaply as the larger mines with better facilities; hence if they are operated at all, it is necessary for them to receive a high price for their product, which is no better; indeed, is likely to be on the average poorer than that from the large mines.

While differences in prices exist for like products in the same districts, it has been the aim of the Fuel Administration not to make the differentials greater than necessary in order to secure a great production. The larger part of the variations in the prices announced for bituminous coal is due to difference in quality of the coal and to freight differentials.

The practice followed is in complete contravention of economic theories accepted before the war. If a mine were rich and conveniently located it gained a much larger profit per ton than did the poor mine badly located. The owner of the better property gained all the advantages of cheapness of operation and convenience in transportation. Even with the prices fixed, this is still the situation to a considerable extent, but the effect of the price fixing is to reduce the differences between the gains of the rich and the poor mine.

Under the fuel law another method of attack would have been possible. The law authorized the government to be the exclusive buyer and seller of the coal of the country. Had this authority been used, the coal mined would have been sold to the Fuel Administrator at a fair profit for each operator. The coal, then the property of the Fuel Administration, could have been pooled and sold at prices dependent upon its value, taking into account its thermal power, its other qualities, and its position in the country in regard to freight and demand, the prices being fixed so as to return to the Fuel Administration its cost with a sufficient amount to cover administration. Indeed, this was the plan of the Federal Trade Commission, except that the plans of the Commission went even further and required the operation of the mines.

Had this suggested procedure been followed, the inequality of cost of the same quality of coal at the same place would have been avoided. The Fuel Administration, however, would have had the extremely difficult problem of determining the cost of the production of coal at each mine, dependent as this is upon so many complex factors, including the cost of labor, reduction of the value of the mines due to extractions of material, the depreciation of permanent property, and the interest on the investments. The method would also have placed upon the Fuel Administration the entire burden of apportioning and marketing the coal, a gigantic undertaking. While, therefore, the method of buying coal by the government and pooling the same might be theoretically advantageous, its difficulties were such that the alternative of price fixing was chosen.

One of the most difficult and important of the problems with which the Fuel Administration had to deal was that of apportionment of the available supply of coal. The excess in the demand at various places during the summer of 1917 was very considerable as compared with that of previous years, and there was fear of an absolute shortage on account of insufficient transportational facilities. This situation was accentuated by many manufacturers buying far in advance of their ordinary needs at high prices before the Fuel Administration was established. As illustrating a case of this kind, announcement was made October 2 that the Fuel Administration had discovered at one factory a reserve of 204,000 tons of coal—a year's supply.

Supply for the railroads had to be considered first, that they might operate to their full capacity. In consequence of this fact, on October 11 when it appeared that there was a shortage for the Pennsylvania Railroad, an order was given that a sufficient amount of coal should be furnished so that the road might continue full operation. Similar orders were later made to cover the Baltimore and Ohio, Chesapeake and Ohio, Lehigh Valley, the New York, New Haven and Hartford, and the Central New England railway companies. Under these orders the railways have priority over contracts.

Probably next to the need of the railroads were those of the steel plants and coke plants, in order that these products might be available for munition and other war materials. Therefore the Fuel Administration arranged with the steel mills and coke plants that their necessary needs should be supplied.

Next came the necessity for accumulating coal at the upper lake points before the close of navigation, at Chicago, Milwaukee, Superior, and Duluth. Otherwise it would be necessary to make all-rail shipments from the mines to the consuming place in the territory tributary to the lakes during the winter; and this would make an excessive demand upon cars—the point at which the shortage is most acute. Hence it was necessary that the customary supplies be accumulated at lake points before the end of November, and accordingly it was ordered on October 5 that the accumulation of coal at the upper lake ports should have priority over the accumulation elsewhere. In order to deliver the largest amount of coal, iron ore boats which brought ore down the lakes were compelled to carry coal up the lakes on their return trips.

By giving Great Lake ports priority, the Fuel Administration succeeded by November 2 in accumulating at the lake ports as much coal as usual at that season of the year and the priority order for the Northwest was suspended on lines east of Pittsburgh. Later, further modifications of the priority orders were made, diminishing the amount of coal which went to the Northwest, and on November 30 the priority for the Great Lake ports ceased altogether.

Because of consideration of these three demands the coal supplies became reduced to very low minimums in a number of states, so that alarm was created as to whether the industries would not be shut down. The situation was especially acute in New England, Ohio, and Michigan, and at the cities of Washington, New York, and Chicago. Whenever a case arose, however, in which it appeared that there was necessity for immediate action in order to relieve the coal shortage to keep industry in operation, there was diverted a sufficient amount of fuel to prevent actual cessation of industry. As illustrative of the sort of action necessary to meet local needs, it may be said that all the coal mined on October 29 in western Pennsylvania, Ohio, Michigan, eastern Kentucky, and West Virginia, was diverted to Ohio and Michigan for distribution to householders. This suspended for one day the priority order under which coal was to go to the lake ports.

To increase the efficiency of the cars of the railroads and to increase the proportion of transportation by water, it was announced on November 7 that the formation of the "Tidewater Coal Exchange" had been approved. This exchange requires all shippers of coal to New England, Baltimore, and Hampton Roads to work through this exchange. This pooling of coal and classifying of grades should result in very greatly increasing the efficiency both for cars and for vessels, since there may be prompt unloading of the cars to any vessel which may be available.

On November 12, in order to relieve the situation in New England and to accumulate coal in advance, it was ordered that all mines having contracts for New England coal should ship maximum amounts for consumption to the states of Maine, Massachusetts, Vermont, Rhode Island, and Connecticut. Thus it became possible in November to begin the accumulation of coal in the central and eastern states, and this accumulation went on rapidly after December 1.

Another aspect intimately associated with the coal for the United States is that for Canada. In consequence of the threatened shortage in the United States, and especially because of the fact that there had not been accumulated coal at the upper lake ports, on September 14, the Fuel Administrator requested the Exports Administrative Board to allow no coal to be exported out of the United States without specific license. On October 1, exportation of fuel to Canada was prohibited to dock companies and all producers and jobbers. Coal on the way to Canada was diverted to the Lake Erie ports for transmission to the upper lakes.

It was not the intention, however, to prevent Canada from having an adequate supply of coal; on the contrary, it is the purpose to furnish coal to that country on the same basis that coal is furnished to the states. Since the output of the mines probably will be about ten per cent more than last year, the plan is to supply Canada during the rest of the year at a rate not to exceed ten per cent more coal than was exported to her last year.

The United States is not the only country which has been confronted with a fuel problem during the war: indeed the same problem has confronted every country engaged in the war, and far more seriously than the United States. Of these countries, England has the largest supply of coal. The government took control of all the coal mines in the United Kingdom, the owners operating the mines. The cost of production is supervised by the government. Thus, for the most important element in the cost, that of wages, all arrangements between the miners and the operators must be approved by the government. The maximum profits on coal are limited. The government requirements are given priority in the distribution of coal and the allotment of coal cars. There is a fifty per cent excess profit tax on the profits of the mines over those of the two best years of 1911, 1912, and 1913.

In France the state has been made the sole depositary of the coal. The general and municipal councils act as dispensing agent. Paris, her suburbs, and other cities have been on coal rations. Coal cards have been issued, so that a central heating plant, a business, or an industrial plant may each receive its fair allotment of the diminished supply of coal. For domestic consumption the quantity of coal per month is based upon the number in the family.

The Italian government produces no coal. It imports all the coal of the country and acts as a clearing house for its distribution.

In Germany the control of coal has been centralized under the government administration.

That there has been fuel shortage in all countries engaged in the war is due largely to the fact that this is a war of coal-driven machines. This war differs from previous wars in that to a vastly greater extent than ever before its prosecution depends upon machines, that is, upon mechanical power instead of man power. This is the first great war which has been fought since the modern concentration of industry. This is indeed a war of machines driven by engines: of gigantic guns, of shells, and other explosive devices: of ships and railroads; and behind these, the necessary multiform supporting manufactures, of which iron is the most important. Any and all of these are possible only through the use of coal.

Coal, therefore, lies back of the war efficiency of all nations. The nations that possess abundant supplies of coal are in an enormously advantageous position. Germany's original strength in coal—and in addition to that she immediately acquired control of the coal fields of Luxembourg, Belgium, and northern France—has given her a superiority in coal power as compared with France and Italy which has placed her in a most advantageous position. Great Britain is the only one of the nations of Europe that has coal power commensurate with that of Germany, and she has been compelled not only to furnish coal for herself, but also to furnish a large amount of coal to the rest of the Allies.

Of all the nations engaged in the war, however, the coal power of the United States is by far the greatest. Indeed our production of coal before the war was more than equal to that of Germany, England, and France combined. But even in the United States the enormously increased demand for coal for railroads, for munition plants, for shipbuilding, and for government use, has made greater requirements than can be met. This limitation, however, is not that of the mines. The limitation to some extent is that of labor at the mines, but to a far greater extent that of the railroads.

The railroads are unable to furnish cars to transport the necessary coal. The magnitude of this task frequently is not appreciated. The tonnage of coal handled by the railroads is greater than that of any other commodity; indeed greater than that of food. About twenty-five per cent of the motive power of the roads is used in handling coal.

As the war continues it is certain that the demand for coal will continue further to increase. Since the production of adequate coal is fundamental in order to dominate, as our coal resources make it possible, in the mighty mechanical contest of winning the war, it is absolutely essential that the railroads shall have sufficient equipment in coal cars and motive power to furnish the necessary amount of coal; and whatever steps are necessary to put the railroads in this situation must be taken. If adequate steps be taken to bring to bear all the potential possibilities of our vast coal and iron resources, in the war of mighty machines driven by the energy of coal, we shall overwhelm the enemy.

PHOTOGRAPHY AND ORNITHOLOGY

A SERIES OF PHOTOGRAPHS REPRODUCED FOR THEIR SCIENTIFIC VALUE, AS EXPRESSING THE NORMAL BIRD IN ITS MOST CHARACTERISTIC POSE

BY ARTHUR A. ALLEN

Assistant Professor of Ornithology, Cornell University

As the study of the living bird assumes a more important place in ornithology, photography becomes increasingly valuable. With the camera, complete and instantaneous records of observations can be made, and accurate representations of the living birds can be preserved. It must not be thought, however, that the camera is infallible. For, while it can reproduce the living bird nearly as realistically as can the art of taxidermy, a poor photograph is more dangerous to ornithological science than a poorly mounted specimen is to a museum, because, with seeming truth, it often conveys an entirely erroneous impression. Technical faults of exposure and lighting, distortion due to foreshortening or due to shallowness of the focal area, render imperfect a great many of the pictures taken. Or a photograph may be perfect technically and still, owing to unnatural setting or to an unnatural position of the bird, have little scientific value. Indeed a large percentage of good bird photographs, instead of showing the real character of the bird, show only the bird's response to fear.

A perfect photograph shows at a glance what pages of text would fail to convey. Moreover, it shows it more accurately, and it conveys exactly the same impression to everyone. In fact, the value of a photograph can be measured by its degree of superiority over a written description. The percentage of perfect photographs obtained by even the most experienced bird photographer is always necessarily small.

The accompanying photographs have been selected from the author's entire collection. With the exception of the least bittern, the birds are devoid of fear and oblivious to the presence of the photographer.

A WATER CHICKEN AND ITS NEST

The Florida gallinule, water chicken, or mud hen is about the size of a bantam and has many henlike notes including a loud raucous cackle, quite startling when heard close at hand. The gallinule belongs to the same family as the rails, and although it has the typical long, slender toes without webs, it swims readily. It does not usually venture far from the shelter of the reeds, however, and at the slightest alarm it patters across the water for cover. Its large, spotted, coffee-colored eggs are laid in a shallow nest of dried flags. If the water in the marsh rises, the nests are often built up a foot or more to keep the eggs dry

Wood pewee, a bird of the orchards and shade trees.—The mother bird is standing composedly by her nest on a dead branch after having fed her one remaining youngster. The nest is a shallow structure ornamented with bits of lichen, a concealing device employed also by the humming birds and gnat catchers

Yellow-breasted chat, a strange warbler.—This is the wariest, most timid, and therefore the most difficult to photograph of all our birds. During the breeding season it is often seen to spring from the top of a tree and, with dangling legs, jerking tail, and wings that seem disjointed, to flop through the air like a bird wounded and striving to reach the adjacent tree before falling to the ground. Its notes resemble everything from the clear whistle of a boy calling his dog, to the cry of a startled feline, or the chugging of a motor cycle climbing a hill

Smallest of our birds, the ruby-throated humming bird.—Here is a glimpse of the humming bird's home life. The young birds have their mouths open and are about to be fed with the nectar and minute insects that the mother bird has brought back in her crop. In feeding she inserts her bill far down into the throat of the young bird and injects the food into its crop. This particular nest, with its concealing lichens, is saddled on the branch of a pitch pine, a rather unusual site

A SECRET IN THE CAT-TAILS, THE HOME OF THE MARSH HAWK

To portray character is the ambition of an artist, but here the camera has caught the wild, fierce nature of the hawk just as the bird has alighted upon its nest and glanced about to see if all is well. The marsh hawk is a bird of open fields, shores, and marshes, and seldom alights in trees. It feeds mostly upon mice and frogs but sometimes takes birds. Its face is somewhat owl-like, owing to its large, though concealed, ears and, as with the owls, hearing probably plays an important part in the bird's pursuit of mice as they dart about in the long grass

SPRINGTIME SPARROWS THE SONG AND WHITE-THROATED

Birds and flowers are always associated, and with the blooming of the saxifrage and hepaticas come the song sparrows and whitethroats. The restlessness of the song sparrow and the composure of the whitethroat, so characteristic of each species, are here depicted as the two birds meet at the feeding station among the wild flowers. Feeding wild birds has become almost a pastime in many places. It saves the lives of many birds in times of stress, it gives much pleasure to those who can watch the feeding stations, it gives profit to the neighboring gardeners—and it makes unlimited opportunities for the bird photographer. It is in winter that food is most needed by the birds, but it is appreciated all through the spring and even in summer

AN EMBLEM OF PEACE, THE MOURNING DOVE

The camera has here caught a mourning dove in a pose true to its nature. Since the extermination of the passenger pigeon, this has been the only species of wild pigeon found in northeastern North America. Doves are poor nest builders and their crude platforms of sticks are often dislodged by storms. They usually select a stable site, however, and this nest, wedged against the trunk of a willow about fifteen feet from the ground, is quite secure. The soft cooing notes of the mourning dove are familiar sounds about orchards but they are not enjoyed by superstitious persons or others given to pessimism

RESTING GREEN HERON AND CONCEALING POSE OF LEAST BITTERN

Judging from this photograph, one could never guess the anatomy of the heron tribe. The long slender neck, so useful in spearing fish, is folded back on the shoulders and entirely concealed by the long feathers. The long legs also are partly concealed, and were it not for the long sharp bill and the short tail, one might suppose it to be a bird of ordinary shape.

Herons of all species while immature are either trustful or stupid and allow a close approach especially in a boat, but the adults are notably wary and thus are difficult subjects to photograph

The poses assumed by some birds when alarmed are quite suggestive of mimicry, seen most commonly among insects and rare in higher forms of life. This least bittern, normally shaped somewhat like the green heron, has stretched up its neck, pointed its bill upward, and drawn the feathers of the foreneck to a point, so that it simulates a broken reed or cat-tail and might be passed unnoticed. Indeed the writer, upon discovering the nest, actually counted the eggs before he noticed the bird perched in this position on the back of the nest

A WATER BABY'S FIRST SWIM

The young pied-billed grebe, just out of the egg, has struggled from the nest and the anxious mother is watching its first efforts at swimming. The pied-billed grebe, "water witch," or "hell-diver," is one of the most interesting birds of our ponds and marshes. It builds a floating nest of débris, anchoring it to the rushes, and when alarmed, quickly covers its eggs and dives from sight. Formerly this led to the belief that the grebes did not incubate their eggs as do other birds. The young birds have a striped pattern of black and white. The protective value of this is illustrated in the young bird crouching at the front of the nest. The young birds frequently climb on the back of the mother, and when there is any cause for alarm, she covers them with her wings and dives from sight

A water sprite, the Louisiana water thrush.—This is a bird of ravines and cascades. Ever tilting its body as though it had difficulty in balancing on its slender legs, it runs lightly over the wet stones. This photograph shows it resting for a moment in midstream, its bill full of black fly larvæ picked from the rocks in the swift current. Its young are near in a nest on a moss-covered ledge overhung with roots and ferns

A rocky cradle.—The killdeer builds no nest but merely scratches a hollow in the ground. The young killdeers do not need a soft nest because they are able to run about as soon as they hatch from the eggs. The killdeer formerly was shot as a game bird but it is now grouped with other migratory, insectivorous birds and given the protection that it deserves. Killdeers frequent fields, shores, and ploughed ground, sometimes far from water, and feed upon locusts, cutworms, and other insect pests

Thin as a rail.—The proverbial rail was more likely a fence than a bird, but thinness is quite as characteristic of these strange birds of the marshes. The body is compressed like that of a flea, to enable it to slip through the dense vegetation. Here a Virginia rail is sneaking to its nest

THE MEADOW LARK, A BIRD OF THE FIELDS

The meadow lark is ever alert and watchful, wary yet not timid. It is here shown perched on a rock in the grass near its nest. From the flirt of the tail to the glint in the eye, it is a wild, free meadow lark, unabashed by the presence of the concealed camera. In its bill are some insects for its young. Indeed the meadow lark is one of our most valuable, as well as most striking birds, consuming with great avidity grasshoppers, cutworms, army worms, white grubs, and other destructive pests of the field and garden. It is found in open fields throughout the eastern United States, and its clear plaintive whistle of several notes is one of the sweetest sounds of spring. In the West it is replaced by a very similar species, whose song, however, is quite different

SHEATHBILLS ON THE COAST OF SOUTH AMERICA

The sheathbills or kelp pigeons are allied to the shore birds, coming up in the fall from islands hundreds of miles south of Cape Horn where they nest, and spending the winter months along the beaches of South America. The crews of sailing vessels when passing through the Strait of Le Maire between Tierra del Fuego and Staten islands in the winter often see the birds flying out from shore to circle about their ships

Narrative of a Bird Quest in the Vicinity of Cape Horn[1]

By ROLLO H. BECK

ON THE twenty-eighth of December, 1911, we hoisted anchor at five thirty o'clock in the morning and started south from Hermite Island for the Horn. Before an hour had passed fog was pouring over Hermite Island, and the wind increased to a strong breeze. We headed in behind Jerdin Island and dropped anchor once more. The wind died down in the evening, and on the twenty-ninth we turned out again at five o'clock and got under way. A light northeast wind carried us down to Horn Island, and we rounded the Horn in flying style as the wind freshened on nearing the cape. Being in a small boat and the wind off shore, we passed close along the southern side of the island, taking photographs of the cape from different angles and, although at times sailing with the rail under water in the sudden fierce gusts that swooped down off the high cliffs of the promontory, we enjoyed to the full this pleasant passage of the Horn—a trip I had many years longed to make. Shearwaters and albatrosses swung high and low around us, and the rapacious skuas hurried from one flock of fishing birds to another in search of food, while the timber-strewn beach reminded us that the stories of wrecks credited to this point were not all fables.

We sailed to the southward about ten miles, but the breeze freshening, we turned back, and by the time Herschel Island was gained a heavy wind hurried us up the South Sea Pass to an anchorage at the southernmost point of Wollaston Island. We were held at Wollaston Island a week by prolonged gales, but found much of interest there, discovering and photographing sooty shearwaters' nests being the most important work. Near the top of a rocky ridge I found my first nest of this shearwater, and glancing up as I reached it, saw Cape Horn looming over Herschel Island just below me. When I thought of the thousands of sooty shearwaters I had seen about the islands of southern Alaska, and the hundreds of thousands in Monterey Bay, California, it seemed as if I had made a long journey before I finally laid my hands on my first nest within sight of Cape Horn. For ferocity in nesting birds I have yet to see the

When making long voyages the sextant is one of the instruments used by the navigator to determine his position. The above scene suggests to the initiated that eight bells soon will be struck and the man at the wheel relieved

[1] Conclusion of article begun in the January JOURNAL. Article and illustrations copyrighted, 1918, by Rollo H. Beck

A steamer trip through Beagle Channel or Smyth's Channel in winter is most interesting. The snow-covered islands with narrow channels between are always presenting new views of surpassing beauty, and although the fog may hang low for a time, one always has the hope that the next turn of the channel will reveal sunshine ahead

At Bertrand Island which lies only fifty miles north of Cape Horn, a few hundred sheep are raised yearly. The owner transports the surplus animals in his schooner "Antarctica" to Ushuaia, a small town in Tierra del Fuego, and his sailors are shown here passing a cargo from the lighter to the hands on board. The high price of wool and mutton makes the business a profitable one at present

equal of the sooty shearwaters. They scratched and screamed and were utterly unmanageable, absolutely refusing to remain in any position in the nest where their heads would show. After several birds were tried, I finally took one photograph with the bird ramming her head far up in a crack in the after part of the nest. Alaskan scenes were brought back to memory here also when I unexpectedly flushed a large seed snipe from the top of a rock-crowned ridge. The actions and color of the bird were so like those of the crouching white-tailed ptarmigan that squatted by lichen-marked rocks on the rocky peaks about Seward, Alaska, that I wondered at the resemblance. I spent much time trying to obtain specimens and did find a brood of young, but the old birds eluded me until later.

The adaptability of the beeches, the principal tree of the southern forests, was shown here also. One could find within thirty yards trees from thirty feet or more tall down to creeping ones that could not exist if they raised their branches six inches above the granite rocks over which they crept. It was merely a question of location. One could walk along under the trees below a ridge, but as he began to get up where the wind from the west swept across, the branches suddenly multiplied and in some places were so thick that it was not difficult to walk along on top of the growth. When one got a little higher, however, where the unrestricted lash of the wind was felt, the branches dropped down into vinelike runners, and crept along for yards over the face of the granite rocks and boulders which littered the mountain-sides. Here also we saw burrows of the sea otter and the well-worn trails leading from the water up to them. Although we had seen many shells of the delicious centolla crabs at rocky points where otters had been feasting, not an animal did we encounter. We enjoyed on several occasions the excellent mussels which occur in such abundance in this region, and which in winter probably form the principal diet of the Indians. Centolla crabs we preferred to lobsters, which had been fed to us in abundance on Juan Fernandez Island the year be-

Fewer than a hundred of the fast disappearing Yahgan Indians of southern South America now remain, and the absence of children about their settlement at Rio Douglas, Navarin Island, is the most noticeable feature to the traveler who has seen the abundance of children about other Indian villages

CROWDED QUARTERS ON SHIPBOARD

The bird student who makes a specialty of collecting large birds often finds himself hampered by lack of room. While a dozen sparrows might be prepared on his lap or on a small box, a dozen geese require more space. The hold of a ship and a large packing case prove ideal. The presence of one hundred sheep also in the hold is not necessarily detrimental to the work, especially in winter when the temperature drops below zero

ROCK HOPPER PENGUINS

At the left, two rock hoppers on their nests, with their mates standing close by; at the right, parent rock hoppers, their helpless offspring between them. The nest of this species is merely a depression in the ground, sometimes with a few grasses for lining. The rock hopper is an odd-looking fellow, clothed in slate-gray and white, with a bright red bill and erectile head plumes of sulphur-yellow. Like all penguins he is very sensitive to light. Note that three of the birds in the photograph have their eyes partly closed because of the brilliancy of the sunshine fore. The sailors caught very few fish for some reason, but the mussels and crabs and a couple of young fur seals which the captain palmed off on us as canned mutton proved very welcome additions to our larder. We used the wild celery in soup, and the Italian polenta, made of cornmeal and chopped duck and plovers, prepared by our captain, who sometimes took charge of the culinary operations, was excellent.

The wind subsided somewhat on the fifth of January, and we sailed around to the northern side of Wollaston, proceeding the next day to Bertrand Island, on which is probably the most southern sheep ranch in the world. A few years ago some sheep were kept for a while on Wollaston Island, but the Indians gradually killed them off. Bertrand Island is owned by Captain Grande, with whom I sailed a couple of times around Tierra del Fuego Island. His family being at the ranch when we arrived, we were treated to a piano recital by the daughter and tea and cakes by the *señora*, which brought us quite within civilization again.

We spent the next night anchored at Rio Douglas Mission, where the Yahgan Indian is making his last stand against extinction. It seems to be a losing fight, for the kindly, conscientious missionary, Mr. Williams, who had been in the country many years, told us not more than eighty remained of the hundreds that roamed the straits thirty years ago. When we visited them, only a dozen were about the encampment and, although there were at least four women to be seen, only a single child was noted, a babe in arms. The colony differed in this respect from the Indians of other localities visited, where as a rule one found from four upward to be the average number of children to each woman. Although Darwin, on his memorable voyage in the "Beagle," decided that this was one of the most degraded of human tribes, we found some of these Indians at least able to understand and speak a little English and Spanish besides their own language. Two of the men were working in the garden adjoining their huts, but the others seemed to have no pressing labor on hand. Several of them, however, the next morning gave us a hand in towing our boat out of the river against the tide, and we passed northward through the Murray Narrows to the Beagle Channel and headed back toward Punta Arenas. Our progress was somewhat slower going westward, as the winds usually blew from that direction. For forty miles the channel nowhere exceeds four miles in width, and it narrows down to less than a mile at one spot. The mountains close to the channel run up three thousand feet or so, although French Peak, seven or eight miles back on the Tierra del Fuego side, stretches up more than seven thousand feet. Several glaciers crawl down and drop their ice into the cold waters of the channel, and the trip through this part of the archipelago is one of exceeding interest.

One morning, just after passing the most picturesque part of the journey, we saw smoke curling up from behind a point of land near us, and on investigation discovered an old Indian and his squaw camped on the gravelly beach, preparing to enjoy a repast of boiled young shags. The manner of cooking the birds was most simple: they were grasped by the neck in the same condition as when taken from the nest and deposited in a kerosene can half full of boiling water. As the lower bird in the can became cooked it was hauled out with a stick, and an uncooked bird pushed down in its place. A small cat and three dogs accompanied the Indians, who later came paddling past our boat in their little dugout canoe with dogs, cat, fire, and food distributed promiscuously from stem to stern.

Although we had started westward in Beagle Channel on the eighth, the head wind and bad weather retarded us to such an extent that Brecknock Pass, about a hundred and fifty miles from Murray Narrows, was not reached until

One of the striking effects of the heavy gales that sweep the Cape Horn region is shown in the photograph of the western end of Gable Island which lies in Beagle Channel and thus is fully exposed to the prevailing winds. Gable Island has been used for a sheep range for many years, the owners finding a ready market for their mutton at Ushuaia, the Argentine penal settlement a few miles away

The most southern ranch house in the world is situated on Bertrand Island, Chile, about fifty miles north of Cape Horn. The house can be seen at the right-hand side of the photograph, and the schooner "Antarctica" which, with the island, belongs to Captain Oreste Grande, is shown on the left. Navarin Island, in the back ground, is the home of hundreds of guanacos. Many are killed in winter when they are forced down to the seashore by heavy snowfall in the interior

The higher peaks of the southern islands are seldom seen, being usually hidden by enveloping clouds, but when the veil is lifted for a short time, one gets views of cold precipitous cliffs, as was the case when the above photograph was taken

Ushuaia is situated on the south side of Tierra del Fuego Island, and contains a large prison in which are confined the worst criminals of Argentina. The prison, which is modeled after a Philadelphia one, contained about eight hundred prisoners in 1915, and was still unfinished. A small steamer makes frequent trips from Punta Arenas, and a monthly trip is made from Buenos Aires. A small wireless station keeps the inhabitants posted on the happenings to the northward of them the nineteenth. As we reached the pass the squalls increased, and we had to run in and anchor. Rain, hail, or snow would sweep over the island in a sudden squall, after which, perhaps, the sun would shine for a few minutes and then be blotted out by another squall. While awaiting fairer weather, I climbed up to the top of Brecknock Island and obtained several of the large seed snipe first seen on Wollaston Island. On a nest with four eggs, by the side of a small rock, a sitting bird was wholly exposed to the beating hail squalls. One of these passed over just before I reached the nest, the cutting pellets driving with such force that I could not face them. A couple of broods of half-grown young were seen running about among the rocks, but they were as invisible as young terns on a gravelly beach the moment they squatted down to hide.

Heavy seas and squalls drove us back three times when we essayed to weather the point into the open Cockburn Channel, and the third time we drifted on to a sunken rock when edging in to anchor. Although we ran out the kedge anchor, it was not until a substantial rise in the tide assisted us that we finally slid off our precarious perch. The fourth trial was successful and we ran out into Cockburn Channel at five o'clock on the morning of January 22. Heading northward before a fair south wind, we made the ninety miles to Punta Arenas by seven o'clock in the evening, thus finishing a most interesting two months' trip in a locality where, unless one is provided with experienced help, he is very likely to be reported missing, as were the two youths we met during our short cruise.

Although the trip had been well worth while, and a most interesting lot of material had been gathered, I had not obtained the yellow-nosed albatross, one of the most desirable birds of the southern ocean. Meeting Captain Grande, who was carrying firewood from Beagle Channel to Rio Gallegos, about forty miles north of Magellan Strait, I bargained with him to run out to Diego Ramirez Island with me after he had discharged a small cargo at Ushuaia, the Argentine penal settlement just across Beagle Channel from Murray Narrows. It was two months before we got away from Punta Arenas and it was April 7 before we reached Lort Bay again, having had to turn back on account of bad weather after getting a few miles outside of False Cape Horn. Diego Ramirez is similar to Ildefonso Island inasmuch as only a fair weather landing can be made. We remained at Lort Bay until April 20, having both anchors down most of the time, and howling gales with heavy snowfalls to prevent our leaving. As we had expected to return to Bertrand Island about April 10, we had taken only a couple of sheep and a guanaco to eat and these had been consumed by the twentieth. Therefore when clear weather showed on that date we sailed back to the captain's ranch and I decided, as the birds probably had left the nesting ground by this time, to take a chance on finding them off the south side of Tierra del Fuego as we sailed out of Beagle Channel. We took a load of sheep from Bertrand Island for Ushuaia and left Beagle Channel with a load of firewood for Rio Gallegos on May 6, but although wandering and black-browed albatrosses were seen, none of the yellow-nosed were sighted, nor were any seen on the run up the coast.

As winter time was near at hand and there was a probability of some of the pelagic Antarctic birds coming up along the Tierra del Fuego coast, I made a second trip around this island with Captain Grande, and in September hired his vessel for a run out to sea around the Falkland Islands down to Staten Island and back to Magellan Strait. In all these months I never once saw an unmistakable yellow-nosed albatross and finally gave up the quest as the summer time drew near.

A MIOCENE WATER HOLE

Preliminary sketch by Erwin Christman for a group of fossil skeletons from the great Agate Quarry in western Nebraska, to be placed in the center of the Tertiary mammal hall of the Museum. Four skeletons of *Moropus* are included in the group, one of which has been completed. The other five animals in the foreground are the giant pig, *Dinohyus* (right), and dwarf rhinoceroses, *Diceratherium* (center). The remains of these three animals are found in the quarry in great abundance and finely preserved. It was perhaps an ancient water hole where these animals came to drink and were caught in a quicksand bottom

The Mounted Skeleton of *Moropus* in the American Museum

A "CLAWED UNGULATE" FROM THE MIDDLE TERTIARY OF NEBRASKA

By W. D. MATTHEW

MOROPUS is a big extinct animal that lived in North America. It was one of the oddest looking beasts of its time, a combination of horse, rhinoceros, and camel or giraffe in its general appearance, but with enormous claws on the front feet and smaller claws on the hind feet, utterly unlike the hoofs of the ordinary ungulates or "hoofed mammals."

All of the large herbivorous animals today and nearly all of the extinct kinds have hoofs on the feet. They have no need for claws. The feet are used to carry them about, but not for attacking other animals or for tearing their prey or for digging, as in the clawed animals. This is so general a rule that it was long thought to be universal, a law of nature, and it was, in fact, included in the Law of Correlation expounded by the famous naturalist, Cuvier, a century ago. Horns and hoofs he declared were the exclusive prerogative of vegetarian animals. If the horns were in pairs, so too were the hoofs. Conversely, claws pertained to carnivorous animals for the most part, while no carnivorous animal had hoofs.

They tell a story about Cuvier to illustrate his confidence in this "Law of Correlation." It seems that one of his students, who desired to give the *Maître* a scare, disguised himself as the Devil, with the usual horns and hoofs and barb-tipped tail. He penetrated at midnight to Cuvier's room and, standing by his bedside, roused him from sleep with the announcement, "Cuvier, Cuvier, wake up! I am the Devil and am come to eat you up." The scientist gazed at him sleepily, looked him over for a moment, and replied, "Hmm—horns—hoofs—you're graminivorous. You can't do it." Whereupon he turned over and went to sleep again and the student retired discomfited.

But for all Cuvier's faith in his Law of Correlation, there are some exceptions, and our *Moropus* is one of them. Many years ago, when the first scattered bones of this animal and its fossil relatives in Europe were discovered, the teeth and skull parts were described as related to the rhinoceroses and the extinct palæotheres and titanotheres, all of them belonging to the Perissodactyl order of ungulates which includes also the horse and the tapir. The claws and other footbones were supposed to belong to an entirely different animal related to the anteaters. Cuvier himself described one of the great claws as a "pangolin gigantesque"—a gigantic anteater. It was many years before it was found that these skulls and these footbones belonged to the same animal. No complete skeletons have yet been found in the Old World.

In this country a few scattered bones of *Moropus* had been found thirty or forty years ago, but it was not until the discovery of the great Agate Spring Fossil Quarry in western Nebraska that much was known about the animal. This quarry was first discovered by Mr. James H. Cook, of Agate, Nebraska, and was opened up and worked on a large scale by the Carnegie Museum of Pittsburgh between 1904 and 1908.[1]

[1] They obtained a great series of skeletons of the little pair horned rhinoceros, *Diceratherium*, a skeleton of the giant pig, *Dinohyus*, and a number of incomplete skeletons of the *Moropus* from which a mount was reconstructed.

The American Museum has had parties working in this quarry for several years past, and has been especially fortunate in obtaining a whole series of more or less complete and finely preserved skeletons of the *Moropus*, besides quantities of other material. There are no fewer than seventeen skeletons, each being the bones of one individual, and the best of them are virtually complete.

Skeleton of *Moropus*, found in the great Agate Spring Fossil Quarry, western Nebraska, and recently placed on exhibition in the Tertiary mammal hall of the American Museum. Note the large claws on the fore feet although it belongs to the ungulates or hoofed animals. The big extinct *Moropus* was one of the oddest looking beasts of its time, a combination of horse, rhinoceros, and camel or giraffe in its general appearance, but as seen here, with enormous claws on the front feet and smaller claws on the hind feet. American Museum parties working in this quarry for several years past have been unusually fortunate in obtaining a large series of *Moropus* skeletons, no fewer than seventeen representing the bones of as many single individuals, and the best of them virtually complete

The task of extracting and preparing these thousands of fragile and delicate bones has been a long and difficult one, and it is only now that we have been able to place the first skeleton of *Moropus* on exhibition.[1] This is mounted in a standing position, the pose adopted representing the animal as looking off into the distance (toward the visitor as he enters the hall). Other skeletons, of both male and female animals, will be added later to form a group.

The *Moropus* was a relative—albeit a distant one—of the rhinoceroses, tapirs, and horses, and belongs with them in the order of Perissodactyls, hoofed animals with an odd number of toes on the hind foot. The ruminants,

[1] The field work and preparation of the specimens have been in charge of Mr. Albert Thomson of the Museum staff. The skeleton was mounted by Mr. Charles Lang. The technical skill, carefulness, and scientific accuracy through all stages of the work make this skeleton one of the finest examples of modern methods of dealing with fossil vertebrates. The visitor with a little constructive imagination can readily see in the skeleton the proportions and pose of the animal; and it is as accurately true to life as the most careful scientific study can bring about.

camels, pigs, and hippopotamuses have an even number of toes—either two or four. *Moropus* has three, like a rhinoceros or tapir. It is about the size of a rhinoceros, but very different in proportions. The head and neck are proportioned more like those in the horse, the rounded back suggests the tapir, and the legs, while massive, are longer than in the rhino, especially the fore limbs. The feet with their great claws are entirely different, and more like those of anteaters and similar digging animals than any of the hoofed animals to which *Moropus* really belongs. The front teeth are like those of ruminants, while the grinding teeth are most like some of the extinct Perissodactyls—the palæothere of Europe and the titanothere of North America.

The teeth show that the animal was herbivorous, of browsing habits, and quite inoffensive. What use he made of his big claws is rather a puzzle. They could not have been of much value for fighting, for the foot and limb are too stiff and clumsy to be used except for ordinary locomotion. For the same reason they could be of only limited use in digging. The anteaters and armadillos use their great claws in digging out ant hills; the sloth uses his in hanging from trees; the bear finds his claws useful both in digging and fighting, while the cat family reserve their sharp claws strictly for fighting. But bears and cats have much more mobile limbs and feet, and it is certain that the *Moropus* did not live on ants or any such food, and could not possibly climb a tree, much less hang from one. The teeth show clearly that his food was leaves and herbage, and that he cropped it after the fashion of a deer or cow. He was not even omnivorous like the pig, which does a considerable amount of digging after succulent roots and tubers with his snout though not with his feet.

The only plausible suggestion that has been made is that the great claws were designed to aid the *Moropus* in scraping away sand in dry riverbeds or other suitable places to make a water hole where he might drink. There is good reason to believe that the western country where he lived was even then more or less arid, with a scanty water supply in the summer or seasons of drought. In Central Africa today the animals congregate in great numbers around the scattered water holes, and some of them may dig out the holes more or less with their paws. Our *Moropus* could do that sort of thing to great advantage, and the powerful claws often might enable him to dig down in a sandy riverbed to water that otherwise would be beyond his reach.

The modern moose and caribou use their long and rather narrow hoofs not only to support them on soft ground, but also to dig down through the snow and uncover food beneath it in the hungry winter season. But it is not likely that the Western Plains was a region of cold winters and deep snows in the time when the *Moropus* lived there. Rather was it like Central Africa today, at least in the summer season, although not having a tropical climate the year around.

Courtesy of the New York Zoölogical Society

SMALL-MOUTHED BLACK BASS WINTERING IN NEW YORK AQUARIUM

Although the various species of fresh water fishes react differently to cold, it is known that many can endure very low temperatures, even freezing. Certain species of the North like the Alaska blackfish have extraordinary vitality, and when thawed out after lying frozen for many months will prove as lively as ever. In winter at the New York Aquarium the water flowing through the tanks sometimes reaches a rather low mark. When it is below forty degrees Fahr., some of the fishes become sluggish and take little food. Young yellow perches remain on the bottom but the young black bass poise in water, fifty or more compactly bunched, mostly heading one way. For the game qualities of black bass see *Fishes*, by David Starr Jordan, Vol. II, pp. 301–304

Democracy and Science

Each man, each idea, each theory standing for what it is, with all the "garment of make-believe thrown off"

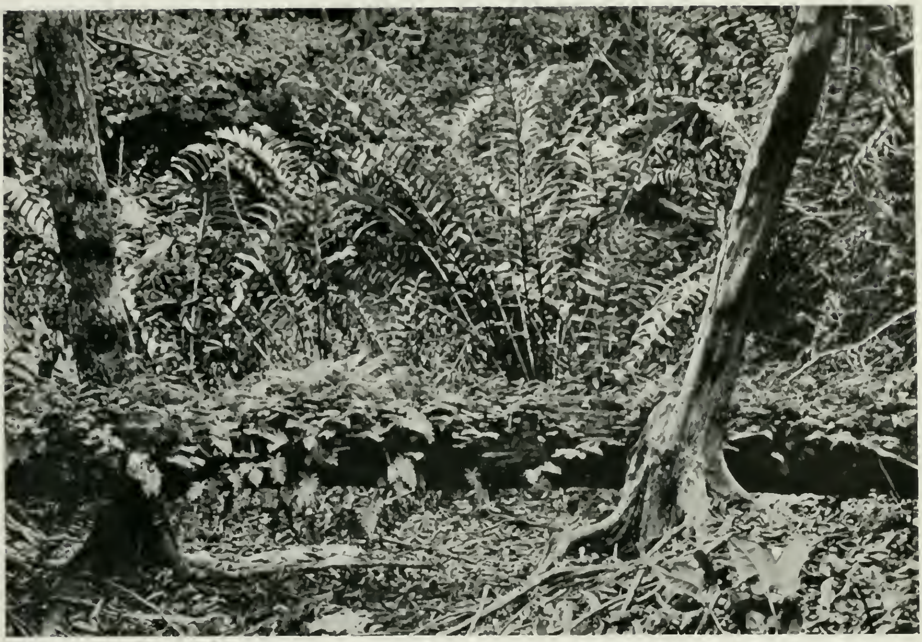
By DAVID STARR JORDAN

THE spirit of democracy favors the advance of science. Democracy seems at first to level, because it tears down all artificial props. All men start alike, and all ideas must struggle alike for existence. The tradition of a thousand years to a democracy, is, to borrow Huxley's phrase, "but as the hearsay of yesterday." And this should be true of all tradition in the face of truth. A truth is valued for what it is—nothing more. In a democracy truth stands on its own feet, as a man ought to, and opinion may be assailed from any side. Tradition does not help it, and there is no weight in authority. Democracy at last brings each one to his own. It is not a leveler. It is the great unequalizer, the power which makes each man equal to his own fate, regardless of the fate of all other men. And as no two men deserve the same in life, fair play must end in final inequality.

In the fields of Science, it is easy to notice the influence of political conditions on the individual point of view. The American worker applies his rules regardless of whether they affect great men or small. He knows no tradition large enough to check the movement of knowledge. Among the Scandinavians and the Dutch, in nations too small to obscure the democracy of learning, we find much the same feeling. In Germany, in France, even in England, the tradition of great names, the customs of great institutions, largely outweigh the testimony of things themselves. There is always a reserve of exceptions in favor of great men or the traditions of great institutions. The willingness to adopt new views, to utilize new classifications, to see things in new lights, is, broadly speaking, in proportion to the spirit of democracy by which a worker is surrounded. A perfect democracy means a perfect intellectual perspective—each man, each idea, each theory standing for what it is, with all the "garment of make-believe thrown off."

MAIDENHAIR GROWING ON THE PERPENDICULAR SIDE OF A LIME SINK

The shady or southern side of lime sinks often harbors such a luxuriant growth of this graceful fern that the eroded rock wall is completely hidden by drooping masses of brilliant leaves, giving the appearance of a green water fall. This plant grows as well on the horizontal hammock floor, concealing from view the numerous little well-like sinks. It thus makes walking in the hammocks dangerous. Scattered among the maidenhair may be seen a few leaves of the halberd fern, and in the shadow in the left-hand corner are a few leaves of the creeping wood fern. On the hammock floor, about the edge of the sink, is a plant of the strap fern with erect leaves, and to its right a cluster of leaves of the sword fern



Only after a rainfall does the resurrection fern expand its leaves and become green and as conspicuous as it appears on the prostrate log in the foreground. At other times the numerous leaves are curled up and shriveled, exposing only gray, scaly, lower surfaces, and the plant appears as a dead mass attached to the trunks of trees or lying on the branches. The spore cases are set in pocket-like depressions on the lower side of the leaf blade, thus helping to retain the spores during alternate expanding and shrinking of the leaves.

In the moist soil of the bottom of the sink are several plants of the leather fern. These remain fresh and green throughout the year, and sometimes attain a height of ten feet. The numerous spores and spore cases completely cover the lower surface of some of the leaflets with a red or brown feltlike coating

Ferns of Tropical Florida[1]

By JOHN KUNKEL SMALL

Head Curator of the Museum and Herbarium of the New York Botanical Garden

THE fern flora of tropical Florida is exceedingly rich. The number of ferns and fern allies in this region is quite remarkable when we consider that the area involved comprises only a few hundred square miles, a mere fraction of the state's large area. Although variety in soil and other physical features is slight, this area harbors more than fifty per cent of the fern flora of Florida. An overwhelming majority of the species are typically tropical American. In addition to these, there are several cosmopolitan and a few endemic ferns. Nearly one third of the species are epiphytic, living on the moisture of the air only, while anchored on trees or on prostrate logs. This condition doubtless makes up to some extent for the lack of variety in topography, climate, and soil.

Tropical Florida, as here understood, consists of two definite areas composed

[1] Written as preface for a new handbook on the ferns and fern allies of tropical Florida, now in preparation by Dr. Small. The illustrations are from photographs by the Author

BED OF BOSTON FERN IN AN EVERGLADE HAMMOCK

Sometimes occurring in impenetrable masses so dense that the tangle of living and dead leaves is firm enough to support a man walking three or four feet above the hammock floor, the vinelike leaves of the Boston fern clamber over shrubs and up the trunks of trees, and hang over the branches. For length of leaf this fern holds the record. In a few favorable localities leaves more than eighteen feet long are not uncommon. The longest leaf on record recently measured was twenty-seven feet, two inches. A few scattered plants of the sword fern are shown here mingled with the Boston fern. Both are terrestrial and very common in the high pineland and Everglade hammocks; the sword fern is also epiphytic, growing on trunks and branches of various hardwood trees and thriving luxuriantly among the old leaf bases just under the crown of leaves on the cabbage palmetto. The sword fern is especially abundant in the Lake Okeechobee region of limestone and of coral rock. The one area comprises the Everglade Keys[1] (limestone), which are situated in the southeastern part of the Everglades; the other, the Florida Keys (coral rock and limestone), which are situated in the tropical sea. Although outside the bounds of the torrid zone, their vegetation, like that of their neighbors, the greater number of the Bahama Islands, is predominantly tropical.

The Everglade Keys consist of two main divisions, the Biscayne pineland[2] and the Long Key pineland. The former group is made up of about a dozen larger islands, which are mostly bounded by the Everglades on two sides and separated from one another by narrow channel-like intersecting prairies. The Long Key group has a much smaller area than the Biscayne pineland. It consists of about five larger islands and a few smaller ones. Both groups are of limestone, and they are slightly elevated above the Everglades. The rock is rather porous, and the softer spots of the almost universally exposed surface have been eroded mostly by leaching out, so as to form a surface honeycombed with all sizes of cavities having very ragged and sharp edges. These limestone islands are almost completely forested with the Caribbean pine (*Pinus caribæa*) which grows nearly everywhere on the exposed rock. However, the pine woods, or pinelands, are interrupted here and there by hammocks[3] or areas of hardwood shrubs and trees, some areas small and some much larger, although all taken together these comprise but a very small percentage of the region under consideration. The hammocks may be divided into two groups: First, the high pineland hammocks which are islands, so to speak, of hardwood trees in the pine woods. They are dry except for the water contained in deep lime sinks and in the humid air. They number about a score. Second, are the low pineland hammocks, indefinite in number and situated along the boundary line of the pinelands and the Everglades proper and prairies. These are usually high and dry toward the pine woods and low and wet along the Everglades or prairies.

The ratio of pineland ferns to hammock ferns seems astonishingly small. Only two kinds of ferns are naturally pineland plants. Even these two ferns will spring up in clearings in hammocks which have been partly destroyed either by nature or by man. The other fifty species of ferns are hammock plants! Their habit ranges from the stiffest to the most graceful, and their structure from the coarsest to the most delicate. The pineland species are strictly terrestrial in habit. The hammock kinds are to a great extent epiphytic.

The hammocks of the Biscayne pineland are rich repositories of ferns. Nearly all the kinds of ferns of tropical Florida may be found in them. The well-like lime sinks, the hammock floor, and the trunks and limbs of rough-barked trees are the habitats of the many species, and each and all form ferneries of indescribable beauty. They can be appreciated by the eye alone, even the camera falls far short of doing them justice. In some places the deep

[1] The word "key" (Spanish *cayo*, British *cay*), primarily applied to islands along the coast in and near Spanish speaking countries, largely replaces the use of the word "island" in southern Florida, and by the inhabitants is applied to islands in the Everglades as well as to the islands of the coasts and reef of Florida.

[2] These two groups of islands are separated from each other by a distance of three miles. The intervening Everglades contain a number of sloughs which represent the upper reaches of an unmapped river that flows southward and empties into the Bay of Florida. The larger or eastern group of islands takes its name from Bay Biscayne which washes the shores of one of the islands for a distance of about fifteen miles. The smaller group takes its name from Long Key, the largest island lying west of the sloughs referred to above.

[3] A hammock—the word probably of Indian origin—is a dense growth of mostly broad-leaved shrubs and trees, thus giving shade, in a pine forest or on a prairie. The use of the word is confined especially to Florida and adjacent states. It was formerly confused with the word hummock.

HIGH PINELAND HAMMOCK ON THE EVERGLADE KEYS

The strap fern (in the foreground) often produces tufts of leaves reaching as high as a man's head. This fern grows equally well in the humus of the hammock floor and on trunks and limbs of trees, throughout the southern half of the Florida peninsula as well as in nearly all parts of tropical America. It is more common on the Everglade Keys, although it grows sparingly on most of the larger islands of the Florida reef.

Sword fern and Boston fern may be seen growing among the plants of the strap fern. Back of the ferns is a dense jungle in which several kinds of air plants, both bromeliads and orchids, are growing on the tree trunks.

A PITFALL IN THE FLOOR OF A HAMMOCK

This mass of leaves of the halberd fern hides a lime sink, the stems of most of the leaves being wholly within the well-like hole underneath. The broad leaves grow from a foot to a foot and a half long; sometimes they are merely lobed, or they may be parted, or compound, and the divisions again lobed.

Scattered leaves of the sword fern and maidenhair may be seen, and four long narrow leaves of the strap fern are shown rising near the center of the mass sinks have their sides completely covered with mats of iridescent filmy ferns to the exclusion of all other vegetation, while adjacent tree trunks and logs are completely covered with another kind of filmy fern. The filmy fern is common in tropical America. It was not discovered in Florida until 1901. Some species are found in dense hammocks, growing on trees and shrubs both near the ground and high up, often covering trunks and limbs with masses that can be stripped off as mats several square feet in size. In other sinks the small halberd fern, the most abundant of the fern species, predominates, while in still others we find the honeycombed rock sides adorned with various ferns, filmies, maidenhair, halberd fern, wood fern, and spleenwort, not to mention the rarer holly fern.

The hammock floor is another kind of fernery. There the strap fern, various wood ferns, maidenhair, spleenworts, sword fern, and large halberd fern, comprise the most conspicuous kinds. One species of wood fern (*Dryopteris ampla*) is, at the same time, the most conspicuous and the most elegant. This is the largest of our shield ferns and grows in small lime sinks on the hammock floor. The erect rootstock is commonly raised a foot or a foot and a half above the surface of the ground, thus forming a trunk which supports a crown of beautifully arching lacelike leaves with a spread of twelve feet! Thus, in habit it is a tree fern. The large leaves separate readily from the rootstock, and in parting retain a dense tuft of brilliant red scales at the base of the petiole. Still other varieties of the shield fern prefer the hammock floor to the lime sinks, and in the dense jungle often grow very large. Leaves eight feet long with slender narrow leaflets are not unusual. A tangled mass of these large plants, covering from a square rod to a quarter of an acre, is a wonderful sight.

In these remarkable hammocks there are ferns everywhere—ferns underground, ferns on the ground, and ferns in the air. The trunks and limbs of rough-barked trees are actually clothed with masses of ferns, as well as with orchids and other air plants. The resurrection fern, the leaves of which shrivel and curl up in dry weather, but are restored to a perfectly fresh state by a rainstorm, the strap fern with its long narrow leaves, and the Boston fern, are the most common epiphytic kinds. The last mentioned has the distinction of having the longest leaves of any of our ferns, a length of eighteen feet being not uncommon, while the maximum length is twenty-seven feet and two inches. These long leaves often clamber like vines over shrubs and up tree trunks and hang over the limbs of trees. The climbing fern occurs plentifully in one hammock. Its stems and branches adhere closely to the stems of shrubs and trees, especially to the smooth-barked kinds. Occasionally it climbs up trees to the height of twenty-five feet. Palmetto trees are often conspicuous ferneries. Below the crown of leaves and growing from among the old leaf bases one often finds a collection of Boston fern, grass fern, hand fern, and serpent fern.

One rather extraneous area comes within our range, namely Royal Palm Hammock.[1] This is an Everglade hammock lying between the Biscayne pineland and the Long Key pineland. It has a low rock floor, which is covered with a foot or more of humus. Thus far it is not known to have any ferns that do not grow also in the hammocks of the rest of our area. There are about a dozen kinds of ferns common in its jungle.

The Florida Keys comprise two divisions of a chain of rock islands which are really situated in the waters of the

[1] Known also as Paradise Key. Now within a reservation with the official designation of Royal Palm State Park. See *Tropic Magazine*, 4: 5–16, 1916, and *Journal of the New York Botanical Garden*, 17: 165–172, 1916.

WOOD FERN OF TROPICAL AMERICA

The bed of which the picture shows a part, was several square rods in extent. Large areas of the floor in high pineland hammocks are often covered by this fern, especially where the shade is not too dense. The more or less horizontal blades of the arching leaves are commonly so numerous that they completely hide the ground beneath them. The leaves do not take root at the tip; the fern reproduces itself only by the myriads of spores which are distributed from numerous small spore cases borne on the under side of the leaves

Gulf Stream. These are the Upper Florida Keys (coral) and the Lower Florida Keys (limestone). The Upper Keys are for the most part long and narrow ridges of coral rock and are clothed with hardwood forests which harbor two species of ferns not yet known to occur on the Everglade Keys. The Lower Keys are more spread out, and rather less elevated above the sea. They are clothed both with hardwood forests and, in the case of a half dozen islands, with pine woods at least in part. The Lower Keys have as yet disclosed no ferns not already known on the Everglade Keys. In fact, the Florida Keys have a much smaller fern flora than the Everglade Keys. Only about one fifth of the species of the Everglade Keys have been found there. No doubt in their past the fern flora was larger than it is now. It may have rivaled or excelled that of the Everglade Keys, for the Florida Keys consist of two areas of different ages, coral and limestone; but this region has been for a long time decidedly on the wane.

In addition to the leaching process of erosion that has reduced the surface of the Everglade Keys, the Florida Keys have had the mechanical and chemical action of the sea to contend with, and the evidences of reduction are not hard to observe. Compared with the Florida Keys the Everglade Keys have had a very peaceful existence. The latter have been sheltered by their inland position, while the Florida Keys have received the hard knocks. These islands not only have been worn down and washed away by the never ceasing action of the sea, but also by the hurricanes of ages. This is quite evident. The rock surface, particularly in the case of the Lower Keys whose limestone corresponds to that of the Everglade Keys, is polished off and platelike, instead of merely leached out and honeycombed. What the former fern flora consisted of we cannot even imagine, but we are safe in assuming that it was more extensive than that which we find there now.

About two score years ago a writer on ferns, judging from a few collections that had reached him from southern Florida, predicted that more tropical American ferns would be discovered in that region. Since the beginning of this century his prophecy has been fulfilled by the discovery of about a score and a half of ferns and fern allies before known only from insular and continental tropical America.

This creeping wood fern is a "walking fern." The long tips rest on the surface of the rock, take root, and form new plants, which in turn repeat the process. The fern is reproduced also by spores which are borne in round spore cases on the lower surface of the leaves. This colony of walking fern was found growing on the perpendicular walls of a lime sink in a high pineland hammock

On the Use of the Diving Helmet in Submarine Biological Work*

By E. W. GUDGER

Professor of Biology, State Normal College, Greensboro, North Carolina

IN a number of the *Bulletin of the New York Zoological Society* for 1916, Dr. Alfred G. Mayer[1] referred incidentally to the use of a diving helmet for work in submarine biology at the Tortugas, Florida, Marine Biological Laboratory of the Carnegie Institution of Washington, and gave a figure of such an apparatus in actual use. In accordance with Dr. Mayer's customary liberality in providing everything available for furthering the work at Tortugas, the use of such a hood there was inaugurated in the season of 1915. At that time this helmet was a new thing, and its utilization for the study and collection of marine organisms in their natural habitat was thought to be its first use for such a purpose in the history of science. However, such is not the case.

At Tortugas, during the season of 1915, Prof. W. H. Longley and Dr. Lewis R. Cary did considerable experimental work with this diving helmet. During the summers of 1916 and 1917 the helmet was in very frequent use, both these men becoming quite skilled in descending to moderate depths and in studying the fauna and flora there. By its use Professor Longley was enabled to go down on to the coral reef off Loggerhead Key and there, in Dr. Mayer's words, "to become a fish among the fishes," which he studied literally at arm's length. Thus equipped and thus located, he has made observations of the habits of reef fishes as valuable as they are interesting. Furthermore, wearing this helmet and using a camera contained in a specially devised watertight metallic box, Professor Longley has been able to take some remarkable submarine photographs of the fishes in the rocky recesses of the reef, their home. Especially valuable are these photographs in the study of the changeable color phases of the fishes when under the influence of various emotions, or when changing from one colored substratum to another, or when varying with the amount of light received.[2]

The diving helmet[3] is really an apparatus as simple as it is effective for use at moderate depths. It consists of a barrel-shaped brass hood with a conical top having a handhold or grip for putting it on or lifting it off the head of the diver. In front, corresponding in position with the face of the diver, is a plate glass window through which the wearer makes his observations. At the base of the hood are metal flaps descending a short distance over the breast and back of the wearer but cut away in the region of the shoulders to let the apparatus fit snugly and securely around the neck and on the shoulders. To the back flap, and if necessary to the front one also, may be attached masses of lead to overcome the buoyancy of the diver and to hold him firmly on the bottom. Fastened to the hood is a rubber hose extending to the attending boat at the surface where it is connected with a double-cylindered hand pump worked by a long lever so attached as to compress the air in each cylinder alternately. The respired air, together with the excess of air driven into the hood by the pump, escapes under the edge of the hood in a great stream of bubbles. The shallow and wonderfully clear water at Tortugas makes it possible for a man sitting in the boat and using a "water glass" (a bucket having a pane of glass set in the bottom) when the surface of the water is covered with ripples, to see easily what is going on below and hence to regulate readily the amount of air sent down for the use of the diver. Professor Longley found that about eighty pounds of "ballast" were necessary to steady him on the bottom in water from eighteen to twenty feet deep, and that he could easily remain down for thirty minutes in comparative comfort.

[1] Mayer, Alfred G., Longley's and Reighard's Studies of the Reef Fishes of the Tortugas, Florida. *Bulletin New York Zoölogical Society*, 1916, vol. 19, pp. 1335–1336. 1 fig.

[2] Longley, W. H., Studies upon the Biological Significance of Animal Coloration. *Journal of Experimental Zoölogy*, 1917, vol. 23, pp. 533–600. 1 pl.

[3] Invented by Mr. W. S. Dunn of Miami, Florida.

* Indebtedness is acknowledged to Mr. W. F. Miller, president of the Miller-Dunn Company, Miami, Florida, for the use of the illustrations in this article, as well as for valuable data.—E. W. G.

The writer conjectures that the idea resulting in the development and use of this diving hood probably originated in the following interesting way. The building of that wonderful over sea railroad, the Florida East Coast Railway Extension, from Homestead to Key West, called for the erection of miles and miles of concrete viaduct, most of it in relatively shallow water. In this work the services of many divers were in constant demand. The work of such men called for hours of service and for quickness of movement when in the water, as well as for quick ascent to the surface and ready removal of the armor, rather than for protection from a great weight of superincumbent water. To meet these exigencies of service, the regular scaphander or diving suit was in the main abandoned, the helmet only being retained. The gain in ease of work while in the water, in quick ascent to the surface, and in ready removal of the helmet when in the boat, at once will be perceived by any one who has watched the snail-like movements of an armor-encased diver, his slow ascent to the surface, and the slower process of removal of the helmet. Wearing the helmet only, a diver, in case of danger or of trouble in the matter of his air supply, needs but to lift off the helmet to be driven to the surface like a shot. I have myself seen a diver, working on the railway docks at Key West, sitting on the bottom in twenty feet of water calmly sawing off piles with a one-man crosscut saw. When tired, or when his work was done, he would climb a ladder to the surface, his helmet would be removed and he would sit down quietly until wanted again. Then in three minutes he would be at his post.

The use of the helmet alone of a diving suit probably is common in shallow and clear waters the world over, but its use in the United States seems to be restricted to the clear waters of Florida.[1]

The use of the scaphander or diving suit in submarine work dates back to about 1839. Its use in biological work apparently is limited and recent. Its use in the commercial collecting of sponges, however, has attained considerable importance. Virtually all the vessels of the Greek sponging fleet having headquarters at Tarpon Springs, Florida, are so equipped. To this the writer can testify from personal observation of such a fleet forced into harbor at Key West by a hard "blow" in June, 1915.

The use of the diving helmet for submarine biological work would seem to have originated at the Tortugas Station in 1915, but such is not the case. In Quatrefage's *Rambles of a Naturalist*[2] may be found the data given below concerning the apparatus used in a search made by Milne-Edwards over the bottom of the Bay of Taormina on the southern coast of Sicily some time between March, 1844, and June, 1845.

"The apparatus employed by M. Milne-Edwards in these submarine explorations was that which had been invented by Colonel Paulin, a former Commandant of the Fire Brigade of Paris, to be used in case of fires in cellars. A metallic helmet, provided with a glass visor, encircled the head of the diver, and was fastened round the neck by means of a leather frame supported by a padded collar. This helmet, which was in truth a miniature diving-bell, communicated by a flexible tube with the air-pump, which was worked by two of our men, whilst two others stood ready to replace their companions."

The reader probably has come to the conclusion that this was a unique occurrence, the first of the kind in the history of the world, and, used for the purpose Milne-Edwards had in mind, it probably was the first; but history repeats itself. The full or closed helmet diving dress, essentially in its present form, was practically perfected by an Englishman, bearing the German name of Augustus Siebe, in his work on the wreck of the "Royal George" about the year 1839. This, however, was but a perfection of the open

[1] That the use of the helmet alone in diving is not a new thing, and that it did not originate as conjectured, I have ascertained since writing the above. Mr. Ernest Cotton of Marathon, Florida, division engineer of the Florida East Coast Railway, Key West Extension, has been in charge of the underwater work of the over sea railway since its inception in 1906. He informs me that although in his work very extensive use has been made of the helmet alone of the diving dress, it did not originate with this work, but that Key West divers had made use of it for some years prior to its use on the Extension. His men often have worked in forty-foot water with the helmet only, but his understanding is that Key West divers have gone twenty feet deeper without having to put on the full suit.

Even though this use of the diving helmet did not originate as has been conjectured, there can be no doubt that its use was carried to its present perfection in the submarine work necessitated in the building of the scores of miles of concrete work on this remarkable railroad.

[2] *The Rambles of a Naturalist on the Coasts of France, Spain and Sicily*, volume II of which, translated into English by E. C. Otté, was published in London in 1857.

Courtesy of Miller-Dunn Company

BECOMING A MARINE ANIMAL FOR STUDY OF UNEXPLORED TROPICAL SEAS

The diver is free to move about as he wishes to a depth of twenty or thirty feet, and to sit or recline in any position his work demands. As shown at the right, he can remove the helmet while under water (holding his breath in the meantime) and will be kept at the bottom only because he retains the weighted hood in his hands

Courtesy of Miller-Dunn Company

The diving helmet is extremely simple—a brass hood with a handhold at the top, a plate glass window in front, and lead weights below. Professor Longley found about eighty pounds necessary to counteract the buoyancy of the body. This photograph shows Mr. Rex Beach, the author, about to go down in eighteen feet of water

helmet diving dress invented by Siebe in 1819 (the authorities differ as to the date, some assigning it as the year 1829). This consisted of a metal helmet with metal shoulder plates terminating below in a canvas or leather jacket, under the free edges of which the respired and surplus air escaped. This in its turn seems only to have been a refinement of the crude apparatus of Kleingert of Breslau, who in 1798 made use of an egg-shaped metal cylinder which was slipped over the head and trunk of the wearer. This, however, was probably a somewhat modern development of still earlier diving apparatus.

The earliest known figure of a submarine diver attired in his suit is probably that contained in the 1511 or 1532 edition of the *De Re Militari* of Vegetius. This engraving, which I have not been able to locate, is said to represent a diver attired in a leather helmet with a leathér tube extending to and supported by a bladder at the surface of the water. Such an apparatus at once recalls an elephant swimming wholly submerged but for the tip of his trunk extending above the surface.

Furnishing a steady supply of air under pressure to the diver seems to have originated with one Borelli in 1679, who attached a simple air compressing pump to such a leather diving helmet as that described above.

All these devices are, of course, but refinements of the crude diving bells used far back in ancient times, in one of which Alexander the Great descended to the bottom of the sea and studied the plants and animals found therein, to be noted as probably the earliest submarine biological observations ever recorded. The earliest account of the use of any sort of diving apparatus is found in Aristotle, who records its use in times dating back to about 1000 B.C.

Probably the latest and simplest, and by far the cheapest, development of diving apparatus for use in shallow water, is that perfected in the diving hood described in this article. So valuable has it been found in submarine biological work at Tortugas that it has been made a part of the permanent equipment of the station there.

Ernest W. Smith: In Memoriam*

A LOVER AND ACCURATE OBSERVER OF NATURE, WITH RARE POWER TO MOUNT BIRDS SO THAT THEY HAD A SEMBLANCE OF LIFE, AND TO REPRODUCE FLOWERS WITH WAX AND COLOR SO THAT THEY HAD THE DELICATE BEAUTY OF THE LIVING ORIGINALS

CERTAIN words are lacking from the English language, among them those that might differentiate between various grades of taxidermists and serve to distinguish between American artists like Akeley, and those well defined as "bird stuffers." So we can only say of the late Ernest W. Smith that he was an unusually excellent and artistic taxidermist, with a keen eye for noting the facts of nature and skilled hands for embodying what he saw in pose or form in permanent materials. He rarely dealt with the larger mammals, and in the early years when he did work with them methods now employed were unknown, but the stately Alaskan moose that confronts the visitor at the entrance to the North American hall in the American Museum shows what he might have done.

His work was directed especially to birds and to wax reproductions of plants and flowers, and was characterized by accuracy and finish. This made his aid invaluable in such pieces of work as the New England spring group and the great Florida group, on the latter of which he was engaged just prior to his death.[1]

Mr. Smith was always pleasantly free from "artistic temperament" or professional jealousy, and this made it possible for him to work in harmony with other taxidermists and to accept and carry out suggestions—and there are times when this is quite as important as purely original work.

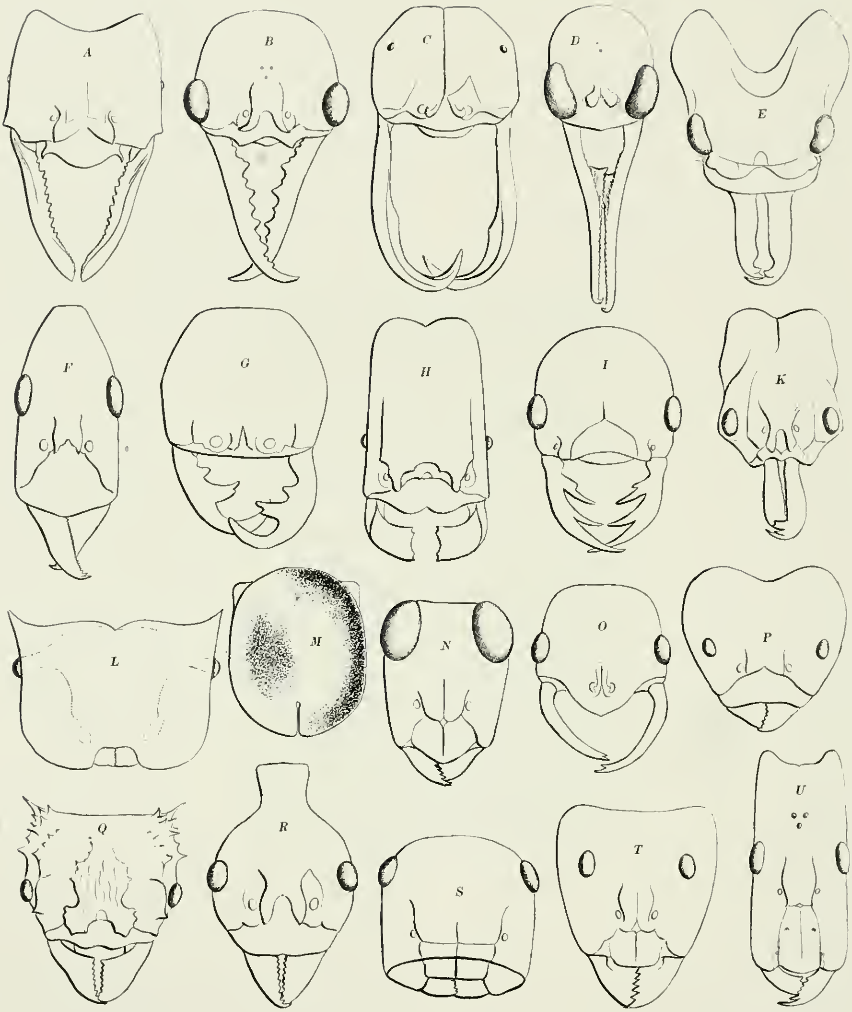
Mr. Smith came to the American Museum of Natural History in 1890 and was there until 1902, when on account of failing health he was forced to seek conditions under which he could devote much time to out-of-door life, and work when best he could. During these later years he mounted in the Brooklyn Museum the group of Pribilof sea birds, in which the individual birds for correctness of form, pose, and expression are unequaled. He also prepared the seasonal groups of wild flowers that form one of the attractions of the Crane Museum at Pittsfield, Massachusetts, and some of the bird groups for the collection of Mr. John F. Thayer in Lancaster, Massachusetts.

The foliage and flowers in the New England spring group in the American Museum testify to his dexterity and power for accurate detail and delicacy of finish. Mr. Smith was one of several who obtained their first knowledge of the technical methods of reproducing foliage from Mrs. E. S. Mogridge who, with her brother Mr. H. Mintorn, prepared the leaves and flowers for the small habitat groups of British birds that were installed long ago in the British Museum, and were the genesis of the large groups of today, but he, like others of Mrs. Mogridge's pupils, improved greatly upon her knowledge and technique.

Mr. Smith will long be missed by those with whom and for whom he worked, as his cheerful, kindly disposition and his deep interest in whatever he undertook made friends of all who knew him.—F. A. LUCAS.

[1] In conjunction with Mr. Frederick H. Stoll, who has continued the work to its completion.

* Mr. Smith stopped work on the Florida group at the American Museum in May, 1917, because of threatening inroads of the tuberculosis he had fought so many years, and died at his home in Dover, New Jersey, October 5, 1917.



HEADS OF VARIOUS KINDS OF ANTS

Not a new assortment of brownies. The jaws or mandibles of ants vary remarkably in form, in accordance with the uses to which they are put. Figures *A*, *B*, *C*, and *O* are piercing jaws of highly predacious ants; *D*, *E*, and *K* are mandibles used in jumping; *H* represents a pair of jaws adapted for cleaning and severing, and *G* and *I* for tearing. The others are of more ordinary types. *M* shows the part of an ant head used in stopping the entrance to a burrow (From Wheeler's *Ants*, by courtesy of the Author and of the Columbia University Press)

The Biting Powers of Ants *

By W. L. McATEE

United States Biological Survey

IF THE title had not been too long, not to say pedantic, this paper might well have been headed "The Natural and Artificial Uses of the Mandibular Powers of Ants," neither would it have been amiss to entitle it "Uses and Misuses of Ant Jaws."

Jaws may be used for many things, and so indeed they must, in the case of most invertebrates, as in addition to the normal functions connected with eating, the jaws form the sole means of prehension, and therefore are the most important medium of contact of the organism with its environment. Mandibles are hands and tools in one, but they have many special uses, and this is particularly true of the order of insects to which ants belong.

It is well known that many of this group (Hymenoptera) maintain their position while sleeping, or in other words, keep themselves in bed, by the use of the mandibles. In Texas two species of bees resort regularly to certain trees for sleeping and firmly insert their jaws into the wood.[1] At a hymenopterous "hotel" at Falls Church, Virginia, two species of bees and three of wasps were observed to sleep on grass stems which they grasped tightly with their mandibles.[2] Enough similar observations have been made to prove that this is a more or less general habit, not only of species in the United States but also of those in other countries. Parasitic Hymenoptera have been found attached by the jaws to their host insects, apparently awaiting a favorable opportunity for oviposition. This has been especially noted in the genus *Scelio,* which deposits its eggs in those of grasshoppers.

Proceeding to ant "jawology" in particular, we may best divide the discussion into (1) The biting powers of ants as used by themselves in their own, or what they consider their own, affairs, and (2) The use by other animals of these powers of ants. In the pursuit of their accustomed activities, ants naturally use their jaws chiefly in ways advantageous to themselves, but good things often are carried too far, and ants in using their jaws furnish no exception to the rule. We therefore have a category of actions which are disadvantageous.

The advantageous uses of the jaws form a part of most of the normal activities of ants: "The mandibles, being the parts with which the ant comes into most effective relations with its environment, present, like the beaks of birds and the teeth of mammals, a bewildering variety of structure. They are used for excavating soil or wood, cutting up the food, fighting, carrying the prey, their young, or one another, and in some species, even in leaping by closing them rapidly against hard bodies. Ants are remarkable in being able to open and close their mandibles independently of the maxillæ and labium."[3]

Mandibles of the normal type "are palmate, toothed along the receding edges, and terminate on the inside margin in a large pointed tooth or tusk. These two opposed instruments, working against each other, form the composite tool and war weapon of ants. With these they dig their galleries in the earth, or carve them out of wood, cut down grass, defoliate trees, seize and cut up food of all sorts. Being palm-shaped as a rule, the gathered and comminuted material can be compressed into their hollows, and so carried as conveniently as in a basket or barrow. As the muscles permit the application of much or little force at the insect's will, the mandibles can be clamped together with power enough to break and tear tough fibres, or approximated so gently that the soft eggs and tender larvæ can be borne about as daintily as an infant in a mother's arms."[4]

Every one has observed trees that have

[1] Observation of Mr. E. A. Schwarz.

[2] Fact reported by Mr. Nathan Banks.

[3] Wheeler, W. M., *Ants,* 1910, pp. 18–19.

[4] McCook, H. C., *Ant Communities,* 1909, p. 206.

* This article by Mr. McAtee was prepared originally to be read before a learned body of scientific men, the Biological Society of Washington ("for their amusement," Mr. McAtee explains); it nevertheless obtrudes no technicalities of language or distracting bibliographical references—although presenting through frequent footnotes the authority for every statement and the original sources for further research by the interested student.—THE EDITOR

been hollowed out by ants and it is apparent that their biting powers are equal to working in the hardest woods. In tunneling, ants are expert, and authentic cases are known of their tunneling under ditches and streams. Indeed a South American ant is said to have excavated a tunnel under the bed of the Parahyba River at a place where it is as broad as the Thames at London Bridge. The nest mounds of ants, entirely the work of their versatile mandibles, are familiar to all. Those made by some tropical species reach an enormous size, but even in the United States, the hills of *Formica fusca* reach a height of four and one-half feet and a diameter of six. In making the gigantic hills of the tropics, the ants tunnel[1] from ten to thirteen feet or more below the surface. It goes without saying that this hastens the decay of the rocks. "The impression one gets from the work of the ants . . . in the tropics, is that they are vastly more important as geologic agents than the earthworms of temperate regions." (Branner, p. 152.)

Aside from their use in constructing nests, the busy jaws of ants find multifarious uses in the normal round of life. All food is gathered by their aid; the eggs and young are tended with solicitous care; and the queen is groomed and fed; the plant lice, the ant people's cattle, are moved from place to place, and shelters are sometimes built over them; the mandibles take part in most features of the toilet of ants—and they are very cleanly creatures; supernumerary males and the dead are disposed of; often the ground about the nest and long trails leading away from it are cleared of all vegetation and obstructions; and in some species "the soldiers bar the entrances to the nest with their heads, and snip intruding ants in two with their strong mandibles."[2] In *Pheidole instabilis* "the soldiers have an office for which their abnormally large heads and strong jaws peculiarly fit them. . . . Their heads are so large proportionately to their bodies, that if turned upon their backs they are often unable to right themselves, and if not relieved may die practically standing on their heads. This big-headedness, with its corresponding development of the jaws . . . has led to a peculiar service. The soldiers act as the communal carvers or trenchers, and crack the shells of the oily seeds and the . . . chitinous cases of the insects which the foragers collect."[3]

All this is mandible work, some functions calling for strength and others for delicacy of action. One domestic phenomenon, in which the mandibles play an interesting part, deserves more extended description. The green wood ant of southeastern Asia (*Œcophylla smaragdina*) makes its nest of leaves fastened together by a fine white web. The adults, however, do not have the power of spinning silk; that is an accomplishment possessed only by their larvæ. The edges of the leaves being held together by the jaws of workers, other workers carry in larvæ which spin fine threads from their mouths. By touching the freshly issuing threads first to one side then the other, in fact using the larvæ as shuttles, the worker ants quickly fasten the seam.

"The assiduity with which ants carry burdens, and especially the grain-collecting habits of various species inhabiting warm countries, led to their being introduced as seed-sorters into fairy tales. We find a typical instance of this in the story of Cupid and Psyche. One of the first of the impossible tasks imposed upon Psyche by the malice of Venus, was the mixing of poppy, vetch, millet, wheat, and other seeds and grains into a large heap, which Psyche was commanded to sort out, each kind into a separate heap. But an ant who was passing took pity on Psyche, and called all its companions to her assistance. They came forth from their habitations in troops, like the waves of the sea, and very soon sorted each kind of grain by itself, and when they had finished the work, they withdrew to their nests."[4]

Among other uses of ant mandibles, falling in the category of advantageous actions, is that of leaping. Leaping seems quite a different function from biting, but as we shall see, it is made possible by the simplest of all the movements of the mandibles—namely, closing them together. "In *Odontomachus*, the 'tic-ant' of the tropics, for example, the linear mandibles are in-

[1] See article by Professor John C. Branner, entitled Ants as Geologic Agents in the Tropics, *Journ. Geol.* Chicago Univ., 8, 1900, p. 151.

[2] Kirby, W. F., *Marvels of Ant Life*, 1898, p. 137.

[3] McCook, H. C., *Ant Communities*, 1909, p. 203.

[4] Kirby, 1898, p. 149. This tale is related in the myth of Eros and Psyche in Apuleius' "The Golden Ass."

serted close together at their bases and provided along their inner edges with a few sense-hairs which are nearly as long as the mandibles. When the ant is excited it opens its mandibles to their utmost extent, till they form together a straight line at right angles with the long axis of the body. Then as soon as a hard object is touched by the sense-hairs, the blades are suddenly closed, striking the object with their tips with sufficient force to throw the insect backwards into the air for a distance of several inches." This habit is also exhibited by several other genera and species with similar mandibles, among them "the large-eyed Brazilian *Gigantiops destructor*, which is able to 'leap from twig to twig,' and an Indian ant, *Harpegnathus cruentatus*, with extraordinary mandibles, which is said to leap forward like a grasshopper to a distance of eighteen inches (Wroughton)."[1] A New Guinean ant only three mm. long can spring on the average forty-seven cm., which is more than one hundred and fifty times its own length.

From remarkable leaping performances it is easy to pass to feats of strength. The following observations [2] were recorded a few years ago:

"While walking on the university campus the other day, my attention was arrested by what appeared to be a grasshopper moving along the sidewalk without using his hind legs. Upon closer examination, I saw that the grasshopper was dead and was being dragged along by a small ant.

The difference between the size of the little laborer and his load was so extraordinary that I thought it might be of interest to know the exact weight of each. I accordingly weighed them carefully on an analytical balance and obtained the following figures:

Weight of ant	3.2 mg.
Weight of grasshopper . .	190.0 mg.

Thus, the ant was dragging a load that weighed approximately sixty times his own weight. This is equivalent to a man whose weight is 150 lbs. *dragging* a load of 4½ tons, or a horse of 1,200 lbs., a load of 36 tons! Is this not somewhat remarkable?"

We must admit that the feat is remarkable, but this record like so many others, has emphatically been broken. An Australian ant (*Myrmecia forficata*) has been known, while suspending itself by its feet, to support in its mandibles a pair of gloves which were more than 1100 times its own weight. Working out equivalents after the fashion above, it is clear that this performance would only be equaled if the one hundred and fifty pound man, hanging by his toes, supported in his teeth a weight of eighty-two tons.

Seriously, however, these feats—the real ones of the ants, I mean—do point toward a conspicuous characteristic of the biting powers—namely, tenacity. This is the thread upon which will be strung most of the remaining incidents in "jawology" I have to cite. The ant just mentioned as supporting the gloves is popularly known in Australia as the bulldog or bull ant, it not being known "whether they most deserve the name of bulldog from the square shape of the head, their pugilistic disposition, or from their tenacity in retaining a hold. They certainly deserve the title by reason of their courage." [3]

The latter trait is common to all ants; fear does not enter their make-up; battle is unhesitatingly entered into with any foe no matter what the odds, and self-sacrifice is a universal rule.

"The mandibles are the principal weapons and these alone in the larger species of *Camponotus* and *Atta* are sometimes employed with telling effect. In the Myrmicinæ and Ponerinæ their action is often supplemented by that of a well-developed sting. Many species of *Formica* spray their enemies with formic acid, or inject it into their victim by moving the gaster forward and centering its tip on the wound made by their mandibles. In battles with other species or aliens of their own species they pull their opponents' legs or antennæ with their mandibles and spray the tense membranes between the joints. . . . In *Polyergus* and *Leptogenys* all the workers have sickle-shaped mandibles adapted to piercing the heads or bodies of their victims." [4]

"This instrument, for the two mandibles work together as one organ— . . . is at once a war-club, battle-axe, and sword; it will decapitate a foe with the facility of a sabre or guillotine, will sever a leg or antenna as deftly as a scimitar, or crush a skull in its formidable vise as would a tomahawk or club. It is terrible to see, in the fierce encounter of emmet warriors, the cruel havoc wrought by this weapon." [5]

[1] Wheeler, *Ants*, 1910, p. 180.

[2] Observations by Mr. Armand R. Miller. *Science*, Vol. 16, N. S., Sept. 26, 1902, pp. 514–15.

[3] Quoted from Mr. E. R. Barker, *Victorian Naturalist*, 20, No. 8, Dec., 1903, p. 105.

[4] Wheeler, *Ants*, 1910, pp. 181–182.

[5] McCook, *Ant Communities*, 1909, pp. 206–207.

The sanguinary character of ant battles is well illustrated by the following account[1] of a conflict in which a small species (*Cremastogaster læviceps*) conquered a much larger kind (*Formica purpurea*).

The larger ants were seized by six or eight of the smaller, "which held on with bulldog-like tenacity, whilst more of their comrades sawed the hapless prisoner into several pieces. When once the small ants get a good hold they never let go, mutilation, and death even, failing to loosen their grip. Many of them were bitten off at the neck by the powerful jaws of the large species, but still the heads remained clamped on to the legs and antennæ of their adversaries."

Ants pursue the same bulldog tactics in capturing living prey. In Bermuda a small red ant is a common enemy of the house fly, as related below:[2]

"This creature attaches itself to the tarsus of the fly by means of its mandibles. It was a matter of common observation to see flies on the wing with these small ants attached. On one occasion I disengaged the ant and placed it on a table. It remained quiet until a fly came within suitable distance, when it made a rush, and was carried off clinging to the leg of the fly. I believe that the attack was made for the purpose of finally eating the fly. The ant hung on until its host became exhausted, and then attacked a more vital spot than the foot, and killed it."

It is probable that this method is effective with a variety of middling size prey, too large to be carried off bodily, but yet small enough to be gradually worn down. I once observed a common spotted cucumber beetle (*Diabrotica duodecimpunctata*) with a peculiar bunch underneath the fore part of the body. Upon examination this bunch proved to be an ant that had grasped both front tarsi (how he got both of them I would like to know) of the beetle in its jaws. Even with this handicap, the beetle was able to crawl up the window pane. It is probable, however, that this incident would have resulted in victory for the ant as the beetle had no means of getting rid of its little tormentor.

Larger prey is clung to in the same way, often by several ants. In India an observer[3] "once caught a butterfly (*Euplœa siamensis*), which was especially conspicuous from its extremely erratic flight, and found that a red worker of the large wood ant (*Œcophylla smaragdina*) had bitten itself fast on its body." Another interesting case describes a struggle between some harvesting ants and a caterpillar:

"I was once a witness of a singular contest between a soft-bodied, smooth, greyish caterpillar, about an inch in length, and two medium-sized *barbara* Ants. The Ants were mere pigmies in comparison with their prey, for as such, I believe, they regarded the caterpillar, but they gripped its body with set mandibles, showing the most savage determination not to lose their hold.

"When I first discovered the group, the war was being waged in a tuft of grass over one of the entrances to the Ants' nest, and the caterpillar was striding along the leaves, and thrusting itself between the culms in the hope to shake off or brush away its little persecutors. From time to time the caterpillar would turn viciously around and endeavour to pluck away its assailants; but though it actually succeeded in stripping, by means of forelegs and mouth, five of the six legs of one of the Ants, which was within its reach, they never loosened their hold.

"At length, a chance movement of mine shook the grass leaf on which they were, and the Ants and caterpillar rolled together down a steep and rocky slope to about four feet distant. They tumbled over and over several times, but still the Ants gripped their prey as firmly as ever.

"The last endeavour of the giant victim was to rub off the Ants by burrowing into the soil; but on uncovering its retreat I saw that their position was still the same. After watching this struggle for twenty minutes, time failed me, and I returned home, carrying with me, however, the combatants. When on my return I opened the box in which they were imprisoned, these bulldog Ants were clinging with mandibles locked as firmly as ever; and now as I write, in death they are clinging still, drowned in a sea of spirits of wine."[4]

The last observation reminds me of the experience we have in examining bird stomachs filled with ants; some of the ants have grasped other particles of food; some their own limbs (and one finds jaws clamped down on nearly severed legs); many seize other ants, and sometimes, when picking out an ant from the mass with the forceps, a whole cluster, like tacks attracted by a magnet, follows—bound together by the death grip of the jaws.

While still holding to the thread of tenacity we cross the dividing line between ad-

[1] By Mr. J. Booth, Fighting Ants, *Victorian Naturalist*, 22, No. 4, Aug., 1905, pp. 75–6.

[2] By Major H. A. Cummins. *Science-Gossip*, Vol. VI, No. 64, London, Sept., 1899, p. 124.

[3] Dr. Erich Haase, *Researches on Mimicry*, Part II, 1896, p. 99.

[4] Wood, J. G., *Insects Abroad*, 1874, p. 447. Observation attributed to a Mr. Moggridge.

vantageous and disadvantageous uses of the jaws. Tenacity within reason brings desirable results, but we have seen that in this particular field of endeavor ants know no limit, hence they sometimes get into trouble. This is usually the case when they attack a larger animal which can defend itself by biting or otherwise. Various insects are occasionally captured with the heads of ants clinging to their legs. A tiger beetle (*Cicindela laurentii*) and several other species have been seen so adorned.[1] Tiger beetles probably have no difficulty in decapitating ants, but they are unable to break up the hard heads themselves.

The same sort of tenacity is illustrated in the story of a slave-holding ant which went home with a dissevered head of an ant clinging to its leg.[2] Professor W. M. Wheeler, of Harvard University, told me that he once came upon a colony of harvesting ants (*Pogonomyrmex molefaciens*) evidently recently visited by an army of driver ants (*Eciton cæcum*). Almost every harvester had several *Eciton* heads dangling from its legs, the bodies having been bitten off.

Another observer [3] relates that on one occasion he had put two ants of the species *Camponotus pennsylvanicus*, which had come from an oak log in his room, into a bottle with a turtle (*Kinosternon pennsylvanicum*), and that they had attacked the turtle and had bitten so hard that the heads remained attached to the turtle's neck after the bodies had been removed. Still another observer [4] tells me that he once collected a ground squirrel in the Southwest that had an ant's head fastened in the edge of one of its nostrils. The part was entirely perforated, and the head swung loose; the animal thus had a veritable nose ring and it was certainly of unique pattern, even if not of so much value as those affected by certain savage tribes. It is rather a common occurrence, furthermore, to collect flickers—birds which dig into ant hills and feed freely on their inhabitants—that have ant heads attached to their wing and tail feathers.

In all these cases, disadvantageous jaw work is illustrated; the ants had bitten off more than they could chew. As a rule they encounter the same state of affairs when they attack man. They may annoy or even severely punish, but ultimate victory lies with the attacked. One scientific gentleman [5] told me of an experience he had with an ant accidentally taken into his mouth with a berry. The little fellow at once set his jaws into the inside of the cheek; in dislodging it, the first pull brought away the thorax and abdomen, but the head remained. At the second attempt the head was brought out but a piece of epithelium came with it.

The driver ants of the tropics, *Eciton* in America, and *Anomma* in Africa, are a terror to every living thing. When they are on the march, those creatures able to flee do so at once, those which lag behind are quickly consumed. These ants at times make things very interesting for man. When their line of march takes in a native house, the owners decamp immediately, and the ants are left in full possession. They soon pass on and these visits are not without advantage to the house dwellers as all cockroaches and other vermin are thoroughly cleaned out.

Another observer [6] tells me that at times when looking among the tree tops for birds, he has been taken unawares by an army of these ants. The soldiers among the driver ants have tremendously developed heads and jaws; their bite brings blood and they hang on until the heads are pulled off. The most interesting feature of their attack is the remarkable unanimity with which they set their teeth into the skin. Whether they accomplish this by mental telepathy or otherwise, the fact remains that several ants scattered here and there over one's anatomy all decide to bite at one particular moment. Considering the severity of their bite we may well believe the observer's statement that a surprise party of this kind fairly lifts a man off the ground.

An African ant of similar habits, the *siafu*, has a broad flat head with crescent-shaped mandibles which it buries in the flesh of its victim and there literally stands on its head. This ant exhibits the same biting habits [7] described for the Central American species. As a result one may have twenty-

[1] Observation by Professor D. E. Lantz.

[2] McCook, *Ant Communities*, p. 200.

[3] Wm. T. Davis, *Journ. N. Y. Ent. Soc.*, Vol. XVI, No. 3, Sept., 1908, p. 196.

[4] Mr. Vernon Bailey, of the United States Biological Survey.

[5] The late Professor F. E. L. Beal, of the United States Biological Survey, Washington, D. C.

[6] Mr. E. A. Goldman, United States Biological Survey.

[7] Authority of Mr. Edmund Heller, African explorer.

five to thirty ants upon him before he realizes their presence. The only remedy is to strip and pull them off individually, and usually each one picked off takes a piece out.

An old fable (one of Æsop's collection, in fact) found by the writer in somewhat altered style among the Creoles of Louisiana, has as its main point the singular effectiveness of a good honest ant bite. Briefly the fable is as follows: A dove seeing an ant struggling in the water threw the insect a leaf by means of which it was able to reach shore. Another day the dove sitting drowsily in a tree was approached by a hunter. As the hunter raised his gun and was about to fire, the ant, taking in the situation, quickly climbed to the man's neck and bit with all his might. With a sharp cry the hunter put his hand to his neck, and in so doing dropped his gun. The commotion aroused the dove which flew off in safety.

Another fable explains how certain ants acquired their thrilling power of jaw. A black ant of Ceylon, called by the natives *coddia*, is said to "bite desperately, as bad as if a man were burnt by a coal of fire; but they are of a noble nature and will not begin unless you disturb them." [1] The reason the Cingalese assign for the horrible pain occasioned by the bite is curious. "Formerly these ants went to ask a wife of the *Noya*, a venomous and noble kind of snake; and because they had such a high spirit as to dare to offer to be related to such a generous creature, they had this virtue bestowed upon them that they should sting after this manner. And *if they had* obtained a wife of the *Noya*, they should have had the privilege to sting full as bad as he." The "Noya" is, of course, the well-known Naga, or cobra de capello.[2]

In the categories of biting thus far considered, the ants were in no sense the tools of other creatures; they were doing just what they pleased. The fact that they sometimes lose their lives in misguided ventures does not alter the entirely volitional character of these attempts. But the mandibular powers of ants are put to use by other animals, chiefly by man. Some of these uses are praiseworthy, others are decidedly the reverse. The terrific biting powers of some tropical ants, together with the abundance in individuals of these species, have prompted their use not only in moderate punishments, but also in revolting forms of torture and execution. It has been found [3] that in British Guiana biting ants are used in certain ordeals and in punishing youngsters. The ants are placed in the interstices of specially woven mats, and held there by stretching upon the handles. These ant mats are then applied to various parts of the body of the victim, where the ants naturally bite their best, thus carrying out the wishes of the monitor. There is an account [4] that among the Mundurucu and related tribes of Brazil, biting and stinging ants are used to test the courage of the young men. Bark cylinders half full of ants are put on a young man's arms, and while enduring the most fiendish biting and stinging, the victim must go about the village paying his respects to various householders and officials, showing no signs of distress. From the fact that the fire ant or *tecandiero* is preferred, it is certain that the stinging is more essential to the complete success of this ceremony than the biting.

Ants are used even as executioners. In Burma the criminal is usually tied to a tree, smeared with honey, and left to be devoured by the ants. The Kafirs of South Africa used to stake down their prisoners upon an ant hill, "and they were eaten atom by atom in a few hours." [5]

Passing to less exciting but more praiseworthy uses of the biting powers of ants, we must remember their utility to science in cleaning skeletons. Those who have tried this method know that a beautifully cleaned, but still articulated skeleton is the result. Their proficiency in this occupation is sometimes painfully obtruded upon the zoölogical collector.[6]

It is stated that during pioneer days in the Southwest, it was a custom to throw clothing upon an ant hill, for the purpose of freeing it from the vermin frequently an unavoidable accompaniment of mining camp

[1] Quoted from Knox.

[2] Kirby, 1898, pp. 146–7.

[3] By Dr. W. E. Roth, *Journ. Roy. Anthrop. Inst.*, 42, 1912, p. 539.

[4] By Captain Mayne Reid, *Odd People*, pp. 134–6.

[5] Authority of Sir Richard Burton. Kirby, 1898, pp. 134–5.

[6] Mr. Heller states that the *siafus* often completely consumed the catch of his entire line of traps, the skeletons only remaining. Messrs. Nelson and Goldman became acquainted with a Mexican ant which had a very precise formality to be accomplished before actual skeletonizing began. The hair of the specimens was all bitten off close to the skin, leaving the mice and other small mammals looking as if they had been shaved.

life. We have it on the authority of an army surgeon, that "one of the best examples of scavenger work of the ant" may be had by taking a bed ridden with bedbugs, or better, a mattress, and placing it over an ant heap. Every nook and crevice will be cleansed of eggs and bugs in a fashion that will put disinfectants to shame.[1] Ant colonies are placed under houses in China so that the ants may destroy the termites that infest them.

The most interesting use of ants by man that I have so far learned about is in surgery. I present part of an account given by the director of the Laboratory of the Medical Faculty of Paris:[2]

"The mandibles of ants and of several coleopterous insects, *Scarites* in particular, have long been employed in Asiatic surgery. This usage is of the most ancient date with the surgeons of India and is perpetuated in our day in Algeria by the Arab operators and to some extent by the Turks in Asia and the Greek barbers of Smyrna.

"According to an English entomological journal,[3] the barber presses upon the edges of the cut with the fingers of the left hand and applies each ant by means of forceps held in the right hand. The mandibles of the ant are widely opened, the animal being in the defensive attitude, and as the insect is gradually brought near the wound it seizes the projecting surface . . . and immediately forces its mandibles through the flesh . . . and remains in this attitude, pressing the one mandible against the other with force and consequently holding the two edges together. Then the barber separates the head from the thorax with a snip of the scissors, and the head with the mandibles remaining in place continues its function while the thorax and abdomen fall to the ground.

"The same operation is repeated with other ants until at times there may be a dozen pairs of mandibles placed at regular intervals, so that through its whole length the skin is united by this very ingenious procedure. The heads are allowed to remain a few days, after which, since the healing has been effected, they are loosened and having performed their office are henceforth useless."

It is stated on good authority[4] that in Brazil the savages use this species "for holding together the edges of a wound. . . . Then they tear away the abdomen and the thorax leaving only the head at the edges of the closed wound. It is not rare to see among the Brazilian natives one who has a wound in which the process of healing is assisted by the heads of 7 or 8 of these ants" (p. lxvii).

I know of but one instance of the use of the mandibular powers of ants by any animal other than man, but this single instance is decidedly interesting and I believe indicates that future observations will bring to light other similar phenomena.

The observation is as follows:[5]

"The occupants of a recently disturbed ant hill were excitedly crawling about the hill and the adjacent cement walk. They were large, and to a blue jay in a neighboring tree they must have looked luscious, for flying down, the jay began to pick them up with an eagerness that seemed to say that this was an opportunity that might come his way but once. As rapidly as he could do it he seized the ants, with each capture lifting a wing, sometimes one, sometimes the other, and seemed to deposit his prey amongst the feathers back of and underneath it. So quickly he worked and with such evident eagerness to make the most of this rare occasion that, as he lifted the wing, putting his bill amongst the feathers, it often seemed that he must lose his balance and topple over backwards. But he kept his poise, worked on with all speed and had laid in quite a store when a passerby frightened him from his task."

There can be no doubt that this bird was taking advantage of the biting-on habit of ants to attach a number of them to its feathers. What the ultimate object of the action was can only be learned from further observation.

To sum up, the biting powers of ants are brought into play in practically every activity of these insects; to themselves the more delicate functions of the mandibles, as well as their most powerful piercing, cutting, and crushing uses, are valuable. To other animals the strong biting powers and especially the jaw locking habit of ants seem most important. The adaptation of these qualities of ants to ordeals and executions is ingeniously cruel, and their use in surgery by savage tribes is wonderful. What then shall we say if it is confirmed that an animal lower than man has learned to turn to its advantage the instinctive death grip of ants?

[1] Capt. P. L. Jones, *The Military Surgeon*, 27, 1910, pp. 78–79.

[2] Baudoin, M., The Use of Ants in Operative Medicine. *Rev. Scient. du Bourbonnais*, 11, 1898, pp. 252–253.

[3] Mr. R. M. Middleton who wrote the article in an English entomological journal referred to by Dr. Baudoin, gives the name of the species of ant used in Asia Minor as *Cataglyphis viatica* Fabr. A South American leaf-cutting species *Atta cephalotes* L. is known to be used for the same purpose.

[4] M. E. Moquerys in the *Bulletin of the Entomological Society of France*, meeting of October 23, 1844.

[5] By Grace Ellicott of Newcastle, Ind., Note on the Food of Blue Jay, *Guide to Nature*, I, No. 5, Aug., 1908, p. 168.

"... FOR OF SUCH IS THE KINGDOM OF GOD"

Mural decoration, by Will S. Taylor, mural artist at the American Museum of Natural History. Presented to the City Park Chapel, Brooklyn, by Mr. Frederic B. Pratt

Mr. Taylor has recently painted a decoration for the City Park Chapel, Brooklyn, which is so genuine and sympathetic in its presentation of child love that the JOURNAL considers itself fortunate to be able to reproduce the accompanying photograph taken in the studio at the Museum before the removal of the painting to the church. Any black and white reproduction carries a poor conception of the picture, however, as the color is handled with great charm. It is a pleasure also to quote in full, with the permission of the Art Editor of the *New York Times*, the notice of the decoration which appeared in the *Magazine Section* of this newspaper October 28, 1917. A most interesting suggestion is made in this appreciation of Mr. Taylor's work, namely, that the American Museum, in its murals and group backgrounds, is in line to create a new school of historical painting. In this school, the work will not necessarily lose in atmosphere and poetic influence compared with the standards of art, this depending here as everywhere on the personality and power of the individual artist; it will gain in never departing from a basis of truth.—THE EDITOR

A New Type of Mural Painting[1]

Critical note relative to the decorations in the North Pacific hall of the American Museum

"THE mural decorations by Will S. Taylor at the American Museum of Natural History have attracted attention by their freedom from convention and their mural quality. The artist has just completed a mural painting for the City Park Chapel in Brooklyn in which he has followed the same general course as in the Museum paintings and produced a decoration that is quite personal and unhackneyed, although based upon a theme, Christ blessing little children, that has been a subject for artists through many centuries.

"The chief interest of the painting for students of art is the management of the light and shade. The easiest way to get a mural decoration to seem a part of the wall upon which it is placed and not a hole through the wall or a relief detached from it, is to treat the composition like a map, tying the parts together with a strong bounding line surrounding the larger patches of color, after the fashion of designs for stained glass windows. It may be taken for granted that to be satisfying to the observer the decoration should seem a part of the architecture of the building, but there are other ways of solving the problem. Mr. Taylor treats his composition in the spirit of the sculptor carving his wall in low relief. He permits little reflected lights to bring out the salient forms of his design and his figures have a look of solidity, and nevertheless keep well within one plane. He also pays attention to character. There is no halo and no religious mystery in his picture. The Christ, friendly and benignant, has come to a public square surrounding a well, where the children play and the mothers congregate for gossip, according to the custom in Eastern countries, where the drawing of water is the important feature of the day's occupations. He is seated among the children and is talking affectionately to those nearest, while others stand about in attitudes of interest and curiosity, as they might today in any of the east side streets where something out of the common was attracting their attention. The gestures and poses are entirely natural. The little girl at the left holding a baby in her arms might be duplicated any day in the poorer quarters of New York.

"The artist has, in fact, picked up his models here and there from among the young visitors to the Museum or the children he has observed in the neighborhood. The costumes have been made for him with as close an approach to archaeological accuracy as could be managed, but they clothe the figures naturally and have none of the artificiality of reconstructed history. The picture is flooded with sunlight, which streams over the buildings in the background and makes bright patches on the pavement in front of the well. This letting the spirit of out-of-doors into a church also is a modern note. The greens and blues and yellows of the color scheme are skillfully managed and make a strong harmony. Without making any pretense of greatness, the whole decoration speaks of sincerity and the delight of the painter in his work. It would not be surprising if a distinct type of mural decoration grew out of the work done in the American Museum of Natural History. The painters working there are surrounded by objects of the past, not as they are represented in art, but as they are discovered and preserved for precise study, and their special concern is to place these objects in a natural environment. They have as much of nature as can persist through the disintegrating processes of time to suggest color and form, and many contrasts and resemblances. In the mineral section alone are palettes ready set with colors in beautiful and extraordinary relation. And they have for their benefit, as well as for their hampering restriction, an atmosphere of respect for actual fact which discourages much indulgence in poetic license. Even if no masterpieces are created in such an environment, there probably will be enough interesting and well-considered compositions to form a distinct school of historical painting wholly different from the empty and dull imaginings of the earlier historical painters. Holman Hunt and the young Millais would have a good word for Mr. Taylor's methods."

[1] Quoted from the Magazine Section of the *New York Times*, October 28, 1917.

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WELCOMING CEREMONY OF THE BELLA COOLA INDIANS

The murals in the North Pacific hall of the American Museum, executed by Will S. Taylor, already have won distinction and praise, especially for their color and composition values. There are two series of these murals completed. Six panels on the west side of the hall tell stories of Indian industries; a second six, ceremonial in character, run the length of the east wall. A preliminary study for the sixty-foot canvas to occupy the full width of the south wall is at present on exhibition at the New York Architectural League

Museum Notes

Since the last issue of the Journal the following persons have been elected members of the American Museum:

Benefactor, Mr. J. P. Morgan.

Patrons, Mrs. Chas. B. Alexander * and Mr. John E. Thayer.*

Fellows, Mrs. George Barton French * and Messrs. George Barton French,* Lewis A. Platt,* Mortimer L. Schiff,* and Charles Steele.*

Life Members, Mrs. Henry R. Hoyt, Mrs. Ralph Sanger, Misses Josephine Adams Osborn, Alice Lee Welcher, Amy Ogden Welcher, and Emma Park Avery Welcher, and Messrs. Edward G. Acheson, W. W. Atterbury,* Henry Balfe,* David L. Brainard,* Reginald Brooks, Henry G. Bryant,* Robert A. Chambers, E. W. Clark,* Henry Dodge Cooper,* Grenville T. Emmet,* C. W. Gordon,* Geo. M. Gray,* Levi H. Greenwood,* Henry Hornblower,* M. J. Look,* Charles F. Mathewson,* Paul B. Morgan,* Effingham B. Morris, James C. Parrish,* Samuel T. Peters,* Louis A. Shaw,* Charles A. Stone,* W. B. Thomas,* Paul Tuckerman,* Edwin S. Webster,* Frank G. Webster,* and R. H. Williams.*

Annual Members, Mrs. L. Luykx van Oosterzee, Mrs. Jennie E. B. Webster, Mrs. Maurice Wertheim, Miss Henrietta M. Schwab, the Rev. H. G. Enelow, Dr. Arthur Hastings Merritt, and Messrs. John H. Abeel, Harold G. Aron, George Bender, Henry Kelly Brent, Stanley W. Dexter, Wm. H. Eddy, James M. Edwards, William Fox, Thomas A. Howell, Howard McWilliams, Henry B. Reed, A. T. Simpson, J. J. Slocum, Phineas Sondheim, and Neil A. Weathers.

Associate Members, Miss Lydia T. Morris, Dr. Lloyd P. Shippen, and Messrs. William Macrum, F. Corlies Morgan, S. Rowland Morgan, F. W. Morris, Jr., C. S. W. Packard, M. L. Parrish, H. W. Raymond, James M. Rhodes, William Biddle Sheppard, Charles S. Starr, J. Barton Townsend, Wm. Henry Trotter, Charles Wheeler, and Charlton Yarnall.

A memorial service for the late Mr. L. P. Gratacap was held in connection with a meeting of the New York Mineralogical Club in the American Museum on the evening of January 16. Numerous tributes to the lovable character of Mr. Gratacap and to his scientific attainments were made by friends and associates present. A collection of his writings which was placed on view shows a very considerable range of subject as well as the great amount of valuable work accomplished.

The cover design of this number of the Journal, "A Characteristic Reef Scene," is from a copyrighted photograph taken in about ten feet of water by Professor W. H. Longley at the Marine Biological Laboratory, the Tortugas. The massive coral at the right is about four feet high; the fishes, about eight inches in length. Both the more numerous yellow and the common grunts (*Hæmulon sciurus* and *plumieri*) are nocturnal species. They rest during the day as indicated, but scatter over the reefs at dusk to forage individually. Both are changeable in color. The common grunt, in particular, adjusts its shade accurately to that of the underlying bottom.

In appreciation of his many generous contributions and of his continued interest in the work of the Museum, Mr. J. P. Morgan was elected benefactor at a meeting of the board of trustees of the American Museum held on February 4.

The Journal wishes to call attention to the list of research associates appearing on the inside of the front cover under the scientific staff of the American Museum. It is as follows: In anthropology, Dr. J. Howard McGregor and Mr. M. D. C. Crawford; in ethnology, Dr. George Bird Grinnell; in vertebrate palæontology, Dr. Charles R. Eastman; in geology, Mr. W. Elmer Ekblaw; in physiology, Mr. Alessandro Fabbri; in mineralogy, Dr. George F. Kunz; in coleoptera, Mr. Charles W. Leng; in annulata, Dr. A. L. Treadwell. Through the interest of these men, the Museum derives great benefit along special lines of scientific research; and the large significance of their work and the importance of their connection with the institution cannot be overemphasized.

* Honorary election in recognition of support of Crocker Land Expedition.

Attention is called also to the use of the title honorary curator in connection with the names of Prof. Henry Fairfield Osborn, Dr. W. M. Wheeler, and Dr. Bashford Dean. This title is now reserved for men who formerly have been at the heads of departments and are still connected with the research and scientific work of the Museum.

"Foreign Monuments, Their Erection, Protection, and Restoration," was the subject under consideration by the American Scenic and Historic Preservation Society, which met in the main assembly hall of the American Museum on the evening of January 17. Addresses were made on: "Protection and Destruction of Historic Monuments," by Edward Hagaman Hall; "Care of Allied Soldiers' Graves," by Colonel Henry M. Sackett; and "Ancient Monuments of China and Tibet," by Roy Chapman Andrews. Each lecture was accompanied by many beautiful illustrations on the screen. The following is a copy of a resolution adopted at this meeting:

Resolved, That the American Scenic and Historic Preservation Society and the American Museum of Natural History, meeting in conjunction, desire to extend to the President of the Republic of China their felicitations upon the plans that have been made for the protection of Chinese monuments and antiquities from vandals, and the collection of these priceless relics of the history of China. We renew the expression of our hope that these collections may be safely preserved in a national museum.

Following the memorial which was addressed in nineteen hundred fourteen to the Government of China by fifty-two American institutions of art, learning and humanity, the members of our institutions desire to renew the pledge that we shall use all our influence to prevent the despoiling of China by the unauthorized sale of ancient works of art. We also believe that it is the duty of the civilized countries of the world, so far as possible, to return to China her ancient historical national monuments and antiquities for proper preservation under national custodianship.

A new anthropological publication, to be known as the *Journal of Physical Anthropology*, has been established with editorial offices at Washington, D. C. Dr. Ales Hrdlicka will be editor in chief of the new journal and among the associate editors are Dr. Clark Wissler, curator of anthropology in the American Museum, and Dr. J. H. McGregor, research associate in anthropology in the American Museum and associate professor of zoölogy at Columbia University.

That whale meat may form an acceptable addition to the diet was well demonstrated at a luncheon tendered to thirty guests of the American Museum by Professor Henry Fairfield Osborn on Friday, February 8, where whale *hors d'œuvre*, whale *pot au feu*, and planked whale steak were the prominent features of an attractive menu. A small model of the humpback whale, which is the kind most frequently captured and which makes the best eating, decorated the center of the luncheon table. The luncheon was arranged to call attention to a large possible source of meat supply which has not yet been taken into account by the food administrators. The 15,000,000 pounds of meat obtained by the capture of one thousand or more whales annually on the Pacific Coast are now used only for fertilizing the soil. Whale meat is said to be equal in food value to beef, and could be marketed in New York City at twelve and a half cents a pound. The Victoria Whaling Company furnished the steak for the luncheon, which was prepared and served by Delmonico. Among the guests were: Mr. Arthur Williams, New York City Food Administrator, Mr. Roy Chapman Andrews, the authority on whales at the American Museum, through whose effort whale meat as a war food has been brought to the attention of the Food Administration of the United States, Admiral Robert E. Peary, Dr. Frederic A. Lucas, and Messrs. Charles H. Townsend, Herbert L. Bridgman, Caspar Whitney, William T. Hornaday, George H. Sherwood, Bashford Dean, Louis Wiley, William Fellowes Morgan, Severo Salcedo, Don C. Seitz, and Charles M. Puckette.

The American Museum received a visit in December from M. Alphonse Mathey of Dijon, France, who came with a letter of introduction from Mr. Barrington Moore, associate curator of woods and forestry, with whom he has been closely associated abroad. A series of lantern slides for use in the soldiers' camps was presented by the Museum to M. Mathey. These slides included subjects taken from the American Museum and scenes in various parts of the country from San Francisco to New York.

On February 28, 1918, the American Museum of Natural History, in coöperation with the delegates from the New York Academy of Sciences, Section E of the American Association for the Advancement of Science and the New York Mineralogical Club, will hold a memorial meeting at the American Museum of Natural History in honor of Abbé Réné Just Haüy, 1743–1822, the great French crystallographer. Papers are expected from Edgar T. Wherry, Edward H. Kraus, George F. Kunz and others, and one written for the celebration by the late L. P. Gratacap will be read. Portraits of Abbé Haüy and the Haüy Frères, as well as mineralogical books of the eighteenth and nineteenth centuries, will be shown.

"Au Savant Auteur des Traités de Physique et de Minéralogie"

An important addition to the American Museum's collection of Asiatic insects has been made through the presentation by Mr. Harry E. Caldwell of the large number of specimens collected by him in China. The gift is of particular value because of the previously small representation in the Museum of insects from this most interesting region.

A series of lectures by Professor A. L. Kroeber was given in the American Museum during the month of January. Professor Kroeber discussed the traits of culture of each of four native tribes of California, two in the northern and two in the southern part of the state, whom he classified as legalists (the Yurok), indifferents (the Wintun), mystics (the Luiseño), and dreamers (the Mohave). It was shown that these four Indian groups, all within the boundaries of one state and usually considered as among the lowest in the scale of primitive peoples in this country, are as distinct from one another in their philosophy of life as are the peoples of any four countries of Europe.

Two interesting fish groups are nearing completion in the department of preparation of the American Museum. One, featuring a large blue shark with a brood of young, presents a scene in the deep currentless region of the Atlantic known as the Sargasso Sea, where the drifting gulfweed comes to rest, scattered loosely about or forming great yellow fieldlike masses. The blue shark, which grows to a length of about ten feet, is perhaps the commonest surface shark of the open ocean. It is a beautiful blue above, matching the color of the sea, and a dazzling white below, slender and graceful in all its lines. Many problems of lighting had to be contended with in this group, to make a satisfactory view below the surface of blue offshore waters. When seen from below, the surface of the water is an almost perfect mirror. By introducing an actual mirror a more realistic effect has been obtained than could have been produced in any other way. Material is being assembled for an adjoining group designed to show protective adaptations of smaller pelagic fishes, many of which hide in the drifting gulfweed, which they resemble so closely as to be almost invisible, or seek protection about the powerful stinging tentacles of a bright-colored "Portuguese man-of-war."

Six beautiful specimens, three of opal and three of tourmaline, have been added to the gem collection of the American Museum through the generosity of Mr. J. P. Morgan. The three opals, which glow with shades of green, red, and blue, are from Humboldt County, Nevada. Two of the tourmaline specimens, of the rose red or pink variety, are from Minas Geraes, Brazil; the third, a large uncut piece, is from San Diego County, California.

The entire series of carved ivories collected by Mr. Herbert Lang during the American Museum's Congo Expedition is now displayed in the gem hall of this Museum, where it occupies a twenty-eight foot wall case. The exhibit is fittingly placed in this hall, as the ivories are in the nature of crown jewels to the African chiefs. Whenever a native shows aptitude for carving he is immediately attached to some chief and uses his talent for him alone. The size and importance of the collection made during a chief's lifetime are an indication of his rank. When he dies the carvings are destroyed, which accounts for the fact that no very old objects are to be found. The exhibition includes large carved and etched horns, ornamental hair combs, arm bands, weapons, bowls or cups, knives and forks, mortars and pestles, fine ivory pins, and ceremonial objects—all showing remarkable skill in carving and many of them exceedingly rare.

Russell J. Coles, who has spent several weeks on the coast of southwest Florida in reconnaissance of the possibilities of winter shark and ray fisheries, tells us that these large fish, formerly wasted, are now being shipped from that field to northern markets. He looks forward to great expansion of the shark and ray output along our entire coast within the next few months, and a significant addition from this source to the nation's food, leather, and oil supplies.

Mr. Roy Chapman Andrews, associate curator of mammalogy in the American Museum of Natural History, was elected corresponding member of the Zoölogical Society of London at its meeting on December 19, 1917.

Dr. Edmund Otis Hovey represented the American Museum at the annual meeting of the Geological Society of America, in St. Louis, December 27–29. The meeting was well attended considering the disturbed condition due to the war, and many papers of scientific interest and some of direct bearing on the relations of geology and geologists to the conduct of the war were presented. After the meeting Dr. Hovey visited the important new lead and zinc mining district of northeastern Oklahoma, and made arrangements for the collection and transfer to the American Museum of material illustrating the beautiful grotto developments of the ores growing in the mines there.

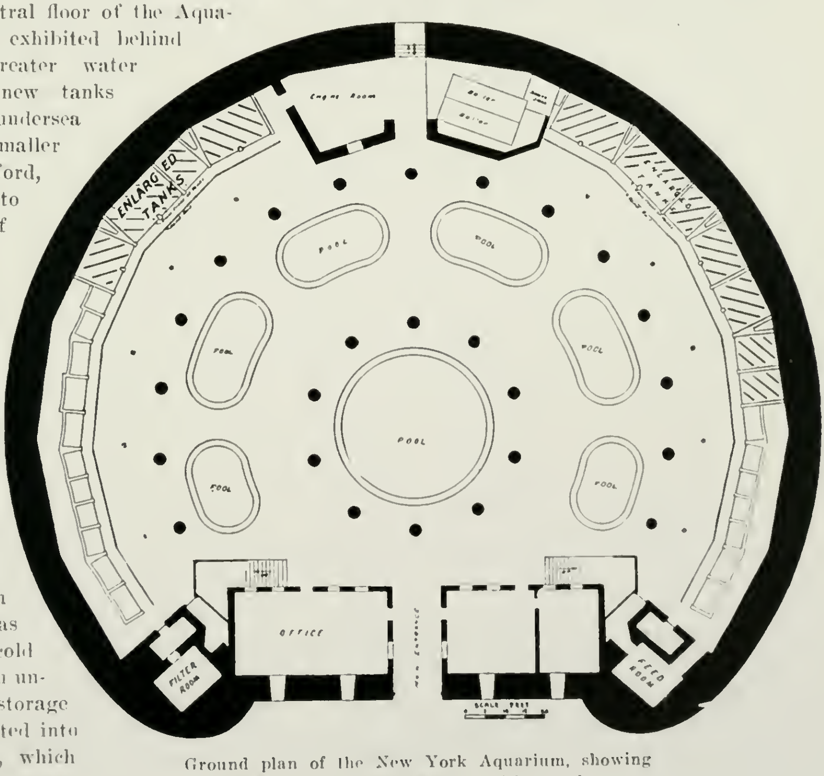
Dr. Bashford Dean of the Metropolitan Museum of Art and the American Museum, now Major of Ordnance in the United States Army, returned from Europe in January.

Dr. C-E. A. Winslow, of the department of public health of the American Museum, was awarded a presentation medal by the National Institute of Social Sciences at its meeting on December 18, for his services to the cause of public health.

Mrs. Elsie Clews Parsons, who for several years has been carrying on independent investigations in the social organization and ceremonies of the Zuñi and other Pueblo Indians, has signified her willingness to become a volunteer worker under the direction of the department of anthropology of the American Museum. She will give particular attention to the important ceremonies of the Indians, in order to determine how far these may have been influenced by Spanish culture, particularly by the teachings of the church fathers. Mrs. Parsons is now on her way to Zuñi to begin this work.

The New York Aquarium, under the directorship of Dr. Charles H. Townsend, has increased its attractiveness, as well as its usefulness, by the enlargement of several of the glass-fronted exhibition tanks on the ground floor of the building. The original tanks, built of heavy masonry, were only seven feet long and four feet from front to back. By removing the partitions between some of these small tanks larger ones were made, averaging fifteen feet in length. The rear walls of the tanks were then extended to the outer walls of the building, giving a depth of twelve feet. Thus space was obtained in which could be shown a larger number of species for each tank; also sharks and sturgeons, formerly kept in large pools on the central floor of the Aquarium, could be exhibited behind glass. The greater water space in the new tanks produces an undersea effect which the smaller tanks did not afford, and adds much to the appearance of the exhibit, besides greatly improving conditions of life for the occupants. In order to make two of the enlarged tanks of the fresh-water series available for salt-water exhibits, an extension of piping was made. When cold weather came, an unused wooden storage tank was converted into a water heater, which made it possible to exhibit in this water system many local sea fishes not to be found along our shores in winter. This improvement is especially valuable, as marine species of fishes and invertebrates are much more numerous than fresh-water species, and should be given a larger representation in the collection than has hitherto been possible. Due to Dr. Townsend's personal initiative and effort in the work, eleven of the new enlarged tanks are already open for exhibition and an additional four are under construction.

A paper by Mr. G. K. Noble, ready for publication, covers the Nicaragua amphibian collections of the American Museum. Of the twenty-seven species two are described as new, and four others are reported for the first time from Nicaragua. Many of the species are rare in collections. *Hyla boulengeri,* which formerly was known only from the type, is represented by three specimens. It is interesting that one of the new species, a semi-arboreal salamander, should have been taken at several widely separated localities. The Nicaragua Ornithological Expedition, 1917, collected one specimen on Mt.



Ground plan of the New York Aquarium, showing position of the enlarged exhibition tanks

Mombacho in the west, while the Nicaragua Reptile Expedition, 1916, found the species almost at sea level in the east.

Mr. Leo H. Miller, assistant in ornithology in the American Museum, is now located at Fort Sill, Oklahoma, where he is engaged on active duty as lieutenant in the Aviation Corps of the United States Army. His inclusion in last month's Journal among those commissioned in the infantry was an error.

Through the courtesy of Mr. John M. Hoffmire, of Newark, New Jersey, nephew of the late Titian Ramsay Peale, naturalist and artist, the library of the American Museum is the recipient of a very valuable unpublished work prepared by Mr. Peale. This consists of a book of colored sketches of Lepidoptera and their larvæ with the plants upon which they feed. The sketches, which are accompanied by written descriptions of the subjects, bear dates ranging from 1833 to 1880.

The American Museum has acquired by purchase about one hundred and fifty pieces of pottery taken from a single ruin near Adamana, Arizona. This pottery portrays a type of ware and decoration hitherto represented but little in the collections of the institution. A dugout canoe, made many years ago by the Indians of Ulster County, New York, is another fortunate acquisition. The canoe is in an excellent state of preservation.

An exhibit of birds used in falconry, on the second floor of the American Museum, is attracting the attention of those interested in mediæval practices. The birds in the exhibit range from the small hobby falcon, used by the young squires in the pursuit of small game, to the large golden eagle, capable of carrying away a small mountain goat. The taming and training of birds of prey for sport was practiced in China as early as 400 B.C., and although it was not introduced into Europe until much later, it had become the usual custom in western Europe and England by the end of the ninth century. In the language of falconry the term "falcon" was applied only to the females; the males, which were about one third smaller, being called "tiercels." In Shakespeare's time everyone who could afford to do so kept a hawk, and the rank of the owner was indicated by the species of bird which he carried. To a king belonged the gerfalcon; to a prince, the falcon gentle; to an earl, the peregrine; to a lady, the merlin; to a young squire, the hobby. A yeoman carried a goshawk; a priest, a sparrowhawk; and a knave, or servant, a kestrel.

When an attempt was made in 1917 to introduce into England the practice of selling song birds in the food market, the Royal Society for the Protection of Birds quickly interfered. The custom is common in southern Europe and northern Africa and once was prevalent in our own state of Louisiana. In England, however, larks are still sold legally and in large numbers in open season.

A plan to restore the bird population of France is advanced by M. André Godart in a book entitled *Les Jardins Volières.* M. Godart calls attention to the scarcity of birds in France, due to insufficient protection, and the consequent loss to grape growers of the Gironde in 1910 of forty millions of francs, as well as a decrease in the oil production of southern France so great that the olive growers threatened to abandon the industry. He suggests that goldfinches, bullfinches, linnets, yellow-hammers, thrushes, blackbirds, and starlings, all of which nest readily in gardens, be reared in large and specially designed aviaries and released when full grown to repopulate the now deserted woods and fields.

The department of geology has just acquired two important collections of invertebrate fossils, principally from the famous fossil coral reefs at the falls of the Ohio, near Louisville, Kentucky, and from other important localities in the Middle West, many of which have now been exhausted or otherwise rendered unproductive. One of these is the George K. Greene collection, comprising some four hundred thousand specimens including about five hundred types of the species of corals which were described by Mr. Greene. Mr. Greene was an industrious collector of the old school, being contemporary with Collett, Bassett, Meek, Worthen, and other well-known collectors and palæontologists of the Middle West in the last century. The other acquisition is the Wm. J. McConathy collection, which consists of about seven thousand specimens, principally silicified fossil corals from which the limestone matrix has been carefully etched away with acid.

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 1916:

Visitors at the Museum	847,675
Attendance at Lectures	96,353
Lantern Slides Sent out for Use in Schools	38,912
School Children Reached by Nature Study Collections	1,118,000

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 the JOURNAL. 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.

The various Classes of Membership are as follows:

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

They have the following privileges:

An Annual Pass admitting to the Members' Room
Complimentary tickets admitting to the Members' Room for distribution to their friends
Services of the Instructor for guidance through the Museum
Two course tickets to Spring Lectures
Two course tickets to Autumn Lectures
Current numbers of all Guide Leaflets on request
Current copies of the AMERICAN MUSEUM JOURNAL

Associate Membership

In order that those not living in New York City may associate with the Museum and its work, the class of Associate Members was established in 1916. These Members have the following privileges:

Current issues of the AMERICAN MUSEUM JOURNAL—a popular illustrated magazine of science, travel, exploration, and discovery, published monthly from October to May (eight numbers annually), the volume beginning in January

A complimentary copy of the President's Annual Report, giving a complete list of all Members

An Annual Pass admitting to the Members' Room. This large tower room on the third floor of the building, open every day in the year, is given over exclusively to Members, and is equipped with every comfort for rest, reading, and correspondence

Two complimentary tickets admitting to the Members' Room for distribution by Members to their friends

The services of an Instructor for guidance when visiting the Museum

All classes of Members receive the AMERICAN MUSEUM JOURNAL, which is a magazine issued primarily to keep members in touch with the activities of the Museum as depicted by pen and camera; also to furnish Members with reliable information of the most recent developments in the field of natural science. It takes the reader into every part of the world with great explorers; it contains authoritative and popular articles by men who are actually doing the work of exploration and research, and articles of current interest by men who are distinguished among scientists of the day. It takes the reader behind the scenes in the Museum to see sculptors and preparators modeling some jungle beast or creating a panorama of animal life. It shows how the results of these discoveries and labors are presented to the million public school children through the Museum Extension System. In brief it is a medium for the dissemination of the idea to

which the Museum itself is dedicated—namely, that without deepening appreciation of nature, no people can attain to the highest grades of knowledge and worth.

Publications of the Museum

The Scientific Publications of the Museum comprise the *Memoirs, Bulletin* and *Anthropological Papers,* the *Memoirs* and *Bulletin* edited by Frank E. Lutz, the *Anthropological Papers* by Clark Wissler. These publications cover the field and laboratory researches of the institution.

The Popular Scientific Publications of the Museum comprise the *Handbooks, Leaflets,* and *General Guide,* edited by Frederic A. Lucas, and the JOURNAL, edited by Mary Cynthia Dickerson.

POPULAR SCIENTIFIC PUBLICATIONS[1]

HANDBOOKS

NORTH AMERICAN INDIANS OF THE PLAINS
By CLARK WISSLER, PH.D. — Paper, 25 cents; cloth, 50 cents

INDIANS OF THE SOUTHWEST
By PLINY EARLE GODDARD, PH.D. — Paper, 25 cents; cloth, 50 cents

ANIMALS OF THE PAST
By FREDERIC A. LUCAS, SC.D. — Paper, 35 cents

DINOSAURS
By W. D. MATTHEW, PH.D. — Price, 25 cents

TEACHERS' HANDBOOK, PART I, THE NORTH AMERICAN INDIAN COLLECTION
By ANN E. THOMAS, PH.B. — Price, 10 cents

TREES AND FORESTRY
By MARY CYNTHIA DICKERSON
A new edition in course of preparation.

HEALTH IN WAR AND PEACE
By C-E. A. WINSLOW, M.S., M.A. — Price, 25 cents

ANCIENT CIVILIZATIONS OF MEXICO AND CENTRAL AMERICA
By HERBERT J. SPINDEN, PH.D. — Cloth. Price, 75 cents

ILLUSTRATED GUIDE LEAFLETS

THE COLLECTION OF MINERALS
By LOUIS P. GRATACAP, A.M. — Price, 5 cents

NORTH AMERICAN RUMINANTS
By J. A. ALLEN, PH.D. — Price, 10 cents

THE ANCIENT BASKET MAKERS OF SOUTHEASTERN UTAH
By GEORGE H. PEPPER — Price, 10 cents

THE MUSICAL INSTRUMENTS OF THE INCAS
By CHARLES W. MEAD — Price, 10 cents

THE SAGINAW VALLEY COLLECTION
By HARLAN I. SMITH — Price, 10 cents

PERUVIAN MUMMIES
By CHARLES W. MEAD — Price, 10 cents

[1] Prices net; postage extra

THE METEORITES IN THE FOYER OF THE AMERICAN MUSEUM OF NATURAL HISTORY
By Edmund Otis Hovey, Ph.D. — Price, 10 cents

PERUVIAN ART
By Charles W. Mead — Price, 10 cents

SYLLABUS GUIDE TO PUBLIC HEALTH EXHIBITS IN THE AMERICAN MUSEUM OF NATURAL HISTORY
By Lawrence V. Coleman — Price, 10 cents

THE HABITAT GROUPS OF NORTH AMERICAN BIRDS
By Frank M. Chapman, Sc.D. — Price, 25 cents
Second edition issued May, 1916.

THE INDIANS OF MANHATTAN ISLAND AND VICINITY
By Alanson Skinner — Price, 20 cents

PLANT FORMS IN WAX
By E. C. B. Fassett — Price, 10 cents

THE EVOLUTION OF THE HORSE
By W. D. Matthew, Ph.D. — Price, 20 cents

MAMMOTHS AND MASTODONS
By W. D. Matthew, Ph.D. — Price, 10 cents

HOW TO COLLECT AND PRESERVE INSECTS
By Frank E. Lutz, Ph.D. — Price, 10 cents

OUR COMMON BUTTERFLIES
By Frank E. Lutz, Ph.D., and F. E. Watson — Price, 15 cents

THE BIG TREE AND ITS STORY — Price, 10 cents

THE INSECT GALLS OF THE VICINITY OF NEW YORK CITY
By William Beutenmüller — Price, 15 cents

SOME REPRINTS

THE GROUND SLOTH GROUP
By W. D. Matthew, Ph.D. — Price, 5 cents

THE WHARF PILE GROUP
By Roy W. Miner, A.B. — Price, 5 cents

THE SEA WORM GROUP
By Roy W. Miner, A.B. — Price, 10 cents

THE ANCESTRY OF THE EDENTATES
By W. D. Matthew, Ph.D. — Price, 5 cents

THE STORY OF MUSEUM GROUPS
By Frederic A. Lucas, Sc.D. — Price, 10 cents

THE NEW AFRICAN HALL
By Carl E. Akeley — Price, 5 cents

SOUVENIR STAMP ALBUM
A series of 100 subjects printed from four color plates, each stamp $2\frac{1}{8} \times 3$ inches. Sold in sets of 15 stamps for 10 cents. Album providing space for the entire series including 10 stamps, 15 cents. Album and complete series of 6 sets of stamps, 75 cents; postage, 4 cents.

GUIDE TO THE NATURE TREASURES OF NEW YORK CITY
Price, 75 cents
The purpose of this illustrated guide is to render accessible under one cover an account of the public scientific institutions of Manhattan, the Bronx, and Brooklyn.

POPULAR BOOKS[1]

Based on Explorations, Collections, and Researches of the American Museum of Natural History[2]

AUTOBIOGRAPHICAL NOTES AND A BIBLIOGRAPHY OF SCIENTIFIC PUBLICATIONS OF JOEL ASAPH ALLEN. *American Museum of Natural History*, 1916.
Cloth, \$2.50; Paper, \$2.00

WHALE HUNTING WITH GUN AND CAMERA, ROY CHAPMAN ANDREWS. A naturalist's account of the modern shore whaling industry, of whales and their habits, and of hunting experiences in various parts of the world. *D. Appleton & Co.*, 1916. Cloth, \$2.50

CAMPS AND TRAILS IN CHINA, ROY CHAPMAN ANDREWS AND YVETTE BORUP ANDREWS. An account of the American Museum's Asiatic Zoölogical Expedition, 1916–17. Sixty-five illustrations. *D. Appleton & Co.* (In preparation.) Cloth, \$3.00

THE WARBLERS OF NORTH AMERICA, F. M. CHAPMAN. With 24 full-page colored plates, illustrating every species, from drawings by Louis Agassiz Fuertes and Bruce Horsfall, and half-tones of nests and eggs. *D. Appleton & Co.*, 1907. Cloth, \$3.00

CAMPS AND CRUISES OF AN ORNITHOLOGIST, F. M. CHAPMAN. With 250 photographs from nature by the author. *D. Appleton & Co.*, 1908. Cloth, \$3.00

COLOR KEY TO NORTH AMERICAN BIRDS, F. M. CHAPMAN. With bibliographical appendix, and upward of 800 drawings by Chester A. Reed. Revised edition. *D. Appleton & Co.*, 1912.
Cloth, \$2.50

HANDBOOK OF BIRDS OF EASTERN NORTH AMERICA, F. M. CHAPMAN. With introductory chapters on the study of birds in nature; full-page plates in colors and black and white by Louis Agassiz Fuertes, and text cuts by Tappan Adney and Ernest Thompson Seton. Revised edition. *D. Appleton & Co.*, 1912. Cloth, \$3.50

BIRD LIFE, F. M. CHAPMAN. A guide to the study of our common birds. *D. Appleton & Co.*, 1912. Cloth, \$2.00

TRAVELS OF BIRDS, F. M. CHAPMAN. Our birds and their journeys to strange lands. *D. Appleton & Co.*, 1916. \$ .40

HITHERTO UNPUBLISHED PLATES OF TERTIARY MAMMALIA AND PERMIAN VERTEBRATA, EDWARD DRINKER COPE AND WILLIAM DILLER MATTHEW. Published and distributed with the coöperation of the United States Geological Survey. *American Museum of Natural History*, 1915. Cloth, \$5.00; Paper, \$4.25

DOCTRINE OF EVOLUTION, ITS BASIS AND SCOPE, HENRY E. CRAMPTON. *Columbia University Press*, 1911. Cloth, \$1.50

STUDIES ON THE VARIATION, DISTRIBUTION, AND EVOLUTION OF THE GENUS PARTULA, THE SPECIES INHABITING TAHITI, HENRY E. CRAMPTON. *Carnegie Institution of Washington*, 1916.
\$15.00

A BIBLIOGRAPHY OF FISHES, BASHFORD DEAN. Enlarged and edited by Charles Rochester Eastman. 2 vols. Publications grouped under names of authors; Vol. I, A–K; Vol. II, L–Z. *American Museum of Natural History.* Vol. I, 1916. Vol. II, 1917.
Paper, per vol., \$5.50

THE FROG BOOK, MARY C. DICKERSON. North American toads and frogs with a study of the habits and life histories of those of the northeastern states, with more than 300 photographs from life by the author. *Doubleday, Page & Co.*, 1906. Cloth, \$4.00

A REVIEW OF THE PRIMATES, DANIEL GIRAUD ELLIOT. 3 vols. Vol. I, Lemuroidea, Anthropoidea; Vol. II, Anthropoidea; Vol. III, Anthropoidea. *American Museum of Natural History*, 1913. Paper, \$35.00; Cloth, \$37.00; Morocco, \$60.00

CHECK LIST OF MAMMALS OF THE NORTH AMERICAN CONTINENT, THE WEST INDIES, AND NEIGHBORING SEAS, DANIEL GIRAUD ELLIOT. *American Museum of Natural History*, 1917. Paper, \$1.25

GEOLOGY OF THE CITY OF NEW YORK, LOUIS P. GRATACAP. With numerous illustrations and maps. 3rd edition, enlarged. For use in schools, institutes, and classes. *Henry Holt & Co.*, 1909. Cloth, \$2.50

POPULAR GUIDE TO MINERALS, LOUIS P. GRATACAP. With chapters on the Bement collection of minerals in the American Museum of Natural History and the development of mineralogy. *D. Van Nostrand Co.*, 1912. Cloth, \$3.00

THE ORDERS OF MAMMALS, WILLIAM K. GREGORY. Parts I and II, Author's edition, Bulletin of the American Museum of Natural History, Vol. XXVII, February, 1910. Cloth, \$5.00

BOOK OF THE PEARL, GEORGE F. KUNZ AND CHARLES H. STEVENSON. The history, art, science, and industry of the queen of gems. *Century Co.*, 1908.
Cloth, \$12.50

[1] In alphabetical order of Authors.

[2] Wholly or in considerable part.

THE CURIOUS LORE OF PRECIOUS STONES, George F. Kunz. A description of their sentiments, folk-lore, superstitions, symbolism, mysticism, and use in medicine, religion, etc. *J. P. Lippincott & Co.*, Philadelphia, 1915.
Cloth, $5.00; Morocco, $10.00

MAGIC OF JEWELS AND CHARMS, George F. Kunz. With 90 illustrations in color, doubletone, and line. *J. P. Lippincott & Co.*, Philadelphia, 1915.
Net, $5.00; Half Morocco, $10.00

IVORY AND THE ELEPHANT IN ART, ARCHÆOLOGY, AND IN SCIENCE, George F. Kunz. The Belgian Congo edition. *Doubleday, Page & Co.*, 1916. Cloth, $7.50

RINGS FOR THE FINGER FROM THE EARLIEST KNOWN TIMES TO THE PRESENT, George F. Kunz. With full descriptions of the origin, early making, materials, archæology, and history of rings, with 290 illustrations in color, doubletone, and line. *J. P. Lippincott & Co.*, Philadelphia, 1917.
Cloth, $6.50

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THE AMERICAN MUSEUM JOURNAL

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

March, 1918

Volume XVIII, Number 3

THE AMERICAN MUSEUM OF NATURAL HISTORY

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THE AMERICAN MUSEUM JOURNAL

CONTENTS FOR MARCH

MARY CYNTHIA DICKERSON, *Editor*

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

The Journal 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.

DONALD B. MACMILLAN

Leader of the Crocker Land Expedition, which went North in 1913 and returned in the summer of 1917. The main aim of this expedition was to find and explore land which Peary thought he saw northwest of Grant Land and which he had named Crocker Land. This appearance of land undoubtedly was a mirage, for a sledge journey was made by Mr. MacMillan over moving sea ice to a point beyond where the land was thought to lie, without discovering any conditions indicating nearness of land. Other sledge journeys of geographical interest were made, notably to Finlay Land and North Cornwall and along the western coast of Ellesmere Land from Cape Sabine to Clarence Head.

According to agreement among the three organizations supporting the expedition, the American Geographical Society, the University of Illinois, and the American Museum of Natural History, publication of all geographical reports lies with the American Geographical Society. It is with pleasure that the JOURNAL presents the accompanying article on "Food Supply," together with some of Mr. MacMillan's remarkable Arctic photographs.

THE AMERICAN MUSEUM JOURNAL

VOLUME XVIII | MARCH, 1918 | NUMBER 3

Food Supply of the Smith Sound Eskimos[1]

A STORY OF PRIMITIVE LIFE MAINTAINED ON THE NATURAL RESOURCES OF A FROZEN ARCTIC LAND AND SEA

By DONALD B. MACMILLAN

Illustrations from photographs by the Author

ALMOST beneath the very shadow of the North Pole live the Smith Sound Eskimos, the most northern people in the world, far away from the great struggle of nations. Today while we are engaged in a World War and are trying to solve problems of food and fuel shortage, they, in their warm rock huts beneath turf, grass, skins, and snow, are singing the long dark night away, and talking of the white man in the south who has gone "*pi-blork-to*" (run amuck). The naked child on the bed platform is sucking a frozen egg; the mother is ripping the skin from the body of a frozen dovekie; the father holds in one hand a piece of raw bear meat, in the other, pure fat—bread and butter to an Eskimo.

Conservation of food supplies is the predominant topic of the day, not alone in our country but throughout the world, so far-reaching is the great war in its effects. The Eskimo at the top of the world does not dream as yet that a prolonged world struggle might affect his welfare seriously. How could it? He clothes himself in skins, and eats a purely meat diet—this he has done for centuries without the help of white man.

Let us review the year's work of the Eskimo people; follow the hunter out over the drifting pack ice, up over glaciers, and on into the caribou and musk ox fields; let us sit with the mother and children upon the bed platform,—become one of them.

The minute subdivisions of time reveal the energy, the fervor, the ambition, the progress, and the productiveness of civilization. There are no split seconds from Cape York to Etah, no minutes, or hours, or days of the week. Time rolls majestically on without register, no trains to catch, no whistle to blow, no curfews to ring. The Eskimo takes his time. "Why hurry through life when life is too short as it is?" an old man queried of me, as I impatiently kicked my toes against my sledge.

There is, however, a certain definite time to which all Eskimos look forward with unguarded expressions of pleasure. It is the subject of conversation for weeks in advance. The long dark night has given way to continual sunshine; the snow is melting on southern slopes; water is dripping from bergs; pools of water are found in the hollows of rocks; finally the time comes when the blue of the sky is scanned eagerly day after day, and then resounds through every village the glad cry, "The little auks are here!"

The arrival of this bird marks the transition from winter to summer. From now on it is one long feast.

Hunger, suffering, and privations of the past winter are forgotten, as flying fingers work the sealskin thongs into nets and old harpoon handles into poles. *"Ark-pood-e-ark-suit! Ark-pood-e-ark-suit!"* (Little auks! Little auks!) is heard from tupik to tupik. Pets, pups, and cripples among the dogs (the good dogs are away with their masters) strain at their traces in an endeavor to haul a sledge load of shouting women and laughing children to the bird cliffs a mile away. Here are the birds in countless numbers. The talus slope is literally covered, and the air is filled, the birds resembling at a distance nothing so much as a gigantic swarm of mosquitoes.

The women take their positions in holes among the rocks which have been used for centuries. As flock after flock wheels past within reach, the long dip net sweeps across the path, catching from one to ten birds at a sweep. Many of these birds are eaten raw upon the spot, some are cached under the rocks for the following winter, others are placed in sealskin bags and taken to the tents to be boiled, each person eating about eight birds. The skins are sucked thoroughly to remove the fat, then dried, and used in the manufacture of birdskin shirts.

The eggs of this bird and those of the eider duck are delicacies with these northern people. I have often been one in a party that gathered six thousand eggs in a few hours. Strange to say, these eggs remain fresh for a year if left under the rocks out of the direct rays of the sun. Chilled during the summer, they are frozen hard in September and during the following months. The Eskimos eat many of

This is Borup Lodge, headquarters of the Crocker Land Expedition at Etah, North Greenland, as seen in early spring from the hill above. The house is one of the warmest buildings ever constructed in the North, the walls being double with a four-inch air space. It contains a large living room, four sleeping rooms, a work room, an electrical room, and a photographic dark room these eggs raw, sometimes boil them, and also break them into the intestinal sheath of a seal, thus making egg sausages for the winter months. The children suck the frozen egg as a child at home sucks candy.

The staple food of the Eskimo, however, is the seal, which begins to sun itself on the surface of the ice about the first of May. The hunter hides his approach by means of a white cloth bound to a small sledge, through a hole of which a rifle is pointed—a camouflage. Pushing the screen in front of him, the Eskimo creeps stealthily to within thirty yards of the seal, takes careful aim, and usually wounds the seal—although a large number succeed in wriggling into their holes to die beneath the ice.

Mr. Hoover would be delighted in seeing how an Eskimo utilizes the different parts of a seal; very little is wasted. The skin is used chiefly for clothing and for tents; the fat for fuel; and all the remainder of the body for food, even the intestines and eyes.

Early in the spring, along the edge of the ice many narwhals, the fabled unicorns, are seen. Extremely wary, they are approached and caught only by the most skillful in the tribe. This twenty-foot animal is highly prized by the women, for from its back is obtained the very best sinew for thread. The smooth mottled skin, especially when frozen, is considered a delicacy, and tastes very much like chestnuts. A square foot is none too much for a moderate eater. The meat itself is dark, bloody, and oily; frozen hard and consequently very tender, it is delicious at the close of a long cold drive—almost anything is.

The Arctic home of the Crocker Land Expedition, as it appeared during the short Arctic summer. Well heated during the long winter, lighted by electricity, and having telephone communication with the surrounding Eskimos in their igloos beneath the snow, this house provided quarters more comfortable and convenient than many a New York apartment during the late cold snap

For Eskimo dogs, walrus is *par excellence* the food. A walrus weighs from one to three thousand pounds, and its capture is of vast importance and a source of congratulation. Seldom unaided does an Eskimo accomplish this feat, because of the fighting qualities of the animal and its tremendous bulk. Help is always at hand and eagerly proffered; for to all who help comes a portion of the precious meat. Small boys are seen with large knives busily engaged in amputating a huge hind flipper, skillfully severing muscle attachments and avoiding all bone. The body seems to fall apart of its own weight into twenty-two pieces, which apportioned, or better, seized by all engaged, are cached under a pile of rocks to be sledged to the winter home by dog team some months later, where they arrive as hard as boulders.

For a few days while thawing, the meat serves as a buffet lunch for family and visitors, who are continually hacking it with hatchets and knives. Frozen meat is much more tender than cooked, is easily digested, and highly nutritious. Strange to say, the Eskimo affirms that it has greater heating properties than when cooked. Raw, frozen walrus liver served with bits of fat, we should say at home, but at Etah, "a bite of liver and a bite of fat," is the entrée which often assumes the proportions of a full meal. Walrus meat is tough, too tough for the weak jaw muscles of a white man.

Fish do not seem to be caught or eaten much by the Eskimos of Smith Sound. The number of salmon caught is negligible, a few being obtained at the head of Inglefield Gulf, at Etah, and from the lakes near Rensselaer Harbor. The meat is very poor in quality, seeming to lack flavor-producing fat.

In the fall, Arctic hare are numerous, and in excellent condition after a two months' diet of grass, willow, and the tender leaves of various kinds of low plants. The meat is excellent and relished by all. Oftentimes, I believe,

The little auks were in countless numbers on the talus slope; the ground, too, was literally covered with them, and often the air was so filled that at a distance they resembled a swarm of mosquitoes

It is a great day for the Eskimos of Etah when the little auks arrive, and immediately the women and children start for the little auk cliffs at the head of Foulke Fiord. Laughing and shouting they set forth, for they are certain to capture from one to ten of the birds at each sweep of their long dip nets, and the food shortage of this most anxious part of the year is past

The Eskimos gather the eggs of both eider duck and little auk by the boat load. I have seen six thousand gathered in a few hours. These eggs will remain fresh for at least a year if placed under the rocks, away from the direct rays of the summer sun. Eggs are sometimes boiled but more often are eaten raw and frozen. A frozen egg as a winter delicacy brings as much enjoyment to an Eskimo child as does candy to the child in the United States

LITTLE AUKS ABOVE THE NESTING SITE AT ETAH, NORTH GREENLAND

It is indeed a time of rejoicing in the Eskimo village when the cry is heard, "The little auks are here!" For this marks the coming of summer, when the long dark night gives way to continual sunshine, the snow melts on the southern slopes, and the water drips from the bergs and forms pools in the hollows of the rocks

THE "TIGER OF THE NORTH," HOLDING DOGS AT BAY

Polar bear hunting might well be called the national sport of the Eskimos, who have many stories to relate regarding the "big bear." What a picture he makes in his coat of yellow fur above the white snow, surrounded by dogs, none daring to go within reach of his powerful claws and glistening teeth

A GIANT NARWHAL—GOOD FOOD FOR MANY WINTER DAYS

Hauling a narwhal out on the ice by the employment of a very ingenious rawhide tackle devised and used by the Eskimos for centuries.—The twenty-foot narwhal is an extremely wary animal and can be caught only by the most skillful of the tribe. The smooth, mottled skin is considered a great delicacy, especially when frozen, and a square foot is none too much for a moderate eater. It tastes much like chestnuts. Dried narwhal meat also is highly prized by the Eskimos, while from the back of the animal is obtained the very best sinew for thread

THE NARWHAL'S TWISTED IVORY "HORN"

The eight-foot horn is an enlarged canine tooth of the male narwhal. Very rarely two "horns" of equal length are found. Previous to the introduction of wood among these Eskimos the ivory horn of the narwhal was used for harpoon shafts, killing irons, and sledge shoes.



THE LAND, THE AIR, AND THE WATERS OF THE ARCTIC YIELD FOOD

The Eskimo women wear sealskin bags supported about the neck, in which to bring home their quarry of little auks. Many of the birds are eaten raw upon the spot; some of the remainder are cached under the rocks for winter use, but a large number are carried home in the seal-skin bags to be boiled for feasts in the tents

Ah-nee-na is bringing home two salmon trout caught in Alida Lake at the head of Foulke Fiord. Salmon are not caught, however, if other food can be obtained

In the fall, Arctic hare are not only numerous but also in excellent condition, after a two months' diet of grass, willow, and the tender leaves of herbaceous plants, and a backload such as Ah-nah-we is bringing home is of high food value

A FALLEN MONARCH OF THE GREAT LONELY WASTES OF ELLESMERE LAND

The Eskimos make annual journeys to the musk oxen grounds of Ellesmere Land. Hundreds of musk oxen are taken out each year, providing the very best meat and skins. The animal is easily approached, with the help of dogs, and falls a victim to the killing iron as quickly as to the modern rifle. The bulls always advance in defense of the herd and are the first to fall

The little ringed seal forms the staple diet of the Eskimo. All food administrators of the World War would delight in the Eskimo's conservation of this food supply. No smallest part is wasted, even the intestines and the eyes are utilized as food. The skin furnishes tent material and clothing, and the fat is stored for winter fuel

in the past this animal has kept the Eskimo family from starvation in the decreasing twilight of better times—the long summer day. The locker is empty. During the winter months many visitors have called. Walrus and seal meat, birds and eggs are gone. There is but little blubber. In semi-

Seals begin to appear on the ice above their breathing holes about the first of May. The Eskimo seal hunter makes use of what we have learned to call a camouflage. He approaches his quarry screened by a white cloth which he binds on the front of a small sledge. Creeping stealthily across the ice to within thirty yards of the seal, he aims his rifle carefully through a hole in the screen and usually succeeds in wounding the animal

From the skin of the bearded seal the Eskimos manufacture their harpoon lines and boot soles

darkness the Eskimo family sits fully dressed upon the bed platform listening to the roar and whizz of wind and drifting snow past the translucent window of seal intestines. Where is the meat to come from? The sea ice extends off-shore about twenty miles. Far away at its edge there may be walrus, but if sea and wind should break the pack, death would be the inevitable result. No seals are up on the surface of the ice as yet, and the breathing holes are hard to find. On the land in the neighborhood of the Eskimo village there are but two living things, the Arctic hare and the Arctic fox. Before the advent of the white man, the fox was caught in rock traps, the hare was snared and shot with the bone bow and stone-tipped arrow. At present cheap, small caliber Remingtons and Winchesters are used.

Arklio, dog driver of the expedition, and dead caribou at the northern end of Axel Heiberg Land. The Eskimo values the caribou for its tender meat, but more for its light warm fur

With an equipment consisting of harpoon and float Eskimos hunt the walrus from their kayaks. The capture of a walrus is cause for great congratulation to the successful hunter

In the coast region between Cape York and the Humboldt Glacier, musk oxen became extinct in 1860, not due to the introduction of firearms, but to the human instinct to kill something. This animal, with the help of dogs, is easily and fearlessly approached, and falls a victim to the killing iron as readily as to the modern rifle.

Since 1898, when Peary first wintered in Smith Sound and obtained musk oxen at Bache Peninsula, Ellesmere Land, the Eskimos have journeyed almost annually to these musk oxen grounds. In 1907 they first crossed the heights and descended into Bay Fiord and Eureka Sound, from which region hundreds of musk oxen were taken out last year, furnishing the very best meat and skins.

E-took-a-shoo is inflating a sealskin to be used as a float in hunting walrus. This will be attached to the end of the harpoon line, and its position on the water after the harpoon has been thrown will mark the spot where the body of the walrus has sunk

Another important food of the Eskimo is the caribou which is valued more for its light, warm skin than for its flesh. Caribou meat is tender and sweet, but lacks stamina-giving properties for dog or man. Each year, in October, six or seven sledges can be seen slowly ascending Brother John's Glacier at the head of Foulke Fiord. The trail leads to the north, to the rocky valleys and glistening lakes lying between the coast and the ice cap of Greenland. The children laugh, and chatter, and talk of hearts, tongues, and liver; the women watch their fox traps dangling from the back of the sledge and visualize themselves riding into southern settlements during the long moonlit periods in their new blue fox coats. The men talk of long difficult shots, of raw tenderloin, and frozen brains.

Polar bear hunting might well be called the national sport of the Eskimo. Father and mother and child are filled with stories and traditions of "*Nanook-suah!*" (big bear). King of the White North, he has only two enemies, the Eskimo and his dog. See the picture! A yellowish white body mounted on a snow-white pedestal, surrounded, as I often saw him, by ninety dogs! And not a dog with courage to go within reach of those powerful claws and glistening white teeth.

Bear flesh cooked is oily and tough; frozen and raw, it is delicious. What is obtained is put in cache, and carefully preserved for the forthcoming visits of relatives and friends. It is the best which the host can offer, a badge of honor and a mark of prowess. The successful polar bear hunter is highly respected by all in the tribe.

There is one other dish which the Eskimo is very proud to offer to his friends, one perhaps the most highly prized of all. Following my arrival at a winter home several miles below Cape York, the host immediately harnessed his dogs and dashed off in the darkness, returning an hour later with what resembled the body of a seal. Upon closer examination, it proved to be the stuffed skin of a large ringed seal. Imagine my surprise upon seeing the Eskimo cut a slit in the side, roll up his sleeve, and plunge in his arm to the elbow. As he withdrew it, clutching in his hand several objects of questionable food value, I decided that in the dark he had brought in the wrong bag, or was going to feed the dogs. But if you could only have tasted those black strips of meat! My introduction to dried caribou tongue some years before

The walrus weighs from one to three thousand pounds, and its capture is not often effected by an Eskimo unaided, because of its fighting qualities as well as on account of its huge bulk. The flesh is prized by the family and is also the best food for the dogs among the Naskapi Indians had been very pleasant. My second introduction to dried meat—the contents of the bag had proved to be dried narwhal—served with oil was even more agreeable. The definition of what constitutes good food varies according to a man's appetite, the magnitude of which depends upon his physical condition. Extremely low temperature in the north demands heat-producing food. The internal fires must be kept at full blast. However, no Eskimo of my acquaintance ever "greedily consumed the contents of an oil lamp," as narrated by travelers, or "devoured blubber in huge chunks." He is not a blubber eater, as characterized. We relish fat on our bread; the Eskimos relish fat with their meat.

When the body is compelled to draw all its nourishment from meat alone, naturally very large quantities are consumed, in the endeavor to seize upon all the various ingredients needed for energy and for the renewing of wasted tissue. An Eskimo family of four easily consumes four thousand pounds of meat in a year, about half of which is eaten raw and frozen. A kill is always followed by gorging, and a long sleep. "Eat all that you can possibly hold" is the law of the Eskimo, who believes in enjoying his food while he has it, for days are coming when caches are empty and the larder lean.

It is interesting to note that among these apparently perfectly healthy people there are lacking what we as civilized people consider essential for the maintenance of good health, namely, bread, fresh vegetables, fresh fruits, salt, and sweets. The medical profession for years considered fresh vegetables or lime juice necessary for the prevention of scurvy, so prevalent among the crews of whaling ships and Arctic expeditions. The Eskimo of Smith Sound knows no scurvy.

Is it true that the World War is so far-reaching that no nation or savage tribe will not feel its effects? At first thought the Smith Sound tribe of Eskimos, three thousand miles to the north, seems as remote and as independent of civilization as any tribe in the world. Yet within a year after war was declared, the warning note reached the Eskimos, "Save your cartridges; the white men in the south are fighting and need them all."

Had the white man never gone into the north, the savage would still be free and independent of white man's goods; but after becoming used to them, if deprived of them today, he would fare ill, I am afraid, for years to come. From 1891 to 1909 Rear Admiral Peary kept the Smith Sound Eskimos well supplied with what they now consider essentials, namely, firearms, ammunition, wood for kayaks, sledges, and harpoon shafts, steel traps, knives, matches, needles, thimbles, and tobacco. During the last eight years there has been a Danish trading station at North Star Bay, which has supplied the Eskimos with these and various other commodities—at present utterly lacking because of the scarcity and high price of supplies and the nonarrival of the trading ship in 1917.

After these years of dependence on white man's goods, it would demand of the present generation of Smith Sound Eskimos most severe discipline, extreme suffering, and probably death, to be obliged to return to the hunting methods of a century ago, to the bone bow and stone-tipped arrow, to the unwieldy ivory harpoon shafts, to flint and meteoric iron knives, and to the patient stalking of caribou and seal by the imitation method. This tribe, to which the American people owe so much, cut off from the world to the south, poorly clothed and ill-fed, would dwindle in numbers to a pitiful few. When another summer's sun temporarily frees the waters of ice, they will be standing on the cliffs watching for the smoke of the on-coming steamer to tell them that the world is at peace.

SCENES FROM THE EASTERN ARCTIC[1]

REPRODUCTIONS IN GRAVURE FROM PHOTOGRAPHS

BY DONALD B. MACMILLAN

LEADER OF THE CROCKER LAND EXPEDITION, 1913-1917

In addition to its scientific data and collections in geology, botany, zoölogy, and other lines of field research, the Crocker Land Expedition brought back nearly 5000 negatives and 12,000 feet of motion picture film These are of especial value in showing the country and the manners and customs of the Smith Sound Eskimos

PAN ICE AT ETAH, NORTH GREENLAND

Salt water freezes in the North to a thickness of from six to nine feet. This shows one season's ice which drifted from the inner bays and fiords out into the harbor of Etah about July 1. There are about ten Eskimos living at Etah. There are 276 Eskimos altogether in the Smith Sound tribe. Contrary to the prophecy of early explorers, this tribe is increasing in numbers. In 1906 there were only 211. Etah is the most northern settlement; the most southern is Cape Seddon in Melville Bay

MACMILLAN'S DOG TEAM AT ETAH, NORTH GREENLAND, IN SUMMER

These dogs traveled 8000 miles in the four years of the expedition's work. Upon one occasion they traveled five days with no food whatever, covering 180 miles. Walrus meat is the best dog food in the eastern Arctic. When the expedition lacked fresh meat for its dogs, pemmican was used, made of the best dried beef and suet

CROCKER LAND EXPEDITION CAMP ON SEA ICE

In the construction of a snow house about forty-two blocks, 24 x 18 x 4 inches in size, are used. When traveling over sea ice, we made a new house each night, consuming in time about fifty minutes

BUILDING A SNOW HOUSE AT PETERAVIK, NORTHWEST GREENLAND

Note the small houses at right and left of the large igloo. These were constructed for storage of the expedition's meat and other supplies so that they would be safe from attacks by the dogs or by wandering bears or foxes

PULLING OUT A NARWHAL, THE FABLED UNICORN OF THE ANCIENTS

These animals are from fifteen to twenty feet in length. The long, spirally twisted tusk which protrudes from the left upper jaw like a horn furnishes ivory of commercial value

ETAH FIORD AND BORUP LODGE IN EARLY SEPTEMBER

The first fall of snow on the hills and the first ice in the harbor, as seen from the hill west of the headquarters of the expedition. Etah is a little village where some of the Smith Sound Eskimos live, in their stone huts from September to May and in sealskin tents during the summer

A BED OF FLOWERS AT ETAH

After the early purple saxi. frage, which appears about June 10, comes the yellow Arctic poppy. This begins to bloom about June 20 and remains until August 25 It is the flower which is found at the most northern point of known land in the world, Cape Morris K. Jesup, only three hundred and seventy miles south of the Pole

LOW WATER AT ETAH IN SEPTEMBER, SHOWING FORMATION OF ICE FOOT

FASHIONS IN FUR

Al-ning-wah, wife of Arklio, the expedition dog driver, can well smile and defy the fifty degrees below zero, for she is wearing a blue foxskin coat, the fashionable winter costume among the Smith Sound Eskimos. Shy little Megishoo, the boy, Kah-da and Ah-nee-na, the best seamstress for the Crocker Land Expedition, are wearing coats made from skins of the little ringed seal. Note the pattern of Ah-nee-na's hood, cut high to accommodate her hair underneath

AN ICEBERG AT ETAI

An offshoot from the fro
of some glacier, it has com
from the heights of Greenlan
moving gradually toward th
sea at the rate of from a fe
inches to ninety feet a day

THE KING OF THE NORTH

In the harbor in front of the Crocker Land Expedition's headquarters at Etah. The polar bear has but two enemies, the Eskimo and his dog. Bear meat is the best offering which an Eskimo host can offer, its possession being a badge of honor and a mark of prowess

THE WITCHERY OF THE NORTHLAND

The Sonntag Glacier at Sulwuddy, south of Cape Alexander. The Sun is due south. Scenes like this stay in the memory and bring homesickness for the silence and great spaces of the Arctic

Photograph by W. Elmer Eklau

HERD OF MUSK OXEN ON THE FOSHEIM PENINSULA

As late as 1881 it was thought that these animals must migrate southward during the winter for food. They have been found, however, at the most northern points of Grant Land and Greenland during the darkness of the winter night, feeding on the frozen grass laid bare by violent winds

THE FROZEN NORTH

The region about Clements Markham Glacier, south of Peteravik, Northwest Greenland, is the great spring hunting ground of the Smith Sound Eskimos. Since 1898, when Peary

SHOO-E-GING-WA WITH POPPIES

Weird effect of the midnight sun behind an iceberg

The midnight sun photographed at twenty-minute intervals from Sunrise Point looking due south over Littleton Island—well known for its marked place in Arctic history. The dip of the sun in the North depends upon the latitude of the observer. At the North Pole such a line of suns would be nearly straight, that is parallel with the horizon, gently rising until June 21, after that date falling until September 20, when the sun would set below the horizon for the long night of six months

"The Origin and Evolution of Life"[1]

A NOTABLE BOOK BY HENRY FAIRFIELD OSBORN

By FRANK R. LILLIE

Professor of Zoology at the University of Chicago

THIS attempt to define the problems of organic evolution in terms of modern mechanistic science represents the first comprehensive effort in this direction. For many years the tendency of research has been toward specialization at a constantly accelerating rate, with a consequent accumulation of scientific treasure in physics and chemistry, in astronomy, in geology, and in the various biological sciences. In the last, progress has been marked by a more rigorous exactness of biological conceptions, by the extension of biological chemistry and the origin of new ideas concerning chemical correlations within the organism, by an immense development of the cell doctrine which dominates the special physiology of every part, by the rise of exact genetic study and the extension of experiment to all parts of the analytic biological field, by the rapid growth of palæontological knowledge and the consequent revision of animal and plant classification—and by much besides. Every specialist was so engrossed in the beauty and fertility of his own problems, and so impressed with the almost radically insoluble character of the fundamental questions of his own field, that the greatest of all biological questions, the synthesis of the whole—the origin and evolution of life—seemed even farther removed and more difficult than it could have appeared to the naturalists of Darwin's time.

To be the architect of this supreme construction, who so fitted as the palaeontologist who has the sense of time the creator—who coöperates with the geologist and thus lays hold of the genesis of the earth itself? But the palaeontologist who would attempt this must link hands with the biologist who experiments and deals with life in action.

Professor Osborn has these contacts and has used them; he has had the coöperation of scientists in all fields. His book stands midway in the Hale Cosmic Evolution Series of Lectures of the National Academy of Sciences, which opened with Sir Ernest Rutherford's discourse on "The Constitution of Matter and the Evolution of the Elements," and continued with "The Evolution of the Stars and the Formation of the Earth" by William Wallace Campbell, and the "Origin of the Earth" by Thomas Chrowder Chamberlin. It thus rests on these authoritative presentations of the present status of inorganic evolution, and essays to bridge the greatest gap in the evolution problem—from lifeless to living—and to formulate the most difficult of all evolutionary problems, that of living things.

The author is fully aware of the greatness of his task. In the preface he says: "In these lectures we may take some of the initial steps toward an energy conception of Evolution and an energy conception of Heredity, and away from the matter and form conceptions which have prevailed for over a century." Again: "We are not ready for a clearly developed energy conception of the origin of life, still less of evolution and of heredity; yet we believe that our theory of the actions, reactions, and interactions of living en-

[1] *The Origin and Evolution of Life, on the Theory of Action, Reaction and Interaction of Energy*, by Henry Fairfield Osborn. Charles Scribner's Sons, New York, 1917, pp. xxxi, 322 with 136 illustrations

ergy will prove to be a step in the right direction."

The problem leads from a purely inorganic world to a world with simple life forms, and from such a simply peopled world to one with all the amazing richness and diversity of the living present. Astronomy and geology furnish us with a clear and simple conception of the evolution of the stellar universe and of the earth itself, demonstrable in many of its features. Do these processes of evolution lead to the origin of life forms, or with the origin of life forms have we a manifestation of some new principle? If life forms originated conformably with stellar and world forms, was it a gradual or a sudden process? Has the farther evolution of organisms proceeded according to definite physiological laws of development, or has it been guided by chance as conceived by Darwin?

Whatever the difficulty of these questions, however inconceivable it may appear that demonstrable answers can be furnished, or that the almost infinitely various detailed problems on which the solution of the whole rests should be worked out, it is impossible that the attempt should not be made to work out a single causal nexus of events. A great merit of the present work is that it evades no difficulty, but clearly sets forth the problems to be solved, and utilizes all the resources of the various evolutionary sciences to furnish suggestions and propose hypotheses.

That evolution is due to the actions, reactions, and interactions of the forms of matter and energy of the primitive world, which occur everywhere in the universe, is the guiding idea. These constitute four groups in the actual evolutionary process, namely, the inorganic environment, the organism, the heredity-germ, and the life environment—hence the term tetraplasy—and selection is operating constantly at every stage of the process.

The chapters deal with the preparation of the earth for life; the sun and the physicochemical origins of life; energy evolution of bacteria, algæ, and plants; the origins of animal life and the evolution of the invertebrates; the visible and invisible evolution of the vertebrates; evolution of body form in the fishes and amphibians; form evolution of the reptiles and birds; evolution of the mammals.

The aspect of adaptation runs all through the treatment. To begin with, Professor Osborn takes over with approval Henderson's conceptions of the fitness of the life elements and of the inorganic environment; he finds fitness in the nature of the colloidal system of protoplasm "peculiarly favorable to . . . the free interchange of physicochemical energies." He emphasizes the adaptation of the organism to the environment, and the adaptation of the internal correlations of the organism through internal secretions, enzymes and the nervous system. Special aspects of adaptation are dealt with in the laws of form evolution with reference to locomotion, offense and defense, and reproduction, as illustrated in the laws of convergence and of adaptive radiation. The independently adaptive aspects of different organs, as they radiate in evolution in correlation with varied environments, "is fatal to any form of belief in an internal perfecting tendency which may drive animal evolution in any particular direction or directions. Finally, it is fatal to Darwin's original natural-selection hypothesis, which would imply that the teeth, limbs, and feet are varying fortuitously rather than evolving under certain definite although still unknown laws."

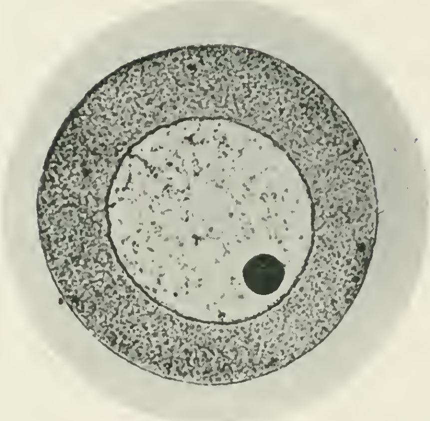
The study of evolution runs in two closely related parallel lines, the visible line of the body or soma and the invisible line of the germ or "heredity-chromatin." The author states the Lamarckian hypothesis that somatic evolution precedes and controls germ-evolution and the revised Darwinian hypothesis that germ-evolution is primary but undirected, and body-evolution secondary. He holds

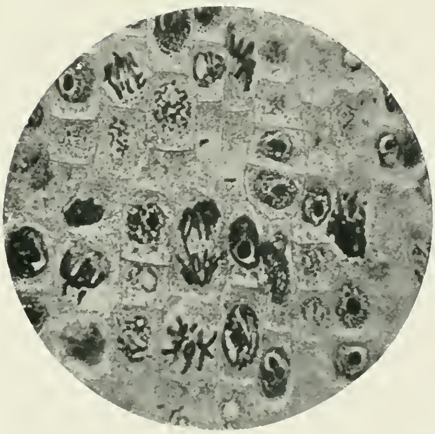
> "that our search for causes must proceed along the line of determining which actions, reactions, and interactions invariably precede and which invariably follow—those of the body cells (Lamarckian view) or those of the chromatin (Darwin-Weismann view). The Lamarckian view that adaptation in the body cells *invariably* precedes similar adaptive reaction in the chromatin is not supported either by experiment or by observation; such precedence, while occasional and even frequent, is by no means invariable. The Darwinian view, namely, that chromatin evolution is a matter of chance and displays itself in a variety of directions, is contradicted by palaeontological evidence both in the Invertebrata and Vertebrata, among which we observe that *continuity and law in chromatin evolution prevail over the evidence either of fortuity or of sudden leaps or mutations*, that *in the genesis of many characters there is a slow and prolonged rectigradation or direct evolution of the chromatin toward adaptive ends*. This is what is meant in our introduction by the statement that in evolution law prevails over chance."

The chapters on the evolution of the vertebrate classes are a brief and illuminating survey of a field of the greatest popular and scientific interest, which has hitherto been accessible only to the specialist. This part of the subject lies within the author's own field of research, and has special interest on that account. It is illustrated with many beautiful reconstructions and drawings of extinct forms based on the rich collections of the American Museum of Natural History and other sources. In the work he has had the collaboration of Dr. W. K. Gregory in the reconstructions, and the skillful animal artist Charles R. Knight in the drawings.

The entire graphic and fascinating presentation of the history of life upon the earth is such as only a master in palaeontology could present. The theory, therefore, naturally concerns primarily the great evolutionary movements. The writer, however, constantly emphasizes the principle, that the great evolutionary events and tendencies that may span millions of years are the resultant of the elementary laws of biology. But he does not attempt to utilize such laws in theoretical construction, but rather for illustration often of an exceedingly apt character; an example is the application of hormone theories to explain certain changes of proportion of parts in the evolution of mammals. The laws of inheritance and of experimental biology with relation to evolution are, however, to form another volume of the same series by Professor Conklin.

By virtue of its very rigor and comprehensiveness the book leaves us with a sense of almost infinite inadequacy before the problem of the physiology of form and character evolution. The morphology of the process we are beginning to know with some approach to completeness in certain places. Will it ever be possible to trace the actions, reactions, and interactions of Professor Osborn's four complexes of energy in the evolution of living things? Certainly before this can be done the physiology of embryonic development and of heredity must be much farther developed. But to have surveyed for us the field from so rich a fund of experience is a notable service to that integration of scientific work which is so great a need of the present.





HEREDITY-CHROMATIN A CENTER OF PHYSICOCHEMICAL ACTION

Osborn's book, *The Origin and Evolution of Life,* discusses four great interrelated evolutions guided and controlled by four great sets of interacting energies. One is the evolution of the earth itself, which becomes the environment or home of any organism, to which it must adapt itself or die; another is the great world of plants and animals among which any organism lives, its *life environment,* where also it must adapt itself or die and end its race—in other words where "selection" acts to preserve or eliminate it. The other two are respectively the visible and the invisible (the latter purely speculative) evolutions that take place in the organism itself, that is (1) the evolution of the body which is temporary and will die and (2) the evolution of the heredity-chromatin of the germ, that connection between organism and organism of successive generations, which does not die and represents the continuity of life from the beginning until to-day.

The heredity-chromatin (shown black in the figures), always in a surrounding protoplasm (shown grayish dotted), is visible under a microscope, and certain items of its behavior can be observed. Chemically it contains an unusually large amount of phosphorus, and is one of the most complex of all substances. Scientists believe that it carries the heredity determiners, both of the individual and of the species. Under its influence the cell protoplasm divides and subdivides into self-reproducing cells.

The upper figure shows an egg cell from the ovary of a sea urchin. In this resting stage the chromatin is concentrated into a small sphere.

In the middle figure are cells from the rapidly growing root tip of an onion.

Below are cells from the embryo of a giant redwood tree.

In the large cell in the center the chromatin is seen dividing into rod or sausage-shaped masses. These are grouped in two rows facing each other at the middle of a spindle (the two rows are somewhat indistinctly shown; note later stage in a central cell of figure next above). Later the cell divides through the middle of the spindle so that one row of the chromatin rods is drawn into one half of the cell and the other row into the other half. The heredity determiners derived from both parents are at first united and then in this way redistributed so that every cell (with certain exceptions) in the developing body of the new organism has an equal amount of chromatin carrying heredity determiners

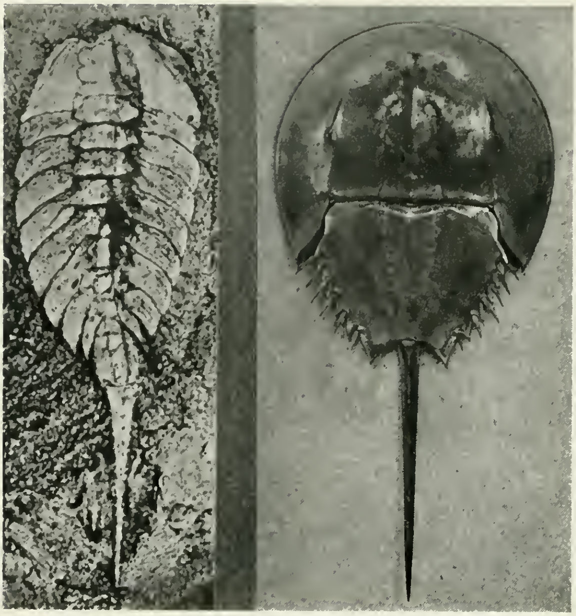
From *The Origin and Evolution of Life*

CHROMATIN OF REDWOOD TREE AND TRILLIUM

It is thought that each species remains constant in the bulk of its heredity-chromatin; but this bulk may bear little relation to the size of the organism. The chromatin (black rods, magnified about one thousand diameters) of the embryo of the redwood tree is somewhat less in bulk than that of the low woods flower, trillium—the former nevertheless carrying heredity determiners for an organism two hundred or more feet tall and of very long life (two thousand or more years), the latter for a relatively minute, short-lived form.

Profound interest in the study of the chromatin lies in the bare fact that it carries the heredity determiners and, distributing itself throughout the given organism, controls it to take on not only its normal species form but also its inherited individual variations and to maintain both often through many decades of radical change in the actual matter composing it.

It is remarkable that in plants, all of which, even the largest redwood tree, lack a nervous system, there is perfect and sometimes rapid coördination of parts and response to stimuli. This is probably brought about by physicochemical interactions, resulting in the circulation through the tissues of invisible "chemical messengers," corresponding with certain ferments and secretions of ductless glands in the animal body



PERSISTENCY OF TYPE

An inhabitant (*Molaria spinifera*, at the left) of the seas many million years ago (mid-Cambrian), presented for comparison with its modern descendant, the common horseshoe crab (*Limulus*).—They well illustrate adaptation to their sand and water environment, and also the persistency of a type through vastly long periods of time.

In such an example of evolution (visible of the body and invisible of the germ), the body has been in direct contact with the forces of the inorganic and the living environments; the heredity-chromatin of the germ has been remote from contact with external environments. Professor Osborn records that, nevertheless, the study of prehistoric animals tends to prove that the evolution of the heredity-chromatin, while slow and prolonged, always is directed toward adaptation of the species to its life in the given environment.

A geologic estimate made in 1899 (Geikie), of the age of life, or of the earth since bacterial life appeared, is from one hundred to four hundred million years; an estimate made in 1909 (Sollas) gives from thirty-four to eighty million years. These estimates were made by computing, at rates of deposition today, the limestone and other deposits due to the work of bacteria (followed later by other mineral-depositing life forms, algæ, diatoms, protozoans, and mollusks).

Whether chromatin is as old as the bacteria, or in fact whether it exists in the bacteria of today, is a disputed question. It is the opinion of the author, following that of Wilson (Columbia University, New York) that chromatin is as old as protoplasm, and that it takes its place with protoplasm as one of the two great tangible elementary structures of all life even unto man.

OFFENSIVE AND DEFENSIVE ADAPTATIONS

The carnivorous "tyrant" dinosaur (*Tyrannosaurus*) (it towers about 18 feet from the ground) is approaching a group of horned herbivorous dinosaurs (Ceratopsia).

The Origin and Evolution of Life discusses the theory of the beginning of life as a recombination of energies and elements preëxisting in the cosmos. It puts forth the idea that there is an energy control of life, that energy is the cause of evolution, that some combination of energy always precedes and molds form in the living world. We recognize that invisible energy lies back of the phenomena of the electric train and of wireless telegraphy; it is possible that the energy transmitted from the microscopic chromatin, acting in an infinitely complex and, to us, mysterious way, can control the development of a giant tree or a dinosaur.

The author emphasizes that it is the function of life to "capture" energy wherever it can be found and to utilize it. Earliest forms of bacterial life, feeding directly on inorganic matter, used heat energy from the sun; green plants capture light and heat energy (they can make starch only in sunshine), storing these within themselves in passive form (in starches, oils, sugars, etc.) which the animal retransforms into active energy when the plants are used for food. The giant dinosaurs were the climax in capture, storage, and release of energy. The evolution of the defensive types proceeded step by step with that of the offensive types, producing an example of counteracting evolution similar to that in North American wolves and bison or deer. This approach by Osborn to life and evolution through a study of energies primarily and of matter and form secondarily sets a direction for future researches by the many—instead of by the few as in the past

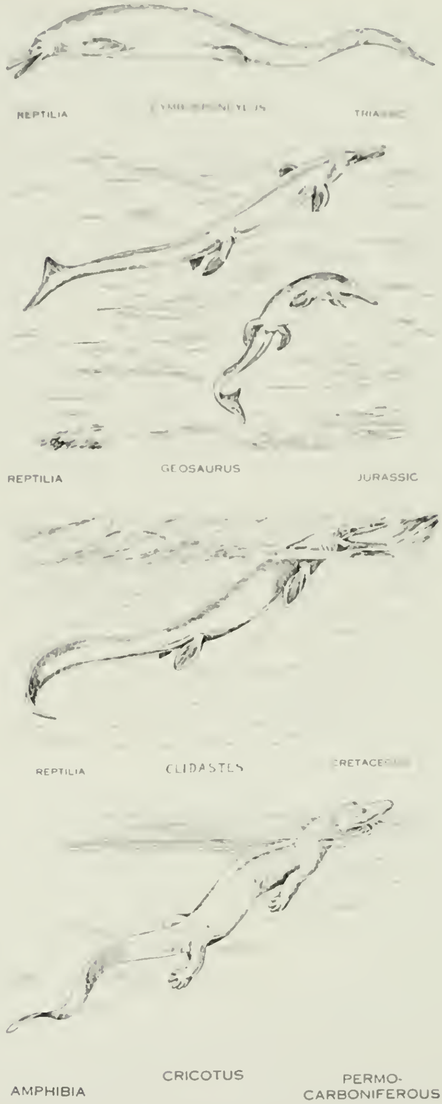
EXAMPLES OF CONVERGENT ADAPTATION

Animals become structurally adapted to the environment in which they live, and forms not closely related — in fact very distantly related and living in widely separated parts of the globe — may take on exactly similar adaptations when acted upon by similar environments.

This is easily seen in adaptations for aquatic locomotion. In each instance the mechanical resistance of the water to rapid motion is overcome by long and slender body lines and sidewise flattening of the tail; rapid propulsion is accomplished by sinuous movement of this long body, and sweeping paddle work of the tail, aided by movement of the fore and hind appendages which take on more or less perfectly the form of fins.

The three upper drawings represent restorations of three extinct reptiles, — ichthyosaur, primitive sea lizard, and sea crocodile; the fourth below, is an extinct amphibian; the fifth a mammal (a primitive whale) — and we know that rapid-swimming fishes also have the same adaptations.

Such development of similar structures and habits responsive to similar external forces, implies similarity in the physicochemical energies of protoplasm and chromatin and orderliness in their behavior, as well as constant similarity in the working of selection



CHOIR OF THE LITTLE CHURCH ON THE CERRITO DEL CARMEN

Built in 1620 this chapel survived the frequent and heavy shocks of the seventeenth and eighteenth centuries only to collapse on the night of January 3, when within two years of its third centenary

The Guatemala Earthquake

By SYLVANUS GRISWOLD MORLEY

Carnegie Institution, Washington, D. C.

THRICE, and each time located in a different spot, the capital of Guatemala has been destroyed by earthquakes: in 1541, in 1773, and lastly in the recent shocks of Christmas week, 1917.

Close on to four centuries ago, in 1524, Pedro de Alvarado, a captain of Hernando Cortéz, the intrepid conqueror of Mexico, penetrated this region for the first time, and brought it under the banner of the King of Spain; and in 1527 his brother, Jorge Alvarado, founded the first capital of the new Kingdom of Guatemala in the smiling valley of the Panchoy at the very base of the lofty volcano of Agua.

In spite of its sonorous title, "Santiago de los Caballeros de Guatemala" (Saint James of the Gentlemen of Guatemala), this first city of the name was destined to a short life. On the night of September 10, 1541, after some days of excessive rainfall, there was felt a prolonged and violent movement of the earth, and immediately thereafter the city was deluged by a torrent of water, mud, and rocks, which, rushing down the side of the volcano of Agua, filled the city's streets, destroyed its houses, and killed many of its inhabitants. In this calamity many people of the city, including Beatriz de la Cueva, the widow of the Adelantado and his successor in the rule of the kingdom, lost their lives. The Adelantada was drowned in the private chapel of her own home whither she had fled with twelve of her ladies-in-waiting to escape the rushing waters.

This event cast a profound gloom over the survivors, and the following year the new capital, the second city of "Santiago de los Caballeros de Guatemala," was founded in the same valley but about one mile and a half east of the old location, that is, farther away from the base of the volcano. And all that now remains of the first capital is a crumbling ruin said to have been the house of Doña Beatriz. The site was not entirely abandoned, however, and a small village called La Ciudad Vieja, The Old City, has since grown up there.

In time the new capital became the most magnificent and populous city in Central America, having as many as sixty thousand inhabitants by the middle of the eighteenth century, and more than fifty churches, monasteries, and convents. The Franciscans, Dominicans, Capuchins, Jesuits, Recollects, and of the sisterhoods, those of Santa Theresa and Santa Clara, all had large and splendid establishments in the city, the ruins of which still excite the liveliest admiration. And all of this enterprise in the face of repeated discouragements on the part of nature, for the earthquakes continued at frequent intervals. Indeed the history of the second city of Saint James of the Gentlemen is one long series of disastrous shocks: 1565, 1575, 1576, 1577 (two), 1586, 1607, 1651, 1663, 1679, 1681, 1683, 1684, 1687, 1689, 1702, 1717, 1719, 1751, 1757, 1765, and four during the latter half of 1773.

This last blow of fate, four shocks within a six-month (two even on the same day), was too much for the long suffering citizens, and after many stormy sessions of the city council, they finally decided to move the capital a second time. In favor of this change were the civil and military authorities; opposed, were the ecclesiastics. Both the secular clergy and the monastic orders had too heavy an investment in churches and vast conventual establishments to view with equanimity any change which would tend to decrease property value, and they bitterly objected to the proposed change. But in spite of this opposition the matter went slowly forward.

Royal engineers were sent over from Spain, and after due deliberation and study a new site was chosen in the next valley, twenty miles east of the former capital; and in 1776, the third city of Santiago de los Caballeros de Guatemala was formally founded here, although the government itself was not moved over until three years later. Again, as in the case of the first city, the second was not entirely abandoned. Many people refused to leave their homes, and under the name of Antigua the place has been occupied down to the present day. It is for all that, however, a city of the past; its magnificent churches and public buildings are in ruins, and its population has shrunk from sixty thousand to less than ten thousand.

The third city of Guatemala was located where it now stands because of the supposed immunity of the place from earthquakes. And when the site was chosen there were some grounds for such belief. There had stood here since 1620, on a little hill in the midst of the plain, called the Cerrito del Carmen, a small church and monastery, which had weathered successfully the numerous shocks of the seventeenth and eighteenth centuries. The site, moreover, was surrounded on three sides by steep barrancas or cañons. Rightfully or wrongfully the royal engineers believed these cañons to have been responsible for the immunity which the little church and the surrounding plain had enjoyed.

In due course of time and in spite of repeated shocks, 1827, 1830, 1852, 1853, 1855, 1858, 1861, 1862, 1870, 1873, 1874, and others of lesser intensity since, a new and still larger and more beautiful city grew up. A handsome cathedral was built; church and government buildings were erected. The place finally came to have a hundred thousand inhabitants and became known as "The Paris of Central America."

The present "family" of earthquakes, which culminated in the great shocks of December 25 and 29, 1917, and of January 3, 1918, began as far back as the middle of November; and indeed are probably to be correlated more remotely with the same subterranean activity as that which caused the destructive earthquake and volcanic eruption in San Salvador six months earlier, on June 7, 1917.

On the evening of November 17 last, Guatemala City experienced a brisk little shake but of short duration. During the days which followed, scarcely a week went by without some slight tremor of the earth being felt, but nothing came of it. The people became inured to these *temblorcitos* or "little shocks" as they were called, because of their very frequency, and ceased to worry about them. It seemed that even Mother Earth could cry the wolf too often. At seven o'clock in the evening of December 24 there was a second brisk little shock. Dishes rattled on the tables, electric light fixtures swung back and forth, people even ran from their houses for the moment; but again nothing came of it, except one wise order from the government that there be no performances in the moving picture theaters on the following evening.

Christmas evening about seven we felt a slight tremor but scant notice was taken of it. Perhaps by relating my own experiences in the few hours that followed I can best describe how the shocks came and how the city reacted to them. I had been out to dinner that evening and was returning to my hotel. The night was cold for the tropics, about 55° Fahrenheit, and a brilliant moon was in the sky.

Suddenly and without previous warn-

CHURCH OF THE RECOLLECIÓN, GUATEMALA CITY

This was one of the largest churches in the city and was completely destroyed. The shock of January 3 brought down the two towers and the pediment between, shown as still standing in this picture taken after the shocks of December 25 and 29

A typical street scene. House after house in ruins and the interiors exposed to view

Temporary shelters of matting, cloth, canvas, and sheet iron.—Thousands are living in huts like the above

The Villa Earnestina on the Paseo de la Reforma, the suburban residence of the former President Reina Barrios, completely wrecked

A broken water main in front of the National Palace serves many uses. Clothes are washed on the stone flags of the street just where the water bubbles forth, and are spread on blocks of fallen masonry to dry. Water for cooking purposes is drawn here, and even the mules partake of the flow. Most of the mains are broken, and such chance sources of supply as this constitute one of the gravest menaces to the health of the city, which our American Red Cross is striving hard to shield from disease

The military school on the Paseo de la Reforma, the West Point of Guatemala. This view was taken after the shocks of December 25 and 29; the shock of January 3 did even greater damage ing the ground lurched up under my feet and began to shake violently. An arc light overhead went out, flashed on, off, and on again. Wires short-circuited, spluttered and spit. The buildings on both sides rocked back and forth. My first thought was of the wires, and I darted into the nearest doorway to escape electrocution. Plaster and even brick began to rain down here and I ran back into the street to escape falling walls.

I perceived at this instant, that the only safe place in my immediate vicinity was the Plaza de Armas or the large central square of the city, and I set off running thither at top speed. As I passed the American Club there tumbled from the big front entrance pell-mell into the street perhaps a dozen men who joined me, running toward the plaza. By the time we reached there people sketchily clad were pouring into it from all sides. The air was filled with a fine impalpable dust from the fallen adobe walls and a mist had drawn over the moon.

Slight tremors followed one after another almost without cessation. One felt instinctively that it was not over and all braced themselves for the next shock. At half past eleven the ground

The new market on the Plaza de Armas in front of the Cathedral.—The stalls were removed from the old market to this open space and business goes on in the new quarters as usual

Church of the Sanctuary.—In the foreground are temporary shelters with sides of matting and cloth and roofs of sheet iron

The Ministries of Fomento (Interior) and Hacienda (Finance) are housed in this shed in the Plaza de Armas

The Ministry of War occupies this open thatched shed facing the Plaza de Armas

Temporary chapel of wood and cloth hastily erected on the Cerrito del Carmen to shelter the figures of the Christ and the Virgin Mary rescued from the church, and the improvised altar. The congregation sits in the open lifted a second time under our feet, jerked back and forth, and all but upset us. Buildings crashed down, wires short-circuited, and a choking dust again filled the air.

In view of the fact that their homes were being shaken down almost about their heads, the inhabitants were surprisingly calm. I saw very little hysteria and no disorder. The Indians fell on their knees when the second shock started, and began to pray. Lighted tapers were produced from somewhere and the drone of many prayers came from all sides. This second shock was far more severe than the first, and was the one which really destroyed the city. Subsequent shocks only brought down previously cracked and loosened walls. There followed an interval of minor quivers until ten minutes past two in the morning, when the third and last great movement of that long night shook the city, bringing down many more houses.

We all underestimated the damage that night. In the darkness there at the plaza we could see and hear only a small part of the destruction going forward, and it seemed that the city was weathering the assault fairly well. But dawn undeceived us as to the true condition of affairs. Guatemala City was in ruins.

I had been in San Salvador a week after the earthquake of June 7, and the destruction there was nothing compared with this. To be sure Guatemala is twice as large as San Salvador, but relatively, as well as actually, the destruction was greater. My first walks through the city showed that the streets were filled with the débris of fallen houses, tiles, bricks, plaster, adobe; façades were riven by tremendous cracks; interiors were exposed to view, the intimate details of the home opened to the curious; walls leaned at perilous angles; roofs hung by single beams; a tangle of wires draped the telephone poles; and everywhere people were huddled in the streets waiting, waiting, waiting. Later in the day it was possible to learn further details of the catastrophe. Railroad and telegraphic communication with both the Atlantic and Pacific coasts was cut. Indeed it was not until forty-eight hours later that the first news of the disaster left the stricken city.

In the shocks of Christmas night about seventy persons were killed, mostly in the poorer quarters where the building construction was of adobe brick, of very inferior type, which crumpled like a house of cards. Considering the amount of damage done to the houses, the loss of life was surprisingly low. That it was not higher, may be laid to the fact that the first shock, although it drove everyone out of doors, actually brought few houses down.

The government at once took the situation in hand. Martial law was declared. Emergency tent dispensaries and hospitals were established in all parts of the city, and the free distribution of food (corn and beans) was begun. Business ceased while the people took up the work of moving their lares and penates into the streets, parks, squares, plazas, and open lots about the city. Wooden sheds were erected in the Plaza de Armas, and here the government departments, banks, and drug stores opened temporary offices. Gradually confidence returned; slight tremors continued but nothing violent; people ventured again into their homes to salvage their belongings from the wreckage—and then fell the next blow.

At two o'clock on the afternoon of December 29 the fourth heavy earthquake shook the city. This time the motion was horizontal, not vertical as in the case of the preceding three, and in consequence many more walls toppled over. And also because it was in the daytime, and people were in the houses, more were killed than on Christmas night. It is estimated that more

The British Legation after the shocks of December 25 and 29, and from the same point of view after the shock of January 3. Note the complete collapse of the second story in the later photograph. This last shock finished the work of destruction. What the others had spared, it shook down

The railroad station was damaged only slightly by the shocks of December 25 and 29. The hole in the tower was left by the clock dial when it fell out of the wall. It was thoroughly wrecked by the shock of January 3. The differences between these two pictures give an excellent idea of the relative destructiveness of the two shocks than one hundred lost their lives in this one shock alone.

The inhabitants were now thoroughly terrified. No one could tell when the thing was going to stop. All waited for the volcanic eruption, which would relieve the tremendous subterranean pressure and alleviate the situation as it had done in San Salvador six months before, but none came. A great exodus began. People fled from the city by the hundreds, going for the most part to the cities on the Pacific coast-plain, Esquintla, Mazatenango, Quezaltenango, and Retalhuleu.

A new and gruesome situation developed. Hundreds of recently buried corpses were thrown from their vaults in the cemeteries and a pestilence therefrom was imminent. The government again acted with gratifying promptitude, however, and vast funeral pyres lighted the sky on that and succeeding nights. It is estimated that more than four thousand bodies were then disposed of.

Again the stricken city strove to compose itself. Slight tremors still continued but of diminished violence. A few shops opened here and there; fewer people left the city; confidence was returning a second time, when at twenty minutes to eleven in the evening of January 3, the city was rocked to its very foundations by the most tremendous shock of all. The earth lifted up as though pushed by some vast subterranean agency seeking outlet, held a moment thus, and then in terrific jerks and twitchings, settled back. By stop-watch this mighty movement lasted eleven minutes from its first cataclysmic second to its last dying tremor. And the destruction which it accomplished was more than that of all the others combined.

It is true, that the city had already been fairly well loosened in its joints, but the earthquake of January 3 finished the work of destruction. What the others had spared, it shook down. The lofty twin towers of the cathedral were hurled to the ground like so many pill boxes. The massive pediment between fell in one solid block. The roof caved in. This edifice, the largest, costliest, and most magnificent in the country, is in ruins. Even the little chapel on the Cerrito del Carmen built three centuries ago, around which this third capital had been built, succumbed to this last violent movement of the earth. The roof fell in, and only with difficulty some of the faithful extricated the statue of the Christ and installed it in a temporary shelter outside. More than a hundred lost their lives in this last shock, bringing up the total of deaths to about three hundred. The city again was demoralized and thus it was when I left it five days later, coming down to Puerto Barrios on January 8 by the first train to leave the city after the last shock.

For the third time since its organization the capital of Guatemala finds itself in ruins. For the third time the work of relief and rebuilding must be undertaken.

Nearly one hundred thousand people are now living under temporary shelters of the flimsiest sort, matting, canvas, carpets, curtains, boards, sheet iron roofing, theatrical scenery, tables, beds, carts, wagons—even in the open; and if greater suffering and loss of life are to be averted, these people must be adequately housed before the rainy season in June. Money, building materials, and what might be called "alleviation and reconstruction" experts are required more than anything else in Guatemala's present extremity. The need is urgent; the obligation ours.

Adult skimmer, type of revealing coloration, and young skimmer, type of concealing coloration

Common Sense and Animal Coloration

ON THE FUTILITY AND ABSURDITY OF BASING GENERALIZATIONS REGARDING THE COLORATION OF ANIMALS FROM BUTTERFLIES TO PRONGBUCKS ON OBSERVATIONS OF ONE ISOLATED, HIGHLY SPECIALIZED GROUP OF FISHES

By THEODORE ROOSEVELT

SOME years ago I wrote a paper[1] discussing the question of concealing coloration among birds and mammals. It was done in elementary fashion, because in its groundwork essentials the question is one of kindergarten simplicity. But until writers have passed the kindergarten stage they are not fit to deal with the more advanced and intricate phases of the question. The kindergarten stage is that in which reasonably intelligent persons learn that among the higher vertebrates there are thousands of species with concealing coloration, and thousands with revealing coloration. Until this fact is grasped in such manner that all discussion about it is seen to be as superfluous as discussion whether the earth goes around the sun, there is no use trying to deal with the more intricate developments of the matter. But as the question seems to invite confusion of mind among quite a number of per-

[1] *Bulletin* of the American Museum of Natural History, August, 1911

Illustrations from photographs of exhibits in the American Museum sons, it is worth while to take it up once more. But let my readers remember that I am dealing only with elementary, with kindergarten scientific matters.

Professor W. H. Longley, who has been working at the Marine Biological Laboratory, the Tortugas, Florida, has recently published an interesting paper[1] on animal coloration. The paper really consists of two wholly distinct parts. It is primarily a careful study of the colors and color changes of West Indian reef fishes; secondarily, it consists of a number of *obiter dicta,* and of recklessly drawn generalizations, on the subject of concealing coloration among the higher vertebrates.

As regards the first, the legitimate part of the study, I am not qualified to express an opinion. Professor Longley traverses and emphatically denies the justice of the conclusions of Professor J. E. Reighard[2] in his study of the same subject. Longley's studies have been so painstaking and so seemingly scientific that I would unhesitatingly accept them were it not that his very unscientific remarks on the general subject give just cause for inquiry as to whether a mind so biased may not unconsciously twist facts out of shape. As it is, before accepting his conclusions—and while fully admitting that on their face they seem at least in large part justified—I should like to get the careful judgment thereon of some expert like Professor Reighard, whose purpose obviously is to find out the truth wherever it leads, and who is not betrayed by any prejudgment into expressing or suggesting on kindred matters conclusions which have no warrant or basis in fact.

It is the second part of the paper, containing these *obiter dicta* and generalizations on the general subject of animal coloration, with which I propose to deal. Inasmuch as Professor Longley has done me the honor to include me among the writers (Wallace, Weismann, Beddard, Reighard, Allen, Selous, Dewar and Finn) whose statements he regards as "diametrically opposed to the just inference from the facts" noted by him, for the purposes of this paper it will be sufficient for me to deal with his comments on the positions I myself have taken, save where, as in the case of Dewar and Finn, I have made the statements of others my own.

Professor Longley's position in the specific matter to which his words above quoted refer, well illustrates the peculiar twist in his mind, when the question of animal coloration is concerned. He writes[3] that the statement that "movement will betray an animal even if protectively colored" is based upon "wholly illogical" reasoning, is "dia-

[1] Studies upon the Biological Significance of Animal Coloration, *Journal of Experimental Zoölogy,* August, 1917. By W. H. Longley, of Goucher College, Baltimore, and the department of marine biology, Carnegie Institution of Washington, Tortugas, Florida.

[2] Jacob E. Reighard, professor of zoölogy at the University of Michigan. Author of *An Experimental Field Study of Warning Coloration in Coral Reef Fishes,* Papers from the Tortugas Laboratory, Carnegie Institution of Washington. Vol. 2, pp. 257–325.

[3] In Prof. Longley's paper, *Biological Significance of Animal Coloration,* in the section which discusses color change and states that various species of fish in moving from one environment to another change color to match, we find the following paragraph (p. 553):

"At this point one should refer for a moment to an idea one frequently encounters, and which seems in fair way to become an article of faith in the matter of animal coloration. The reasoning upon which it rests is wholly illogical, as the reader will observe. Sometimes it is simply affirmed *ex cathedra:* 'Absence of movement is absolutely essential to protectively colored animals.' (Beddard, '92, p. 90.) Sometimes it is stated with some attempt at justification: 'No color whatever could make a flying butterfly invisible to its enemies, because the background against which its body shows is continually changing during its flight, and, moreover, the movement alone is enough to betray it, even if it is of dull color.' (Weismann, '04, p. 74.) 'No observer of Nature can have failed to remark how the least movement on the part of an animal will betray its whereabouts, even though in color it assimilates very closely to its environment. . . . Thus in order that protective coloration may be of use to its possessor the latter must remain perfectly motionless.' (Dewar and Finn, '09, p. 200.) The same sentiment is expressed by Werner ('07), Selous ('08), Palmer ('09), and is quoted from Beddard with approval by Roosevelt ('10, p. 493). It reappears in Allen's ('11) review of Roosevelt's *Revealing and Concealing Coloration in Birds and Mammals,* yet is diametrically opposed to the just inference from the fact noted in the present section of this paper. It is one of the 'obvious' things, the number of which used in constructing theories of coloration is so great, that if all were eliminated, the skeleton remaining would be scarcely recognizable. It is so inconsistent with the fact that an unusually active fish, such as *Iridio bivittatus,* which seems never to rest by day, possesses three color phases, which it changes appropriately as it passes from one environment to another, that farther comment is unnecessary."

metrically opposed" to the facts he has noted about reef fishes, and indeed is "so inconsistent" with what he has observed about one fish that "fuller comment is unnecessary." In other words, because Professor Longley finds, or thinks he finds, that protective coloration is of concealing value to certain coral reef fishes when in motion, therefore he takes the position that this observation on a small number of fishes necessarily proves that motion does not reveal protectively colored animals generally! Because in a very small field he believes that he has found a rule to obtain, he believes it must obtain everywhere. To use his own words, it would be impossible to take a more "wholly illogical" and therefore a more utterly unscientific position than this. Moreover, as to birds and mammals, and certainly as to most (and probably as to all) land reptiles and batrachians, Professor Longley is in actual fact wrong and the naturalists whom he criticises are right. In my articles to which he refers, I state that I am dealing only with birds and mammals, and Dewar and Finn[1] deal mainly with birds and mammals. The facts as regards these are so obvious that any man of common sense *must* realize them, if he wishes to translate his theory into action. To deny them stands literally on a par with denying that two and two make four, or that a straight line is the shortest distance between two points.

Ptarmigan in summer and in winter plumage, types of concealing coloration

No man can successfully shoot ducks, no man can successfully hunt big game, without treating as axiomatic the fact that sudden motion on the part of the hunter, if in view of his quarry will warn it, no matter what color his clothing may be. Professor Longley apparently thinks that this is treated as "obvious" without attempt to test it by trial; the real fact is that the trial test invariably and instantly establishes the fact to any human being of the smallest intelligence, so that thereafter he accepts it as being "obvious" in the same sense that it is "obvious" that if a chair is withdrawn from under a man who is sitting down he will fall to the floor—really, it is about as absurd to argue on behalf of one position as on behalf of the other. But, if Professor Longley must have "proof" of the obvious, I will explain that I have approached and observed many thousands

[1] *The Making of Species.* By Douglas Dewar and Frank Finn. J. Lane, London and New York.

of big mammals (not to mention many thousands of birds). I have found by indefinitely repeated experience that if I was entirely motionless I was very rarely observed; but that, no matter how carefully I chose a concealing coloration for my clothes, I was almost invariably revealed by motion—certainly by anything excepting stealthy motion—if within ken of the animal's vision. (In my writings I explicitly state that in order that concealing coloration may actually conceal an animal, there must be either lack of motion or stealthy movement.)

But there is no need to go after big game to test this fact. In the woods near my house wood frogs are common. I almost never see them unless they jump, and at the end of the first jump, when my attention has simply been attracted by the motion, I usually lose sight of the frog; but by moving around in the neighborhood I make it reveal itself by another jump, which I follow with my eye so that at its end I am usually enabled to place the frog. It is practically invisible when still, thanks to its color, and without regard to its color it is instantly seen when it moves. I am almost ashamed to have to recite such an "experiment"; a child of six who has been in the woods ought already to understand its truth. I shall quote a far keener and more experienced observer than I am. Mr. William Beebe,[1] speaking of the creatures of the tropic forests, says that "one of the most pronounced laws of the jungle" is that "the operation of protective coloration" depends entirely on immobility. "Clad in white, or in any conspicuous color, you may successfully hunt the wariest of jungle creatures, provided you select some suitable spot and remain quiet. Garbed in leaf green and the most invisible of khaki, the common agouti and the trustful trumpeter bird will easily escape you if you persist in walking about or moving some part of your body or hands."

Professor Longley's thesis is that there is no warrant for belief in the existence of "conspicuousness of animals of high color," and he in effect denies "that there are conspicuous animals," and states that what he believes he has shown to be true of one group of fishes is inconsistent with the assumption that animals of high color "possess more than minimal conspicuousness under natural conditions." The marvelous logic of this last proposition is that the existence of concealing coloration on certain fishes is inconsistent with the assumption that such utterly different animals as ravens, flamingos, white pelicans, sable antelopes, white goats, and black squirrels with white tails "possess more than minimal conspicuousness under natural conditions." He announces the "essential truth" of Mr. Thayer's "hypothesis of concealing coloration."[2]

Mr. Thayer's book[3] deals mainly with mammals and birds. Dewar and Finn in their capital book deal mainly with mammals and birds. I specifically stated that what I said referred only to mammals and birds. Longley's observations refer only to reef fishes. Thayer states that all animals which ever are prey or are preyed on (which means virtually all) are concealingly colored, coloration being a survival factor produced by natural selection; and the great majority of his illustrations and examples are drawn from among birds and mammals, as to which two classes he specifically and sweepingly lays down his—imaginary—law. I state that as regards birds

[1] Ornithologist at the New York Zoölogical Park. Author of *Tropical Wild Life in British Guiana*, from which the quotation following is taken (p. 73).

[2] *The Law that Underlies Protective Coloration*, Abbott H. Thayer, *The Auk*, Volume XIII, 1896, and Smithsonian *Yearbook*, 1898. Thayer's hypothesis states that animals are "countershaded," painted by nature darkest on those parts which tend to be most lighted by the sky's light and *vice versa*, and that this causes them to disappear, their colors and patterns becoming pictures of such background as one might see if the animal were transparent.

[3] *Concealing Coloration in the Animal Kingdom*, being a summary of Abbott H. Thayer's discoveries. By Gerald H. Thayer. The Macmillan Co., New York, 1909.

Pika, type of concealing coloration

and mammals there are very many species where the adults or the young, or the adult individuals of one sex, are concealingly colored, this coloration doubtless being a survival factor, and very many others as to which this is not so; and that among the latter are numerous animals with a conspicuous or advertising or revealing or directive coloration—I care not which term is used.[1] This is the point at issue.

Professor Longley apparently takes the ground that animal conspicuousness does not exist in nature. He says he is "impressed by the uniform absence of effort to demonstrate that conspicuousness exists," by various observers, including myself, and adds, "that the conspicuousness so lightly assumed is a subjective phenomenon is capable of demonstration," and proceeds to "demonstrate" that I am in error when I speak of a *pronghuck* as conspicuous by saying that other observers have mistakenly thought *red fish* to be conspicuous! I would really like to know just how Professor Longley regards this as a "demonstration." He refuses to "grant that there are conspicuous animals," and "demonstrates" that such animals as prongbucks are inconspicuous by saying that red fishes live in the dark and come to the open surface only by night, having nocturnal feeding habits! Would he regard this statement as to red fishes to be "demonstrated" to be erroneous by my pointing out that *red birds*, such as tanagers, cardinals, flamingos, and macaws, are diurnal?

Now, as to the failure to "demonstrate" that "conspicuousness exists," as in the case of the prongbuck: the trouble is in demonstrating the self-evident. If I were asked to "demonstrate" that a black coal scuttle on a white sheet, or a crow on a snowbank, is conspicuous, I should be rather puzzled to know where to begin; and a Rocky Mountain goat or a cock ostrich is normally as conspicuous as the coal

[1] There has hitherto been no successful effort to answer my articles in which I discussed Mr. Thayer's sweeping theories; Professor Longley certainly does not; and if he will turn to Mr. Beebe's book above mentioned (pp. 104–108), he will find, in a purely incidental allusion to coloration, the kind of recorded observation which really does help to throw a little light on the subject.

Photograph by M. P. Skinner

PRONGBUCKS, WITH WHITE RUMP DISKS DISPLAYED; EXAMPLES OF REVEALING COLORATION

There is probably no such thing among mammals and birds as a coloration which under all the conditions of the wearer's life is always either completely revealing or completely concealing; but it may be one or the other, 999 times out of the thousand. On the plains of the Little Missouri I could see the prongbuck when I was half a mile away or more scuttle on the sheet. There is probably no such thing among mammals and birds as a coloration which under all the conditions of the wearer's life is always either completely revealing or completely concealing; but it may be one or the other, 999 times out of the thousand. Out in the Bad Lands of the Little Missouri I once saw a raven against a coal seam in a cliff, and its color for the moment was concealing; and once at dusk a poor-will lit on the bare veranda beside me, and its coloration was for the moment revealing. Yet under all ordinary circumstances, the direct reverse is true in each case; and it is just as absurd to deny that a raven (or a crow, or a grackle, or a cow bunting, or a white egret, or a full-grown black and white skimmer on its nest) is revealingly colored and conspicuous, as to deny that a whip-poor-will (or a nesting grouse, or a desert lark, or a fledgling skimmer) is concealingly colored and inconspicuous.

However, I will attempt the "demonstration." The pronghorn on the plains of the Little Missouri was conspicuous exactly as a wildebeest on the plains of the Athi or the Guaso Nyiro was conspicuous. If camped for any length of time in their haunts, I always grew to know the probable range of each group of pronghorns or wildebeests, as the case might be; and then there was never the slightest difficulty in seeing them. Around my ranch there were occasions when a small herd, or a couple of pronghorns, or a single animal would settle down in a certain locality; and then it was impossible not to see them if I went thither; I could always find the party of does and kids, or the solitary old buck, or the two yearlings, which I expected to find. In the same way, in Africa, in the camps where we spent a considerable length of time, there would often be wildebeest stationary in the locality; in one instance which I remember there was a herd which haunted the neighborhood of a hill and, on the other side of camp, an old bull which kept with a herd of gazelles, and I could always find either without difficulty. The coloration of the prongbuck made me see it even when I was half a mile away or more; the wildebeest struck my eye when I was nearly a mile away; and under such circumstances to deny that the animal was "conspicuous" seems to me to represent quibbling over terminology, and not the effort to appreciate facts and to draw therefrom honest conclusions.

Is the above not a "demonstration"? Conspicuousness is of course relative, just as is the case with speed. On the plains where the pronghorn dwelt there were skunks and jack rabbits. The jack rabbits ran faster than the skunks. I assert this in the "sweeping" and "reckless" manner to which Professor Longley objects. The fact was "obvious"—again to use the word to which Professor Longley objects. I never "demonstrated" this fact, however, any more than I "demonstrated" the conspicuousness of the prongbuck. One fact stood just as much in need of demonstration as the other, and no more so. Whoever needed to have either fact "demonstrated" to him would have quarreled with Æsop or Uncle Remus about the relative running capacities of a rabbit or hare and a tortoise.

There must be a foundation of common sense for every scientific structure. Until a man understands that a crow is conspicuous and a wood frog inconspicuous (and that there are very, very many—doubtless thousands—of other animals as revealingly colored as the crow and of yet others as concealingly colored as the frog), he has not learned the A B C of animal coloration; and if he perversely refuses to learn the alphabet his future studies will not tend to enlightenment.

Mr. Thayer's book is delightfully written and contains valuable artistic truths; just as Milton's account of the creation of life in *Paradise Lost* contains noble poetry; and as regards mammals and birds Thayer's book contains just about as much new scientific truth as does *Paradise Lost*. To treat his book as in this respect superior to such a book as Dewar and Finn's, stands on a par with ranking the noble Miltonic poem of the creation as scientifically above Darwin's *Descent of Man*. Until we have attained the elementary knowledge necessary in order to understand that the facts above outlined have been amply "demonstrated," further biological discussion does not tend to edification.

My discussion[1] of revealing and concealing coloration among birds and mammals covers but a tiny corner even of the question of animal coloration; but I do not think that it is possible to controvert my main thesis, which is, that as regards these higher vertebrates, concealing coloration (with or without countershading as a basis), as a survival factor working through natural selection, has been of trivial consequence in producing the special color patterns on the great majority of birds and mammals; that it has in an immense number of cases been wholly inactive, so that in very many of these cases the animals are extraordinarily conspicuous in nature at almost all times, including the vital moments of their lives; and that in most of the large number of cases where it has actually been a factor it has merely set limits of conspicuousness, sometimes very narrow, sometimes very broad, which must not be exceeded, but within which innumerable tints and patterns are developed, owing to some entirely different slant of causation.

I have not tried to deal with reptiles and batrachians as a whole, nor at all with fishes and invertebrates. I am very confident that as regards some common land reptiles and insects which I continually come across—black snakes for instance, numbers of black or showily colored beetles, and woolly caterpillars which are boldly marked with black and red or which are white—the coloration has not the slightest concealing, and probably has a revealing, quality; that they are conspicuous.

I am quite prepared to find that the reverse is the case as regards many, or even the vast majority, of the lower forms of life, including especially all those in which the individuals undergo a rapid change of color corresponding with the change in the color of their backgrounds. It seems to me utterly unscientific to try to generalize, negatively or affirmatively, about all animals from observations on one highly specialized group; and above all to try to apply deductions from observations made on such a group as that of the coral reef fishes to groups of animals like prongbucks or white goats, or ostriches, or crows, or white egrets, or scarlet tanagers, where practically every condition is entirely different. In the bay beside which I live are mollusks with white, black, dark green, slate, gold, silver and brown shells; and the pebbles on the beach have about as varied colors; but I do not try to generalize from the shellfish to the pebbles or *vice versa*.

There is ample room for genuinely scientific study in order to find out what coloration laws, if any, apply universally to Long Island Sound shellfish, to coral reef fishes, to land insects, to reptiles, to forest and desert birds, and to mountain and plains mammals; and what laws apply only in one or another group. But in order that our studies shall be to good purpose, we must be willing to face all the elementary facts, including our ignorance as to most of them; and when once these elementary facts have been shown to be obvious, we must not waste time in reinvestigating them without sufficient cause.

November 15, 1917.

[1] See *Bulletin* of the American Museum of Natural History, August, 1911; *African Game Trails*, Scribner's, 1910, Appendix, pp. 491–512; also *Life Histories of African Game Animals*, Scribner's, 1914, pp. 54–148.

The Red Cross and the Antivivisectionists [1]

AN APPEAL TO THE FAMILIES AND FRIENDS OF OUR HEROIC TROOPS AND TO THE COMMON SENSE OF THE AMERICAN PEOPLE

By W. W. KEEN, M.D.

Emeritus Professor of Surgery, Jefferson Medical College; Major Medical Reserve Corps, United States Army

FIRST of all let me make two facts clear.

1. This paper has been written entirely on my own responsibility and not at the suggestion directly or indirectly of the Red Cross. I have been moved to write it solely in the interest of our brave soldiers, and especially because their sufferings and lives are involved in the suit against the Red Cross by the antivivisectionists to prevent the use of $100,000 of the Red Cross funds in such beneficent life-saving researches.

2. The Red Cross as an organization is neither an opponent, nor an advocate, nor a defender, of vivisection. It states officially that the *supreme* aim of the Red Cross is to *relieve human suffering* [and it might well have added "and to save thousands of human lives"].

> "The War Council was advised from the ablest sources available that an immediate appropriation for medical research would contribute to that end. The War Council could not disregard such advice."

They then refer to the many unsolved medical and surgical problems that have arisen from wholly new conditions and methods of warfare. Letters from a number of my own surgical friends in France emphasize and the medical journals teem with papers on these new problems. They relate to the treatment of the horribly infected wounds—and practically *all* wounds are of this kind—never met with in civil surgery; to the treatment of "trench fever"—a peculiar form of fever never before seen; of "trench heart"; of "trench foot," often followed by lockjaw; of "trench nephritis" (inflammation of the kidneys); gas gangrene; tetanus; shell shock; poisonous gases; fearful compound fractures, especially of the thigh, etc. Every man enabled to return to active duty as a result of solving these problems helps to win the war. Every man who dies, or is permanently disabled because of our ignorance, hinders our winning the war.

It must be remembered that our surgeons, physicians, and physiologists over there are the very flower of the American medical profession. These fine men, under the supervision of the Medical Staff of the United States Army, superintend all the work. Nothing is done that has not the direct approval of Brigadier General A. E. Bradley, Medical Corps, U. S. Army.

Experiments on animals form a necessary but a minor feature of the researches.

> "The animals used are principally guinea pigs, rabbits and white rats. If operations causing pain to animals are performed, anesthesia is used."

This certainly does not suggest "cruelty" or "torture."

I appeal to the common sense of the American people and especially to the families and friends of our brave soldier boys: Which do you prefer, (1) That our soldiers shall be protected from attacks of these new (as well as of the familiar) diseases, their sufferings lessened or even prevented, and

[1] Quoted from *Science*, February 22, 1918, with slight additions by Dr. Keen.

their lives saved, or (2) will you insist that not a single guinea pig, rabbit, or rat shall suffer the slightest pain or lose its life, in researches to lessen the suffering and save the lives of our soldiers?

Remember, if you choose the second you deliberately condemn your son, brother, or husband to sufferings far beyond any suffering of these animals. In many cases, as I shall show, you will condemn your dear one to death, and in some cases a horribly painful death.

In the "Bill of Complaint" of the antivivisectionists, seven grounds of opposition to vivisection are mentioned. The sixth reads as follows:

> "That although it [vivisection] has been practised for many years, *nothing has been discovered by means of it that is at all beneficial to the human race.*"

This is the crux of the whole matter. If this were true I would vigorously oppose vivisection myself.

I entered upon my medical studies in 1860. I took part in the horrible surgery of the Civil War—as we now know it was. I have taught anatomy and surgery to not far from 10,000 students. I taught and practised the old dirty surgery—the only kind we then had—up to October 1, 1876. Since that date I have practised and taught the new antiseptic surgery, which has been created by researches similar to those now proposed. Since the Great War began I have diligently studied the newest surgery. I submit, therefore, that I may be presumed to be fairly familiar with these three stages of surgery. Let me give now a few examples of some of the things that HAVE "been discovered by it [vivisection]" and that *are* "beneficial to the human race."

I may remark in passing that animals themselves have benefited by the same means, almost, and possibly quite as much as the human race.

1. *Typhoid Fever.*—This has been one of the historic scourges of armies. In 1880 the bacillus—the cause of the fever—was discovered. It was soon proved that the disease was spread through infected milk, infected water, and very largely by the house fly. The last, after walking over the excrement of a typhoid patient, and then walking over our food, conveys the disease. Prevention of contamination by these three means—sanitary measures based on the discoveries of bacteriology—prevents the disease to a large extent. But our real triumph over the disease was not achieved until lately.

I may here call attention to the fact that the antivivisectionists entirely reject bacteriology, a science which has disclosed to us the causes of many diseases, and has enabled us to prepare antitoxins to neutralize the poisons developed by these bacteria. Without bacteriology the physician and the surgeon today would be as helpless as a mariner without a compass.

	Cases		Deaths
During the Civil War typhoid fever resulted in.	79,462	and	29,336
In the Boer War there were	58,000	"	8,000
(In that war the total number of deaths was 22,000. Typhoid alone, therefore, was responsible for more than one third of all the deaths!)			
In our war with Spain there were	20,738	"	1,580
Our Army numbered 107,973 men. Therefore every fifth soldier fell ill with typhoid in 1898! Over 86 per cent of *all* deaths in this war were due to typhoid!!			

During the Boer War imperfect attempts were made to control typhoid by an antitoxin similar to that against diphtheria, which has saved such multitudes of children. Gradually the method has been improved so that in our army it was at first recommended as a voluntary protection (1909). The results were so favorable that in 1911 it was made compulsory. It has been said that it should still be voluntary. But as every case of typhoid imperils the health and life of multitudes we surely have a right to make it compulsory so as to protect all the rest. All that is necessary to prove this is to look at these tables of cases and deaths in our Army and Navy.

TYPHOID FEVER IN THE UNITED STATES ARMY

Year	Cases	Deaths
1906	210	12
1907	124	7
1908	136	11
1909	173	16
1910	142	10
[VACCINATION MADE COMPULSORY]		
1911	70	8
1912	27	4
1913	4	0
1914	7	3
1915	8[1]	0

TYPHOID FEVER IN THE UNITED STATES NAVY

Year	Cases	Deaths
1909	189	17
1910	193	10
1911	222	15
[VACCINATION MADE COMPULSORY]		
1912	57	2
1913	22	4
1914	13	0
1915	15	1

On the Mexican border, though the fever was rife near the camps, only *one man* out of 20,000 troops, a civilian, who unfortunately escaped vaccination, fell ill with it.

Now let us see the results in the armies in the present war.

In the British armies, on March 1, 1917, Mr. Forster, Under Secretary for War, stated in the House of Commons that

> The last weekly returns showed only twenty-four cases in the four British armies in France, Salonica, Egypt and Mesopotamia. He added that the total number of cases of typhoid fever in the British troops in France down to November 1, 1916, was 1,684, of paratyphoid[2] 2,534, and of indefinite cases, 353, making a total of 4,571 of the typhoid group.

Now the English armies number at least 5,000,000. If they had suffered as our Army did in 1898 there would have been 1,000,000 cases! In fact there have been less than 4,600! Besides that, the percentage of fatal cases in the inoculated men was 1.7 per cent, in the uninoculated 23.5 per cent; and perforation of the bowel, the most dangerous complication, occurred *six times more frequently* among the unvaccinated than among those who had been protected. In the British armies the antityphoid vaccination is still voluntary but more than 90 per cent have sought its protection. If it had been compulsory, hundreds of the 1571 *who died would have been saved!*

In our own Army in more than four months (September 21, 1917, to January 25, 1918), a period one month longer than our war with Spain (the Surgeon General's Office gives me the official figures), we have had an average (*i. e.*, every day of these four months) of 742,626 men in our cantonments and camps. These men have come from all over the country, in many cases from where autumnal typhoid was reaping its annual harvest, in practically all cases unprotected by vaccination. Between these two dates there have been 114 cases of typhoid and 5 of paratyphoid. *Had the conditions of 1898 prevailed there would have been 144,506 cases instead of 119 in all!* The reason is clear. The men were all immediately vaccinated against typhoid, paratyphoid and smallpox.[3]

Besides this as soon as the antityphoid inoculation was completed the number of cases rapidly fell and from December 14 to February 15—9 weeks

[1] Four in the United States; 4 in Hawaii.

[2] A form of fever caused by a bacillus somewhat similar to the typhoid bacillus but causing a much milder infection.

[3] Of the last disease, there have been only 4 cases, all unvaccinated.

—there have been only 6 cases of typhoid and one of paratyphoid among probably now nearly 1,000,000 men! Truly marvelous!

Now all this is the *direct result of bacteriological laboratory work*. Was it not worth while? Has it not "benefited the human race"? Are you not glad that *your* son is thus protected?

I may add that the German armies show a similar absence of typhoid. I have seen no figures but only general statements.

Tetanus or "Lock-jaw."—Few people realize what terrible suffering this disease causes. The mind of the patient is perfectly clear, usually to the very end, so that his sufferings are felt in their full intensity. All of my readers have had severe cramps in the sole of the foot or calf of the leg. The pain is sometimes almost "unbearable." In tetanus not the muscles of the jaw alone are thus gripped, but the muscles all over the body are in cramps ten or twenty-fold more severe, cramps so horrible that in the worst cases the muscles of the trunk arch the body like a bridge and only the heels and head touch the bed!

Never shall I forget a fine young soldier during the Civil War who soon after Gettysburg manifested the disease in all its dreadful horror. His body was arched as I have described it. When at intervals he lay relaxed, a heavy footstep in the ward, or the bang of a door, would instantly cause the most frightful spasms all over his now bowed body and he hissed his pitiful groans between tightly clenched teeth. The ward was emptied, a half-moon pad was hung between the two door-knobs to prevent any banging; even the sentry, pacing his monotonous steps just outside the ward, had to be removed beyond earshot. . . . The spasms became more and more severe, the intervals shorter and shorter; it did not need even a footfall now to produce the spontaneous cramps, until finally a cruelly merciful attack seized upon the muscles of his throat and then his body was relaxed once more and forever. He had been choked to death.

Do you wonder at the joy unspeakable which we surgeons have felt of late years as we have conquered this fearful dragon? In 1884 the peculiar germ, shaped like a miniature drumstick, was discovered. Its home is in the intestines of animals, especially of horses. The soil of France and Belgium has been roamed over by animals and manured for over 2,000 years, even before Julius Cæsar conquered and praised the Belgians. The men in the trenches and their clothing are besmeared and bemired with this soil, rich in all kinds of bacteria, including those of tetanus, gas gangrene, etc. When the flesh is torn open by a shell, ragged bits of the muddy clothing or other similarly infected foreign bodies are usually driven into the depths of the wound. Now the tetanus bacilli and the bacilli of "gas gangrene" are the most virulent of all germs. It takes 225,000,000 of the ordinary pus-producing germs to cause an abscess and 1,000,000,000 to kill, while 1,000 tetanus bacilli are enough to kill. This readily explains the frightful mortality from tetanus during the Civil War. It killed 90 patients out of every hundred attacked.

In the early months of the Great War the armies suddenly placed in the field were so huge that there was not a sufficient supply of the antitoxin of tetanus. Hence a very considerable number of cases of tetanus appeared. Now it is very different. At present every wounded soldier, the moment he reaches a surgeon is given a dose of antitetanic serum. As a result, *tetanus has been almost wiped off the slate*. I say "almost," because to be effective the serum must be given within a few hours. The poor fellows who lie for hours and even days in No Man's Land cannot be reached until too late. All the surgeons on both sides concur in saying that tetanus, while it still occurs here and there, has been practically *conquered*.

Every step of this work has been accomplished by the bacteriologists and *the surgeons working together in the laboratory and the hospital.* Would you seriously advise that no such experimental researches should have been carried on and that your boy should suffer the horrible fate of my own poor Gettysburg boy? Confess honestly, are not these and other similar researches to be described as humane?—as desirable?—nay, as imperative?

Nay, more. "We feel," say forty-one of our medical officers on duty in France, "that any one endeavoring to stop the Red Cross from assisting in its humanitarian and humane desire to prevent American soldiers from being diseased, and protecting them by solving the peculiar new problems of disease with which the Army is confronted is in reality giving aid and comfort to the enemy." But the antivivisectionists declare that bacteriology is false—that such vaccination is "filling the veins with 'scientific filth' called serum or vaccine"! They are doing their best to persuade our soldiers not to submit to any such "vaccination"!

Smallpox.—The word vaccination leads me to say a word about smallpox. I confess that I was amused by a recent paper in an antivivisection journal entitled "Vaccination as a *Cause* of Smallpox"! During the last year hundreds of thousands of soldiers have been vaccinated against smallpox. Surely there should have been *some* cases of that disgusting disease if it were caused by vaccination.

But what are the facts? I have just received the Report of Surgeon General Gorgas for 1917. The section on Smallpox reminds one of the celebrated chapter on "Snakes in Ireland." On p. 81 on Smallpox in the Army in the United States, I read "*No* cases of smallpox occurred within the United States proper during the year." On p. 175, I read "*No* cases [of smallpox or varioloid] occurred in the islands" [among the American troops in the Philippines]. On p. 188, I read under Smallpox that "nine cases occurred during the year" [among the Philippine Scouts].

My friend and former student, Dr. Victor G. Heiser, as director of health in the Philippine Islands for years, vaccinated over 8,000,000 persons without a death—and with what result? In and around Manila the usual toll of smallpox had been about 25,000 cases and 6000 deaths annually. In the twelve months after his vaccination campaign was finished there was *not one death* from smallpox.

Per contra, in 1885 in Montreal, as stated by Osler, one Pullman porter introduced smallpox into a largely *un*vaccinated city. There followed 3164 deaths and enormous losses to the Montreal merchants.

But why say more? We all know that a single case in any community causes every intelligent person to be protected by vaccination.

Gas Gangrene.—One of the terrible and new surgical diseases developed by this war is called "gas gangrene." It has no relation to the poisonous gases introduced by the barbarous Germans at Ypres. About twenty-five years ago Professor W. H. Welch, of the Johns Hopkins Hospital, discovered a bacterium which produced gas in the interstices between and in the muscles. This bacillus does not occur in Great Britain. I never saw a case of gas gangrene in the Civil War, and but one case since then in civil practice. On the contrary in Belgium and France in the soil and, therefore, on the clothing and on the skin of the soldiers these bacilli abound. From what Bashford calls the "cesspool of the wound" the germs travel up and down in the axis of the limb. If the gas escapes from a puncture it will take fire from a match. Gas has been observed within five hours. An entire limb may become gangrenous within sixteen hours. If the whole limb is amputated the gas may be so abundant that the limb will float in water! Death is not long delayed.

Now your son in France runs a very serious risk of becoming infected with this deadly germ. Would you be willing positively to forbid any experiments on animals which could teach us how to recognize this infection as early as possible? Would you forbid any experiments which might teach us how to conquer or better still to prevent this virulent infection and save his life? Which would you prefer should suffer and very possibly die, a few minor animals or your own son? If a horse or a dog or even a tiny mouse can help in this sacred crusade for liberty and civilization, if it even suffers and dies, is it not a worthy sacrifice? Should they be spared and our own kith and kin give up their lives?

I need not wait for a reply! I am sure you would say "My boy is worth 10,000 rabbits or guinea pigs or rats! Go on! Hurry, hurry! and find the remedy." That is true humanity which will save human lives even at the expense of some animals' lives.

Now see the result. By careful observation and experiments with different remedies the surgeons have discovered valuable methods of treatment. But very many still die. Prevention is always far better than cure. At the Rockefeller Institute Drs. Bull and Ida W. Pritchett have discovered a serum which in animals prevents this gas gangrene and yet does no harm to the animal. It is now being tried on the soldiers in France.

Again I ask: Is it not our duty even to *insist* on such experiments so that our troops may be spared the dreadful suffering and even death following this virulent infection? If the Bull-Pritchett serum proves ineffective should not our efforts be redoubled? The common sense of the American people will reply: "Yes, by all means. You will be recreant to humanity and to your duty if you do not."

Modern Surgery.—"Lister," in Howard Marsh's fine phrase, "opened the gates of mercy to mankind." Pasteur and Lister are the two greatest benefactors of the human race in the domain of medicine. I am not sure but that I might even omit the last five words.

The revolution which Lister produced in surgery is so well known to every intelligent person that I need say only a few words. Forty years ago a wholly new surgical era was inaugurated by Pasteur and Lister. In the Civil War there were recorded 64 wounds of the stomach and only *one* recovered. Otis estimated the mortality at 99 per cent. In more than 650 cases of wounds of the intestines there were only 5 cases of recovery after wounds of the small bowel and 59 from wounds of the large bowel—together only 64 out of 650 recovered, *i. e.*, more than 90 out of every 100 died!

The complete statistics of the present war cannot be tabulated and published for some years. I give, however, the result of one series of abdominal gunshot wounds as a contrast, on a far larger scale and in far worse wounds. Out of 500 such operations, 245 *recovered!* and only 255 died. Contrast 51 per cent of deaths in these wounds with mutilation and infection unutterably worse than in the Civil War, with 99 per cent of deaths, according to Otis.

Is not this a triumph of bacteriological and surgical research? Would you prohibit similar researches now when your boy's life may be saved by them?

Is not this one of the things that *have* "been discovered" by vivisection and has not such change in surgical treatment been of "*benefit* to the human race"? In all honesty would you be willing to have your son treated as I myself (may God forgive me!) ignorantly treated hundreds during the Civil War?

This advance I not only *think* and BELIEVE, but also I KNOW is due to

Pasteur and Lister and their followers. I know it by personal experience just as you know the high cost of living, the shortage of sugar, and the scarcity of coal.

The bacteriology which the antivivisectionists scorn and reject I KNOW is the CORNER-STONE of modern surgery. Before Lister's day out of 100 cases of compound fracture 66 died from infection. Now the percentage of deaths is *less than one* out of 100. Before Lister my old master in surgery, Dr. Washington L. Atlee, one of the pioneers in practising ovariotomy, lost 2 out of every 3 patients—now only 2 or 3 in 100 die. Before Lister we never dared to open the head, the chest or the abdomen unless they were already opened by the knife, the bullet or other wounding body. Now we open all of these great cavities freely and do operations of which the great surgeons of the past never dreamed in the wildest flights of their imagination. Could they return to earth they would think us stark crazy until they found that the mortality was almost negligible and the lives saved numbered hundreds of thousands.

I have given but a few instances of the many wonderful benefits which have resulted from medical research in every department of medicine. But I believe they are sufficiently convincing. I should have been glad to tell the story of tuberculosis, syphilis, the bubonic plague, yellow fever, malaria, the hookworm disease, diphtheria, typhus fever, cerebrospinal meningitis, Malta fever, leprosy, and many other diseases, every one of which has had its progress stayed, its victims rescued, its toll of human lives cut down enormously, sometimes to one half or less, by researches similar to those which will be conducted in France. Most important and life-saving researches on surgical shock already have been made by Porter, Cannon, and others. Ought these to be abandoned and our soldiers left to perish when we can save their lives?

I can sympathize with the deep feelings of those who wish to spare pain to animals, but is it not a higher and more imperative, a holier sympathy that has spared and will spare pain eventually to human beings and also to other animals in uncounted numbers?

Do you wonder that after more than forty years of steady practice, teaching and writing I assert, conscious of the great responsibility of my words, that "I regard experimental research in medicine as a medical, a moral and a Christian *duty* toward animals, toward my fellow men, and toward God."

There is so much yet to be learned, chiefly by experimental research! So many devoted lives to be saved to our country and to mankind if we only knew how! Do you wonder that I am in dead earnest?

Finally. What have the antivivisectionists themselves done to diminish sickness and save life?

A. In animals? Absolutely nothing.

In spite of the enormous ravages of animal diseases causing enormous suffering to animals and costing this country $215,000,000 every year, not a single disease has had its ravages diminished or abolished as a result of anything *they* have done. They have not even tried. But medical research is saving every year thousands of animals from anthrax, hog cholera, chicken cholera, Texas fever, and other diseases.

B. In human beings? Absolutely nothing. I do not know a single disease of human beings which has had its ravages checked, abated or abolished by any work ever done by the antivivisectionists. Again, they have not even tried.

The only thing they *have* done has been to throw as many obstacles as possible in the path of those who are striving to benefit both animals and men.

This present suit is characteristic.

Photograph by John Rowley

STELLER'S SEA LIONS ON AÑO NUEVO ISLAND, CALIFORNIA

[See illustrations on pp. 244 and 245 with note, regarding the group of Steller's sea lions in the new Museum of the California Academy of Sciences, San Francisco]

The Sea Lions of California[1]

By EDWIN CHAPIN STARKS

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LITTLE as they look like lions, the sea lions of the Pacific coast have the assertion of such resemblance firmly fixed upon them by their name. Nor is their resemblance to wolves any more apparent, although the early Spanish residents in California evidently so imagined, for they called them sea wolves. They are sometimes called hair seals to distinguish them from their first cousins the fur seals, but the name "seal" applied to either the fur seal or the sea lion is rather unfortunate, for they are very different from the true seals. Perhaps of all the names that have been applied to them that of "sea bears" is most appropriate. This name indicates their true relationship, for they are thought to be more closely related to the bears than to any other strictly land animal. They are rather bearlike in their movements. As the old males go on their swinging amble across the rocks, their manes bristling, their heads swaying from side to side, they have a striking resemblance to bears.[1]

On the California coast are two species of sea lions, Steller's sea lion (*Eumetopias jubata*) and the California sea lion (*Zalophus californianus*). Steller's sea lion is much the larger, the males reaching a length of fourteen feet and the weight of a ton, while the males of the California sea lion do not exceed eight or nine feet in length. The females always are very much smaller.

Steller's sea lion is found from Bering Strait southward to the Santa Barbara Islands. The range of the California sea lion has not been well made out. It is found along the entire California coast and indefinitely northward. Its southern range is at least to Cape San Lucas and the Gulf of California. Although these two forms mingle along the Pacific coast for several hundreds of miles, their breeding ranges scarcely overlap, for the southernmost rookery of Steller's sea lion is said to be on Santa Rosa Island, while the northernmost rookery of the California sea lion is said to be on San

[1] The group to which these animals belong—the Pinnipedia—includes the sea lions, fur seals, walruses, sea elephants, and true seals. This group has been divided into three families, the first of which contains the true seals and sea elephants, and the second, the fur seals and sea lions, the walruses forming the third. The fur seals and the sea lions are closely related to each other, and form a family known as the eared seals. They are separated from each other chiefly on account of the character of the body covering, the fur seal having an under fur that the sea lion lacks.

The eared seals have small external ears. Their hind flippers instead of pointing straight back are bent forward at the ankle joint like the hind feet of a bear, and have a long web extending beyond the claws. There are claws on the hind feet only. In the fore feet the web extends far beyond the bones of the toes. The flippers are large enough to raise the body completely from the ground, and enable the animal to climb steep rocky cliffs. They can attain considerable speed over the ground in a sort of an awkward trot. The neck is long and the head may be held erect at an angle with the body.

The true seals, of which the common leopard seal, or harbor seal, found on both our Atlantic and Pacific coasts, is an example, are more aquatic than the eared seals, the flippers being much better adapted to life in the water than on land. The flippers are very short, and both the fore and hind ones are armed with claws, beyond which the web scarcely extends. The hind flippers cannot be bent forward at the ankle joint. The true seals are very helpless on land. They cannot raise themselves from the ground, but progress by a series of short hitches. The neck is short and there are no external ears. They do not venture very far from the water's edge.

The old zoölogists naturally believed that the seals and sea lions bridged the gap in the relationship between the land mammals and the purely aquatic, whalelike mammals. It is now apparent that the whales are descended from a group entirely different from those that gave rise to the seals, so while the seals and their relatives are not a link between the land and marine mammals they are, nevertheless, intermediate in the use of their limbs, for these are adapted for use both on land and in water.

[1] Illustrations from photographs by the Author and Mr. John Rowley.

Miguel Island, which is only a few miles north of Santa Rosa Island.[1]

The sea lion seen by the visitor to zoölogical park and circus, is almost always the female of the California sea lion, although occasionally a small bull of that species, or a cow of Steller's sea lion, is seen. A large bull of Steller's sea lion never has been taken alive. Once on one of the Santa Barbara Islands a boat's crew of fifteen men succeeded in getting a rope around the neck of a sleeping bull of this species, but they might as well have lassoed a locomotive. The sea lion kept the rope as a souvenir.

[1] I record this with considerable doubt and hesitation, and emphasis on the words "said to be." I have personal knowledge that these rookeries are as recorded for the above species, and also that the several rookeries I have visited south of Santa Rosa were only of the California sea lion, but for the coast between San Miguel Island north to Año Nuevo Island, I have only hearsay evidence obtained from men who apparently were able to distinguish between the two species. Among these men, however, was a boatman who for many years has made a business of catching sea lions on the Santa Barbara Islands for zoölogical parks and menageries, and who knows the sea lions probably better than anyone else on the coast. The Santa Barbara Islands include the above islands and lie just below Point Conception, where the coast bends sharply eastward, and where a break between the breeding ranges of the two species logically might occur, for here several subtropical aquatic forms find their northernmost range.

There are several rocky islets along the California coast that are known as "seal rocks." Such are the famous Seal Rocks off the Cliff House at San Francisco. These are not breeding grounds but resorts of the sea lions and seals, although an occasional pup may be born on them (usually by a cow in her first year of breeding). Hence the observer must be cautious in reporting these resorts, or so-called "hauling grounds," as rookeries.

Among sea lions the same breeding grounds or "rookeries" are used year after year. Just why a certain piece of rocky coast should be selected always when the contiguous pieces are apparently identical is not known, but so it is. The sea lion is polygamous, the breeding bulls forming harems of from ten to twenty or even more.[2]

[2] The names applied to the breeding habits and breeding places of the sea lion are most curiously mixed, and these names are used even in scientific literature. The breeding adults are known as bulls and cows; the adults not yet breeding are known as bachelors and virgins; the young of both sexes are called pups; and the breeding places are known as rookeries. Thus the names of the breeding adults are the same as those applied to cattle; the names of adults not yet breeding are those used for humans; the name of the young is the name used for the young of the dog; and the name of the breeding place is the name applied to the breeding places of birds.

Photographed from specimens in the American Museum

Skulls of male and female of the Steller's sea lion (on the left) and of the California sea lion (on the right) show the comparative sizes of the two species. In the Steller's sea lion the two posterior upper molars are separated by a wide space, whereas those of the California sea lion are close together

Once I watched the forming of the harems of Steller's sea lion at Año Nuevo Island, a little rocky island lying nearly a mile off shore on the middle California coast. The rookery here is the best situated for observation of any on the coast. The government has a fog signal and light station on the island, and the light keeper's home makes a convenient place to stay when one is fortunate enough to have him for a friend. I was sure of a welcome, for I had passed some time there the year before, during the last of the breeding season. A couple of hundred yards off one end of the island are two smaller islands of bare rock. On one of these is the rookery. One may see nearly the whole of it from the larger island, or one may row over to it and find many convenient hiding places from which to watch the animals at close range. In the latter case it will be necessary for the observer to forget that he has a sense of smell.

I arrived at the rookery on May 29 and found it in possession of a year-old pup, but I was told that a few days before a band of fifteen or twenty cows had "hauled out," to use a sealer's term, for a few hours. The next day small bands of cows landed at different times, but no bulls appeared until evening, when a large one came and started a nucleus of a harem of three or four cows. By morning this had increased to eighteen cows. Two other bulls had arrived, but their time was so occupied in keeping out of the way of the first bull, who was a big battle-scarred old veteran, and driving away bachelors, who persisted in land-

From specimens in the American Museum

An upper view of the skulls of the female of both species reveals a marked difference in shape of the region between the eyes

From specimens in the American Museum

The under side of the same skulls shows clearly the gap between the posterior upper molars of the Steller's sea lion and the regularity of spacing of the corresponding teeth of the California species

Año Nuevo, an island bearing a United States light and fog signal, one mile off the California coast, twenty miles north of Santa Cruz

Steller's sea lions on the bare flat rocks of Año Nuevo. The rookery on Año Nuevo Island is best situated for observation of any on the California coast

At Año Nuevo Island one may reach the flat rocks of the rookery and photograph the young sea lions at his leisure ing on all sides, that they could do nothing toward forming harems.

The next morning (June 1) our old patriarch had a harem of twenty-three cows, and one of the other bulls had five. Six or eight more bulls arrived during the day, and by night there were two small harems besides the first large one. Our old friend, whom I dubbed Brigham Young, appeared satisfied with the number of his wives and remained quiet all day, except when another bull would come too close. Then he would make a fierce rush to do battle, but the intruder never accepted the challenge. When a cow attempted to land, the other two bulls made such a rush that they succeeded in driving her away more often than "rounding her up" in their harems. The other bulls kept to themselves, occasionally fighting and occasionally retreating before the rushes of some of the three with harems, but not yet attempting to form harems for themselves.

While the "pups" are young, the "cows" do not always desert on approach. They may prove somewhat aggressive instead

On June 2, the herd had increased to fifty, but by night had decreased to about what it was the day before. The next morning I counted eighty, but by night there were not more than thirty. There were still only three harems divided among our three old friends, who seemed to have an understanding, and no longer trespassed on one another's territory. Three times on two successive days the entire band stampeded into the water for some unknown reason, but soon returned to its original station.

From June 3 to 7 things went on in about the same way, the herds increasing in the morning and decreasing in the afternoon. Hence I decided that the afternoon and night were the hunting and feeding times. Other harems were started, and some of them lost, or fell, to the might of some stronger warrior. The bachelors that had been persistent in landing on the rookery seemed to have lost heart, and formed a little band on the other rocky islet, from which point they answered the roars of the old bulls in a less certain key.

By the middle of the month the cows numbered about one hundred and fifty and were in charge of sixteen or eighteen old bulls. Nearly a hundred pups had been born. The harems were now not at all separated, being in one large herd in which here and there a bull could be distinguished. Apparently each bull had marked out for himself a certain arbitrary area over which he was lord and master by right of might, and he never left his station except to offer battle to the lord of some adjacent realm.

Soon even this indication of harems was lost, for the bulls did not appear to confine themselves to any one area. No bachelors were allowed to land on the rookery, however. By the twentieth of the month virtually all of the pups had been born, about one hundred and fifty fat, sleek, sleepy little chaps. They were wholly without fear, and one could handle them and walk about among them if he were a little careful to avoid their puppy-like snaps, for their jaws were armed with very sharp little teeth.[1]

I have read somewhere that a child with a popgun can drive a whole herd of sea lions into the sea. This is usually so but not always, for they refuse

The Steller's sea lion pup weighs between forty-five and fifty pounds. Its use of the fore and hind flippers in climbing about the rocks is well shown here

to be driven for a short period after the pups are born. At this time they may be dangerous. Although I have never heard of anyone being harmed by a sea lion, boatmen tell many stories of having had to run from a wounded bull or an angry cow. I have had cows make savage lunges at me open-mouthed when I approached too near to a newly born pup, and after receiving such warning I had little inclination to get closer to those big white teeth and bristling whiskers.

Those of us who have children as an excuse for going to the circus, or who are honest enough to admit that we go for our own amusement, remember seeing the trained sea lions catch balls that are thrown to them. This seems to be a natural instinct. Once, when I wished to get a cow out of my way that I might examine a certain pup, I threw a stone at her, and to my surprise she caught it in her mouth. We

The young sea lions spend much of their time sleeping contentedly on the hard rocks. These pups are probably four or five weeks old

[1] Each cow bears a single pup each year, the period of gestation being nearly a year. The cow nurses the young nearly to the time the next pup is born. I have been told that when a cow loses her pup for any reason she allows her pup of the year before to keep on nursing. As evidence confirming this I once shot a fat California sea lion pup that was about two months over a year old, and found its stomach filled to its capacity with milk. I have no opinion or evidence as to how long this might continue.

Cows in their first breeding year have their pups earlier than the older ones, often even before the harems are formed. I saw three of these early pups drowned on the Año Nuevo rookery, having been washed from the rocks or clumsily knocked off by their mothers. That the mothers were inexperienced was shown by their futile attempts to save them. I have frequently seen old cows seize their pups by the nape of the neck and dive into the water with them, easily supporting them, and at last bringing them safely out again.

But apparently the cows sometimes have not the skill, or hesitate to do this, for I watched five pups on the main island, that supposedly had been washed off the rookery. Their mothers came every night and at intervals through the day and nursed them. Two of them I saw swim unaided back to the rookery, a couple of hundred yards distant, and against a strong wind and a rather rough sea. They could not have been more than three weeks old, although under other conditions I never saw pups voluntarily enter the sea until they were six weeks or more old.

Sea lion pups, showing how the body is lifted from the ground and the hind flipper is bent forward in walking

had quite a game of toss and catch until she became enraged and chased me.

I found, during a count of two breeding seasons, that more males were born than females. What becomes of the excess males is difficult to determine. At the rookeries there are two or three times as many females as males. Some of the bulls are perhaps killed in their fights, and one man asserted that most of the breeding bulls die at the end of the breeding season. At any rate, all of the old bulls leave the rookery by the first of July, and it is said none are seen until the next season. The bachelors stay, however, and may be seen on the coast at any time. But even if all of the breeding bulls die, that does not account for the elimination of two thirds of the males.

The cows frequently leave the rookery to get food, but during the three or four weeks of the breeding season the bulls take no food whatever. In each of fourteen breeding bulls shot at the end of the season the stomach was found empty.

One problem I had in mind was whether a pup would be allowed to nurse from any but its own mother. Often I have seen a pup come nosing up to a cow and be picked up by the neck and thrown ten or twelve feet away, end over end, so that it was a wonder its neck was not broken or its skull fractured. Sometimes the pup would land against or near another cow which would angrily throw it again. Once I saw a pup thus thrown three times before it was allowed to rest. Though the pup may not know its mother, there is no doubt that the mother knows her pup. It was a common sight to see a cow go through a lot of pups, pushing them aside until she found her own, which she would cuddle beside her with the greatest satisfaction.

Some of them look at you, inquiringly; others are too sleepy to note particularly your approach

Once I marked a pup whose mother had been killed so that I could recognize it at a distance. I watched it for ten days, but after three or four days it began to grow thinner and thinner from day to day. It often tried to

Photograph by John Rowley

ADAPTED FOR LOCOMOTION ON LAND AND IN THE SEA

A Steller's cow with her pup in her mouth about to dive. Detail of the sea lion rookery on Año Nuevo Island

OFF THE ROCKS AT AÑO NUEVO

In California the sea lions resort to rocks which are called "seal rocks." The animals, when approached, make their way rapidly into the water, but having reached a place of safety, they linger and watch the intruder

When annoyed, the young sea lions may growl and snap at your hand, puppy-like, but are quite harmless

A Steller's bull never has been captured alive. The combined efforts of fifteen men, who once lassoed a huge fellow, were insufficient to prevent his escape, lasso and all nurse but in every case was illtreated, and in the many times I saw it try, I do not believe it ever succeeded in getting the least nourishment. There were always some starving pups on the rookery. One day one of these persisted in sucking the ear of a very fat and sleepy neighbor pup. The sleepy one would shake the other off and growl, but it was so sleepy that it could not keep its eyes open, and the minute it would drop off the other would go at it again. It would be interesting to know whether a cow that had lost her pup would adopt one of these orphans.

Several years ago I helped to examine the stomachs of forty sea lions that were shot for this purpose. The sea lion has always been a bone of contention between people who are interested in preserving them and fishermen, who claim that the animals are depleting the fisheries. Fifteen of the forty were Steller's sea lions, all cows but one young male. Eight of these had fish remains in the stomach, and three of the eight had squid in addition. The stomachs of the remaining seven were empty. In other words, those that had anything in the stomach at all had fish. One of them had nearly thirty pounds of rock cod; one was full of sardines; one had salmon bones.

Twenty-five of the forty were California sea lions, eighteen cows, five young males, and two breeding bulls. Five of these had squid and fish remains in the stomach; eight had squid only; and twelve were empty, two of which were breeding bulls. Among the stomachs that had food remains, two had about two hundred squid pens each, and one had three hundred. The squid pen is a horny rod, shaped like a lance head, that is found along the back of the squid. The squid has a beak much like that of a parrot. In the sea lions' stomachs were a few beaks, but many squid pens. Sometimes many pens would be present and no beaks at all. The only way we could explain this was that the sea lion had bitten the squid off behind the head. The beaks are of the same substance as the pens, but much harder in composition; so it is scarcely possible that they could have been dissolved by the gastric juices without the pens also dissolving.

Another thing easier to explain was the finding of the "ear bones" of fishes when other bones had disappeared. In this case the digestive juices had dissolved the other bones, but the ear bones, being of harder substance, had remained to the last.

Perhaps the most astonishing things to find in the stomachs were stones. These were sometimes in stomachs otherwise empty; sometimes with much or little food. One stomach had a stone in it as large as a base ball; one had three stones of good size; one had fifteen stones equal to a couple of quarts in bulk; two had four stones of good size in each; one had thirty-one small stones. All of these but the first were of the California sea lion. The economy of this habit never has been explained. Fishermen, looking at it from their standpoint, call the stones ballast.

I do not intend to enter into a discussion of the damage sea lions do to the fisheries. It is certain that some animals do a considerable amount of damage to fishing nets and to netted fish. Some fishermen claim that sharks do more damage than sea lions, others that seals do the most, and still others that all three of these animals—sharks, sea lions, and seals—are equally to blame.

Just why these great animals with such interesting habits have been studied and written of so little is difficult to understand, and one reason for my writing this article is the hope that I may influence someone to study them.

On the Planting of a Class Tree[1]

[Knowledge of the processes of nature leads man to give deeper and wiser thought to human affairs]

By T. D. A. COCKERELL

Professor of Zoölogy, University of Colorado

I WAS just recovering from my astonishment at being asked to speak on this occasion, and was thinking of the kindness which had given me such an opportunity, and how I might improve the occasion—or at least avoid disgracing it—when I received a "wireless message" from the tree itself. "Now," said the tree, "I suppose you are thinking that you are of some consequence in this matter, and of the grandiose things you will say; but let me tell you, it is I who am of consequence, I who am to be planted, I who must carry to posterity the message of this class. Long years hence, I must bear witness to successive generations of students and teachers that there once was a class who trusted me, who cared to regard me as a symbol of its hopes and aspirations. For this I must live and grow, and for this I shall modestly esteem myself a little better than the other trees growing hereabouts. But before entering upon this great career, I should like to say a few words, and will ask you to convey them to the class, lest earthly ears be too dull to catch directly the whisperings of my boughs." Thus spoke the tree: and much abashed, I at once signified my willingness to give up my own proposed speech, and read whatever the tree might dictate. I took down her very words—I say her, for as the Latins well knew, all trees are feminine—and here they are:

The Message of the Tree

Like you, my masters, I once was green. In my freshman days, encouraged by the warmth of the sun, I unfolded my delicate buds and exposed my small green leaves to the light and air. Scarcely, however, had I assumed this verdure when the cold blasts of a storm withered my young foliage. I was chagrined, but with the elasticity of youth I returned to the effort, and tried once more to help fill the landscape with greenness. This time I was more successful, and before long had the pleasure of hearing the passers-by say, "What a nice little tree!" "Isn't that a jolly little sapling!" or words to similar effect. This made my sap flow fast, and now that the sun was warm and the air balmy, I grew apace. All might have been well, but for a lot of envious, disagreeable bugs and worms, which fell upon me, and devoured my leaves, nay, even burrowed into my stem. These attacks, as summer wore on, made me feel sick and made me look shabby, but I kept on growing, and I realized that I was coming to know intimately the wicked ways of this world. Thus, in the fall, now a senior or a veteran—what you will—I put off all greenness, as inappropriate to my wiser and sadder estate. My leaves, as though in final defiance of all enemies, turned brilliantly red and orange; my wood hard-

[1] Address on the occasion of planting a class tree at the University of Colorado in the spring of 1917.

ened to be ready for all trials and difficulties. Winter found me strong of stem and branch, bare but capable of resisting cold and wind which earlier would have been fatal. I was not so gay, not so tender, as I once had been, but I had suffered and grown stout of heart and strong of body. Well, what now? My masters, let me tell you a secret, it concerns you as well as me. Presently, I shall grow green again! Once again, unwarned by past experience, my tender leaves will spread toward the sky. Again I shall find myself a freshman, timidly setting out on a new journey. Hope and love and joy once more will impel me forward, mindless of the perils on the way. I shall forget, for the time being, that there are storms or worms, forget the cruelty of frost and hail, and the withering summer drought. The old story will be as new as if told for the first time, yet I shall be stronger and better for the experience of past years. Thus I shall win through to the fall and winter, to wait for another spring. So it will be year after year, and as I renew my growth I shall think of you, and wonder whether you have done the same.

For life is rhythmic,—is a process of renewal. The freshman stage is not to be passed and forgotten: we are continually seeking new adventures, exposing our tender hearts and minds to the unknown. Wisdom fosters ignorance, in the sense that it leads us to new positions, where we are compelled to learn. Hope feeds on the unknown. Love delights in mystery. Some day, when we are old and rigid, the only renewal possible will be through the gates of merciful death; but let us preserve as long as may be the ability to renew our verdure, to wonder and to hope.

Yet as the years pass, the fruits of our labors will accumulate. Nothing need be wasted, and posterity may yet bless us for what we have done. I, your tree, silent after this, shall stand and bear witness, and may I not hope, in the words of a great American poet,[1] that . . . the eyes that look upon me in my later, nobler growth,

"Look also on a nobler age than ours;
An age, when, in the eternal strife between
Evil and Good, the Power of Good shall win
A grander mastery; when kings no more
Shall summon millions from the plough to
learn
The trade of slaughter, and of populous
realms
Make camps of war; when in our younger
land
The hand of ruffian Violence, that now
Is insolently raised to smite, shall fall
Unnerved before the calm rebuke of Law,
And Fraud, his sly confederate, shrink in
shame,
Back to his covert, and forego his prey."

[1] William Cullen Bryant in *Among the Trees.*

CHARLES SPRAGUE SARGENT

Photograph of the bronze bust by C. S. Pietro

This bust has been given permanent place in the forestry hall of the American Museum in honor of Professor Sargent's work in bringing together the Morris K. Jesup collection of North American woods

Museum Notes

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

Sustaining Member, PAUL J. BONWIT.

Annual Members, MRS. LESTER M. NEWBURGER, MISSES ELEANOR FERGUSON and M. M. KENNERLY, PROFESSOR EMIL ROLLER, DOCTORS CORNELIUS G. COAKLEY and SCUDDER J. WOOLLEY, MESSRS. A. BALINKY, LOUIS P. BAYARD, THEODORE BERNSTEIN, ROBERT E. BINGER, J. P. BLAIR, IRVING I. BLOOMINGDALE, GUSTAV BLUMENTHAL, H. P. BONTIES, M. J. BREITENBACH, CHAS. BRODMERKEL, JR., WALTER BROWN, OSCAR BURGI, E. R. BURNETT, CHAS. C. CASTLE, FRANK H. CAUTY, FREDERICK H. CLARK, WALLACE FAIRBANK, PERCY S. MALLETT, FRANK SEAMAN and LOUIS WEBB.

Associate Members, MESDAMES CHAS. ULYSSES BEAR and CHAS. LYMAN, MAJOR GENERAL H. L. SCOTT, U. S. A., DOCTORS GLENN F. BOWMAN, DON M. CAMPBELL, J. H. CARSTENS, JOSEPH C. GUERNSEY, ERNEST W. HAASS, EDWARD K. HOPKINS, HOWARD MORROW and GEO. C. PARDEE, MESSRS. C. L. BRUMMÉ, LEO M. BUTZEL, WM. B. CADY, HENRY WALTON CAMPBELL, B. G. CHAPMAN, AUSTIN CHURCH, FREDERICK L. COLBY, JOHN T. COOLIDGE, JR., WINFIELD S. DAVIS, F. T. DUCHARME, ROBERT KUHN, HENRY LEDYARD, ALVAN MACAULEY, EDWARD E. MCNAIR, JOHN BROCKWAY METCALF, J. HENRY MEYER, EDMUND T. PATERSON, JULIUS C. PETER, A. V. PHISTER, GERALD L. RATHBONE, GEORGE B. SPERRY, HOLLINSHEAD N. TAYLOR, SAMUEL HINDS THOMAS, RALSTON WHITE, GEORGE WHITTELL, BALDWIN WOOD and CHAS. M. WOODS.

AS an expression of appreciation by the American Museum of the valuable contributions made to the science of silviculture by Professor Charles Sprague Sargent, director of the Arnold Arboretum, Brookline, Massachusetts, a bronze bust, executed by Mr. C. S. Pietro, has been placed in the forestry hall. Professor Sargent received appointment to the position he now holds in 1873. With great scientific ability he combines business faculty and a keen perception of landscape beauty. The work that he has accomplished as head of the Arnold Arboretum is of the highest importance to the science of dendrology, and that institution, through his efforts, is unique both in the arrangement of its large collection and in the extent and completeness of the experimental work in planting, pruning, and cultivating all varieties of trees and shrubs that will thrive in the climate of New England. He has striven to discover and introduce hardy varieties from all temperate regions of the world. From 1879 to 1884 Professor Sargent made, under government auspices, a survey of the forest areas of the United States, with especial reference to the geographical distribution of various kinds of trees and their commercial value. As a practical continuation of this work, Professor Sargent, through the generosity of Morris K. Jesup, at that time president of the American Museum, made the representative collection of American woods now on exhibition at the Museum. Twenty years of constant work, during which he visited almost every species of tree in its own haunt, were required to accomplish this undertaking. His *Silva of North America*, in fourteen volumes, published as a result of his explorations and his collection of the Jesup woods, is the only work of its kind and is recognized as among the most notable botanical works in America.

AT the Fourth National Conference of the American Game Protective Association, held at the Waldorf, New York City, on March 4 and 5, the alarming statement was made that the upland game birds of America, including the bobwhite quail, the grouse, and the woodcock, are nearing extinction. The woodcock, in particular, according to Mr. E. W. Nelson, chief of the United States Bureau of Biological Survey, have greatly diminished in numbers within the last few years. To account in part for this situation a theory was advanced by Mr. John Burnham, president of the association, to the effect that in addition to rigorous winter weather and bad nesting seasons, every ten years there is a cycle of disease which kills off the upland game birds. In a discussion of the present demand, especially in rural districts, that the game laws be suspended for the duration of the war in order that beef and pork may be replaced by game, Dr. William T. Hornaday, director of the New York Zoölogical Park, urged the passage of bills now before Congress providing for the establishment of game sanctuaries, claiming that by this plan it would be possible to furnish for the nation's consumption not only vast numbers of wild fowl, but also two million deer annually. At the Waldorf meeting the life of migratory birds in Louisiana was shown in motion pictures, and Mr. M. L. Alexander, conservation commissioner, told what that state is doing to preserve the migratory birds within its borders. Other means suggested by different members of the association for the preservation of game in the United States were a shorter open season and smaller bag limits.

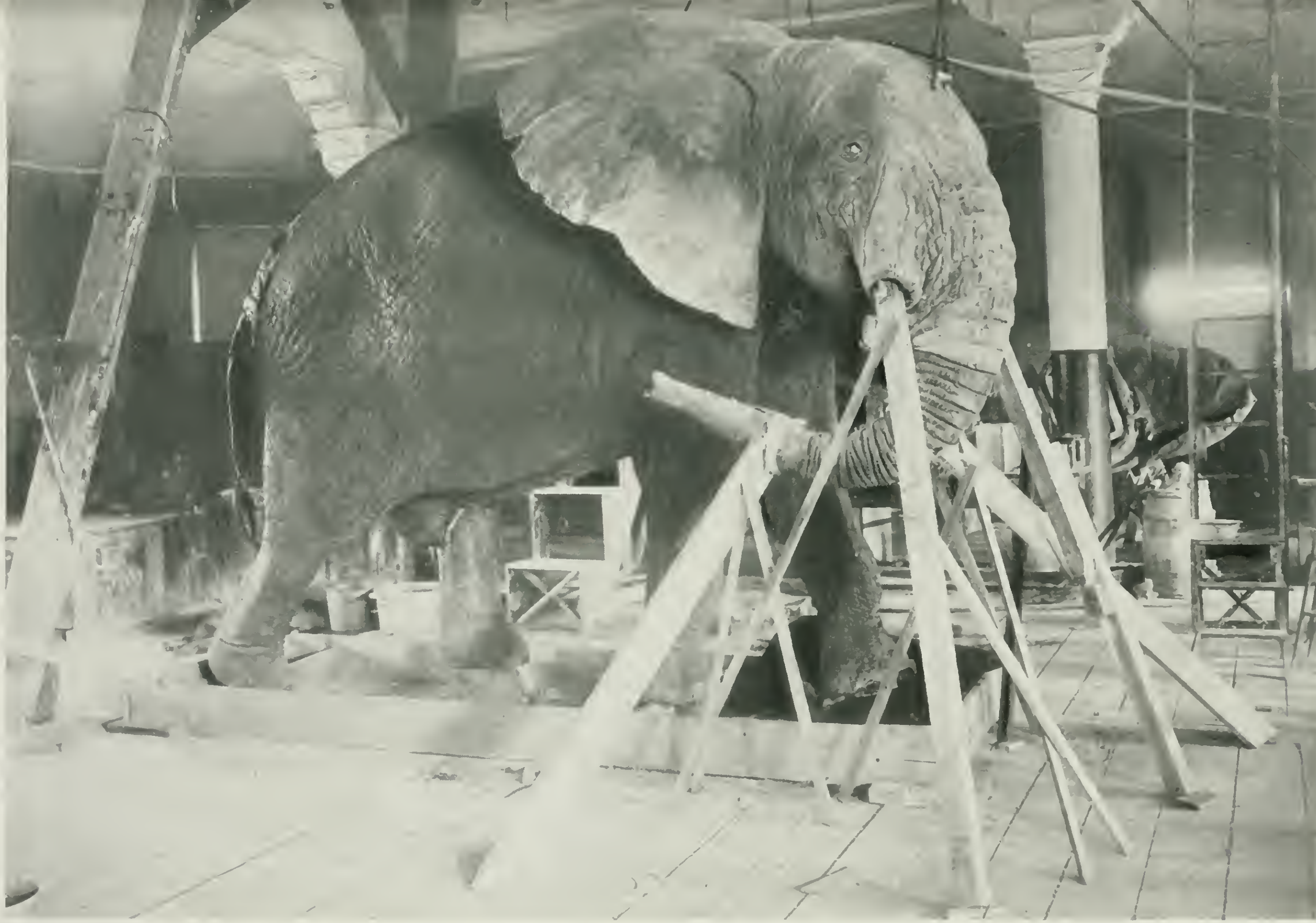
Another mounted figure for the African hall has been completed in the studio of Mr. Carl E. Akeley at the American Museum—the giraffe-like okapi from the Congo region. The same process of mounting has been followed as in the case of the young bull elephant shown in the accompanying illustration, and with the usual lifelike result. The okapi, standing more than five feet to the shoulder, has head uplifted and large ears thrown forward as if alert for the sound which will cause it to plunge into the depths of the underwood—its natural habitat. With its purplish brown body so nearly the color of the tree trunks, and its white legs barred with black, simulating alternate streaks of light and shadow amid the gloom of the forest, this animal may be considered a good example of protective coloration. In structure it resembles the giraffe in having only two toes on each foot, and in the shape of its teeth; it differs in being smaller and shorter of leg and neck, and in having the fore and hind legs about equal in length. The long muzzle is well adapted for feeding on the low forest underwood and swamp vegetation, and the short horns are probably also an adaptation to life in the forest. This animal was first discovered by Sir Henry Johnston in 1901, in the Semliki forest of Uganda, East Africa, and so far as is known, it is confined to that region.

Dr. Herman K. Haeberlin, who was appointed last summer as assistant in the department of anthropology at the American Museum, died in Cambridge, Massachusetts, February 12, 1918. Dr. Haeberlin was a young man of great promise, peculiarly fitted for anthropological investigation, and his death is a decided loss not only to the Museum but also to anthropology in general.

A series of monthly meetings is being held at the American Museum, under the auspices of the New York Academy of Sciences and the American Ethnological Society, for the purpose of reviewing the results of the Museum's explorations in the Southwest under the grant from Mr. Archer M. Huntington. Dr. Clark Wissler, curator of anthropology, introduced the series in January by a general discussion of "The Cultural Problems of the Southwest." On February 25, Mr. N. C. Nelson dealt with "Southwest Archæology," with especial reference to the chronology of the Pueblo ruins. The March meeting will be devoted to an illustrated talk by Mr. Earl H. Morris on the progress of the investigations being carried on at the famous Aztec ruin in New Mexico.

Mr. Earl H. Morris, in charge of the American Museum's explorations at Aztec, New Mexico, arrived in New York about the middle of February. Between June 10 and November 25, 1917, seventy rectangular living rooms and eight circular ceremonial chambers were cleared of débris. This necessitated the removal of more than six thousand wagonloads of earth and stone. The excavated part constitutes the east wing of a quadrangular structure 359 by 280 feet, whose solidly built sandstone walls rise to a height of twenty feet above the surrounding plain. Although the mound of earth resulting from the disintegration of the upper stories of the dwelling had preserved the walls which it covered to a surprising degree, the adobe mortar, wherever moisture had penetrated, had lost its cohesive properties, and, in addition, parts of the walls had been too much weakened by strains developed before the collapse of the structure to permit them to stand long after the removal of the protecting soil. Where such was the case, the walls were torn down and rebuilt in a manner to withstand for many years the action of the elements.

An excellent collection of specimens was obtained during the process of excavation. Burial chambers yielded pottery vessels of varied form and ornamentation, and thousands of beads and articles of personal adornment. From refuse deposits were taken many discarded weapons and implements, besides a surprising representation of textiles, and articles made of hide.



VIEW IN THE ELEPHANT STUDIO OF THE AMERICAN MUSEUM

This young bull elephant is one of a group of four similar animals now being mounted in the studio of Mr. Carl E. Akeley at the American Museum for exhibition in the proposed African hall. These huge beasts are of proportions so vast that they dominate the whole visible space of the eighty-foot studio. The success of the method of taxidermy originated and perfected by Mr. Akeley is demonstrated in such pieces of work as this and the okapi recently completed

Steller's sea lion (*Eumetopias stelleri*), subject of the above group in the new Museum of the California Academy of Sciences, San Francisco, ranges from Año Nuevo Island, near Santa Cruz (on which this rookery is located), northward to Bering Strait. The large male in the center of the group weighed 1810 pounds. Although most fishermen believe sea lions to be very destructive to commercial fisheries, investigations have proved the contrary, and they should be protected at least to some extent. A second species, the California sea lion (*Zalophus californianus*), is common from San Francisco southward. It is an intelligent animal and is frequently seen in captivity in zoölogical parks

Although the position of the Aztec ruin in the chronological sequence of the Southwest marks it as relatively ancient, its excellent masonry and the manufactured articles collected in last year's work show that its inhabitants had developed a wealth of material culture which the Pueblos never surpassed in later times.

In its new museum in Golden Gate Park, San Francisco, the California Academy of Sciences has recently installed a number of habitat groups illustrating the most interesting species of California mammals and birds in their natural environment. Both the taxidermist and the artist visited the various regions where the animals were obtained, in order to make the settings, whether painted or natural, as realistic as possible. The case for each group is twenty-five feet long, thirteen feet deep, and eighteen feet high, with a forty-foot curving background. As there are no windows in the exhibition halls, the lighting being from above, reflections in the front glass of the groups are almost entirely avoided. The northern mule deer and black-tailed deer, found in the coast mountains of California, form the subjects of two groups showing the beautiful scenery of that region, while the elk and antelope, of northeastern California, are no less charmingly presented. In contrast with these is the desert-like region in southern California, in the vicinity of San Jacinto Peak, where mountain sheep are fairly common. The barrel cactus, which

furnishes for these animals both food and drink, appears in the group. Another group shows the northwestern black bear, with its young, in a den among the rocks. This bear, in California as elsewhere, may be either black, brown, or even cinnamon, young of two colors sometimes appearing in the same litter. A second rocky den is occupied by a family of mountain lions, largest of North American cats and destructive to deer, being said to destroy annually an average of one deer a week. Moraga Valley, with Mt. Diablo for a background, is a picturesque setting for the coyotes. Four species of this animal are recognized in California. In the colder parts of its range it acquires a good coat of fur which has a fair commercial value. Raccoons and skunks, both well-known fur bearers, are seen in another group, while seals and sea lions are picturesquely represented in three different regions south of San Francisco. Water birds in the San Joaquin Valley, sea birds on the Farallon Islands, and a desert bird group, depicting a bit of the Colorado desert near the Salton Sea, represent three phases of bird life. The groups have been installed under the general direction of Dr. Barton Warren Evermann, the director of the museum. The mammal groups were prepared under the immediate supervision of Mr. John Rowley, assisted by Mr. Joseph P. Herring, while the bird groups were prepared by Mr. Paul J. Fair. Most of the backgrounds were painted by Charles A. Corwin and Charles B. Hudson.

A dinner in honor of Mr. F. W. Hodge, until lately Chief of the Bureau of Ethnology, Washington, D. C., but now connected with the Museum of the American Indian in New York City, was given at the Faculty Club of Columbia University on the evening of March 9 by local anthropologists. The guests numbered about thirty. After-dinner speeches, voicing the gratification of the many friends of Mr. Hodge in New York that his work now lies in this city, were made by Professor Franz Boas of Columbia University, Dr. Clark Wissler and Dr. P. E. Goddard of the American Museum, and Mr. George H. Pepper of the Museum of the American Indian. Mr. Hodge responded in appreciative terms. That hearty coöperation should exist among all scientific institutions was the prevailing sentiment.

Arctic fishes are so few in number that almost all of them are known to science. Yet rarely are any brought back in a sufficiently good state of preservation to be studied to advantage. A small collection obtained by the Crocker Land Expedition is therefore of considerable interest. The trout, or more properly speaking, charrs, from this collection (the only fish which were found in fresh water) are now being examined by Dr. William C. Kendall of the United States Bureau of Fisheries, who has for many years made a special study of the species and distribution of trout. The marine fishes with the exception of the interesting smeltlike capelin are mostly allied to the cods and the sculpins, in fact, are almost identical with cold-water species of these groups which abound off rocky New England coasts. A particularly fine series of Greenland sculpins,—large-mouthed, thorny-headed fishes whose mottled colors blend with the bottom on which they lie, will furnish exhibition material to illustrate sexual dimorphism. The males have more contrasted colors and the first or spiny back fin, comparatively high and broad. Stomach examination shows that the Greenland sculpin had been feeding on small crustaceans (resembling our shrimp and sand hoppers) which abound in polar seas. They doubtless will eat almost any creature that comes within reach of their cavernous maws.

Dr. C-E. A. Winslow, curator of the department of public health at the American Museum, is serving as a member of two of the subcommittees of the Medical Advisory Board of the Council of National Defense, in connection with nursing and child hygiene, respectively.

The department of invertebrate zoölogy of the American Museum has just received from Mr. Charles W. Leng an important accession of Coleoptera, adding more than seven hundred species to the Museum's collection.

During January a new window group was put on exhibition in the Darwin hall of the American Museum, illustrating the animals and plants of a tide pool on our northern New England coast, based on studies made by the department of invertebrate zoölogy at Nahant, Massachusetts, during recent years. It is the work of Messrs. Show Shimotori, Chris E. Olsen, Herman Mueller, and the late Ignaz Matausch, under the direction of Mr. Roy W. Miner. A more detailed description of this group with illustrations will appear in an early number of the Journal.

Miss Mary Eliza Audubon, granddaughter of the famous naturalist, died on November 23, 1917, at the home of her sister in New Haven, Connecticut. Miss Audubon was born in New York City, at Audubon Park on the banks of the Hudson, then her grandfather's estate. She was a woman of dignity, sweetness, and unselfishness. The large painting entitled "Pheasants," the work of Audubon, had been recently presented to the American Museum by Miss Audubon, who was connected with the institution for many years as life member.

When the building which stood at Broadway and Quincy Street, Cambridge, Massachusetts, burned early in 1917, a notable landmark was thereby destroyed, one which might well have been preserved for all time as a monument to one of America's famous men. For this house had been for many years the home of Professor Louis Agassiz, and after him of his son Alexander for a longer period. Designed especially for Professor Agassiz, it was occupied by him from 1854 to 1873 and during that time was the scene of many interesting events. It was here between 1855 and 1863 that hundreds of young women received instruction from the great naturalist, who was assisted in his work by his wife and daughter. The house was known as one of the most hospitable homes in Cambridge and Boston. Distinguished men of science were entertained within its walls, and many a Harvard man who was young at that time remembers with pleasure its hospitalities. The land upon which the house stood was bequeathed by Alexander Agassiz to Harvard College. It is hoped that when the war activities which now engross the attention of the entire university are no longer necessary plans may be developed for marking the site of the Agassiz House.

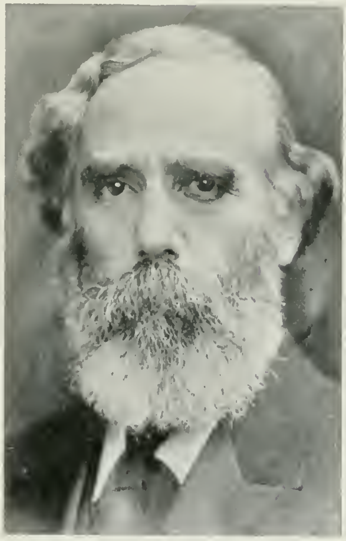
On the evening of February 28, 1918, the American Museum, in coöperation with delegates from the New York Academy of Sciences, the American Association for the Advancement of Science, the New York Mineralogical Club, and other institutions, celebrated the 175th anniversary of the birth of Abbé René Just Haüy (1743–1822), the founder of crystallography. There were read papers by George F. Kunz, Herbert P. Whitlock, Edgar T. Wherry, Frank D. Adams, Henry S. Washington, Alexander Vachon, Edward H. Kraus, and Alexander Hamilton Phillips, and one written for the celebration by the late L. P. Gratacap was also presented. An exhibition of books, portraits, and other memorabilia was arranged in special cases in the mineralogical hall of the Museum and included one original letter and two photostats of the only four letters still in existence which were written by Abbé Haüy.

With a knowledge of crystallography it frequently requires but a glance to determine a mineral either by its crystalline form or by its cleavage—or perhaps the measurement of a few faces by a hand goniometer—obtaining a result that can be verified chemically in a few minutes; whereas an analysis would require hours or days. To Abbé René Just Haüy we are indebted for the discovery upon which the science of crystallography is based. One day he accidentally dropped a hexagonal crystal of calcite (carbonate of lime) and his keen observation noted in a moment that when the crystal broke it parted or cleaved into rhombohedrons, and that these would break into rhombohedrons *ad infinitum.* He ascertained that these cleavage forms were always the same in the same mineral; and from the fact that certain substances have a constancy of crystalline structure the world over, more especially in the cleavage, he established the principle that the identity of a mineral always could be determined by its crystalline form. Thus calcite is always rhombohedral; the diamond is octahedral; and others in like manner. Furthermore, when certain minerals crystallize in the same system, some slight peculiarity on the surfaces or striations on the side will aid in identifying just what the mineral is. The study of crystallography, therefore, was never more important than at the present time, when, because of the constant search for war minerals, it is most important that determination of these minerals be made rapidly.

Mr. B. T. B. Hyde has presented to the library of the American Museum a large number of the original plates of J. O. Westwood's *Arcana Entomologica; or illustrations of new, rare, and interesting Insects,* published in London in [1841]–1845, in two volumes.

The large Florida reptile group, in a darkened gallery on the second floor of the American Museum, constructed under the direction of Miss M. C. Dickerson, is completed, and will be open to the public by the end of March. Among those who have worked on the group are Mr. Frederic H. Stoll, colorist and wax modeler, Mr. Hobart Nichols, landscape artist, and the late Mr. Ernest W. Smith, taxidermist.

The death, at the close of 1917, of Dr. Henry M. Leipziger, supervisor of the Board of Public Lectures of New York City, was an event of large importance inasmuch as it deprived this city of a man whose concern for the education of the masses has been one of the great uplifting influences in the community. Dr. Leipziger was a native of Manchester, England. He came to America in his youth and obtained his education in the public schools and colleges of New York City, in which he afterward gave instruction for eight years. Ill health compelled him to give up this work, whereupon he traveled and studied in Europe for three years. When he returned to New York, in 1883, the city was endeavoring to deal with the problem of adjusting itself to the needs of a large influx of Jewish immigrants, and he was asked to take charge of a trade school for boys. Later, he organized the Hebrew Technical Institute. Dr. Leipziger combined the qualities of the student and thinker with wide human sympathies. It became the dream of his life to bring the privileges of higher education within reach of all the people. To this end he devised and introduced into the schools the public lecture system, which from a small beginning has developed into a number of elaborate courses, each comprising a series of lectures upon topics of general interest in science, literature, music, and art. The American Museum has been one of the centers for these lectures for many years. It is hoped that this great work for the people, to which he devoted his entire energies for more than twenty years, will not be allowed to disappear from the public educational system of New York.



The late Dr. Henry M. Leipziger, supervisor of the Board of Public Lectures, New York City

A bulletin entitled "A War Time Diet," issued in February by the department of public health of the American Museum, provides a marketing list designed to show what food an average family of two adults and three children should buy weekly on an income of fifteen hundred dollars a year. The list sets forth the various proportions of starch, sugar, fat, protein, fruits, vegetables, and milk which should be consumed during the week to insure a well-balanced and healthful diet and at the same time provide for the economies urged by the United States Food Administration. The public is asked to check up weekly purchases and see if food has been bought intelligently. All possible readjustments in our former mode of living should be made to meet the special needs of our army in France and of our Allies.

A particularly large and handsome specimen of copper ore from Arizona and an unusual specimen of lemonite and manganese oxide showing a mosslike development, in which are crystals of native copper bearing tufts of malachite, have been presented to the American Museum by Dr. L. D. Ricketts.

An accession of considerable importance to the work in herpetology at the American Museum was recently obtained through an exchange with the Commercial Museum of Philadelphia. While there are many exotic species in this collection, especial interest attaches to the specimens from Costa Rica and Colombia, which include the types of twenty-five species described by Cope. The bulk of this material was collected by Mr. George K. Cherrie for the Museo Nacional of Costa Rica. In return for these specimens an exhibit of cotton plants, prepared in the taxidermy shops of the American Museum, will be sent to the Commercial Museum.

The Fifth Annual Report of the Pension Board of the American Museum, for the year 1917, shows the increase of membership in this Fund during the year to be thirty-six, with losses due to resignations, dismissals, retirements, and deaths to the number of twenty-one, making the present total 256. Through the good offices of friends of the institution, the Board has been enabled to provide various forms of relief in the way of employment or medical attention to the members of families of deceased subscribers. In addition, endowed beds in the Mt. Sinai and Presbyterian hospitals have been placed at the disposal of the secretary, Mr. George N. Pindar, where free attendance will be given to employees who may need hospital treatment. Through a plan formulated by the officers of the Board, and by the generosity of certain trustees who advanced the necessary funds, opportunity to subscribe to the Liberty Loans on easy payments was given to the members. Many officers and members of the Fund, which amounted to $22,250, are now in war service. Dr. George M. Mackenzie, medical examiner for the Board, is at the Brooklyn Navy Yard serving as medical examiner for the Naval Reserve Force. Mr. S. Herbert Wolfe, consulting actuary, after being detailed to Washington where he assisted in drafting the present measure for soldiers' insurance and compensation in the United States, was sent to France. Of the members, some have entered the Federal Service from the National Guard, some have enrolled in various branches of the Army, and others have entered the Navy.

According to Chancellor Jordan of Stanford University, a new food fish, which may prove of considerable economic importance, has appeared in the California market. This is the priest fish (*Erilepis*), which reaches a weight of two hundred pounds and is found also in Japan. Dr. Jordan says: "It will probably be found in abundance on rocky shallows in the North Pacific; if so, it will prove one of our best food fishes, ranking with the halibut. The flavor is rich and delicate, a little fat, but the oil without the strong flavor seen in mackerels and sardines. It is in fact very much like that of *Anoplopoma*, which is now being largely pushed under the name of 'sablefish' and is, by the way, both fresh and smoked a real addition to our food supplies. The fishermen call the priest fish 'deep-water cod.'" The priest fish has not the least right to be called cod, nor indeed have several other excellent food fishes which bear the name, for instance, the Alaska black cod, another name for the sablefish, and the cultus cod, an excellent and important food fish of our Pacific coast which reaches a weight of from thirty to forty pounds. All three of these fishes are related to one another and remotely related to the sculpins, a very uncodlike group.

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 1917:

Attendance in Exhibition Halls	786,151
Attendance at Lectures	115,802
Lantern Slides Sent out for Use in Schools	63,111
School Children Reached by Nature Study Collections	1,104,456

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 the JOURNAL. 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.

The various Classes of Membership are as follows:

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

They have the following privileges:

An Annual Pass admitting to the Members' Room
Complimentary tickets admitting to the Members' Room for distribution to their friends
Services of the Instructor for guidance through the Museum
Two course tickets to Spring Lectures
Two course tickets to Autumn Lectures
Current numbers of all Guide Leaflets on request
Current copies of the AMERICAN MUSEUM JOURNAL

Associate Membership

In order that those not living in New York City may associate with the Museum and its work, the class of Associate Members was established in 1916. These Members have the following privileges:

Current issues of the AMERICAN MUSEUM JOURNAL—a popular illustrated magazine of science, travel, exploration, and discovery, published monthly from October to May (eight numbers annually), the volume beginning in January

A complimentary copy of the President's Annual Report, giving a complete list of all Members

An Annual Pass admitting to the Members' Room. This large tower room on the third floor of the building, open every day in the year, is given over exclusively to Members, and is equipped with every comfort for rest, reading, and correspondence

Two complimentary tickets admitting to the Members' Room for distribution by Members to their friends

The services of an Instructor for guidance when visiting the Museum

All classes of Members receive the AMERICAN MUSEUM JOURNAL, which is a magazine issued primarily to keep members in touch with the activities of the Museum as depicted by pen and camera; also to furnish Members with reliable information of the most recent developments in the field of natural science. It takes the reader into every part of the world with great explorers; it contains authoritative and popular articles by men who are actually doing the work of exploration and research, and articles of current interest by men who are distinguished among scientists of the day. It takes the reader behind the scenes in the Museum to see sculptors and preparators modeling some jungle beast or creating a panorama of animal life. It shows how the results of these discoveries and labors are presented to the million public school children through the Museum Extension System. In brief it is a medium for the dissemination of the idea to

which the Museum itself is dedicated—namely, that without deepening appreciation of nature, no people can attain to the highest grades of knowledge and worth.

Publications of the Museum

The Scientific Publications of the Museum comprise the *Memoirs*, *Bulletin* and *Anthropological Papers*, the *Memoirs* and *Bulletin* edited by Frank E. Lutz, the *Anthropological Papers* by Clark Wissler. These publications cover the field and laboratory researches of the institution.

The Popular Scientific Publications of the Museum comprise the *Handbooks*, *Leaflets*, and *General Guide*, edited by Frederic A. Lucas, and the JOURNAL, edited by Mary Cynthia Dickerson.

POPULAR SCIENTIFIC PUBLICATIONS[1]

HANDBOOKS

NORTH AMERICAN INDIANS OF THE PLAINS
By CLARK WISSLER, PH.D. — Paper, 25 cents; cloth, 50 cents

INDIANS OF THE SOUTHWEST
By PLINY EARLE GODDARD, PH.D. — Paper, 25 cents; cloth, 50 cents

ANIMALS OF THE PAST
By FREDERIC A. LUCAS, SC.D. — Paper, 35 cents

DINOSAURS
By W. D. MATTHEW, PH.D. — Price, 25 cents

TEACHERS' HANDBOOK, PART I, THE NORTH AMERICAN INDIAN COLLECTION
By ANN E. THOMAS, PH.B. — Price, 10 cents

TREES AND FORESTRY
By MARY CYNTHIA DICKERSON
A new edition in course of preparation.

HEALTH IN WAR AND PEACE
By C-E. A. WINSLOW, M.S., M.A. — Price, 25 cents

ANCIENT CIVILIZATIONS OF MEXICO AND CENTRAL AMERICA
By HERBERT J. SPINDEN, PH.D. — Cloth. Price, 75 cents

ILLUSTRATED GUIDE LEAFLETS

THE COLLECTION OF MINERALS
By LOUIS P. GRATACAP, A.M. — Price, 5 cents

NORTH AMERICAN RUMINANTS
By J. A. ALLEN, PH.D. — Price, 10 cents

THE ANCIENT BASKET MAKERS OF SOUTHEASTERN UTAH
By GEORGE H. PEPPER — Price, 10 cents

THE MUSICAL INSTRUMENTS OF THE INCAS
By CHARLES W. MEAD — Price, 10 cents

THE SAGINAW VALLEY COLLECTION
By HARLAN I. SMITH — Price, 10 cents

PERUVIAN MUMMIES
By CHARLES W. MEAD — Price, 10 cents

[1] Prices net; postage extra

The American Museum of Natural History

Scientific Publications

MEMOIRS

VOLUME I.—Zoölogy and Palæontology.

VOLUMES II–VIII.—Anthropology.

VOLUME IX.—Zoölogy and Palæontology.

VOLUMES X–XIV.—Anthropology.

VOLUMES II, IV, V, VII, VIII, X–XIV, and an ETHNOGRAPHICAL ALBUM form the Memoirs of the Jesup North Pacific Expedition, Volumes I–X.

MEMOIRS—NEW SERIES

VOLUME I.—Zoölogy and Palæontology.

BULLETIN

VOLUMES I–XXIV; XXV, parts 1 and 2; and XXVI–XXXVII.

ANTHROPOLOGICAL PAPERS

VOLUMES I–IX; X, parts 1–6; XI; XII, parts 1–5; XIII; XIV, parts 1 and 2: XV, part 1; XVI, part 1; XVII, parts 1–4; XVIII. parts 1 and 2; and XIX, part 1.

MONOGRAPHS

A Review of the Primates. By D. G. ELLIOT. 3 volumes.

Hitherto Unpublished Plates of Tertiary Mammals and Permian Vertebrates. By COPE and MATTHEW.

A more detailed list, with prices, of these publications may be had upon application to the Librarian of the Museum.

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The American Museum of Natural History

THE AMERICAN MUSEUM JOURNAL

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

April, 1918

Volume XVIII, Number 4

The American Museum Journal

CONTENTS FOR APRIL

Mary Cynthia Dickerson, *Editor*

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

The Journal 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.

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"THE LURE OF LAKE LOUISE AT DAWN"

Typical of the beauty of the Canadian Rockies.—This painting is one of a series of canvases by Leonard M. Davis, which will be on exhibition at the American Museum until June 1

—See note regarding the exhibition, page 314

THE AMERICAN MUSEUM JOURNAL

VOLUME XVIII APRIL, 1918 NUMBER 4

China's Ancient Monuments*

By ROY CHAPMAN ANDREWS

Illustrations from photographs by the Author

A MEMORIAL was addressed to President Yuan Shi Kai of the Chinese Republic in 1914 by fifty-two American institutions of art, learning, and humanity.[1] The immediate result was the promulgation of an edict making legal recognition of China's monuments and antiquities and urging national coöperation in their preservation. Moreover, the governments of the United States, Great Britain, and France through their ministers at Peking instructed their consuls throughout China to use all possible endeavors to further the suppression of vandalism on the part of their citizens.

Although this was an excellent beginning, political events soon gave it an unexpected check. Within little more than a year Yuan Shi Kai's monarchical ambitions were made public, and a rebellion immediately started which involved all China and resulted in the death of Yuan. Since then the republic has been in chaos or has, to say the least, maintained a state of unstable equilibrium. Meanwhile the despoiling of China's monuments and antiquities has progressed unchecked. In the last ten years foreign collectors have visited many remote corners of the eighteen provinces on a systematic search for objects of art or archæological value, and the menace to the records of China's ancient civilization has assumed alarming proportions.

Not only have smaller objects been carried away but pieces of sculpture, bas-reliefs, and parts of temples too large for ready transportation have been cut from their places and sometimes irreparably broken, leaving a scarred and disfigured reminder of ancient glories. Unfortunately this work of despoliation has been aided only too effectually by certain unscrupulous Chinese themselves who saw an opportunity for material gains in the plunder of the art treasures of their own country. Moreover, China is doing very little toward protecting the monuments and buildings which form not only the record of her own ancient civilization but which are of the utmost importance in the history of the world.

The Chinese are great builders, but they seldom repair the monuments which they have erected. In Peking, one of the most unique, picturesque, and romantic cities of the world, there are dozens of ancient buildings which form a precious heritage of the Chinese people and as such should be cared for

[1] This was after an energetic campaign by Frederick McCormick, secretary of the Asiatic Institute, in which Professor Henry Fairfield Osborn took an active part on behalf of the American Museum of Natural History.

* As stated in a note in the February JOURNAL, a joint meeting of the American Scenic and Historic Preservation Society and the American Museum of Natural History was held on January 17, 1918. A resolution, introduced by Professor Henry Fairfield Osborn, was unanimously adopted by the members of the two institutions, extending to the President of the Republic of China felicitations upon the plans that have been made for the protection of Chinese monuments and antiquities from vandals and for the collection of these priceless relics of the history of China, and renewing the expression of hope that these collections may be safely preserved in a national museum. The resolution also renewed the pledge that our influence will be used to prevent the despoiling of China by the unauthorized sale of ancient works of art.

by the nation. The Temple of Heaven, with its golden dome glowing like a great ball of fire above the purple tiles of its sloping roof, the white marble altar open to the sky, made sacred by the worship of China's most illustrious emperors, the beautiful *p'ai lou*, and the marble walks belong to China's posterity as records of her ancient glories. But such rare treasures need care to protect them from the ravages of time and weather.

When I visited the Temple of Heaven less than two years ago, I found its spacious courtyards choked with uncut grass and its beautiful walks and tile-capped walls almost obscured by growing weeds. The tiny roots were slowly but surely accomplishing their deadly work. The marble slabs were cracked, the tiles broken, and the walls crumbling: the great round temple itself was filled with dust and decay. In a very few decades this almost sacred spot will present only a heap of ruins overgrown with grass and weeds, and one more page will have been torn from the book of China's history.

The "Yellow Temple," not far from Peking, is one of the most sacred spots near the capital. Here are buried the garments of a holy Tashi lama who came as an ambassador from Tibet to Peking. It was the lama Panchan Bogdo from Tashi Lumpo, who died of smallpox in 1870. The ashes of his cremated corpse were sent to Tibet, but over his clothes the artist emperor, Ch'ien Lung, erected a *stûpa* in old Hindu style, a mausoleum of marble and gold. When I visited it first, in 1912, a yellow-robed priest showed me, with sorrow in his eyes, the atrocious destruction which had been inflicted on this sacred monument in 1900. This was during the Boxer Rebellion, when Japanese soldiers wantonly knocked off the heads of statues with the butts of their rifles and damaged bas-reliefs, but fortunately only a small part of the marvelous detail was destroyed by this act of vandalism.

On my second visit, in 1916, after an absence of four years, I was appalled at the signs of decay. The ancient temple of gray wood, with faded but magnificent columns, yellow, blue, and green, was full of cracks and rifts. It was already leaning and seemed about to fall. In place of a beautiful *p'ai lou* which formerly faced the *stûpa,* lay a heap of plaster, stone, and yellow tile. It is a very, very old temple but with a little care could still be made to stand for years.

At the end of Ha-ta mên street are the "Temple of Confucius" and the

View from the porch of the main temple at the Ming tombs. These temples and tombs, among the most interesting in China, with only a small amount of care could be preserved for many years. Note the thick vegetation growing among the broken tiles of the roof

"Hall of Classics." One passes through a little door in the wall and enters a quiet courtyard full of trees, some of which were planted a thousand years ago under the Sung dynasty and, although twisted and wrinkled, are still stately and dignified like ancient sages.

Near a large wooden gate are ten curious old stones about three feet high. They are the holy drums of the Chou dynasty and are 2700 years old. Although priceless relics of antiquity, they remain outside, open to the ravages of cold and heat, of frost and rain. In the temple is the wooden soul-tablet of Confucius and in adjoining buildings are tablets of many disciples and pupils of the master.

The Hall of Classics is a group of temple-like buildings in a large garden where the text of Chinese classics is kept engraved on stone tablets. There is a wonderful *p'ai lou,* and in the center of a beautiful lake surrounded by a marble balustrade stands a splendid temple. It is the "Hall of Meditation," but now is deserted and covered with dust; dust is everywhere, blown in from the Gobi desert by whirlwinds from the north. The fine desert sand is powdered thickly over the stately throne and paneled screen, and has dulled the

Stone tablets at the entrance to the Temple of Confucius.—Upon these great slabs of stone are cut many of the Confucian classics. They are of great value and should be carefully housed instead of being left to the destructive action of heat and cold. China should have an active society—an Archæological Survey—financed by the government and administered by trained men, to guard and keep in repair her ancient monuments, and thus preserve for the benefit of posterity priceless treasures of art and antiquity

Marble bridge at the Ming tombs.—The bridge has been broken away at the end and within a few years will be entirely destroyed unless some action is taken to preserve it

P'ai lou in the courtyard of the Hall of Classics.—An atmosphere of neglect, decay, and dilapidation rests on the temple, creating in all observers a feeling of sadness that so much beauty is left to perish

One of the buildings of the Confucian temple.—Weed-grown terraces, crumbling stairways, and falling walls are now characteristic of these splendid temples

Interior of a Confucian temple.—Dust is everywhere—blown in from the Gobi desert by whirlwinds from the north. Stately throne and paneled screen are covered thickly with the fine desert sand, which has dulled the color of the red-lacquered wood and golden ornaments

color of the red-lacquered wood and golden ornaments. In other halls stand classical texts engraved on stone, but between the sacred tablets are piles of boards and benches. An atmosphere of neglect, decay, and dilapidation rests on the Temple of Confucius. Not only is the material dust of the Gobi desert sprinkled over it, but something like mental dust as well, and one leaves it with a feeling of sadness that China's most precious treasures of wisdom and beauty are left untended to perish from the earth.

A few hours' ride on the railroad brings one to Nank'ou and the Ming tombs. At the entrance to the valley in which lie the mortal remains of the great emperors stands a noble *p'ai lou,* one of the most beautiful in China. A magnificent road, once paved with marble slabs but now a crumbling ruin grown thick with weeds and grass, leads through waving fields of corn. Passing down the "Avenue of the Animals," where in huge marble figures, standing and recumbent, all the creatures of the earth are symbolized in mourning for the emperors, one arrives at a shallow stream once spanned by a beautiful marble bridge. This bridge, too, is in ruins, and at the splendid temples and tombs beyond one finds falling walls, weed-grown terraces, and crumbling stairways.

Throughout the length and breadth of China the picture is the same—relics priceless to history and to science neglected and crumbling in decay for want of the care which every civilized nation of the earth lavishes upon the records of its antiquity. Fortunately, the story is different in Japan, where the temples and monuments are cared for by the nation and its people and stand today as permanent memorials of her ancient civilization. In the "Society for Preserving Landscapes and Historic and Natural Monuments" Japan has a custodian for her national

MAUSOLEUM NEAR PEKING

Although the Chinese are great builders, the architecture of China is little known and its history is yet to be written. Upward curving roofs, octagonal towers, and painting in strong pure colors are recognized elements. This *stûpa*, or mausoleum of marble and gold, was built in memory of the lama Panchan Bogdo from Tashi Lumpo, who died in 1870. The bas-reliefs were badly injured by Japanese soldiers at the time of the Boxer Rebellion in 1900

THE TEMPLE OF HEAVEN

This temple, one of the most beautiful in China with its golden dome, purple-tiled roof, and white marble altar, is being rapidly destroyed by the ravages of neglect and decay. In a very few decades it will present only a grass-grown heap of ruins. The beautiful marble walks and *pai lous* are overgrown with weeds. At the open altar from which this photograph was taken the emperor formerly worshiped once each year

AVENUE OF THE ANIMALS AT THE MING TOMBS

A magnificent road, once paved with marble slabs but now crumbling and overgrown with weeds and grass, leads into the valley where lie the mortal remains of these great emperors of China. Huge marble figures, standing and recumbent, border this road, to symbolize all creatures of the earth mourning for the emperors. Throughout the length and breadth of China the picture is the same—priceless relics crumbling in decay for want of that care which every civilized nation lavishes upon the records of antiquity

P'AI LOU AT THE ENTRANCE TO THE VALLEY OF THE MING TOMBS

This is one of the most beautiful *pai lous* in all China and it is now in a fairly good state of preservation; but the roads leading to the temples, and the buildings themselves, are rapidly yielding to the destructive forces of wind, weather, and weeds. Prompt attention would save this monument from the fate that has befallen many such landmarks of China

AT THE END OF THE ROAD

The Avenue of the Animals leads to this once fine temple, which now speaks eloquently of the inroads made by time and neglect. Vegetation springs freely amid the stone flags of the pavement and is rapidly breaking away the tiled roof of the temple itself. Falling walls and crumbling stairways characterize the interior, which keeps pace with the rest in its general aspect of desolation treasures and a safeguard of her history. China should have a similar active society to protect, care for, and repair her buildings, monuments, and antiquities. She needs an Archæological Survey, financed by the government and administered by trained men, to locate and appraise her scientific treasures and to undertake the establishment of national and provincial museums where her priceless objects of art and antiquity can find a permanent resting place and be open to exhibition and study.

In this period of transition China's peril is great. She must awake to save the memorials of her ancient civilization or they will be stolen from her by ruthless vandals, bartered to enrich the coffers of soulless traders, and the records of her glorious past will lie in crumbling walls and heaps of dust.[1]

[1] See *American Museum Journal*, Vol. XVI, pp. 109–112, and Vol. XVII, pp. 525 and 530 for further illustrations of Chinese monuments photographed by Mr. Andrews.

Gate at the old city of Tali-fu in Yunnan.—Marco Polo passed through this gate about the year 1284. The famous traveler visited China during the reign of Kublai Kahn, and it is mainly to his book of recollections that Cathay, as the Chinese empire was known to mediæval Europe, owed the growing familiarity of its name in Europe during the fourteenth and fifteenth centuries. The Polos were pioneers of a very considerable intercourse between China and Europe, which endured for about half a century, or until the end of the Mongol dynasty. Trees are growing from the upper parts of this historical monument and it soon will be a crumbling ruin

A Point of View on China[1]

By L. H. BAILEY

Formerly Director and Dean of the New York State College of Agriculture, at Cornell University

IT is impossible for me to undertake a positive discussion of the missionary enterprise in China for the reason that I am not a student of the subject nor did I attempt any investigation of it in my brief visit. I went to China for a very different purpose. Yet one who is interested in the problems of the people necessarily must consider the foreign or outside influences, and of these influences the missionary movement has outstanding importance. Moreover, for a short experience, I actually saw much of the missionaries, of different groups and denominations.

I do not approach the subject of the missionaries from what might be called the professional or evangelical side, although in sympathy with this fundamental phase of the work. The social, civic, and other results cannot be overlooked, particularly at a time when China is itself in the flux.

If we are to consider betterments in China, we necessarily assume that the present status of the country is markedly defective. This is naturally an assumption of occidentalism. I do not know how far the Chinese make such assumption, although I was impressed with the readiness with which they invite suggestions and the great courtesy with which they treat the recommendations of foreigners. It seems to be a prevailing opinion that China is closed and sealed to outside influence. This may be true in the sense that China has learned much in her long history and has incorporated this acquisition into her philosophy and institutions, but she is ready for change, and her people, so far as they have had advantages, seemed to me to be eager to take hold of many new things.

In our occidentalism, representing a civilization now expressed in terms of commerce, we are likely to think of China as a heathen land, lacking in the development of natural resources and in the applications of science, weak politically and in education, primitive in sanitation, stationary in agriculture, undeveloped in industry. On these questions I now make neither affirmation nor denial. Yet a few great outstanding considerations must be kept constantly before us.

Bear in mind that I here develop a point of view only. This view is personal to me, representing some of my impressions. It is not my purpose now to state any sets of facts as such. Nor do I overlook the many deficiencies that are so likely to impress the visitor from the West, and which have been so often described. These defects, while inconvenient to the traveler and the business man, do not necessarily express the real capacities or potentialities of the people. China did not impress me as either decadent or worn out, but as arrested.

The history and experience of China stimulate speculation as to its future, and raise certain reflections on our own status. Naturally all such statements as here made are relative; and the queries I propound are only to challenge the westerner, not to express dissent.

First, China is generally considered to be the most permanent society or civilization of great dimensions on the globe. Yet it is not a political or patriotic society in our understanding of these words. Its cohesion is of another kind.

(Query: Is the highly developed nationality of the Occident the solution or even the best expression of human progress?)

[1] Enlarged from an address, by request, before a missionary group.

Second, the increase of population apparently has outrun the available land and the food supply: or, to state the case otherwise, the scale of living has been forced to very low terms. There must be something in the organization of their society highly conducive to race increase; there must be a high essential morality and a governmental system that is on the whole kindly or at least not repressive.

We must be careful not to confound racial customs, particularly in their relations to the sexes, with essential morality.

Third, we must recognize that the Chinese have learned the great art of economical living. They know how to use nourishing vegetable foods to the greatest advantage. The Romans knew the value of pulse. Daniel refused that he and his associates should use King Nebuchadnezzar's meat and the wine he drank, but insisted on the simpler diet of the Israelites; and a test was made to the result that the king's dainties were taken from his own men and they were given pulse to eat. We think of China as a land of rice, but it is also a land of soy, and the odor of the bean curd announces your approach to a village. With all our violent conservation, we are not yet in sight of the Chinese economy; and yet I was impressed with the fact that the Chinese live well in proportion to their incomes. They have food freely, and in surprising variety, although simple among the common folk.

We are to hope that we shall never be driven to the extreme food reductions of the mass of the Chinese people, yet we must recognize their maintenance of population in the face of such reduction; it would be well for us to make more extended studies of their dietaries.

(Query: Have the *chef* and the menu added to the virility of our western people? Most of our people do not have these aids: is there any relation here to the birth rate? Are the results of our studies of calories anything more than the elimination of materials which over-supplied persons have learned to add to their stomachs?)

Fourth, there is limitless latent power in her population. China is often described as a country of vast potential natural resources; of this I do not know, but I was much impressed with the potentialities of her undeveloped human resources. Here is endless capacity for labor, patience in the face of great difficulties, a reserve force that some day the world may sorely need.

(Query: Do we of the West give too much weight to the development of the individual, as a separate unit? Or is there an evolutionary power in numbers?)

Fifth, China has withstood the shock of invasions from without and of uprisings within. We think of the present war as the most destructive of life in the world's history; yet I have been told that the estimated loss of life in the Tai-ping rebellion and as a result of it (this rebellion ended about the time of our Civil War) was many millions. There must be some powerful principle in the Chinese civilization, some abiding merit in the institutions, to account for these recoveries throughout the centuries. China has recovered by means of her own internal strength without the need of external help. She has not gone forth for to conquer. China has minded her own affairs; among the great self-governing peoples or powers she is peculiar.

Sixth, China is farthest removed from being a military nation. It has been the diversion of the rest of the world to laugh at her army. Yet she has these centuries to her credit. She has maintained herself. The Chinese invented gunpowder. It is said that it was used to drive away the evil spirits. If she had used it to kill her neighbors we should now class her with the Great Powers and probably would not need to send teachers to her.

China is the great example of a country at peace. She has not been tranquil within herself, for it is a mistake, as I see it, to regard China as complacent; but essentially her contact with the world has not been of the conquering-hero kind. I have been interested to see her conquest in the South Seas. A Chinese comes to a place quietly. He asks no favors, no protection of his government; he raises no flag. Presently he has a good business; he makes himself useful; soon he controls important affairs; he conquers the country, but the conquest is not in the name of China. It is a racial conquest. The only way it can be stopped is to prohibit immigration.

China has had the presumption to put the soldier lowest in the social scale, and yet she has persisted longest: this makes her perhaps the most remarkable and the most significant country. Since China began, Greece has finished. Egypt has buried herself in her sands. Alexander the Great has come and gone. Christianity has come. Rome fell. Spain planted her language around the world. Great states have come out of the renaissance; by vast heroics they are trying to keep their heads above water. China is the Great Fact in history. It was a sensation to me to find that her native systems of education are innocent of Greece and Rome.

(Query: Has any continuous military method of civilization justified itself? May we hope for the continued development of a peace-loving China as the greatest safeguard in the world?)

Seventh. China has not had a continuous government. We think of the Chinese monarchies as extensively despotic, yet such is not the case except within rather narrow powers. Life may have been cheap as against the will of dynasties, yet the powers of government have lain largely in the provinces. Dynasties have been short, an average it is said of about two hundred years, and every succeeding dynasty has been of a different kind and stamp from its predecessor. It is the unwritten law that a dynasty does not write its own history. China has seen marvelous changes of governmental direction. We think she has been sleeping. Some peoples are too wakeful. They do not rest well. When they turn over in bed, the bed creaks, perhaps the windows rattle. When China turns over, the bed falls down, the house collapses, the foundations separate into their elements.

China has lived long enough to prove that there are more enduring things within a people than government. We of the West have not yet learned this. In some parts of the West we still think that government is a copartnership with God.

Eighth. China is described as the oldest great country of widely disseminated learning. This learning may not be universally acquired, but it is nevertheless accessible. Wherever I went, I was impressed with the number of books on sale. I do not know what was in these books, but I saw them.

(Query: Is universal popular education essential to permanent institutions?)

Ninth. China has had probably the most perfect educational system yet devised. We may not agree that the educational result has been most worth while, but it has led directly into civic office and has opened a career for talent.

In the former Chinese system, which came to an end practically with the fall of the Manchus, in very recent years, the wealthy youth even if from the city was not much favored over the poorer youth even if from the country. The clan or family supported the poor boy of promise for the sake of the clan: we support such a one for sweet charity, or the government extends its benevolence. There were no extensive and expensive laboratories and technical schools. The exercise was pure learning, such as should delight the heart of the purest classicist.

Modern education in the all-wise Occident is an urban enterprise. It is very expensive. Introduced into China it is likely unduly to favor the city youth.

(Query: Do our great compulso y systems of uniformity in education open a career for talent? In the old academy days, public opinion allowed one student to be treated differently from another: we still boast of the strong characters that came out of the academies.)

Tenth, China has now thrown off the alien Manchu dynasty, has washed her hands clean of it, and has set herself to the repairing of the experience of the last hundred years or so. I was in China in 1917 when the young Manchu prince was restored. Even in a time of internal dissension and of world disturbance, the youth was allowed in a few days to return to his pursuits. The old order is ended. China cannot live on her past. She knows it.

Eleventh, the Chinese have learned that some things lie beyond the inquisitiveness of man. They have accepted this fact. Confucius taught that some truths of nature are not discoverable. With all our inquiries we seem to be as far as ever from the ultimates. The Caucasian assumes that he can solve the riddle of the universe by rule and balance, by retort, by microscope and telescope. Yet the basis of any science is at first an assumption. Perhaps we shall some day conclude that the ultimate truths must be projected rather than discovered.

(Query: Have we yet learned how to use natural science? Is it to be used for power that we may accumulate to ourselves the physical and material goods of life? Are we not now at battle with this idea?)

Some day we shall learn that science is not merely a handmaiden to industry but that it may expand the soul.

I could much extend these interesting categories but I have given enough for my purpose, which is to suggest that China has much to teach us and that we should send our instructors in no spirit of superiority or complacency; and also that we are not to judge China by what we of the West are fond of calling "progress."

The objective civilization of the West has much to learn from the subjective experience of the East. China is indeed weak in the occidental commercial sense, and we assume that whatever is weak commercially is weak essentially. Here we make a profound mistake. We are even now at war with this idea. We have been dazzled by the efficiency of Germany as a highly organized state, incorporating the methods of business into its system. The western world has prided itself on the discovery of Efficiency. We have worshiped at the feet of the God of Efficiency. Now we find that it is only a species of idolatry and soon we shall be trying to smash the idol. We begin to see that we have been worshiping the Golden Calf.

I am not much given to the demand that we fill the great responsibilities with business men. We live in a commercial civilization, but not the programs nor even the methods of business are necessarily superlative. For public work we need much more than so-called business ability. We need broad views on public questions, outlook into future results, passion for public service. The activity of accumulation, which is the guiding principle in business, is not the best training for public service. I have noticed in good business men a singular lack of judgment on large public policies, and a short reach in dealing with many of the elementary principles controlling economic and social questions. I have come to feel that I want the outside view. The business man is trained in judging men and situations as they affect him. Personally he may be wholly unselfish, but his habitual attitude is likely to unfit him for administrative duties affecting great complexities of interests. We make a major mistake when we assume that business men are by their experience better qualified than all others in executive ability. I resent the complacent assumption that "business" is naturally and as a matter of course superior.

Trade is indeed good for China, but it should be subordinate.

All this being my line of approach, you will understand that I have no remedies and certainly no panaceas for what we may call the deficiencies in China. The problem is China's. I cannot look on the missionary as her salvation, although I am sure he is making a vast contribution. So long as China does not interfere with the peace and prospects of other peoples, her problem is not the responsibility or even the business of any other people or country. It is not the civic responsibility of the missionaries except in so far as they may aid China toward a right solution. The reformation of China (if reformation is necessary) is not to be accomplished by the occidentalization of it, nor by the mere introduction of invention and the extension of commerce. The Caucasian is not called to monitor the world.

Commerce or trade is particularly disqualified for the service needed just now in China, and for the very good reason that it is not disinterested. Trade does not undertake fundamental solutions, but operates in the realm of expediencies, combinations for control, gain for those persons who happen at the moment to be transient on the earth. The operations of the Powers in China have been largely on the commercial plane; the exhibition has not been altogether edifying and much of it will not receive the approval of coming generations. Yet, the way may have been opened for the release of China from herself.

Any foreign influence to be permanent and corrective must first of all regard the welfare of the Chinese, and very much as the best Chinese themselves measure that welfare. We have much to do to correct and to repudiate what has been done in China by the foreigner in the name of civilization. Even because a man is weak or lame is no reason why we should take his coat.

This outside influence must be sympathetic. It seems to be a common idea of the foreigner that he must carry his own institutions into China and plant them there rather than to develop the native institutions. This is well expressed in the architecture of the foreigners. There are many interesting lines and details of motif in Chinese architecture that can be carried over into modern construction; yet, with the exception of an occasional concession in roof lines, I saw little of the oriental in the foreign buildings, no sufficient suggestion of adaptation to the people among whom these foreigners live, nor invitation of kindly sympathy. Considering its place, some of the introduced architecture is repulsive.

We are in great haste to "open up" China. Yet I fail to see the need for haste. It might be a vast gain to humanity if most of the remaining resources of the planet were allowed to lie until we have learned how to utilize them righteously. What matters it if China were not "developed" for one hundred or even two hundred years? I doubt whether the Chinese are yet ready for this development; and for the rest of us, why not leave some of the opportunity for riches to our sons' sons?

Everyone asks me whether China will pull herself out of her difficulties. My greatest fear is that the Powers will not keep their hands off. She will right herself slowly. The process ought to be slow, in keeping with her history. Suppose it requires twenty-five or even fifty years to work out a government suited to the modern needs of China;

what is that as against her thousands of years? It is often said that an international commission should be constituted to govern China. I think an international commission is indeed needed: its function should be to devise ways and means to let China alone.

There are two quickening forces for China: Education. Religion. There are no others. If these forces join hands, regeneration will come irresistibly, if we are patient and if we leave the application to the Chinese.

I have seen something of the missionary work. I admire it and think its results have been remarkable, yet some of it does not strike bottom. You cannot Christianize the Chinese or any others independently of the everyday needs of the people. This the missionaries have learned: to their evangelization they have added schools, hospitals and medical services, industrial education. The strong medicine of evangelization must be accompanied by much economic, social, and civic sanitation.

It is estimated that eighty-five per cent of the population of China is agricultural. The missionary who can aid the people in their farming will have a double hold. Essentially the same need exists in every missionary country. The agricultural mission must be one of the strong movements of the coming years.

The fundamental situation in China today is not its government, its social institutions, or its commercial development, but its agriculture. Those millions of people must be clothed, fed and supported, and the scale of living must certainly rise. The spirit in which all this is accomplished will determine the spirit of the people and their civilization. China needs a vivid awakening in her agriculture. I should beware of any laid-down system of improvement. I should prefer to teach. I wish that some gifted far-seeing spirit, knowing the rural background of the race and in touch with modern science and practice, could spend some years in China, unattached to any mission, unconnected with government, perhaps supported by an organization designed for the purpose, and that he would analyze the rural problem for the people, seeing it from the outside, and present it to them in a clear picture by tract and speech, to the end that they might plan ways to meet the situation, rising to it as they see it.

The Chinese are a people of broad moralities, much given to ethical admonition. They are guided by proverbs and sayings. Their philosophy is very different from that of the Occident, apparently lacking the Scriptural postulate of the fall of man. "The nature of man is good," saith the Teacher, and this statement is repeated in the schoolbooks. The admonitions develop this natural goodness. Lacking the effort to recover the original state of sinlessness, the elements of contrition and repentance, as understood in the West, seem to be absent, with the theological conceptions of atonement and redemption. This attitude largely explains much of the history of China, taken in connection with its ancestorialism. China has been chained to its past, much dominated by its family histories.

The civic value of repentance and remission of sins lies in the fact that one regrets the past and desires a new future. It stimulates constant freedom from oneself. So the worship of a living God rather than the religious veneration of an ancestral tree looks forward and assimilates all that is new. It is the forward look, as I am impressed, that is needed in China, but I trust it may be the racial outlook of the Chinese rather than an imitation of the West.

Position of Science in the Present War[1]

American inventiveness in science, which has given birth to the telegraph, the telephone, the phonograph, the rapid-firing gun, and the flying machine, put also the submarine into the hands of the enemy in the great World War, but this same American inventiveness will soon prove the submarine a most fragile weapon

By M. I. PUPIN

Professor of Electromechanics, Columbia University

IN a world crisis like the present war each human factor plays its true part. Virtue and merit shine with everlasting glory, sham and pretense are swept away like chaff before the wind. That which is strong stands and makes things move, that which is feeble falls and is buried in the dust.

No human endeavor during this world crisis has proved its virtue more splendidly than the efforts of the men of science. When the war started, British scientists rushed to the trenches of Flanders: all honor to their patriotic zeal! But before the war had progressed very far, England discovered that the true place for her scientists was not in the trenches of Flanders but in the research laboratories where they could apply their training and their skill in developing those scientific appliances without which no victory can be expected over an enemy who has for nearly fifty years been preparing for this war in the finest scientific laboratories of the world. The misapplication of science by a ruthless enemy forced England to start in the midst of this war a wise and efficient application of science. She recalled many of her scientists from the trenches of Flanders and started them to work in the laboratories of the United Kingdom. In this manner was born the Advisory Council for Scientific and Engineering Research in the United Kingdom. General Haig in one of his reports speaks in the very highest terms of the great services which this scientific body contributed to the defense of Great Britain. England's preparation for this war consisted not only in drilling her armies and in reorganizing her industrial plants but also in organizing her scientific research facilities for the defense of everything for which England stands. The result has been magnificent.

What I have just said of England is equally true of France. The fate of France is just as much in the hands of her men of science as it is in the hands of her heroic soldiers, who kept the Teuton out of Paris and out of Verdun and are forcing him now to retreat from the sacred soil of France. Carnot, the greatest scientific genius of his time, was also a great power in the defense of his country when, a hundred years ago, France was attacked by the great League of Europe. Today Painlevé, the mathematician, is a distinguished member of the War Cabinet of France, and Painlevé is the general of the great French army of scientists who are making the attacks of the French arms so deadly to the enemy.

The scientific men of the United States are better organized today than they ever were before, because they feel that the country needs now the very best efforts of their service. About two years ago President Wilson appointed a National Advisory Committee on

[1] Presidential address before the New York Academy of Sciences.

Aëronautics, consisting of scientific men capable of advising the government on the development of the aëronautical art. The result has been most excellent, and a continuing three-year program has been evolved which will give within that interval of time to the United States as good an aërial service as there is anywhere in the world. A little more than a year ago Secretary Daniels appointed a Naval Advisory Board, consisting of splendid engineers and scientists, capable of advising our naval departments on every question that may arise in the course of our naval preparations. One of the great results of the work of this Naval Board is the splendid appropriation of several million dollars for the organization of a naval research laboratory. Every scientific problem which is before the Navy, as, for instance, the corrosion of guns, is referred to the Naval Advisory Board, and receives there the very best scientific consideration.

A year ago President Wilson, through the National Academy of Sciences, started the movement for mobilizing all the scientific research facilities of this country, and thus the National Research Council was born. In this National Research Council we have now a splendidly organized coöperative body of all men of science, embracing not only our universities and engineering schools, but also members of the various scientific bureaus in Washington, and our industrial organizations, and all the members of our national engineering and scientific societies. This coöperation is already bearing fruit. Scientific problems which are connected with the defense of the country have been solved or are in rapid process of solution, as, for example, the production of optical glass, and the production of nitric acid.

One problem of the war deserves above all a special mention here. It is the submarine problem. The Germans have announced to the world that unrestricted submarine warfare is their trump card, and that they are staking their all upon this card. The result of this move of German ruthlessness has been most serious: it forced us into the war, and we have now to combat the very weapon which the inventive genius of this country produced. The submarine itself, as well as the instrumentalities employed in its operation, is the product of American inventiveness, the same inventiveness which gave birth to the telegraph, the telephone, the phonograph, the rapid-firing gun, and the flying machine. But the Germans ought to have known that the same inventive genius which gave them the submarine weapon will also knock it out of their hands.

The scientific men of this country command an art which has been developed here during the last five years by scientific research of the very highest order. Some of the very best scientific minds of America are confident that they will soon employ this art to convince the Germans that the submarine is the most fragile weapon which they are wielding, and if this weapon is really the last trump card upon which they have staked their all, then they have lost. Victory will be ours and the people of this country will recognize that after all Scientific Research is the most valuable asset which the country possesses.

Nesting Habits of the African Hornbill[1]

By HERBERT LANG and JAMES P. CHAPIN

THE nest of a pair of African hornbills was discovered about fifteen miles southeast of Medje in the columnar trunk of a mambao (*Macrolobium Dewevrei*), one of the most stately trees of the Congo forests, by natives working for the American Museum's Congo Expedition. The tree measured 140 feet, almost the average height, and the entrance to the nest, a projecting knot-hole facing east, was seventy-one feet above the ground. Mambao trees occurred in great numbers in this locality, and as this particular tree had to be felled, we were forced to test the hardness of the reddish-brown wood, so highly valued for construction purposes because it is not easily attacked by termites. The plaster of mud that nearly filled the opening of the nest was carefully removed by the man who took out the brooding bird. Then the Medje natives, according to their custom, installed their frail fifteen-foot scaffold for the woodcutters and finally, after four hours of strenuous effort during which the native axes had to be sharpened continually, the gigantic tree crashed down. A five-foot section containing the nesting site was cut out and fortunately proved fairly hollow so that the work of splitting and sawing into porter's loads was considerably facilitated, yet fifteen men were needed for the transportation of the different portions.

A frail scaffold of slender poles is bound together with lianas. Large trees are cut from fifteen to twenty feet above the ground to avoid the broad buttresses. The huge weathered columns left standing contrast strangely and picturesquely with the tiny native huts below—especially in moonlight

After two days of hard work, made particularly disagreeable by terrific rainstorms, an incident occurred which explained one of the reasons why the natives value the hornbill and its nest. The chief of the nearest village, about ten miles distant, paid us a visit, fearing that we intended to gather a medicine of remarkable potency from the nest, but, on seeing the porters shouldering their burdens, "mere pieces of firewood," his countenance immediately brightened and with great delight he told us that such trees, not hollow, however, and of better wood, were growing right near his village. If we would give him plenty of cloth, copper, brass rings, beads, and salt, he would have as many cut as he had fingers on his hand, and his people would bring them to the post; not even the smallest branches

[1] There is now installed on the second floor of the American Museum, a group of African hornbills and their nest, the materials for the group having been collected during the Congo Expedition of 1909–1915.

COLLECTING THE HORNBILL'S NEST FOR EXHIBITION IN THE AMERICAN MUSEUM

The hornbill's nest was located within the hollow tree, back of the knot-hole, about seventy feet from the ground. With the small primitive axe, the Medje woodcutters felled the tree after four hours of strenuous effort. The section, by which they are standing, was three feet in diameter. The axes are a common product of ironworkers in the northeastern Congo and are acceptable as currency equal to from ten to twenty cents in American money. Each is carefully fitted into a hole burnt through the wider part of a handle made from a tough knot. (While the tree was being sawed and split into porters' loads, the natives inquired whether all hornbills' nests, like rubber, would in future be packed in baskets and shipped to Europe)

LARGEST OF THE AFRICAN HORNBILLS

(Photographs about one half natural size)

These photographs, male (right) and female (left), of the tree hornbill (*Ceratogymna atrata* Tem.) are from mounted specimens in the American Museum group. The dusky big bill with its formidable looking casque, although probably ornamental, is without the glaring red and yellow of the toucans (corresponding species in the South American forests). The wattles and naked parts around the orbits, however, are often bright blue and red. It has been suggested that the hollow casques are reverberating organs, but equally loud calls are possessed by the female, always with smaller casque, and also by species in which the casque is absent. As a weapon, the beak is used only for snapping, as it lacks the forceful thrust which would be given by a long neck like the heron's. The serrated edges are helpful in peeling pulp from the hard seeds of tropical fruits, the main food of hornbills, although an occasional insect or small mammal is taken would be left in the forest. The white man would never need to come into the wilderness.

On the floor of the nest were the hard, black seeds of a large tree (*Ricinodendron Heudeloti* Baillon), in such quantities that they helped to raise the level of the moist bottom. They had passed through the birds' digestive tract without any apparent change, but when opened they distinctly showed that the oil they contained had been extracted. Three of these seeds are enclosed in a capsule which, when ripe, drops off and automatically opens, scattering the seeds on the ground, where the hornbills are forced to collect them. This is a really perilous feat for the birds because they gather around the spot in such numbers and with such loud cries that the natives, informed of their whereabouts, find it a simple matter to entrap them in carefully set snares.

The male hornbill seals the knot-hole leading to the nest with a plaster of mud, except for a small opening (visible at the lower left corner). The female and young are imprisoned within, and are fed by the male through the small opening. Thus, in the free-standing columnar tree a stronghold is secured for the breeding female and defenseless young, to which nest-pilfering monkeys, birds of prey, and even snakes can hardly gain access

There are 70 species of hornbills (Bucerotidæ), 40 of them being found in tropical Asia and the East Indies, while the other 30 are found only in Africa. The birds in the group, *Ceratogymna atrata* Tem., belong to the largest species among the hornbills of the West African rain forests. One usually sees the birds in pairs, most frequently in the highest tree tops, rather avoiding the neighborhood of villages. Half a dozen or more may gather near certain fruit-bearing trees, making their presence known by the mournful, oft-repeated "whao . . . . whao . . . ." for which the Mangbetu imitatively calls them "Napwungu." Sometimes this call is uttered during the long, deep undulations of their characteristic flight and can be heard at the distance of half a mile. A sure indication of their proximity is the peculiar swishing sound made by them as they pass from tree to tree.

Young hornbills are most helpless at birth. Their eyes remain closed even after the feathers begin to appear, as shown in this two-weeks-old bird. So well does the male feed both female and young that their plump condition is proverbial among natives, who are sure to find fat morsels when looting a nest

The breeding habits of hornbills have attracted much attention and are certainly remarkable, for the male, to all appearances, seals the hen peremptorily in a hollow tree, thus forcing her into an imprisonment often lasting two months or until the young bird is full-fledged. As a matter of fact, however, the parent birds act in perfect harmony, their actions being governed, apparently, by the concerted idea of shutting out all troubling influences that might interfere with the successful raising of their offspring which is born in a particularly helpless condition, without down, and remains blind until after the feathers begin to appear. Though the knot-hole selected leads into a cavity hardly large enough to hold the mother and the young bird, they are less inconvenienced than one would suppose, for there is a peculiar, hinged joint at the root of the tail so that its long feathers can easily be folded over the back, thus enabling the bird to be comfortable in a smaller space than otherwise would be possible. The ground hornbill (*Bucorvus*), said to build an open nest, is probably the only exception among the hornbills to this general practice of nesting in hollow trees.

This young female hornbill was reared in the tree now on exhibition at the American Museum. The tail folds forward against the back and thus the feathers are never damaged by the crowded condition of the nest. The young usually sit on their heels, which have no spinelike excrescences such as those found in toucans, woodpeckers, and barbets. The bill is rather soft and delicate, and the casque does not appear until later

The entrance to the nest is usually situated from 60 to 120 feet above the ground, either in the main stem or on the lower side of a branch, away from neighboring boughs or vines. Nest-pilfering monkeys, genets, or even snakes would have difficulty in securing a hold upon the surrounding smooth bark. The male hornbill, when feeding his charges, clings to the tree much as woodpeckers do, using his tail as a support.

In the big tree-hornbills, such as *Ceratogymna*, the female, after courtship, enters the nest without collecting any nest-building material and lays one pure white egg directly upon the detritus of decayed wood. The male then undertakes the task of gathering soft earth from the edge of one of the numerous brooks, and, from a distance of several hundred yards, carries it in his bill to the nest. The beak hardly seems a suitable instrument for cementing this mixture of coarse sand and clay, yet both parents use it with admirable success until the big hole is narrowed to a mere fissure (about one inch in width) sufficiently large to allow the insertion of food for the female and young. The mixture, perhaps rendered more plastic by the addition of saliva, becomes very hard and, in spite of a thickness of several inches, no cracks are noticeable and perfect adhesion to the bark is secured. The female hornbill is evidently a willing prisoner as she increases the thickness of the plaster considerably by adding to the inside excrement containing chitinous particles of insects and seeds of forest trees. Females of smaller species (*Lophoceros* and *Ortholophus*) which lay two or possibly three eggs, do not give up their liberty until courtship is ended and both or all three eggs have been laid.

Contrary to what has been stated of hornbills in general, the female of *Ceratogymna* does not emerge from confinement with a complete new set of feathers. Only a few of the larger quills are shed inside the nest, and from our subsequent experience we found that the process of molting is not always completed during the breeding period. Gradual molting of adults and young may occur throughout the year, and the nesting season does not seem to be restricted to any particular time, for only near the southern and northern borders of the West African rain forest are seasons well defined.

The plump condition of the young, and sometimes even of the female, proves how great is the devotion of the spouse, for hornbills as a rule are lean. So zealous is this self-appointed purveyor in the task of bringing food to his charges that his continuous flights, increasing with the growth of the young, often invite destruction, for, to the watchful native, they are the welcome signal for looting the nest. It is not only the hope of the roasted bodies that furnishes the incentive, but superstition puts a high price on the possession of the bills of breeding hornbills, so that the native seldom hesitates to spend a day or two in climbing these enormous trees, and he sometimes succeeds in trapping the male birds as well as capturing the females.

When taken from their nests, hornbills bite savagely, but once tucked into a basket, they hardly defend themselves. The big bill,[1] with the formidable looking casque of the male, consisting mainly of thin-walled cellular tissue, is weak except for the sharp tip and the serrated edges. Indeed, it is chiefly ornamental for, in encounters, this weapon is good only for snapping, as it lacks the forceful thrust of a long neck as in the heron. The birds are neither bold nor aggressive in temper as their feeding habits prove, for vegetable food forms their main sustenance. We have found in their stomachs the fruits of eight different kinds of forest trees, together with the oily pulp of palm

[1] There is a curious analogy between the hornbills of the Old World and the toucans of the New: both have big bills, both nest in hollow trees, in both groups the young are born helpless and naked, and in both the tail can be folded upon the back.

nuts, which are often swallowed with their seeds. A great variety of hard-shelled insects are sometimes taken in flight, and some caterpillars which occur on the leaves in great numbers are eagerly sought. Land crabs are taken occasionally, and in rare cases, as other species proved, a lizard or a shrew completes their diet.

To the African native, birds and beasts are invested with properties widely different from those known to science, but quite as interesting. Those attributed to the hornbills are as fantastic as the appearance of the bird itself. The Medje, Mangbetu, and Azande firmly believe that a man who wears on his neck the beak of a breeding hornbill can be sure of the affection of his wife, and the younger, newly-married men especially seem to be desirous of pinning love to their hearts in this fashion. Again, the huge beaks of nearly all species of hornbills are fastened to the waists of tiny children as a cure for malnutrition, for the mothers of these youngsters know that young hornbills are well fed, and so they hope to secure a charm which will fatten their own emaciated little ones. Often, however, a less kindly quality enters into the superstition, and the bird is even supposed to aid in gaining revenge of a certain kind. A disillusioned Azande husband may roam the forest in search of a hornbill's nest merely to collect some of the pellets of excrement, for if he throws the dirt actually taken from the hornbill's secure home, at his unruly wife, she will wander forever without finding another husband, a great disgrace in a land where the unmarried woman is considered an outcast.

Hornbills have even been made the totem of the Wabali tribe living along the Ituri and Aruwimi rivers. They hold the large black-and-white species, *Bycanistes albotibialis*, in greater reverence than their own people, for as cannibals they might not spare relatives, but no one would dare eat this or any other hornbill.

Wabali men are proud of their tribal marks, a series of crescent-shaped scars on breast and abdomen, readily distinguishing them from their neighbors, a vital factor in the thick of battle or other encounter when they fight for each other or die. No coward can be so marked, for as mere boys they must prove in public that they can suffer great pain with a smile.

The famous ceremony of initiation includes a terrible thrashing from the elders, who flog them with long switches until tired. Woe to him who murmurs or cries out,—he can never be bitten by the incensed mother hornbill kept ready to acknowledge his unwavering courage. As a matter of fact the hen hornbill is only an accessory satisfying their superstition, for the wounds are cut by medicine men when the boys are blindfolded. Those who withstand the ordeal wear curious collars of a fibrous, brown material, later thrown into the big, unchanging river, but in the meantime supposedly protecting them from sickness until the sores have healed; and these scars make them men in the eyes of all. Forever thereafter a Wabali is considered brave, striving to raise and protect his offspring as successfully as the hornbill.

PRAIRIE CHICKENS ON THE GRASSY PLAINS OF NEBRASKA

During the mating season prairie chickens gather in the early mornings on certain open fields which have served them as dance areas for many generations. The resemblance of this prairie chicken to the heath hen in appearance and in the habits of the mating season is at once apparent. In fact, not until 1885 was it discovered that the birds of Martha's Vineyard were distinct from the prairie chicken. The species had then been killed out on the mainland and it was too late to determine how far west it had ranged, but it is known to have been abundant in the country east of the Appalachians and south to Pennsylvania. The photograph above is made from the habitat group in the American Museum, constructed in 1906 under the direction of Dr. Frank M. Chapman

Martha's Vineyard, the last refuge of the heath hen.—The immediate scene is the nesting site studied for reproduction, with nest and birds, in the American Museum. (See detail on page 280)

The Heath Hen of Martha's Vineyard[1]

By EDWARD HOWE FORBUSH

State Ornithologist of Massachusetts

A WIDE plain covered with diminutive leafless shrubby oaks and low bushes, with stunted pines showing here and there; to the west low rolling hills; to the south on the far horizon the wide Atlantic; such is the prospect on an April morning from the fire tower on the plains of Martha's Vineyard where the few remaining heath hens now make their last stand. Here in the gray dawn a strange, weird sound fills the air. It swells and dies upon the ear, but never rises or falls, and becomes intermittent or ceases only when the sun rides up the sky. Apparently it is not a vocal effort. It is neither whistle nor call; there is no other sound quite like it in nature. One might imagine it the wail of the wind spirit, but no man understands just what it is or how it is made. We know only that it emanates from strutting, dancing heath cocks, and is one of their customary mating sounds. Heard from a distance, borne on the sea wind, it swells to the fullness of a grand undertone, mingling with the ordinary nearer sounds of the rolling plain. Like the trilling of the toads in a million pools, like the morning chorus of bird song on a thousand hills, it is a vital, virile expression of the fecundity of old Mother Earth. It is a rune of reproduction, foretelling the renewal and multiplication of the species in the coming spring awakening. It is a pæan of hope and joy, a forerunner of the pulsating, vigorous life of summer.

No satisfactory explanation has been advanced regarding the means by which this sound is produced. As we listen to its volume the wonder grows; fifty birds seem to make noise enough for a thousand, and this they do apparently without opening their mouths or using their vocal organs. The sound may be heard under favorable conditions for about two miles. Some future investigator may solve the riddle of its production.

The heath hen is the eastern form of the prairie chicken. It is smaller and ruddier or rustier above than its western congener and much less white below; its tarsi are both relatively and actually shorter; the rigid feathers of the neck tufts are more acutely pointed and fewer in number. Formerly the heath hen was abundant in suitable localities in New England and the Middle States east of the Appalachian Mountains and south to Pennsylvania. It may have extended farther west.

[1] With illustrations from photographs from life by Dr. George W. Field.

even to Kentucky, but as it was not distinguished from the prairie chicken

The nest of the heath hen, merely a slight hollow scratched in the ground, is likely to be under low shrubby oaks or pines. When the young are hatched they are ready to follow the mother within a few hours. (Photographed from group in the American Museum)

until 1885,[1] when it had been extirpated from the mainland and was confined to the island of Martha's Vineyard, Massachusetts, no one knows where its range ended and that of the prairie chicken began.

Its extirpation on the mainland was due mainly to lack of statutory protection and law enforcement. Its preservation on Martha's Vineyard may be attributed partly to local pride in the species as a distinctive bird of the island, and in part to the efforts of the Massachusetts Commission on Fisheries and Game, under whose authority a reservation for the protection of the species has been maintained since 1907, where shooting is prohibited at all times. Since the establishment of the reservation the birds have increased greatly from time to time, but they have been decimated by forest fires. On May 2, 1907, following a severe fire in 1906, the Commissioners could find only twenty-one birds. On January 11, 1908, the number in existence was believed to be between forty-five and sixty. In a careful inspection of the region in 1916, I accounted for fully eight hundred birds, and the superintendent then in charge believed that there were about two thousand. Shortly afterward a raging fire swept the reservation. This was followed during the ensuing winter by a flight of goshawks which are very destructive to grouse, and in April, 1917, I could not account for more than one hundred and twenty-six, a large proportion of which were males. It is probable that fewer than fifty females survived the winter. A few birds meantime had been sent to Long Island, New York, and to Essex County, Massachusetts, in the hope of establishing new colonies, but those on Long Island did not survive. Such in brief is the history of the heath hen.

The most remarkable and interesting

[1] Brewster, William, *Auk*, Vol. II, Jan., 1885, p. 80.

Courtesy Massachusetts Commissioners on Fisheries and Game

The heath hen (*Tympanuchus cupido*) is very similar to the prairie chicken (*Tympanuchus americanus*) but smaller and darker in color. The neck tufts are composed of acutely lance-pointed feathers

habits of this bird are those of the mating season. These are not unique, as other American grouse give more or less similar manifestations of the mating instinct, but they are worth going far to see. My opportunities for watching their mating antics have been all that could be desired. Some of my observations have been made from a blind raised about two feet above the surface of the ground so that the birds could pass not only all about but underneath, and they not infrequently alighted on top of the blind, thus affording chances to view them from all directions.

The male birds begin to "toot" and strut about four o'clock, or even earlier on bright mornings. Many gather on certain open fields or cleared spots that have served as their assembling places for many years, and there the dance goes on apace until about seven o'clock, when it begins to subside and the birds scatter. The "tooting" however may be heard at intervals during the day. Again toward sundown there is another gathering that lasts until the dusk of evening. My observations, therefore, have been made early in the morning, or toward sunset, and were possible only through the courtesy of the Massachusetts Commissioners on Fisheries and Game and their superintendent on the reservation, Mr. William Day.

In April, 1917, I went to the reserve in company with Mr. A. C. Bent. On April 25, at three in the afternoon, I entered a "blind" in a cornfield where the birds were accustomed to dance and where corn had been thrown out to attract them. The standing corn had been cut and removed, providing an

While the male is dancing the plumage is fluffed, the tail erect, and the drooping wings almost touch the ground

Courtesy Massachusetts Commissioners on Fisheries and Game

The Dance.—His beauties displayed, the heath cock is a handsome fellow—if somewhat bizarre and unbirdlike. The neck tufts may be erected and thrown forward over the head with the points together like an inverted V

unobstructed view. At first no heath hens appeared. Red-winged blackbirds came and alighted on the blind, then descended and fed on the corn. A robin came, and it was interesting to listen to the timbre of its well-known notes at a distance of less than three feet. At 4:40 the first heath hen appeared, and soon the show began, but no bird came very near the blind until about five o'clock. Then for an hour the dance went on all about me until the superintendent appeared. This was the signal for the end of the performance. The day was clear, the light excellent, and all conditions for observation were of the best. Only four females came within my range of vision, but from twenty to twenty-five males were in sight constantly. Occasionally a female picked up a little corn, but the males did not feed. They seemed to be obsessed with their own antics and devoted themselves with great enthusiasm to the dance. This exercise consists of running, strutting, bowing, posturing, cackling, calling, flapping up and turning about in the air, and even fighting a little from time to time. All in all it is a great and exciting expression of the abounding energy of the species. While the male is dancing the body is inclined forward, the neck stretched out horizontally with the bill pointed downward, the plumage is fluffed, the tail erected and spread more or less, the wings drooping or partly spread downward but the lowest of the separated primary quills rarely reaches the ground. The pinnates, or "neck tufts," are erected like rabbit's ears, or thrown away forward, over and in front of the lowered head, with the points together like an inverted V. In this position the bird inflates the orange air sacs on the sides of the neck, which sometimes show pinkish or flesh color around the edges, or even purplish at the upper edge, but look much like small oranges and are about the size of a tennis ball. In some cases they appear more triangular than round, but usually they seem globular when seen in profile, and project considerably on either side of the neck. The yellow combs over the eyes are enlarged also at the same time and become turgid, while the bird seems to increase in size. The white tips of the tail coverts show like the

Courtesy of A. C. Bent

On the Run.—In the dance he runs and postures, rises and turns about in the air, and even fights a little from time to time. The neck tufts are thrust forward like a rabbit's ears, and the air sacs are inflated until they resemble small oranges

"white flag" of a deer. With all his beauties thus displayed the heath cock is a handsome fellow, but seems bizarre and unbirdlike to human eyes.

The booming or "tooting" sound is produced, not when the air is expelled from the sacs, but while they are swelling, and stops then until they have been more or less deflated. It is not so deep and resonant as is that produced by the prairie chicken, and never resembles "the distant croaking of bullfrogs or the grunting of buffaloes," resemblances which Nuttall ascribes to the booming of the prairie chicken. It may be likened to the soughing of the wind, or the noise produced by blowing gently into a small bottle or phial, but is more musical. It is commonly a double *woo'-doo*, or at times a triple *oo-oo'-woo*, with the accent on the second syllable and all on the same pitch. There is no perceptible final falling inflection, but it ends in the air like a Scotch ballad. Rarely the last note comes on a lower pitch than the others, and a few birds sound a deeper tone all through it, but most of them maintain the same pitch, and when forty or fifty are engaged in the dance a great volume of sound is produced lasting almost continuously for two hours or more. It has something of the quality of the subdued and distant echo of many medium pitched steam whistles. Above this can be heard a medley of vocal notes, some like the squeal of a frightened rabbit, some regular war whoops, such as *wooow* or *waugh*, others flatter, snarling calls given when two males are facing each other. There are many cackling and laughing sounds, some resembling those emitted by gulls, others those given by barnyard fowls. There are queer clucking and chuckling noises. The conversational character of some of these sounds recalls similar notes heard in more subdued tones from a flock of bobwhites. There are others resembling the whine of a puppy and one of the calls of a jay. Cooing also is heard, but no billing is seen. When close at hand the cries are more striking than the continued chorus of the "tooting," but at a distance of a mile or more, where the booming was plainly audible, only one of the louder vocal calls could be heard.

The males danced much of the time while producing these sounds. The dance reminds one of similar performances by Indians. The bird bows or leans forward with muscles tense and rigid, lifting the feet stiffly but quickly and striking them down hard and very fast upon the ground, so that the sound may be heard for rods. Sometimes he stands in his place while dancing or merely wheels a little to right or left. Again he runs forward five or ten feet, or makes short rushes around the female in segments equaling about one third of a circle, sometimes circling her in three or four runs, but never seeming to approach very near her. I have never seen one caress or molest a female during these mating antics. How the happy pair perform when finally mated no one seems to know. The dancing is accelerated at the end until it somewhat resembles the quick tapping of a muffled drum, ending in a roll. This rapid stamping causes the whole body and especially the wings to quiver in unison with the drumming feet. The roll of the drumming can be heard continuously as it mingles with other sounds of the dance, but two hundred yards away it is inaudible. While dancing the male keeps the sacs and the combs over his eyes more or less distended, but in the "tooting" which usually precedes or follows the dance the sacs are fully inflated. They swell with each toot or syllable and contract more or less between each. I watched four birds perform thus at distances varying from five to eight feet. Audubon, experimenting with the prairie chicken, found that the bird could not produce the sound if the sacs were punctured. Evidently it is emitted in some way during the intake of the air.

Sometimes a male seems to challenge all creation by flying up a few feet, cackling meanwhile, and turning to different points of the compass so that upon alighting he faces in another direction from that in which he started. Two males sometimes, after posturing, dancing, and blowing on the way, charge toward each other for many rods as if urged by the frenzy of battle, and then squat on the ground facing each other, open their beaks, and utter a variety of cries, as if trying to intimidate each other or to muster up sufficient courage to fight. Sometimes one turns and runs away, or backs off, or they may fly at each other like domestic cocks, or one may leap over his opponent, or they may even flutter up a few feet in actual combat, but I never saw blood spilled in any of these contests. Often they strut, dance, and toot without even offering to fight. Withal there is great excitement, constant sound and motion, each bird acting "as the spirit moves," and performing his part with ludicrous seriousness and self-importance. In the midst of all this commotion the females move about, calm and cool, apparently interested only in looking for something good to eat. Indeed they seem so unconcerned and indolent as to squat or lie down to eat corn rather than take the trouble to reach down and pick it up.

As night comes on the birds become more quiet and gradually steal away into the shades. It is remarkable how quickly and silently they can disappear in case of an alarm. They can hide in stubble where it would seem difficult to conceal a mouse, but if flushed they fly swiftly, fluttering and sailing much after the manner of a meadow lark. In this way they can quickly cover a mile. A flock of fifty birds thus speeding across country is an inspiring sight.

The nest of the heath hen is made on the ground, sometimes at the base of a stump, often among sprouts or bushes. From six to twelve or thirteen eggs are laid, buff in color and unmarked. When the downy young are hatched they are ready to follow the mother within a few hours, and she broods them under her wings wherever night overtakes her. They frequent dry and sandy plains and never have been seen to go to the water to drink or bathe. Probably they get what moisture they need from their food or from the dew or rain, but captive birds have been known to take water supplied to them. During the hotter part of the day they seek dusting places in the dry sand along the roads, where they wallow and work the dust into their plumage. They feed upon green vegetation, such as grass, buds, clover and alfalfa, also on berries, acorns, grain, weed seeds and insects. They seem to roost on the ground or in low shrubbery, but sometimes alight on trees, fences, and buildings.

There are several historical legends regarding the heath hen that have been passed along down the years and may have some foundation in fact. Apparently it was a common bird in early colonial times on the sites of some of the largest cities of the Atlantic seaboard. DeVries and Megapolensis speak of it as common where New York City and Albany now stand. Nuttall,[1] writing of the bird in 1832, asserts that according to Governor Winthrop the species was once so common on the "ancient bushy site of Boston, that laboring people or servants stipulated with their employers not to have the *heath hen* brought to table oftener than a few times in the week!"

In 1834, when the legislature of Massachusetts enacted a law for the protection of this fowl, it is said that the printer made a slight typographical error and that the document as printed appeared on the desks of the astonished members with the following title: "A Bill for the Protection of the Heathen of Martha's Vineyard."

In its final refuge the heath hen has the advantage of thick shrubby cover and few enemies. The chief of these, the domestic cat and certain hawks, are kept down to some extent by the guardians of the reservation. There are now few if any foxes, skunks, or raccoons on the Vineyard, and minks are rare. Therefore the species has a better chance to increase on the island than on any area of similar size on the mainland. If it becomes numerous there again in the near future, there is a region on Cape Cod similar in soil and vegetation to the plains of Martha's Vineyard, where surplus birds may be introduced and protected until the species again becomes established in its original habitat.

The future of the heath hen depends upon the treatment accorded it by the people of Massachusetts. If the game officials of the commonwealth are worthy of the trust reposed in them, if the people can be taught to refrain from slaughtering these birds, this remarkable species may be reintroduced into many of its old haunts in the New England and the Middle States. Otherwise, it will not be long ere the last individual of a vanishing race will see its last day fade and die over the hills of its island home, and another species will have joined the long list of those that are no more.

[1] Nuttall, Thomas, *Manual of the Ornithology of the United States and of Canada.* The Land Birds, 1832, p. 662.

Museum Documents and Modern Costume[1]

By M. D. C. CRAWFORD

WITH AN INTRODUCTION BY CLARK WISSLER

Art museums are places where the various art products of the historic nations are preserved for the inspiration and instruction of our artists. But the nonhistoric peoples of the world also produced art objects which are exhibited in the anthropological collections of museums dealing with the natural history of man. The primary object in preserving these examples of primitive art is to instruct us as to the older forms of man's culture traits. We know that the facts of primitive culture are worth while because they inspire and broaden our outlook upon life. But primitive art is nevertheless art and often extremely good art. The readers of this JOURNAL are aware that textile artists have but recently discovered these primitive art collections and drawn from them the greatest inspiration. What they found was a great wealth of originality. Yet textile art is seldom a thing of itself, usually being a mere phase of personal adornment, as costuming. We often think of primitive folk as the unclothed, but that is a matter of definition. The facts are that they give a great deal of attention to costume and body ornamentation, and wherever textile arts flourish these are employed for the embellishment of costume. The American Museum collections contain many examples of primitive costume designing that have artistic merit. Their strong point is their originality. Hence, it is not strange that the costume designers of our day find these collections an unfailing source of inspiration. All this suggests the great potential value of a systematic museum collection of primitive arts and the justification of the space and energy that have been given to such exhibitions. But, in particular, this article upon costume designing in the Museum indicates how the movement for a new American textile and costume art has progressed, a movement which originated in New York City and which centers around the American Museum.—CLARK WISSLER.

IN ONE sense, this is frankly a fashion article. It deals with practical, modern costumes that have been passed upon, executed, and placed on the market by experts. It shows not only some work of young artists, but expresses as well the ripened judgment of professional designers and buyers. For the sake of comparison, the illustrations include a wide range of costume types, and the specialists who have contributed are among the leaders in their profession. In examining the illustrations, it must be remembered that this article deals neither with a theory nor with a promise of the future, but with an accomplished commercial fact. It is intended as a practical demonstration of a very important development in the costume industry in America.

Above and beyond the artistic merit of these costumes, however, they illustrate in a definite manner a very important feature of the educational possibilities and public usefulness of the American Museum. Every single garment in the collection was founded on a specimen in the collections of this Museum. In certain instances, the inspiration is perhaps difficult to trace, but in others it is quite obvious. These garments represent the first fruits of what I may term "creative research" by the American costume industry. The documents in the Museum were studied

[1] The sketches which accompany this article were made by Harriet Meserole, Ruth Reeves Olds, and Sylverna Prior and are among the results of a campaign for the improvement of commercial design both in fabrics and costumes in America conducted by *Women's Wear* during the last three years. In my position as design editor of this publication, I have found of inestimable value the documents in the collections of the American Museum and in its library. The actual work in the Museum with individuals and in talks to groups of artists has been supplemented by the publication of designs and articles in *Women's Wear,* and I take this occasion to say that the debt the American costume and fabric industries owe to the American Museum of Natural History is immense.—THE AUTHOR.

EXAMPLE OF MODERN DESIGN FROM MUSEUM DOCUMENT

A house coat of silk duvetyn, decorated with hand embroidery and trimmed with fur. This costume was designed by Miss Jesse Franklin Turner, of Bonwit Teller & Co., from a Koryak fur coat in the collection of the American Museum of Natural History.

The color plate was donated by Bonwit Teller & Co.

DESIGNS SUGGESTED BY INDIAN DOCUMENTS

At the left, a dinner gown, or negligee, embroidered in wool. The method of connecting the ends of the belt was suggested by girdles from the Goajiro Indians, in the Museum's collections from northern Colombia, and the decoration was inspired by a study of North American Indian collections. *Courtesy of Bonwit Teller & Co.*

At the right, a black satin evening gown with silken and bead tassels. The idea of the tassels owes its origin to the buckskin thongs that hang from a Dakota Indian costume. *Courtesy of Edward L. Mayer.*

In a gown of her own designing.—A class of advanced students in Teachers College, Columbia University, under Miss Ruth Wilmot, instructor of costume design, has created many modern garments along lines of form and decoration suggested by a study of specimens in the American Museum. The success of Miss Wilmot's work is attested by the fact that most of these garments have found ready sale among professional designers

with the view of applying ideas, either in decoration or in line, to modern costumes. Instead of the usual method of importing modern foreign costumes (themselves based, generally, on foreign museum collections), our designers, familiar with the practical needs of today, have gone direct to original documents for their inspiration. The work, therefore, marks one of the most important movements in the development of a truly American type of industrial art.

Last year I described in the JOURNAL a similar development among the fabric designers in this city. It may not be out of place to note that this work has continued steadily, that the results have been not only artistically but also commercially successful. Many of the most interesting designs in printed silks and cottons now on the market owe their origin to some specimen in the American Museum. Not a day passes but I see some textile design either worn in a garment or on display in a shop window that owes its origin to museum inspiration. Thus the Museum has been responsible not only for commercial prosperity but also, by the character of the designs, for an improvement in national taste.

In spite of the importance justly attached to fabric decoration, costume designing is of more vital moment. The problems of the costume artist comprehend not only surface decoration, but color combinations, use of ornament, the general outline or silhouette, and a knowledge of the mass psychology of woman. The perfect artist in dress must have not only some of the feeling of the painter, but also of the sculptor, and added to this rare combination, a vision sufficient to judge the general feeling of women at least six months in advance.

One lesson we have learned from the war is the necessity for coöperation. The development of our natural resources, the proper expression of our national life, rest upon the perfect coöperation and coördination of our physical and intellectual powers. The basis of modern life is a perfectly regulated industrial system. If we are to endure as a great power, if we are to hold and advance our place among the great democracies, we must employ not only the skill and vision of the scientist, but the knowledge of the scholar also and the feeling of the artist as well. But it is not efficiency alone that we need: we must bring back to modern industry as far as possible the personal interest that was in the ancient hand crafts. We must incorporate in our industrial art the charm and enthusiasm of other days.

It is not difficult to understand how important a part our great museums and libraries must play in the proper industrial expression of art. They are for the artist inexhaustible mines of suggestion. The art of each people and age is an evolution from some former type. The artist, especially the decorative artist, is concerned not alone with purely original creation, but with the inspired selection of certain ideas and motives of ancient origin that may have a fresh significance for his own time and people. The scientist and the scholar study the past, reject what is of no avail or is false, and build upon the refined residue our modern science and literature. Elimination and acceptance are of equal importance. So must the artist sift the artistic heritage of the past and salvage what is beautiful and appropriate for his own time.

The spirit that has guided America in this titanic struggle for democracy has enriched beyond estimate or appraisal our spiritual lives. The burdens and sacrifices that we have borne with pride and willingness, the splendid ideals for which we strive, have added a dignity and a feeling to our national life that must find expression in every phase of our physical and intellectual existence. We may confidently expect that the great industrial changes going on about us will be accompanied by a revival in art and literature.

Women's costumes are the first objects to feel the effect of this new spirit. They reflect in simplicity and subdued ornament the reaction of our womanhood to the grave responsibilities and problems of the hour. The superficial and the ostentatious have been almost eliminated, and yet all the appeal and charm of brighter days retained and enhanced. The common sense and finer feelings of American women have resisted every effort to put them into drab uniforms. Had it been otherwise, we should have lost a wonderful charm from our lives. Whatever our subsequent experience, almost our first impression of color comes to us through costumes. And there are great numbers of people whose only art education is derived from fabrics and dress. If we exhibit in our museums the textiles and the garments of former ages, if we properly regard them as objects of art worthy of comparison with the canvases and marbles of the masters, we must admit that modern fabrics and costumes (if they are up to the proper standard) are worthy of consideration with contemporaneous art productions. In every age that expressed an art

The yoke and the knotted ribbons on the right side of this white silk tailor-made blouse were taken from a Korean blouse in the Museum's collections. *Courtesy of Edward L. Mayer* worthy of the name, its influence was felt in even the most commonplace object. The real masters of form and color drew no snobbish divisional line between the so-called "fine" and "applied" arts. The definition of the word "artist" should be: "an individual by whose mind and hands beauty is imparted to any object." The method of execution, the mediums of expression, are of minor importance. If we consider a Peruvian poncho, a Sioux war shirt, or a Soudanese burnous as works of art, it is but fair to give to the product of our costume artists of today (when it merits the distinction) the same consideration. Antiquity, no doubt, has a charm and an interest apart from any other attribute, but it should not be the sole factor that determines the merit of artistic expression.

The costumes shown in this article are the work of five individuals,—Miss Ruth Wilmot, instructor of costume design in Teachers College, Columbia University; Miss Mary Walls, of John Wanamaker's; Miss Jesse Franklin Turner, of Bonwit Teller & Co.; Mr. Max Meyer, of A. Beller & Co.; and Mr. Edward L. Mayer.

Last fall Miss Wilmot brought a small group of advanced pupils to the American Museum to study certain primitive costumes. As a part of their regular class work they created from these suggestions modern garments. When the garments were ready, Miss Wilmot asked me to show them for criticism to a professional jury. Miss Turner, Miss Walls, and Mr. Edward L. Mayer were good enough to come to the Museum one evening and offer suggestions on the work submitted. It is surely a splendid endorsement of Miss Wilmot's effort that Miss Walls and Miss Turner bought from her class virtually all the garments shown. It also proves to students of costume design the practical value of museum research.

Miss Mary Walls, of John Wanamaker's, has long been interested in the development of native talent in costuming. About six months ago she invited a number of young artists to meet her at luncheon to plan for a practical exhibition of their work in her department. Most of these young people have been constant students of the costumes in the American Museum and have attended a number of informal talks there on the subject of the application of primitive designs to modern costumes and fabrics. Some of the costumes that resulted from this interesting coöperation are illustrated in this article.

Miss Jesse Turner, of Bonwit Teller & Co., is a most conscientious and appreciative student of the costume collections in the Museum. With the assistance of independent artists and her own capable staff, she has created many beautiful modern garments from ideas developed through this study. The type of garment she creates makes it possible for her to follow the documents as closely as her taste and experience suggest. For a number of years Miss Turner has traveled in the Orient, studying primitive costumes in their native environment. Her wide experience in creative research qualifies her to appreciate the artistic and professional value of the Museum collections.

Mr. Edward L. Mayer and Mr. Max Meyer are wholesale manufacturers of exclusive costumes. Their creations no doubt are worn by many readers of this JOURNAL, but have passed unidentified through the hands of some retailer, specialty shop, or dressmaker. Men of their standing in Paris would have received public recognition long ago, but unfortunately in America there has survived a faint prejudice in favor of imported goods. Where this prejudice is expressive of superior merit, it is of course quite proper, but the very words "imported" and "domestic" have been distorted from their true meanings and have come to infer excellence and lack

DECORATION OF AFRICAN ORIGIN

A negligee executed in wistaria velvet, the design being produced with wool embroidery in multiple harmonious colors. It was developed from a garment in the African collection of the American Museum, the decoration being virtually the same but the silhouette somewhat modified. *Courtesy of Bonwit Teller & Co.*

Left Figure — The design for the silk used in this dress won first prize in the First Annual Albert Blum Contest for Hand Decorated Fabrics. The artist, Hazel Burnham Slaughter, got the motive from the South Sea Island collection in the American Museum. The design was purchased and executed by H. R. Mallinson & Co. *Courtesy of Edward L. Mayer*

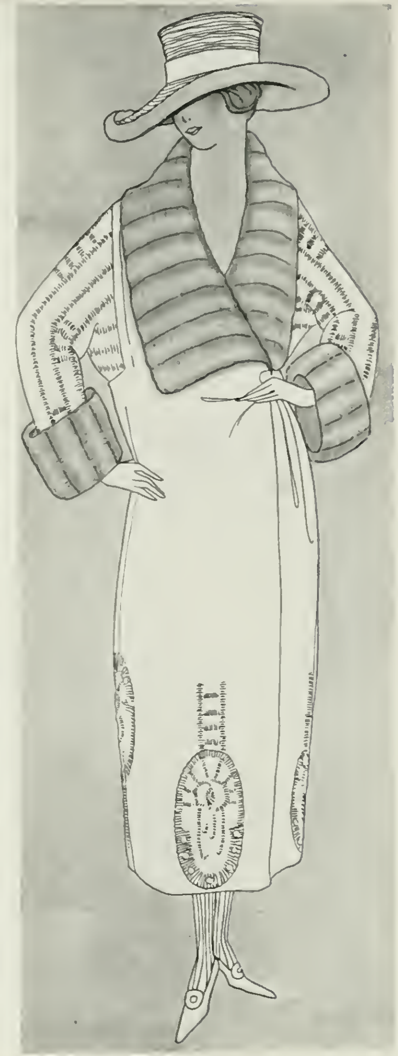
Middle Figure — Linen sport dress with crocheted decoration. The idea of the blouse was taken from the Philippine collections. *Courtesy of John Wanamaker*

Right Figure — A linen sport dress, on which the decorations are reproductions of Russian peasant embroidery. The type of the blouse was suggested by the Philippine Island collections. *Courtesy of John Wanamaker*

LEFT FIGURE — The decorations on the yoke, girdle, cuff, and pocket of this sport dress were designed from the Ainu coats in the Chinese hall of the American Museum. They are a combination of appliqué and embroidery, as in the originals. *Courtesy of John Wanamaker*

MIDDLE FIGURE — A sport dress created from the blouses of the Bagobo tribe, Philippine Islands. *Courtesy of John Wanamaker*

RIGHT FIGURE — A coat of white wool jersey, embroidered in white wool and trimmed with squirrel fur. The decorations on the lower edge of the coat and the form of the sleeve were suggested by the Koryak fur coats in the Russian hall. *Courtesy of A. Beller & Co.*



Left Figure — Automobile wrap in pongee silk, practically an exact copy of a Korean grass linen garment in the collections of the American Museum. *Courtesy of John Wanamaker*

Middle Figure — A dinner gown in chiffon and wool embroidery developed from a Bagobo blouse in the Philippine Island collections. *Courtesy of Bonwit Teller & Co.*

Right Figure — Afternoon dress of white crêpe de chine, with wool embroidery. The form of the blouse is practically copied from a Bagobo costume in the Philippine hall. *Courtesy of John Wanamaker*

Left Figure — A tailor-made suit in blue serge with embroidery on a dull white surface. The spirit of the decoration and its position on the shoulders and around the cuffs were suggested by an embroidered blouse of the Philippines. *Courtesy of Edward L. Mayer*

Middle Figure—The sleeve of this garment was suggested by a Philippine blouse and the design of the embroidery was derived from the Amur River collections. *Courtesy of A. Beller & Co.*

Right Figure — The back panel of this coat was suggested by a document in the Chinese collections of the American Museum. The lining is an imitation in silk of South Sea Island tapa cloth. *Courtesy of A. Beller & Co.*

LEFT FIGURE — The design of this material, a silk voile, was suggested by that on a piece of pottery in the Museum's collections from the American Southwest. *Courtesy of Edward L. Mayer*

MIDDLE FIGURE — A sport coat, the lining of which was suggested by the South Sea Island collection. This design won third prize in the First Annual Albert Blum Contest for Hand Decorated Fabrics. The artist was Martha Ryther and the design was purchased and executed by H. R. Mallinson & Co. *Courtesy of Edward L. Mayer*

RIGHT FIGURE — A sport coat, with embroidery decoration based on primitive basketry. *Courtesy of A. Beller & Co.*

of excellence. All fair-minded people will agree with me that the intrinsic merit of the productions themselves should be considered, rather than the geographical location of manufacture. If the professional reputation that these two gentlemen enjoy was passed on to the public, it would be not only a fitting reward for their years of patient effort, but also an encouragement to other artists in the same field.

In all forms of decorative art today, there is evidence of higher standards. The public taste has advanced during the past decade in an unmistakable manner. No doubt the great prosperity in America, the more settled economic conditions, the diffusion of art education among the people, have all contributed to this condition. The influence of art schools all over the country is making itself felt in the public's heightened appreciation of what is really fine in decoration. That there is still a great work ahead of us—that many of the methods of teaching need modification and amplification—does not alter the fact that propaganda of a highly important character has been spread abroad. We should lay more stress on practical craft work; we must accord to our native talent the recognition we so freely yield to foreign artists; and, lastly, we must make ample provision for training artists to our industrial problems and ensure to them legal protection for their ideas.

The Museum's share in this broad problem is a very important one. Its public halls are a constant influence toward good taste; and the facilities it offers to specialists for research, enrich beyond estimate our industrial arts. Space does not permit a detailed discussion of this latter phase, but perhaps a condensed statement of some remarks that are constantly coming to my ears may not be out of place. Fabric designers and costumers of prominence are simply astounded at the wealth of suggestion that the collections offer to them. I quote from a letter recently received from Mr. Edward L. Mayer: "We have found its collections full of inspiration, and it a storehouse of decorative detail. A sympathetic appreciation backed by an adequate technique should make it an active influence in ours as in all the arts and crafts." This is but one example of many I might quote. Second only to the artistic value of the documents themselves is their accessibility. The freedom from red tape, the constant interest and assistance of the scientific staff of the institution, are matters of the highest praise.

The problems of the fabric and costume designer are many-sided. Success in either of these professions requires special training and a special viewpoint. But however intricate the question becomes, each fresh creation must be based on some suggestion or idea, and the Museum collections (open as they are and free from all unnecessary restrictions) offer a wonderful field for research of this character. The work has grown so rapidly and has entered into so many different phases that it is impossible to keep trace of the results any longer. But it is not too much to say that the American Museum is a full generation ahead of the other forces that are working for good decoration in this country.

LOUIS POPE GRATACAP, 1851-1917

LATE CURATOR OF MINERALOGY AT THE AMERICAN MUSEUM OF NATURAL HISTORY

"Competition of the Centuries"

By L. P. GRATACAP

A nature wise . . . .
With watching from the dim verge of the time
What things to be are visible in the gleams
Thrown forward on them from the luminous past.—LOWELL.

The JOURNAL publishes on succeeding pages many words of appreciation and praise of the late L. P. Gratacap, but it could publish nothing about him which would stand as so powerful a revelation of character and so forceful a memorial as his own words quoted below. They are taken from a speech delivered at the Annual Dinner of the Associate Alumni of the College of the City of New York, in 1901, almost two decades ago, yet, in many ways, might well have been said today. It is a privilege to present them here.—THE EDITOR.

. . . . . .

A moment ago I uttered the word *years*, and as the vibrations of the sound passed from my lips through this intervening space of air, touched the delicate tympana of your organs of hearing, and awoke motions that were communicated to the reportorial activity of that group of bones which Professor Draper insisted should appear on our examination papers in physiology, and passing by filamentous nerves reached the receiving brain, and there stirred the conscious mind, what fancies, what regrets, and among the younger members of us, what tumultuous anticipations, did it not arouse!

I know the subject of years is a delicate one. We have grown accustomed to believe that the fear of age, and especially of its confession, is a feminine foible, but I have noticed in a lifetime, not altogether unobservant, that it is also a masculine weakness, usually met with masculine intrepidity in the form of an unmitigated lie. For my own part, and speaking in the confidence of post-prandial satiety, I think I can say in all frankness that I no longer feel any timidity about the confession of my years. I have passed that transition period when I viewed with apprehension my increasing grayness and the widening of my tonsure, and when I indulged in an imaginative struggle still to retain a despairing clutch upon that part of my life I had called my youth. Now resignation, filtering down through all the porous and susceptible surfaces of prevarication, has so hardened me that I can meet with equal coolness and equanimity the inquisitorial needs of the polling clerk and the gentle importunity of the census man.

But years are not simply matters of personal reflection. Years are those chronological atoms which build up the centuries, those temporal molecules whose incessant repetition fills out the everlasting voids of time. Behind us is that vast accumulation of mounds we call the nineteenth century; and even while I am speaking, the ticking of the clock and the infallible motions of the stars are forming the outlines of a new era.

We are to be the witnesses of the "Competition of the Centuries," and some here may survive long enough to be the arbiters of the supremacy of one or the other. It seems to me that men of my years who are not so young as to seek self-immolation in the membership of a football team, nor so old as to consign their physical activities to the discretion and dispensations of a doctor, may hope, as they have seen the achievements of the nineteenth century, . . . to be able to determine the motions and meaning of the twentieth. Certainly we all, at present, on the 26th of January, 1901, belong to the nineteenth century, and as we look back upon it, how great it appears! From those first years when Napoleon, with avenging violence, stepped out upon the plains of Europe and smote its traditionary monarchies to dust and shame; from those early days when Dalton, with painstaking and scrutinizing care, devised the theory of atoms, which today solves the mystery of chemical mechanics; from that young decade when Channing brought to the pages of the Old Testament the spirit of reconciling grace, how there has swept through it from end to end the antiseptic winds of thought, cleansing from out the crannies of its civilization the miasmas of superstition and the hideous contagions of fear.

If with one word we should attempt to characterize the spirit and the results of this age, that word would be *Knowledge*.

In chemistry, from the first crude beginnings of analysis through the successive discoveries of more perfect methods, the splendid speculations upon the differentiated cycles of the elements, to these days of rapid industrial improvement, when in every avenue of manufacture the beaker glass and the balance of the chemist determine the force and feasibility of each new investment of capital, how astounding has been the progress of knowledge!

The new elements, the new views on the composition of compounds, the new compounds themselves, the subtlety of those processes of inspection by which the air we breathe is split up into new and precarious parts, are all contributions to the vast and overwhelming depositories of knowledge.

In geography, we have pierced the secret places of the world, are engaged in ransacking to their furthest limits their territorial secrets, have even consolidated the Powers in a mutual contract of plunder upon all their available resources. In astronomy, the terrifying abysses of space have responded to the occult touches of photography. In medicine, the scenic splendor of a complete reversion of the ghastly armies of torture and shameless pain has unrolled before our eyes its transforming tableaux. Knowledge in this regard has entered our daily lives, and taught us to walk with dry feet, and warm bodies, and renovated lungs.

In natural science, the endless series of the creations of nature have gone already into card catalogues, and even the story of creation itself stares every schoolboy in the face.

In mechanics, invention, which is applied knowledge, has made the work-a-day world a vast concatenation of boilers and pistons, cogs and levers. In physics, we are entering upon deep and far-reaching schemes of thought and application, and by night our earth rolls through space, an orb bathed in the glory of its own radiance.

In business, knowledge has taught us our selfish interests, and great combinations of capital spread their titanic webs in silence where once the inarticulate clamor of contest spread panic in the commercial agencies, and filled the sheriff's office with fees.

Not indeed that this portentous silence seems altogether healthful or auspicious, but it is one form of that knowledge which rises everywhere, like an effluence of the human mind, from the nineteenth century. In war, knowledge has taught us the economy of slaughter, and we may soon expect that conflicting generals will play whist with each other over telephone wires while their fighting machines effect the necessary amount of carnage in an adjoining field, and the interested taxpayers wait for the results in the evening's extras.

Knowledge—I trust I speak with respect—has entered the pulpit, and in that unaccustomed citadel has added a new virtue to the church. But why epigrammatize longer? Every day the papers are engaged in proving to us the pertinacious fact that in the nineteenth century the human mind has striven with unabated and reckless energy to drive out mystery from the world, to dissect the unknown, and to nail upon the pillars of the temples, "All are free."

But let us not be deceived by our enthusiasm for an unrealized ideal. Mystery yet remains, the unknown, yet unabashed, sits in the nectar-sprayed corolla of every flower, and you and I, the protagonists of liberty, yet limp with shackled minds, and beneath the firm glance of defiant hope carry the quivering lip of suspense and doubt.

With all our laboriously gathered facts, we still fail to touch the hidden recess in which sits the supreme fact. With all our multitudinous books, we fail intelligently to display the Essence, or should I say the Entity, of which all facts are but the expression and symptom. With all our interminable analyses, refined to the intense circumscription of microscopic areas, we fail to put the needle point of our objective upon the exquisite pulse of *life* itself. . . .

We cannot certainly say what is matter, or what is energy; and when we turn to the baffling problem of the conversion of atomic motion into mind, we find the Ariadne thread of research suddenly cut short.

But leaving scientific or philosophical enigmas aside, and looking at this great world as human beings endowed with supernatural ambitions, how clear, or luminously full of purpose does it seem. See this phantasmagoric earth, its wars, its famines, its pestilences, and its bewildering obstructions! Read its history, the unintermittent struggle, the sacrifice of the individual, the underlying untold tragedies of millions of workers, the subterfuges of vanity, the deceits of greed, the mockery of pretension, the hurly-burly of doing and undoing, of everlastingly getting there and never getting there. It may be one increasing purpose runs with the process of the suns, but is its vindication very clear, or is it at all merciful?

Now is it possible that the twentieth century will supersede all competition by bringing revelation to fix and justify knowledge? Can it be imagined that a voice, a touch, a presence, outside of human effort, or study, or sentiment, will illuminate it with a transfiguring message, shall insert the rectifying key into the run-down machinery of our common faith and bring to some proper plane of realization the present helplessness of our songs and our psalms?

Let us be honest. The reading over of impossible statistics does not constitute the highest form of elation. The building up of more and more unwieldy encyclopedias is all right, but if there is no confirming and conforming progress in the social fabric, . . . they are all wrong. I do not wish to particularize. I would not dare to lift a significant finger at the problems you are hammering at today here in New York. We all know the world moves; that sanitation and cheap clothing and department stores have alleviated the domestic burden and covered the nakedness of man. . . .

But, my friends, the spiritual sense of man is dying. Will the twentieth century light again its consuming fires? It is not necessary to ask for fanaticism. How often we pinch ourselves to find out whether we believe in anything at all.

But our spiritual sense will not endure a prolonged famine. Behind a sentiment there must be the overmastering touch of reality. Let me speak boldly, even at this convivial feast. *The message of Christ needs today re-enforcement, re-establishment, re-incarnation!* Will the twentieth century bring it? Let us hail it in that hope; let us trust in it with that faith, and watch with expectant eyes for the light that never was on sea or shore, and listen with straining ears for the voice that shall revive the souls of men.

May it not be that at the end of the twentieth century our desolate humanity, prostrate upon the ruined throne of its high hopes, prostrate upon a grave of buried aspirations, prostrate upon the broken staff of an alluring but deceptive faith, shall lift its tear-stricken eyes into that unriven sky, that pitiless and voiceless azure, that canopy of stars, in whose obscure depths not even the plummet of the inerrant telescope has ever yet found the vanishing threshold of any Heaven, and cry out, *Eli, Eli, lama sabachthani?*

No! No! Rather may it be that celestial voices shall re-awaken the orphic vision of man's supersensual destiny, and with new promises, and new premonitions, quicken the recognition of the divinity within him, and outside of creed or dogma, or book, or bell, or candle, bring upon the earth the apocalyptic glory of peace and righteousness and life!

Biographical Sketch of the Late L. P. Gratacap

By GEORGE FREDERICK KUNZ

President of the New York Mineralogical Club

THE late curator of mineralogy at the American Museum of Natural History, Mr. Louis Pope Gratacap, was born at Gowanus, Long Island, on November 1, 1851. He was of English and French ancestry. He received his education in the schools of New York City and was graduated in 1869 from the College of the City of New York. After a year in the General Theological Seminary, he entered the Columbia School of Mines, from which he was graduated in 1876. Thereafter he devoted his life to scientific and literary pursuits. He came to the American Museum of Natural History (then in the Arsenal Building in Central Park) in 1876, and was appointed assistant curator in mineralogy in 1880, curator of the department of mineralogy in 1909, and curator of Mollusca in the same year. He was a fellow of the American Association for the Advancement of Science and a member of the Society of Naturalists of New York City, as well as assistant general of the Natural Science Association of Staten Island.

In the death of Mr. Gratacap, on December 19, 1917, the American Museum of Natural History lost one of its most valued officers. Earnestly devoted to the study of mineralogy, Mr. Gratacap combined to an unusual degree a knowledge of minerals with a happy faculty of making this knowledge available for the benefit of the many students attracted to the Museum by its splendid collections. The work he accomplished in the cause of public education and in the diffusion of a love for mineralogy scarcely can be overestimated.

Mr. Gratacap was a pupil of Dr. Thomas Egleston[1]—one of his most notable students. He was preëminently a "curator," and the mineralogical and precious stone collection of the American Museum of Natural History, as it stands today, is probably the best displayed collection in this country or abroad. It is remarkable for its absolute cleanliness and for its labeling, and for the evidence of great attention given to specimens. Minerals require care not necessary in the case of many other exhibits, for a single hard touch may mean the permanent injury of a specimen and may result in the displacement of a brittle crystal, such as of sulphur, cinnabar, or wulfenite. With the work that his position involved, much of his time was consumed, preventing him—as has been the case with many other museum curators—from devoting the time to original work that would have been possible if he had assumed charge of a well-established collection rather than of one in its formative period.

In addition to his special activity as curator, Mr. Gratacap found time to write a great number of valuable papers for scientific journals on his favorite subject and to compose several books of sterling merit, in which may be noted a most happy blending of scientific accuracy and wise popularity. Examples of the latter are his "Geology of the City of New York" and "Popular Guide to Minerals." Among the many papers contributed to scientific journals, a group devoted to early museums in New York City, and to the rules to be followed in constructing and arranging a typical museum, is especially worthy of attention as embodying the study and experience of one who had large practical knowledge of this subject.

In his "Formative Museum Period," Mr. Gratacap reminds us that "scientific activity developed more slowly and was less encouraged in New York in the earlier years of this [last] century than in its neighboring rival cities, Boston and Philadelphia." This he attributes, reasonably enough, to the predominant New York interest in mercantile pursuits. In the decade prior to the establishment of the American Museum of Natural History, two societies, the New York Academy of Sciences (founded in 1817 and

[1] Dr. Thomas Egleston was professor of mineralogy at Columbia University and founder of the School of Mines of that institution opened in 1864. He was an American but had studied in the École des Mines of Paris. He elaborated for the New York school the system of installation of collections which existed in the École des Mines. The impress of Dr. Egleston's work is distinguishable in many of the museums throughout the United States, whose curators had been students under him.

since 1876 called the Lyceum) and the Torrey Botanical Club (1870), "were the guardians and shrines of the scientific life of the city."

There are very many articles by Mr. Gratacap treating ably a variety of themes. In the Museum Guide Leaflet, he passes in review the principal donations of minerals, the Clarence S. Bement collection, which constituted the nucleus of the Museum's mineralogical display, and the Spang collection acquired in 1891. An interesting paper is that on the singular class of clay stones and concretions which occur in clay beds of recent or Quaternary age. Devoted to a study of certain aspects of plant life, is a paper relating experiments on plants with solutions of hydrochloric, nitric, sulphuric, and carbolic acids. Certain fossils and traces of extinct animals in the Triassic rocks at Weehawken, New Jersey, furnish material for another paper. An interesting study of a very restricted area is that treating of the flora and fauna of Central Park. The important question of the "zoic maxima" of fossils forms the subject of a paper in which the irregular distribution of fossil remains in the successive strata of fossiliferous rocks is considered to depend upon causes still in operation today.

In his "Palæontological Speculations" Mr. Gratacap recognizes the "valuable results secured by surveys like that of New York in the search for those variations whose accumulated force ushers in new forms in the life series, and by whose action on the organism as a whole a kinetic influence is established in a new direction." A more special study in his favorite field of mineralogy is that of a splendid calcite from Joplin, Missouri. The fascinating aspects of faraway Iceland in a geographical and mineralogical direction are well presented in an article "In and Around Iceland," the minerals being specially treated in another paper which gives interesting details regarding the calcite of Iceland, the famous "Iceland spar."

Endowed with an analytical mind, and having a wide scientific culture, Mr. Gratacap was a prolific writer. In addition to his great amount of published material he has left a considerable number of unpublished manuscripts.

As a slight illustration of the high degree of appreciation accorded to his character and achievements by those who long knew him, we add here a few items and extracts from letters recently sent to the writer.

Dr. Robert Abbe, who was a member of the City College class following, states that Mr. Gratacap's classmates were most deeply impressed by his oratorical abilities. Not only his eloquence, but his deep, resonant, and attractive voice compelled attention. He had a very distinguished manner, especially noticeable in an undergraduate; and he was admired and loved both by the members of his own class and those of the class below him. One could not fail to be impressed with his seriousness of purpose.

Director Charles A. Colton, of the Newark Technical School, writes that his acquaintance with Mr. Gratacap dates back to the latter's student days in the School of Mines, when it was his privilege to be his teacher in crystallography, blowpipe analysis, and mineralogy. He was always a most careful student, and "the surprise and pleasure on his face the first time he obtained a silver button in blowpipe analysis still lingers in my memory. . . . His trip to Iceland was a never ending source of pleasure to him, and he would often entertain his friends with reminiscences, in that pleasing modest way so characteristic of him."

The following testimony of Mr. Gratacap's classmate and best friend, Mr. George C. Lay, serves to explain the stimulating influence he exerted upon those who came in contact with him, either as students of mineralogy or in social and friendly intercourse: "Always of studious habits, wide reading and much originality, he was not only a prolific writer on scientific subjects, but was also the author of several novels. Very early in life he began a diary in which he recorded his travels and the incidents of his life with vivid and rich description. This grew to many volumes. Possessed of an enthusiastic, buoyant temperament, which in spite of all the disappointments and cares of life made him ever cheerful and optimistic, he never lost his intense interest in the struggles of suffering humanity. He was remarkable in his democratic habits, always appearing to put himself on an equality with those who associated with him, however humble, without loss of dignity, and his benefactions and his ever ready sympathy, so characteristic of his kind and genial soul, will long be remembered. He was gifted with a high sense of humor and as a conversationalist he was almost unrivaled. No one could listen to him without imbibing fresh and charming impressions of life and without learning something of interest, which he drew so readily from his stores of learning and research. His modesty, and in the latter years his seclusion in his home life, prevented him from achieving phenomenal success as a lecturer, as would otherwise have been the case; for, gifted with a marvelous vocabulary and flow of speech, he fascinated his auditors by his voice and manner, by his wonderful charm and originality of thought."

One who knew Mr. Gratacap as early as his college years, Mr. Marcus Benjamin of Washington, D. C., considers him to have been an unusually able man, and gifted with great versatility. He says: "He was very modest and even diffident, and it may be that his personality prevented a greater appreciation of his real worth. As I look back over the almost half century since I first met him, I cannot but yield to him all honor and praise for his achievements."

Mr. Julius Hyman, another old friend and fellow student at City College, says of him: "Louis P. Gratacap was a wonderful man. To a superior intellectual ability he had added the power and charm of a wide cultural development. And yet withal he remained a man—a simple human who liked humans and liked to be with them. . . . By instinct and habit he was a gentle-man. A noble courtesy informed all his actions. . . . Endowed beyond the average with natural gifts, he was modest and retiring to the point of diffidence. . . . He had a discerning mind and ever kept his sense of proportion. He despised sham and pretense. He paid homage to merit. In his analysis of leaders of men, in his books on public affairs, he hastened to point out the good in them, and to emphasize the constructive side of their policies. . . . He was a great American, and he loved America greatly. He was for America first, last, and all the time—that America that was to prove the world's leaven. For him America was the justification of history. It was the leavening that would bring salvation to the world. He used to say to me, 'Hyman, America is the greatest experiment in democracy the world has ever seen. Ultimately the world must come around to us. If we go, then the world goes.' . . .

"Louis P. Gratacap was an optimist. He was perennially young. He had life-zest. He lived, felt dawn, saw sunset glow—and loved to describe it in felicitous phrase. He was always enthusiastic—never downcast; his was the Greek's *en theos*, the 'god within.' . . . He was of fine humor, at times almost boyish in its quest. Goldberg's cartoons, with their ingenious grotesqueries, would stir his risibilities much. He had a hearty infectious laugh. He enjoyed a joke and could tell a funny story. And he did love contemporaneous life—the life of our cosmopolitan New York. Of original native stock, he met the more recent Americans with a discerning eye and a mind of understanding. 'Where others saw but a motley crowd, he saw the soul of man behind it.' In old Trinity's churchyard, on that gentle southern slope, just where the daily flood tide of Broadway's bustling business men, clerks, and jetsam swirls into that swift current of bankers and brokers that comes rushing out of Wall Street's commercial cañon, in the very heart of that old New York he loved so dearly, a true *civis Novi Eboraci*, he now lies in peaceful rest. . . . 'His life was gentle, and the elements so mixed in him, that Nature might stand up and say to all the world, "This was a man."'"

In a paper on Mr. Gratacap, read before the Staten Island Association of Arts and Sciences, Mr. William T. Davis said:

"The versatility of the man, as his bibliography will show when published, was quite remarkable. As a lecturer he had few equals, and his many ideas were not only presented entertainingly, but also through the medium of a remarkable vocabulary. It is related that ex-Governor Benjamin B. Odell, a guest at an alumni dinner, after listening to Mr. Gratacap, turned to the president of the occasion and remarked: 'That man a cold scientist? Why, if he went into public life, he would class with orators like Joseph Choate and Horace Porter.' But Mr. Gratacap did not care to go into public life; he was a student, and thought more of the quiet of his home, where after the death of their parents, he and his brother Thomas lived alone, except for the servant. He lived only for his work and for his friends. Very many can testify to his kindly acts both in financial and other aid."

The Tree of Saint Louis in the Forest of Fontainebleau

By WILLIAM A. MURRILL

Assistant Director of the New York Botanical Garden

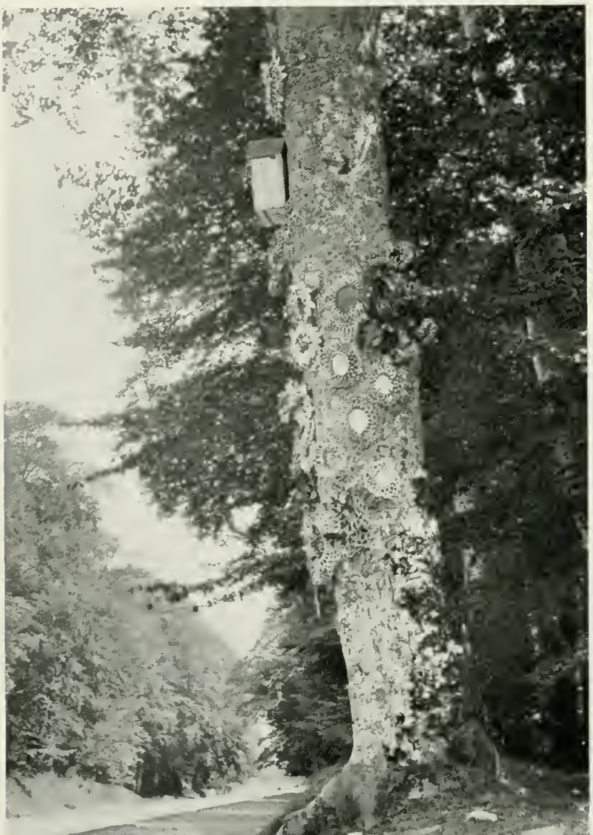
THE forest of Fontainebleau, situated about thirty-five miles east of Paris, is the largest and most beautiful tract of woodland in France. Conspicuous among its trees are splendid oaks and pines and beeches, and the forest floor is covered here and there with dense undergrowths of bracken fern. Where the soil is sandy and water scarce, as at Franchard, picturesque gorges and passes appear with rocks heaped about in confusion and stretches of heather with an occasional stunted juniper or skeleton of a dead tree, presenting the greatest contrast to the subdued and attractive forest depths.

While visiting Fontainebleau not long ago, I was struck with the number of trees bearing the names of noted men. Most of these trees were oaks, named for Charlemagne, Clovis, Francis I, Henry IV, and others; but the one that attracted me most was a beech called the Tree of Saint Louis.

Louis IX, or Saint Louis, stood almost alone among the kings of France for virtue and piety. His piety was simple and fervent, his life frugal, honest, and chaste. Tall, strong, keen-eyed, and sanguine, he delighted in the dangers of the chase and was calm and fearless in battle. The strife of his early years and the disasters of his crusading expeditions served only to develop the sterling qualities inherited from his mother, Blanche of Castile, and at the end of his reign he was the first prince in Eu-

Beeches in the largest and most beautiful woodland of France, the forest of Fontainebleau, about thirty-five miles east of Paris. Many of the trees in this forest are named for noted men,—this view is from a great beech called the Tree of Saint Louis rope, the exemplar of all that was best in his age and the very ideal of a Christian king. Under his just and beneficent rule France enlarged her boundaries and made great advances in learning and the arts. The exquisite Sainte Chapelle, built by him in 1245, may still be seen in Paris; in the palace at Fontainebleau visitors are shown the Salle de Saint Louis; and in the forest, on a main road leading from the palace, is this aged beech, the Tree of Saint Louis, bearing many scars on its trunk and branches from rough handling by wind and weather, but apparently sound and healthy still.

Under this tree the king and his court, a large and brilliant company, assembled to worship. The custom was especially in vogue at the close of the seventeenth century when Louis XIV created the royal and military order of Saint Louis and designed a medal bearing his image. This manner of worship doubtless had its origin in druidism, which was common among the Gauls in the days of Julius Cæsar. Druids were then men of rank who practised mystic rites in woody retreats and held the oak sacred, esteeming everything that grew upon it a special gift from heaven. Druidism resembles oriental pantheism and is probably connected with the ancient religion of the fire worshipers in the plains of Persia, where the plane tree was venerated. Why the beech was chosen in this instance instead of the oak it is impossible to determine with certainty. I noticed, however, that the beech is very abundant and very beautiful in this part of the forest, that the region is level and easy of access to parties coming on horseback from the castle, and that its distance, as well as its attractiveness, must have made it a very desirable spot for ceremonies of this kind.



The Tree of Saint Louis (Louis IX) has added ring after ring of wood slowly marking the years of all the centuries of French history from about 1200 A.D. until today. The peasants of Fontainebleau still hang crowns of beads upon the tree in memory of the pious king whose name it bears

The ornaments upon the tree are crowns of beads placed there by the peasants of the neighborhood. After the French Revolution, such homage to royalty was judged illegal and forbidden, but the descendants of the old servants who were driven from the palace by the Revolution still cherish the ancient custom and come for miles during the night with their tributes to Saint Louis. These crowns or wreaths of woven beads are commonly used upon graves and monuments. The statue representing the city of Strasbourg, in the Place de la Concorde, has been decorated with them continually since Strasbourg passed into the hands of the Germans. They also constitute a large part of the offerings of lovers at the tomb of Abélard and Héloïse in Père-Lachaise.

The historic associations connected with the forest and castle of Fontainebleau are of peculiar interest and cover a large and important part of French history. The forest has been used from very early times as a royal hunting ground. Importance was first given to it by Louis VII, who, after returning from a disastrous crusade, erected upon the spot which the present palace occupies a fortified castle in which he held his court. He also dedicated there a chapel to Saint Saturnin, which was consecrated by Thomas à Becket, then a refugee in France.

While the earliest settlements were being established in America, Louis XIII at Fontainebleau was entering upon a career which, with Richelieu's help, was to lay the foundation of the most glorious period in the history of France. Hither Henry IV had come with Gabrielle d'Estrées and later with Queen Marie de Médicis, and here young Louis was born and baptized, and from Fontainebleau went forth to the early struggles and successes of his long and eventful reign.

Louis XIV, though born at Saint-Germain and occupied with the construction of Versailles, still retained Fontainebleau as his autumn residence, where he went to hunt and to enjoy the exhibitions of new plays intended for the French stage. It was here in 1685 that this tyrannical and bigoted monarch signed away the rights of the Huguenots granted to them nearly a century before by Henry IV in the Edict of Nantes.

The marriage of Louis XV to Marie Leszinska, of Poland, was celebrated at Fontainebleau; but the names of De Châteauroux, De Pompadour, and Du Barry, who succeeded one another in the favor of the king, have attracted more attention than that of his Polish queen. It was a period of license and of petty jealousies during which Fontainebleau was the scene of many personal and political intrigues. Sentimental and unorthodox literature was also much in vogue. Hither came the brilliant and versatile Voltaire to see his plays produced; and here Rousseau, after witnessing the phenomenal success of his "Le Devin du Village," lost courage at the approach of his presentation to the king and hurriedly left the palace without a farewell and without a pension.

The time-honored custom of spending the autumn at Fontainebleau was continued by Louis XVI and his queen, Marie Antoinette. During these visits the king gave himself over to the pleasures of the chase or worked with his locks and bolts. The queen especially looked forward with delight to the freedom and quiet and native beauty of a forest unrestricted by the narrow boundaries of Versailles and beyond the reach of its cares.

The apartments of Napoleon I form an attractive feature of the castle: a large part of the garden, also, was laid out in the English style under his direction. It was during his residence at Fontainebleau that Napoleon willfully put away the Empress Josephine for Maria Louisa; here he was forced to sign his abdication of the throne of France for the empire of Elba; and here, in the Cour du Cheval-Blanc, he bade a touching farewell to the soldiers of the Old Guard, to greet them again on the same spot upon his return from Elba the following year.

And the Tree of Saint Louis has lived through it all, defying time and change as kings and centuries have passed; and, with ring after ring, has slowly recorded the years. Some rings have been thick, others scanty; some even, others uneven. As it is with the tree, so it has been with France: there have been years of plenty and want, of peace and war, of prosperity and adversity in her history. It is to be hoped that the peasants of Fontainebleau will not cease to hang wreaths upon the tree while it lives, or the French people cease to remember what they owe to the good and wise king whose name it bears.

THE LAST OF THE PICURIS RACERS

At the Picuris *fiesta*, August 10, 1917, in honor of San Lorenzo, patron saint of the village, which replaced the old time Scalp Dance, racing on the mesa was the chief feature of the day. The racers were variously decorated: some streaked their bodies with red, others painted them with fanciful designs in white clay

Last Dance of the Picuris

Foreword.—Taos and Picuris, the most northeastern of the New Mexican pueblos, unlike the others are not in the valley of the Rio Grande but at the eastern base of mountains which are really the southern extension of the Rockies. They were first described by Alvarado, lieutenant of Coronado, commander of the Spanish expedition of 1540–42, which was sent into the north from Mexico to search for the "Seven Cities of Cibola" with their reputed stores of wealth. Picuris early became the seat of the Franciscan mission of San Lorenzo, but when in 1680 the Indians made their great revolt against Spanish dominion, the Picuris killed their missionary, burned the church, and for a time abandoned the pueblo. By reason of their proximity to the Jicarillas in later times, the Picuris have a considerable infusion of Apache blood. Annual *fiestas*, curious mixtures of Christian and pagan practices, are held at almost all of the pueblos.—P. E. Goddard.

PICURIS is situated among the mountain peaks of Truches, in northern New Mexico, more than eight thousand feet above sea level, the highest Indian village in the Southwest. Many travelers in this strange corner of the United States have looked toward the purple-veiled mountains, little realizing the great drama that was being played there. Difficult of access and far removed from other pueblos, this village has been visited by few Americans, and is the last to feel the effects of civilization. It is said to have had three thousand vigorous inhabitants not so long ago; now it has only one hundred and twenty-three. Of these, the older men, who still possess a flicker of the fiery spirit of the tribe, are fast disappearing, while the young boys, who are being educated in the American schools, are losing reverence for their native religion and the customs of their people.

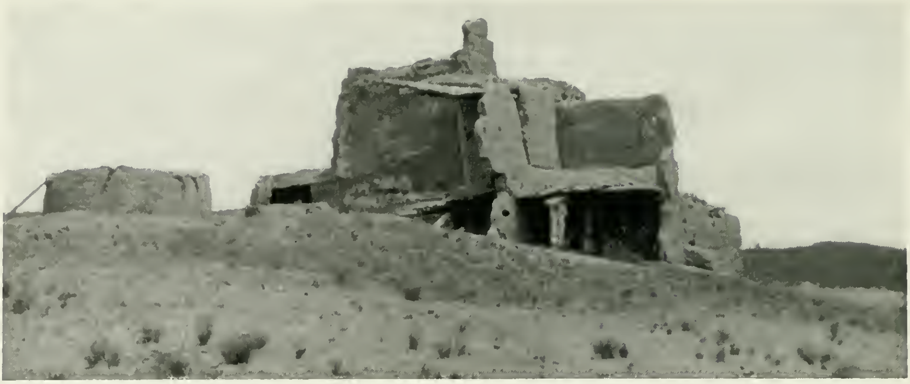
But it was not many years ago, say the historians, when this village of Picuris, because of its location in the rugged mountain tops and its highly defensible position against enemies, was very powerful. When the Spaniards conquered the Indians of New Mexico, the Picuris were the last to submit. Later, in the great Indian revolt, these Indians were the leaders. And when the Spaniards reconquered the Pueblo Indians, the Picuris moved to the plains of Kansas, but finally returned to their original home near the skies and near the burial mounds of their ancestors.

During the summer of 1917 there was talk in the Southwest about a revival of the once famous Scalp Dance which was to be given at Picuris. A number of writers and artists sacrificed considerable personal comfort in the hope of witnessing this weird ceremony. A long hard drive over forty miles of "going up" mountain road, and a bed on the ground, were only part of the sacrifice. There was no Scalp Dance, however. The Scalp Dance is no more—and never will be danced again.

In this village of Picuris was a castle called "Casa Vieja," a guarded communal house, in the tower of which, history relates, was a collection of bloodstained scalps of enemies conquered hundreds of years ago. These had been cherished as sacred relics, gruesome reminders of the days when the stalwart Picuris were brave warriors and the fear of invaders.

When I visited Picuris I expected to see these bloody trophies carried in the dance procession. But I was disappointed. The "Casa Vieja" is in ruins. It is now only a fallen pile of adobe. The old men of the village when asked about the scalps said, "*Quién sabe*," and shook their heads sadly. The young boys who had learned to speak English seemed ashamed, and professed ignorance of any such feature of the dance. Inquiries were made throughout the day of the dance, but all that could be learned was that these trophies had disappeared mysteriously about three years ago.

Instead of the Scalp Dance, the Picuris Indians, on August 10, danced in celebration of the annual *fiesta* of San Lorenzo, their patron saint. Early in the morning, crowds of native Mexicans in horse-drawn caravans, and reckless riders galloping their horses, began filling the plaza in front of the old church. This is said to be the only old Spanish mission church of the Indian pueblos that was built by the ancient system of construction, that is, by preparing a mortar of adobe earth and pouring it into molds to form the walls. After the church services, a statue of San Lorenzo was carried at the head of the procession of dancers, each dancer kissing the garment worn by the image. After many blows on an ancient bell and many volleys from old muskets, the Indians marched from the church to a high mesa where the races were to be held. Here the twenty-six dancers separated into two groups of thirteen each which were stationed at the two ends of the race course; two men started at the same moment, one from



The ruined "Casa Vieja."—In this communal house were once kept as well-guarded sacred relics the scalps of enemies conquered centuries ago. These were brought out only on the occasion of the annual Scalp Dance. All that now can be learned from the Picuris is that these trophies have mysteriously disappeared

each side respectively, and the point at which they passed each other determined the progress of the race. As a racer ran the course and returned to his side, his place was taken by another racer, and so the game continued with its interest centered around the point at which the dancers passed, this point moving first toward one goal, then toward the other—reminding one of the yard gains of a football team. Each racer appeared with different bodily decorations. Some had streaked their bodies with red, others had made themselves grotesque with white clay in fanciful designs.

The governor of the pueblo kept score by marking the progress of the race with large leafy branches. The governor of the Picuris carries two silver-headed canes. One was presented to some former governor by President Lincoln, whose name is inscribed on the head. This has become the only mark of the governor's office. The other

Once so many Picuris warriors took part in the dances that five sacred chambers, or kivas, were needed. In 1917 the ceremony, which formerly lasted from sunrise to sunset, was performed in scarcely thirty minutes, and the few participants disappeared into only two of the kivas cane was presented by the King of Spain when these Indians were under Spanish rule, before the United States acquired the territory. On feast days the governor carries these insignia of his office with great pride and dignity.

When the race was over, the racers again formed two sections of thirteen each and began the "Dance of the Races." These two small groups presented a pathetic picture, trying to enact a drama in which formerly the chants of hundreds had echoed in these same mountain tops. The dance step of the old men had the masterful movement of the great past, and their chant was rich in the spirit they sent heavenward; but it was different with the short-haired Americanized boys. The performance was very brief. The groups of dancers passed through the plaza once, and then on to the kivas.

This Indian village once had so many dancers taking part in its *fiestas* that five kivas, or sacred chambers, were required, each accommodating a hundred warriors. This time the two small groups of dancers hurriedly closed the dance and disappeared into two of the kivas, leaving three vacant. In the olden days the dance started at sunrise and stopped at sunset. This dance lasted scarcely thirty minutes, and when the dancers disappeared into the kivas a deathlike stillness settled over the famous Picuris pueblo, which made mourners of the handful of American visitors, who had seen the last dance of the Picuris.

—Chalmers Lowell Pancoast.

The small group of Indians taking part in the Dance of the Races is in mournful contrast with the hundreds who in former years joined in the ceremony of the old time Scalp Dance. They are here about to enter the kiva at the close of the dance

The Cuban Ground Sloth *Megalocnus*.—The joint explorations by the Havana Academy of Sciences and the American Museum of Natural History secured materials to mount two skeletons of this prehistoric beast. It was about as large as a black bear and a rather distant relative of the extinct *Megalonyx* of North America. The upper figure shows the skeleton sent to Havana. The skeleton of the lower figure is on exhibition in the American Museum, in the hall of the Age of Man

Skeletons of the Cuban Ground Sloth in the Havana and American Museums

Some years ago, on invitation of Professor Carlos de la Torre of Havana, the American Museum deputed Mr. Barnum Brown to investigate with him certain fossil localities in Cuba. As a result of this joint expedition a large collection of remains, chiefly of the extinct Cuban ground sloth *Megalocnus*, was obtained. From the materials we mounted two complete skeletons: one now stands in the hall of the Age of Man in the American Museum, the other was sent to the Havana Academy of Sciences Museum. The importance of this skeleton was appreciated highly by the scientific fraternity of Havana. It represents the first discovered and the most remarkable of the extinct fauna of Cuba, as yet very little known. The exercises at its formal presentation are published in the *Memorias* of the Poey Society, a scientific association founded in honor of the pioneer Cuban naturalist Felipe Poey; and in recognition of the part taken by the American Museum, three of its staff, Professor Osborn, Dr. Matthew, and Mr. Brown, were elected among the first honorary members of the society. The following extract is taken from the report of the secretary of the Poey Society, Dr. Arístides Mestre, for the year 1915–1916:

(*Translation*)

"The Poey Society we state in conclusion has finished by naming its first *honorary members;* has unanimously bestowed that title, the highest in its gift, upon two illustrious Cubans, Doctors Juan Santos Fernández and Juan Guiteras; and upon three learned North American naturalists, Messrs. Henry Fairfield Osborn, W. D. Matthew and Barnum Brown. . . . They have contributed to decipher the enigmas which lie within the soil that we tread upon and to bring them back to life—reconstructing, through the procedures of science and the marvellous methods of an art truly amazing, beings which existed in epochs far remote from ours but which today it is possible for us to know and study.

And these three notable naturalists are joined—and it is of especial interest that we should note it at this moment—with the history of the *Myomorphus* or *Megalocnus rodens*, whose restored skeleton we see today in this hall, and in the earlier stages of whose palæontologic investigation Doctor La Torre was associated. Ah! if Poey could rise from his grave—which for our consolation is very near to this place—and contemplate it, even were it but for an instant, and directing his glance backward, recall to remembrance the description which he gave on the 15 September, 1861, of that fossil mandible from Ciego Montero, he might return certainly to tranquil repose after exclaiming with justified pleasure, 'My favorite disciple has brought to a satisfactory termination the work which I initiated half a century ago. What progress palæontology has made in those five and fifty years!' "—W. D. Matthew.

Notes

Since the last issue of the Journal, the following persons have become members of the American Museum:

Fellow, E. H. Doheny.

Life Members, Messrs. Albert C. Burrage, Michael J. Clancy, Anson W. Hard, Jr., H. B. Harris, and C. H. Sanford.

Annual Members, Mesdames William C. Atwater, A. Frederick Behre, G. H. Bend, C. F. Chamberlaine, and S. T. De Lee, Doctors J. Riddle Goffe and Richard Kovacs, Messrs. E. F. Abell, B. Lord Buckley, George W. Chandler, William V. Cohen, Martin L. Cohn, Rufus Cole, Timothy F. Crowell, Burritt A. Cushman, W. P. Deppé, Lee Deutsch, Hermann Dittrick, William A. Duncan, Walter R. Eimer, Stephen C. Hunter, Fredericko Lage, Carlos la Rosa, Jr., Montgomery H. Lewis, Charles E. Mathewson, John B. O'Reilly, N. T. Pulsifer, and H. E. Raymond.

Associate Members, Miss Laura Alice Joslyn, Doctors Newton Craig, Omar F. Elder, Henry Stevens Kiersted, Edwin Lodge, Thaddeus Walker, Messrs. Alfred Austell, Thomas J. Charlton, F. H. Douthitt, Dean Emerson, John A. Murtagh, Dudley W. Smith, Vanderlynn Stow, and Henry P. Williams.

Free lectures by members of the scientific staff of the American Museum of Natural History will be given to public school children on Mondays, Wednesdays, and Fridays, at four o'clock, throughout April and May. Three courses are scheduled, covering eight talks on geography, eight on United States history, and eight on natural history. These lectures are designed to supplement classroom work and will be fully illustrated with lantern slides and moving pictures.

Dr. Frank M. Chapman, curator of ornithology, who is second in point of seniority on the scientific staff of the American Museum of Natural History, completed on March 1, 1918, his thirtieth year of connection with the institution. He joined as assistant curator of vertebrate zoölogy in 1888. He has, from the first, devoted himself chiefly to ornithology, attaining preëminence in educational and scientific work in that branch. The effectiveness and high ecological value of the large series of habitat bird groups in the Museum, which it is said by competent observers are second to no exhibits of birds in the world, are based on the careful observations made during his extensive field studies.

The Geological Society of France has awarded to Professor Henry Fairfield Osborn the Gaudry Medal, which was established by the Society in the year 1910 in honor of the distinguished French palæontologist, Albert Gaudry. Previous awards of the medal have been to the following palæontologists and geologists: Albert Gaudry, 1910, Marcellin Boule, 1911, Henri Douville, 1912, Edouard Suess, 1913, Emile Haug, 1914, Charles D. Walcott, 1917.

At the annual meeting of the National Academy of Sciences, in Washington, April 22, 23, and 24, will be presented the sixth course in a series of lectures organized for the purpose of giving a complete history of the modern aspects of the evolution theory. The foundation of the series was a gift to the National Academy by the children of William Henry Hale, in memory of their father. The first lectures were given in April, 1914, by Sir Ernest Rutherford, F.R.S., followed by Dr. William Wallace Campbell, in December of the same year; by Professor T. C. Chamberlin, in 1915; Professor Henry Fairfield Osborn, in 1916; and Professor E. G. Conklin, in 1917. Professor John C. Merriam, of the University of California, will deliver the present course, his subject being, "The Beginnings of Human History from the Geologic Records."

A new *General Guide to the Exhibition Halls*, edited by Director Frederic A. Lucas, has just been issued by the American Museum of Natural History. Numerous illustrations, together with diagrams of each floor and very full explanations and descriptions of groups and specimens, make this volume interesting and instructive to the reader as well as helpful to the Museum visitor.

Through the courtesy of Mr. Leonard M. Davis and the Canadian Pacific Railway Company, the Journal has been able to publish as a frontispiece for this number a reproduction in color of one of a collection of paintings by Mr. Davis, which will be on display in the American Museum from the middle of April until June 1. The exhibit includes about fifty small sketches and thirty or more large pictures of scenes in Alaska and the Canadian Rockies. Mr. Davis has made a life study of mountain scenery, and the excellence of his technique and grasp of scenic effects and color give great pleasure. The artist's paintings of Alaskan scenery won for him a silver medal at the Panama-Pacific International Exposition at San Francisco.

A letter from the Reverend A. Kok, of Li-kiang-fu, Yünnan, China, addressed to the president of the American Museum of Natural History, tells of the cordial relations that existed between the members of the Museum's Asiatic Zoölogical Expedition and the Chinese people of the regions where the expedition worked, and gives assurance of the writer's desire to aid in every way such undertakings in the future. He says: "Few foreign travelers have left behind such a good reputation among the population of these parts as the members of Mr. Andrews' party have done. To remember this is a pleasure to me, and, if they ever return to these parts they may be sure of a hearty welcome and every possible assistance."

A group illustrating the nesting habits of hornbills, specifically, of the largest species of hornbill found in West Africa, has been placed on exhibition at the American Museum in the hall assigned to birds of the world. The hornbill in appearance, as well as in habit, is distinctive, the huge bill with its high casque giving to the head a grotesque appearance. There are seventy species, widely distributed over the warmer parts of the Old World. The Museum group has been prepared under the supervision of Mr. Herbert Lang, whose article in the present number of the JOURNAL describes in detail the nesting habits of this particular African species.

AT a recent meeting of the New York Academy of Sciences, the effect of heavy shell fire on the human ear was described by Professor J. Gordon Wilson, of Chicago University. Complete deafness often is caused by the rupture of the tunnel of Corti in the inner ear, but in many cases temporary deafness may be cured or improved by a graded series of sound exercises, tuning forks being placed against the mastoid bone to stimulate the inner ear; later on, resonating boxes are used in the treatment. The speaker exhibited an improved instrument to be worn in the ear which protects it against shell shock without preventing ordinary sounds from being heard.

THE American Museum War Relief Association, which has been an active factor in the Museum since June 1, 1917, reports to date a very considerable amount of work accomplished through its various branches. Knitters for the Red Cross, Navy League, and for Museum men in the service have turned ont 650 garments; sewers have made for the Red Cross 215 surgical shirts and 209 suits of pajamas; while the surgical dressings class, which meets once a week, reports an output to date of 10,000 pieces. In addition, during the recent Red Cross drive for garments to send abroad, energetic workers collected, sorted, and packed for shipment to headquarters one ton of clothes which were turned in at the Museum station. It is the aim of the Association to keep in touch as far as possible with the American Museum men who are in the service, and thus far twenty-two of these have been furnished from time to time with comfort kits, knitted garments, candy, and tobacco, as well as with reading material and letters. Money for carrying on the work of the organization is raised through monthly subscriptions obtained from members of the Museum staff, and through the generosity of Mrs. Henry Fairfield Osborn.

THE *Museum News Letter*, a small publication which had its inception at the 1917 meeting of the American Association of Museums, supplies an actual need in the way of furthering coöperation between educational institutions of this character, keeping them alive to one another's activities, and promulgating new methods of work. The leaflet is edited by Mr. Harold L. Madison, curator of the Park Museum, Providence, Rhode Island.

DR. HERBERT J. SPINDEN, assistant curator in the department of anthropology at the American Museum, is on his way to Colombia, South America, to make a general archæological survey of that little-known country. It is a curious fact that since the time of Humboldt no one has advanced our knowledge of prehistoric Colombia. While on the whole we know very little about some sections of South America, Colombia is the one part about which we know least. Dr. Spinden plans to visit the more promising regions and to gather data upon the distribution and forms of archæological objects. This will give a basis for future intensive work on the prehistoric culture of that country.

A BRONZE bust of the late Dr. Daniel Girand Elliot, mammalogist and ornithologist, is installed on the second floor of the American Museum, in the hall devoted to birds of the world. The bust, which is the work of Mr. Chester Beach, is the gift of Miss Margaret Henderson Elliot, daughter of Dr. Elliot.

A VERY rare specimen of sea otter spear, formerly used by the natives of the Aleutian Islands, has been presented to the department of anthropology of the American Museum by Lieutenant George T. Emmons, of Princeton.

TWO canvases bearing realistic representations of the Dakota Sun Dance may be seen in a case in the southwest hall of the American Museum. These paintings, which are about six by two and a half feet in size, are the work of Short-bull, a famous chief of the Oglala Dakota (Sioux) Indians, now at Pine Ridge Reservation, South Dakota. Short-bull was one of the leaders in the Ghost Dance outbreak in 1893 and fought an engagement with the United States troops at the Catholic Mission near the present site of the Indian agency. The pictures represent the Sun Dance of forty years ago. The green circle in the center of each is the windbreak of fresh cottonwood boughs within which the ceremonies of the Sun Dance were performed. In one of the circles figures are seen performing the famous torture feature of the dance, in which devotees were suspended by cords passing through loops cut in their skin. Another phase of this torture is shown in the second picture, where one of the Indians is seen outside the circle dragging four buffalo skulls by cords run through loops cut in the skin of his back. The ceremony requires that he continue to drag these until the skin is torn loose. In the center of this painting, suspended from the Sun Dance pole, are figures of a man and a buffalo, drawn quite out of proportion as is often the case in Indian art. The camp of the assembled people is indicated by the surrounding tipis, the typical tribal decorations of which are well shown. These paintings were collected by Dr. J. R. Walker, whose account of "The Sun Dance and Other Ceremonies of the Oglala Division of the Teton Dakota" has just been issued as Volume XVI, Part II, of the *Anthropological Papers of the American Museum of Natural History*.

It is interesting to compare with familiar West Indian fishes a small exchange collection recently received from the Museu Nacional at Rio de Janeiro. A queen trigger fish (*Balistes vetula*) which is in this collection has a bearing on the general distribution of fishes by ocean currents. It belongs to a group of small-mouthed, leathery-skinned fishes. Sluggish by nature, they often drift, especially when young, great distances in ocean currents. The queen trigger fish is one of the most gaudily colored of the trigger fishes, common in the West Indies, abundant about Bermuda, where it is known as "queen turbot," and also found in the South Atlantic and Indian oceans. No similar species occurs on the west coast of America although many tropical fishes are represented on both Atlantic and Pacific coasts, evidence of a former sea connection. In 1913, Mr. Robert C. Murphy brought back a queen trigger fish (apparently of a different race from those found in the West Indies) from South Trinidad Islet, six or seven hundred sea miles east of Brazil. This aroused an interest in the variation of the species over its great range. The queen trigger fish was first described from Ascension Island; and in 1916 Mr. Murphy obtained an Ascension Island specimen through the courtesy of Major H. N. Benett, then commandant at the island. The one from Rio gives us another link in the chain of evidence bearing on the problem of its distribution.

Mr. Karl P. Schmidt, research assistant in the department of herpetology in the American Museum, was called to active service in the United States Army in early March.

In the New York Botanical Garden's system for entertainment of visitors, parties are met at the door of the museum building by an instructor at three o'clock on every weekday afternoon and are escorted over various parts of the Garden. Beginning Monday, the routes differ each day as follows: Hemlock Forest, Mansion, and Herbaceous Garden; Pinetum; Fruticetum and North Meadows; Deciduous Arboretum, Public Conservatories, Range 2, Nurseries, and Propagating Houses; Public Conservatories, Range 1; Museums.

April 3 was the birthday of Mr. John Burroughs, author and naturalist. This day, on which eighty-one years ago there was given to the world a child with idealistic, dreaming, nature-loving tendencies, may become an important one in the social history of the United States by its transfusion each year of something of these same qualities into the youth of the country. Already the date has been adopted as an annual "Bird Day" by several states of the Union and we can foresee that the movement is likely to continue. This is not only because of the effect of many years' use of his books for supplementary reading in the schools, or because of the good work of Houghton Mifflin Company, in publishing *Nature Notes*, a small magazine for the use of "Burroughs Nature Club" members throughout America, but especially because of the genuineness and charm of the nature presented in Mr. Burroughs' writings—owing to his own profound interest. His opening sentence in *The Summit of the Years* is, "The longer I live the more my mind dwells on the beauty and wonder of the world."

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 1917:

Attendance in Exhibition Halls	786,151
Attendance at Lectures	115,802
Lantern Slides Sent out for Use in Schools	63,111
School Children Reached by Nature Study Collections	1,104,456

Membership

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The Scientific Publications of the Museum comprise the *Memoirs, Bulletin* and *Anthropological Papers,* the *Memoirs* and *Bulletin* edited by Frank E. Lutz, the *Anthropological Papers* by Clark Wissler. These publications cover the field and laboratory researches of the institution.

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The American Museum of Natural History

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THE AMERICAN MUSEUM JOURNAL

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

May, 1918

Volume XVIII, Number 5

THE AMERICAN MUSEUM OF NATURAL HISTORY

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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 members are now enrolled who are thus supporting the work of the Museum. The various classes of membership are:

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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 the Journal. Price lists and complete data may be obtained from the Librarian.

THE AMERICAN MUSEUM JOURNAL

CONTENTS FOR MAY

MARY CYNTHIA DICKERSON, *Editor*

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

The Journal 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.

Photograph by Theodore Roosevelt

A FALLEN GROTESQUE GIANT OF THE AFRICAN PLAIN

Collected for purposes of scientific study in America.—Few persons realize the great labor and expense involved in the construction of the life groups of big game animals to be seen in the American Museum at New York, and the National Museum at Washington

The giraffe, in striking an enemy, uses not only the front feet but also the teeth of the lower jaw. Great size (the bull may stand 16 feet tall) and bright chestnut-red color make a reticulated giraffe especially conspicuous on the dry open plains or among the sparse thorn scrub where it lives, but it never tries to hide. It trusts to keen sight, wariness, and speed. I have seen it through the field glasses one mile off only to find it gazing steadily at me; and usually before the hunter, or its only other enemy, the lion, approaches to within three hundred yards, the giraffe has started away at a speed a galloping horse can scarcely equal. It may be that during drought the giraffe spends long periods on the dry plain far away from water. Investigation of the problem would be of value to biology. We were interested to find that this rare species (*Giraffa camelopardalis reticulata*) and the common giraffe, at the meeting of the two ranges, do not intergrade. The specimen shown here where it fell (Northern Guaso Nyiro, British East Africa) can now be seen in a stately mount at Washington

THE AMERICAN MUSEUM JOURNAL

VOLUME XVIII MAY, 1918 NUMBER 5

My Life as a Naturalist

WITH A PRESENTATION OF VARIOUS FIRST-HAND DATA ON THE LIFE HISTORIES AND HABITS OF THE BIG GAME ANIMALS OF AFRICA

By THEODORE ROOSEVELT

Illustrations of African big game from previously unpublished photographs by Kermit Roosevelt[1]

I AM asked to give an account of my interest in natural history, and my experience as an amateur naturalist. The former has always been very real; and the latter, unfortunately, very limited.

I don't suppose that most men can tell why their minds are attracted to certain studies any more than why their tastes are attracted by certain fruits. Certainly, I can no more explain why I like "natural history" than why I like California canned peaches; nor why I do not care for that enormous brand of natural history which deals with invertebrates any more than

[1] The JOURNAL is particularly glad of the privilege to publish this zoölogical photographic record, with its many portrait studies and views of the animals in their natural environments. The series is remarkable, especially when we consider that taking photographs was one of the least items of Kermit Roosevelt's work on the Smithsonian expedition. His main aim was to second his father in the work of collecting the game animals of Africa for the permanent collections of the United States National Museum. It is reported by his companions that on a long run or all-day tramp no member of the expedition, black or white, could quite keep up with him. He collected 216 types of game, outside of the small mammals; it was his indefatigable energy which secured species of highest scientific value,—and, therefore, the photographs of them also,—such as the sable antelope, bongo, and greater kudu. He collected the kudu on his twentieth birthday, having, while he was still nineteen, hunted and successfully encountered all the dangerous African big game—buffalo, rhinoceros, elephant, leopard, and lion.

The JOURNAL wishes to express gratitude to Charles Scribner's Sons for the use of certain cuts, particularly those on pages 326, 336 (topi), and front and back covers.—THE EDITOR.

why I do not care for brandied peaches. All I can say is that almost as soon as I began to read at all I began to like to read about the natural history of beasts and birds and the more formidable or interesting reptiles and fishes.

The fact that I speak of "natural history" instead of "biology," and use the former expression in a restricted sense, will show that I am a belated member of the generation that regarded Audubon with veneration, that accepted Waterton—Audubon's violent critic—as the ideal of the wandering naturalist, and that looked upon Brehm as a delightful but rather awesomely erudite example of advanced scientific thought. In the broader field, thank Heaven, I sat at the feet of Darwin and Huxley; and studied the large volumes in which Marsh's and Leidy's palæontological studies were embalmed, with a devotion that was usually attended by a dreary lack of reward—what would I not have given fifty years ago for a writer like Henry Fairfield Osborn, for some scientist who realized that intelligent laymen need a guide capable of building before their eyes the life that was, instead of merely cataloguing the fragments of the death that is.

Courtesy of the Macmillan Company

I was extremely nearsighted as a boy and could not see to make field observations, but I raised young gray squirrels, tamed a woodchuck, and made friends with a mother white-footed mouse

I was a very nearsighted small boy, and did not even know that my eyes were not normal until I was fourteen; and so my field studies up to that period were even more worthless than those of the average boy who "collects" natural history specimens much as he collects stamps. I studied books industriously but nature only so far as could be compassed by a molelike vision; my triumphs consisted in such things as bringing home and raising—by the aid of milk and a syringe—a family of very young gray squirrels, in fruitlessly endeavoring to tame an excessively unamiable woodchuck, and in making friends with a gentle, pretty, trustful white-footed mouse which reared her family in an empty flower pot. In order to attract my attention birds had to be as conspicuous as bobolinks or else had to perform feats such as I remember the barn swallows of my neighborhood once performed, when they assembled for the migration alongside our house and because of some freak of bewilderment swarmed in through the windows and clung helplessly to the curtains, the furniture, and even to our clothes.

Just before my fourteenth birthday my father—then a trustee of the American Museum of Natural History—started me on my rather mothlike career as a naturalist by giving me a pair of spectacles, a French pin-fire double-barreled shotgun—and lessons in stuffing birds. The spectacles literally opened a new world to me. The mechanism of the pin-fire gun was without springs and therefore could not get out of order—an important point, as my mechanical ability was nil. The lessons in stuffing and mounting birds were given me by Mr. John G. Bell, a professional taxidermist and collector who had accompanied Audubon on his trip to the then "Far West." Mr. Bell

Courtesy of the Macmillan Company

THEODORE ROOSEVELT, MY FATHER, TRUSTEE OF THE AMERICAN MUSEUM OF NATURAL HISTORY FROM 1869 TO 1878

My father was interested in natural history through his connection, as trustee, with the American Museum, and when he became aware of my liking for birds and animals he encouraged my bent in that direction. It was when I was about fourteen that he noted my nearsightedness. His gift of a pair of spectacles opened up a whole new world to me.

"My father, Theodore Roosevelt, was the best man I ever knew. . . . He would not tolerate in his children selfishness or cruelty, idleness, cowardice, or untruthfulness. . . . With great love and patience, and the most understanding sympathy and consideration, he combined insistence on discipline. . . ."[1]

[1] *Theodore Roosevelt—An Autobiography.* The Macmillan Company, New York, 1913, p. 8.

was a very interesting man, an American of the before-the-war type. He was tall, straight as an Indian, with white hair and smooth-shaven clear-cut face; a dignified figure, always in a black frock coat. He had no scientific knowledge of birds or mammals; his interest lay merely in collecting and preparing them. He taught me as much as my limitations would allow of the art of preparing specimens for scientific use and of mounting them. Some examples of my wooden methods of mounting birds[1] are now in the American Museum: three different species of Egyptian plover, a snowy owl, and a couple of spruce grouse mounted on a shield with a passenger pigeon—the three latter killed in Maine during my college vacations.

With my spectacles, my pin-fire gun, and my clumsy industry in skinning "specimens," I passed the winter of '72–73 in Egypt and Palestine, being then fourteen years old. My collections showed nothing but enthusiasm on my part. I got no bird of any unusual scientific value. My observations were as valueless as my collections save on just one small point; and this point is of interest only as showing, not my own power of observation, but the ability of good men to fail to observe or record the seemingly self-evident.

On the Nile the only book dealing with Egyptian birds which I had with me was one by an English clergyman, a Mr. Smith, who at the end of his second volume gave a short list of the species he had shot, with some comments on their habits but without descriptions. On my way home through Europe I secured a good book of Egyptian ornithology by a Captain Shelley. Both books enumerated and commented on several species of chats—the Old World chats, of course, which have nothing in common with our queer warbler of the same name. Two of these chats were common along the edges of the desert. One species was a boldly pied black and white bird, the other was colored above much like the desert sand, so that when it crouched it was hard to see. I found that the strikingly conspicuous chat never tried to hide, was very much on the alert, and was sure to attract attention when a long way off; whereas the chat whose upper color harmonized with its surroundings usually sought to escape observation by crouching motionless. These facts were obvious even to a dull-sighted, not particularly observant boy; they were essential features in the comparison between and in the study of the life histories of the two birds. Yet neither of the two books in my possession so much as hinted at them.

I think it was my observation of these, and a few similar facts, which prevented my yielding to the craze that fifteen or twenty years ago became an obsession with certain otherwise good men—the belief that all animals were protectively colored when in their natural surroundings. That this simply wasn't true was shown by a moment's thought of these two chats; no rational man could doubt that one was revealingly and the other concealingly colored; and each was an example of what was true in thousands of other cases. Moreover, the incident showed the only, and very mild, merit which I ever developed as a "faunal naturalist." I never grew to have keen powers of observation. But whatever I did see I saw truly, and I was fairly apt to understand what it meant. In other words, I saw what was sufficiently obvious, and in such case did not usually misinterpret what I had seen. Certainly this does not entitle me to any particular credit, but the outstanding thing is that it does entitle me to

[1] Director F. A. Lucas, of the American Museum, reports to me that Colonel Roosevelt is too modest in this matter. The specimens are on exhibition in an alcove on the west side of the hall of birds, and compare favorably with the specimens in the adjoining cases which were mounted by the ordinary professional taxidermist of that time.—THE EDITOR.

some, even although of a negative kind; for the great majority of observers seem quite unable to see, to record, or to understand facts so obvious that they leap to the eye. My two ornithologists offered a case in point as regards the chats; and I shall shortly speak of one or two other cases, as, for example, the cougar and the saddle-backed lechwi.

After returning to this country and until I was halfway through college, I continued to observe and collect in the fashion of the ordinary boy who is interested in natural history. I made copious and valueless notes. As I said above, I did not see and observe very keenly; later it interested and rather chagrined me to find out how much more C. Hart Merriam and John Burroughs saw when I went out with them near Washington or in the Yellowstone Park; or how much more George K. Cherrie and Leo E. Miller and Edmund Heller and Edgar A. Mearns and my own son Kermit saw in Africa and South America, on the trips I took to the Nyanza lakes and across the Brazilian hinterland.

During the years when as a boy I "collected specimens" at Oyster Bay or in the north woods, my contributions to original research were of minimum worth—they were limited to occasional records of such birds as the dominica warbler at Oyster Bay, or to seeing a duck hawk work havoc in a loose gang of night herons, or to noting the bloodthirsty conduct of a captive mole shrew—I think I sent an account of the last incident to C. Hart Merriam. I occasionally sent to some small ornithological publication a local list of Adirondack birds or something of the sort; and then proudly kept reprinted copies of the list on my desk until they grew dog-eared and then disappeared. I lived in a region zoölogically so well known that the obvious facts had all been set forth already, and as I lacked the power to find out the things that were not obvious, my work merely paralleled the similar work of hundreds of other young collectors who had a very good time but who made no particular addition to the sum of human knowledge.

Among my boy friends who cared for ornithology was a fine and manly

We found that the gerenuk (*Lithocranius walleri*, specimen from the Northern Guaso Nyiro), a small, long-necked antelope (the natives call it "little camel" or "little giraffe"), has habits different from other African antelopes. It rises on its hind legs to browse from the thorn trees, and when alarmed skulks away or hides with its neck stretched out on the ground. It is the only African game animal about which we gained no proof whatever that it ever drinks—and it lives under almost desert conditions. The gerenuk is rare in British East Africa and so extremely wild and wary that it was with difficulty any specimens were collected young fellow, Fred Osborn, the brother of Henry Fairfield Osborn. He was drowned, in his gallant youth, forty years ago; but he comes as vividly before my eyes now as if he were still alive. One cold and snowy winter I spent a day with him at his father's house at Garrison-on-the-Hudson. Numerous northern birds, which in our eyes were notable rarities, had come down with the hard weather. I spied a flock of crossbills in a pine, fired, and excitedly rushed forward. A twig caught my spectacles and snapped them I knew not where. But dim though my vision was, I could still make out the red birds lying on the snow: and to me they were treasures of such importance that I abandoned all thought of my glasses and began a nearsighted hunt for my quarry. By the time I had picked up the last crossbill I found that I had lost all trace of my glasses: my day's sport—or scientific endeavor, whatever you choose to call it—came to an abrupt end; and as a result of the lesson I never again in my life went out shooting, whether after sparrows or elephants, without a spare pair of spectacles in my pocket. After some ranch experiences I had my spectacle cases made of steel; and it was one of these steel spectacle cases which saved my life in after years when a man shot into me in Milwaukee.

While in Harvard I was among those who joined in forming the Nuttall Club, which I believe afterward became one of the parent sources of the American Ornithologists' Union.

The Harvard of that day was passing through a phase of biological study which was shaped by the belief that German university methods were the only ones worthy of copy, and also by the proper admiration for the younger Agassiz, whose interest was mainly in the lower forms of marine life. Accordingly it was the accepted doctrine that a biologist—the word "naturalist" was eschewed as archaic—was to work toward the ideal of becoming a section-cutter of tissue, who spent his time studying this tissue, and low marine organisms, under the microscope. Such work was excellent; but it covered a very small part of the biological field; and not only was there no encourage-

Courtesy of Charles Scribner's Sons

A small handsome river antelope, the saddle-backed or Nile lechwi (*Onotragus megaceras*), collected at Lake No, White Nile, that at the left an abnormal adult male, lacking white saddle.—Many species of mammals have been collected and their skins and skeletons studied, and yet not one thing is known of their habits; whereas it is emphatically true that habits and life histories, as well as structure, may show true blood relationship. Through studying the habits[1] of this small antelope, for instance, it was possible to point out its nearest of kin, the lechwi of the Zambezi—and on examination of its structure the discovery was corroborated. The species has been well known for fifty years but confused with the water bucks and kobs

[1] See Roosevelt and Heller's *Life Histories of African Game Animals*, Charles Scribner's Sons, Vol. II, pp. 519–527.

AN AMERICAN FAUNAL NATURALIST

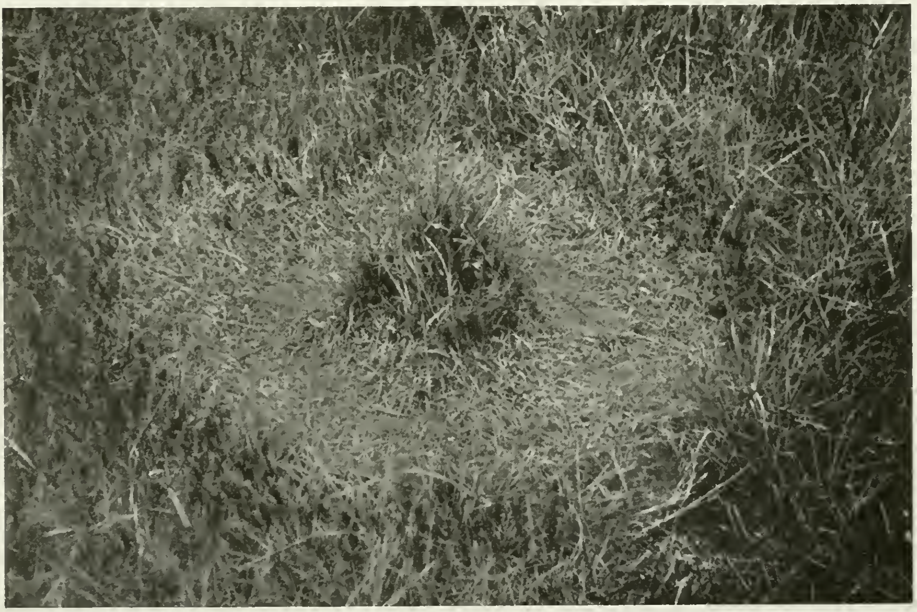
Photographed by Kermit Roosevelt in British East Africa

The smallest first-hand observation of the life of any species of big game is of more value than any trophy. Of fundamental importance are all honest observations of the habits and life histories of animals, with interpretation along such lines as their geographical distribution, blood relationship, life relations to one another, and future with reference to civilization. To open up to the world knowledge of our fauna, answering questions of its place on the earth, what can be our pleasure from it and is our duty toward it, is worthy the serious life effort of any man.

Thirty years ago we gave little thought to the life and beauty of animals: we had not reached an adequate psychical development. But we have been awakening rapidly. The British Government especially has obtained results in protection. In East Africa her game preserves may well be called a "naturalist's wonderland," and under her game laws of a decade or longer, the fauna has not been allowed to diminish. (*"He loved the great game as if he were their father."*—ANGLO SAXON CHRONICLE)

A whydah bird on the papyrus.—I was interested in the wealth of bird life in British East Africa, especially in the strange appearance and habits of the whydah finches. During the breeding season of this species of the Kamiti River, the female remains dull-colored and short-tailed, but the male takes on a shining dark color, with tail feathers more than twice the length of the rest of the bird, and curled at the tips. (The heavy tail is a distinct handicap in flying.)

The time of the mere zoölogical collector is past; every man in the field from now on should become a trustworthy observer and recorder of natural history facts. The work of the camera is more valuable than that of the rifle, but most valuable of all is observation of the life histories and habits of the creatures of the wilderness



The whydah bird's dance ring.—The grassland next the papyrus swamp for one and one half miles along the Kamiti River was everywhere dotted with dance rings. In the early morning and evening the dark-colored male birds were to be seen in the grass, continually bouncing two feet into air, wings spread, tail hanging down, and dropping stiffly back again,—up and down, up and down, as they slowly danced around the rings. The whydahs make the dance rings (about two feet in diameter) by snipping off the long grass at the roots, leaving a central tuft ment for the work of the field naturalist, the faunal naturalist, but this work was positively discouraged, and was treated as of negligible value. The effect of this attitude, common at that time to all our colleges, was detrimental to one very important side of natural history research. The admirable work of the microscopist had no attraction for me, nor was I fitted for it: I grew even more interested in other forms of work than in the work of a faunal naturalist; and I abandoned all thought of making the study of my science my life interest.

But I never lost a real interest in natural history; and I very keenly regret that at certain times I did not display this interest in more practical fashion. Thus, for the dozen years beginning with 1883, I spent much of my time on the Little Missouri, where big game was then plentiful. Most big game hunters never learn anything about the game except how to kill it; and most naturalists never observe it at all. Therefore a large amount of important and rather obvious facts remains unobserved or inaccurately observed until the species becomes extinct. What is most needed is not the ability to see what very few people can see, but to see what almost anybody can see, but nobody takes the trouble to look at. But I vaguely supposed that the obvious facts were known; and I let most of the opportunities pass by. Even so, many of my observations on the life histories of the bighorns, white goats, prongbucks, deer, and wapiti, and occasional observations on some of the other beasts, such as black-footed ferrets, were of value; indeed as regards some of the big game beasts, the accounts in *Hunting Trips of a Ranchman, Ranch Life and the Hunting Trail,* and *The Wilderness Hunter* gave a good deal of information which, as far as I know, is not to be found elsewhere.

To illustrate what I mean as "obvious" facts which nevertheless are of real value I shall instance the cougar. In the winter of 1910 I made a cougar hunt with hounds, spending about five weeks in the mountains of northwestern Colorado. At that time the cougar had been seemingly well known to hunters, settlers, naturalists, and novelists for more than a century; and yet it was actually impossible to get trustworthy testimony on such elementary points as, for instance, whether the male and female mated permanently, or at least until the young were reared (like foxes and wolves), and whether the animal caught its prey by rambling and stalking or, as was frequently asserted, by lying in wait on the branches of a tree. The facts I saw and observed during our five weeks' hunt in the snow were obvious; they needed only the simplest powers of observation and of deduction from observation. But nobody had hitherto shown or exercised these simple powers! My narrative in the volume *Outdoor Pastimes of an American Hunter* gave the first reasonably full and trustworthy life history of the cougar as regards its most essential details—for Merriam's capital Adirondack study had dealt with the species when it was too near the vanishing point and therefore when the conditions were too abnormal for some of these essential details to be observed.

In South America I made observations of a certain value on some of the strange creatures we met, and these are to be found in the volume *Through the Brazilian Wilderness;* but the trip was primarily one of exploration. In Africa, however, we really did some good work in natural history. Many of my observations were set forth in my book *African Game Trails;* and I have always felt that the book which Edmund Heller and I jointly wrote, the *Life Histories of African Game Animals,* was a serious and worth-while contribution to science. Here again, this contribution, so far as I was concerned, consisted chiefly in seeing, recording, and interpreting facts which were really obvious, but to which observers hitherto had been blind, or which they had misinterpreted partly because sportsmen seemed incapable of seeing anything except as a trophy, partly because stay-at-home systematists never saw anything at all except skins and skulls which enabled them to give Latin names to new "species" or "subspecies," partly because collectors had collected birds and beasts in precisely the spirit in which other collectors assembled postage stamps.

I shall give a few instances. In mid-Africa we came across a peculiar bat, with a greenish body and slate blue wings. Specimens of this bat had often been collected. But I could find no record of its really interesting habits. It was not nocturnal; it was hardly even crepuscular. It hung from the twigs of trees during the day and its activities began rather early in the afternoon. It did not fly continuously in swallow fashion, according to the usual bat custom. It behaved like a phœbe or other flycatcher. It hung from a twig until it saw an insect, then swooped down, caught the insect, and at once returned to the same or another twig—just as a phœbe or peewee or kingbird returns to its perch after a similar flight.

On the White Nile I hunted a kind of handsome river antelope, the white-withered or saddle-backed lechwi. It had been known for fifty years to trophy-seeking sportsmen, and to closet naturalists, some of whom had called it a kob and others a water buck. Its nearest kinsman was in reality the ordinary lechwi, which dwelt far off to the south, along the Zambezi. But during that half century no hunter or closet naturalist had grasped this obvious fact. I had never seen the Zambezi lechwi, but I had carefully read the account of its habits by Selous—a real hunter-naturalist, faunal naturalist. As soon as I came across the White Nile river bucks, and observed their habits, I said to my companions that they were undoubtedly lechwis; I wrote this to Selous, and to another English hunter-naturalist, Migand; and even a slight examination of the heads and skins when compared with those of the other lechwi and of the kobs and water bucks proved that I was right.

A larger, but equally obvious group of facts was that connected with concealing and revealing coloration. As eminent a naturalist as Wallace, and innumerable men of less note, had indulged in every conceivable vagary of speculative theory on the subject, largely based on supposed correlation between the habits and the shape or color patterns of big animals which, as a matter of fact, they had never seen in a state of nature. While in Africa I studied the question in the field, observing countless individuals of big beasts and birds, and comparing the results with what I had observed of the big game and the birds of North America (the result being borne out by what I later observed in South America). In a special chapter of the *Life Histories of African Game Animals,* as well as in a special number of the *American Museum Bulletin,*[1] I set forth the facts thus observed and the conclusions inevitably to be deduced from them. All that I thus set forth, and all the conclusions I deduced, belonged to the obvious; but that there was need of thus setting forth the obvious was sufficiently shown by the simple fact that large numbers of persons refused to accept it even when set forth.

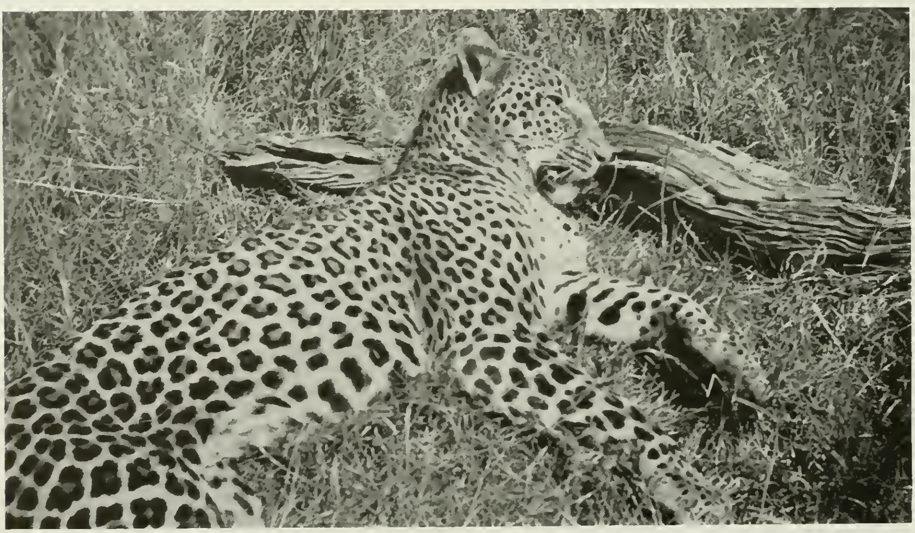
I do not think there is much else for me to say about my anything but important work as a naturalist. But perhaps I may say further that while my interest in natural history has added very little to my sum of achievement, it has added immeasurably to my sum of enjoyment in life.

[1] Revealing and Concealing Coloration in Birds and Mammals, *Bulletin of the American Museum of Natural History,* Vol. XXX, Art. VIII, pp. 119–231, Aug., 1911.

WATCHING THE SKINNING OF AN EAST AFRICAN LION

There is certainly no more splendid sight than the great-maned tawny lion galloping over the plain or facing its enemy for a mighty charge. And I think there can be no grander sound in nature than the full-lunged roaring of a band of lions. I consider the lion, however, the most dangerous of African big game, and for all the wilderness animals he is the "terror by night." Once in every five or six days he can dispose of a hartebeest or zebra. I happened upon several hundred lion kills. The dozen lions our expedition collected would have eaten seven or eight hundred head of the large harmless game in the year following. But lions continually take to man-eating also; in fact British East Africa still reminds one of the primitive world in which warfare with wild beasts was one of the chief features of ordinary existence. The cub lions (the same litter giving forth yellow or black-maned adults) remain in the spot where born for three or four weeks, then travel with the lioness, eating their fill at the kills. By the time they are six months old they begin to help; we found kills of zebra bitten all over by young lions. The lion is without doubt concealingly colored. Sometimes I could scarcely see the crouching form in the brown grass, to take aim. But his color cannot have been developed by natural selection for this use, because his success in hunting comes entirely without the aid of the "protective color"

A cheetah (*Acinonyx jubatus raineyi*) and its kill, the small steinbok antelope.—This beautiful member of the cat family is not so ferocious as the leopard, with not quite the same fury of attack, but it is the swiftest animal on earth for a half mile chase. Unlike the lion it does its hunting by day, also on the open plain—an interesting comparison with the lion from the standpoint of any real part played by coloration in the hunting by either species. The cheetah differs from the lion and leopard in having nonretractile claws like a greyhound



The leopard (East African, *Felis pardus suahelica*) depends on surprise and daring furious attack in getting its prey. We found the leopard everywhere in thorn scrub and open plains country where the lion lived. It often turns "man-eating." It carries off children and, despite its smaller size, will charge a man furiously, being more dangerous to limb than life, however

When the hippopotamus is swimming in deep water, only nostrils, eyes, and ears can be seen above the surface. The British Government has been obliged to modify the protective law that covered these great beasts for under protection they grow bold and come ashore at night to feed in the plantations—with appetites proportionately as large as their bodies

At work on a hippopotamus, to prepare its skin and skeleton for scientific use.—Before going to Africa I had no realization of the amount of labor it is, in a hot climate, to prepare large thick skins like those of the hippopotamus and rhinoceros for scientific purposes. And the handicap for a scientific expedition rests in the great number of men that must be taken along from camp to camp to carry the ponderously heavy skins and help in their preparation. Chosen natives were trained so that under supervision they could successfully remove a skin, but to insure success under the tropical sun, the work had to be done immediately after the specimen was shot. The equipment for the work is proportionately cumbersome and a problem for transportation; for instance, we used four tons of salt in curing skins in the field in British East Africa

Buffalo path through the deep ooze of

IN THE BUFFALO SWAMP AT LAKE NAIVASHA

Examining the fallen buffalo.—The herds of buffalo (*Synceros caffer radcliffei*) left cover to graze in the open in the morning and evening, sometimes in the middle of the day. I was impressed, however, in the case of all the species of game, with the great range of variation in habit in different localities and at different times, and concluded that many habits such as time of day for grazing and going to water were largely artificial and subject to change.

The African buffalo is one of the world's most dangerous big game. He is not likely to charge unprovoked, however, like the elephant, or even quickly when provoked, like the lion, but if he does turn to bay, his power and fury are more dangerous than even the charge of the lion. (I recall that on one buffalo hunt we were away from camp thirteen hours,

A reed cut from the swamp and held

THE ORYX ANTELOPE LIVES IN AFRICAN THORN SCRUB

The oryx is, on the whole, concealingly colored, although shining whitish in certain angles to the sun. In the mixed herds it was much less conspicuous than the zebras and faded out of sight at a distance more quickly than the hartebeests. Oryx meat is good eating; we sometimes used it for the expedition's table (the skin of almost every animal used as food was saved for scientific purposes).

There are more so-called "antelopes" in Africa than in any other part of the world, the largest in the world, like the eland, and the smallest, tiny pigmy antelopes no bigger than hares. The term antelope thus used, however, is of popular, not zoölogical, significance, and means merely hollow-horned ruminants (Bovidæ) which are not oxen, sheep, or goats. Antelopes differ so much that some are more like the buffalo or like sheep than they are like other antelopes.

Of all the African antelopes, the oldest, those with most primitive skull characters, are the oryx, sable, and roan (Egocerinæ).

The portrait, at the right, of the big handsome beisa oryx (*Oryx beisa annectens*), shows its rapier-like horns and striped face. The oryx is a bold fighter, not afraid to charge lion or man. It is especially friendly with the zebras and often wanders and grazes with them

THE SABLE AND ROAN ANTELOPES

The shy rare sable (*Egoceros niger roosevelti,* at the left) is considered, next to the greater kudu, the most beautiful antelope of the world. This specimen from the Shimba Hills has been made the type of a new subspecies named for Kermit who collected it. The sable of British East Africa has been little known to sportsmen or science. As in the case of the rare okapi of the Congo forest, its existence and distribution were guessed from specimens of its beautiful skin seen in the possession of natives. The species is very limited in numbers. It lives in the moist hilly country along the east coast from near Mombasa south to opposite Zanzibar Island. A second geographical race in the Zambezi region adjoins it at the south

The East African roan antelope (*Egoceros equinus langheldi,* in the center) is, next to the eland, the tallest antelope of the world. With the exception of the sable, it is the most savage of all antelopes and may make dangerous hunting. It occupies many kinds of environment and seems well adapted to each, but strangely, nevertheless, is dying out, while other antelopes rapidly multiply. The roan adds to the range of the sable a broken extension northward and westward to the Sahara, but it is plentiful only locally, if at all

EAST AFRICAN TOPI

The topi (*Damaliscus korrigum jimela,* collected on Loita Plains), while classified with the hartebeests (Bubalinæ), is an interesting connection between the oryx-sable-roan group and the more specialized hartebeests proper. The photograph shows one feature illustrating the intermediate position; that is, the horns grow separately instead of being united at the base. The topi is revealingly colored: cinnamon brown of high sheen, and darker below (inversely countershaded)

THE PICTURESQUE AND SOCIAL HARTEBEESTS

Hartebeests fairly swarm over the open plains of British East Africa, Coke's (*Bubalis cokei kongoni*, upper middle photograph) in the east, and in the west the larger Jackson's (*Bubalis lelwel jacksoni*, lower photograph and two portraits). Where we collected, hartebeests were three or four times as common as any other antelope. Their rich color, varying from dark brown to fox-red, makes them rather conspicuous on the plains but less so than the darker topi and wildebeest. (Hartebeests show affinity with the buffalo, through the wildebeest; also the several species of hartebeests are the only antelopes having horns united at the base.)

Many a time I have had the greatest pleasure watching herds at close range. By crouching close beside some thorn bush and remaining motionless, I would not be discovered by an approaching herd which would file past all unsuspicious—hartebeests, zebras, gazelles, even the wary wildebeests. The herds are more often mixed than not. There seems to have been developed in these great plains creatures some psychical need for companionship. They are not only gregarious but are socially inclined toward races other than their own. Possibly the genuine pleasure they now take in fellowship began because of similarity of habit and a sense of greater security against surprise by the lion through multiplied watchfulness. However the habit has grown, today many kinds of antelopes—the oryx, roan, wildebeest, topi, hartebeest, eland, water bucks, gazelles—in ever changing combinations wander the trails contentedly together, with zebras mixing freely among them

THE WILDEBEEST—OF A WILD-NATURED RACE

White-bearded wildebeest (*Gorgon albojubatus mearnsi*), male, Loita Plains, British East Africa.—He is classed with the antelopes but is close kin to the buffalo also. His continually repeated grunting bellow indicates that wildebeest temper is fiery, and attempts to domesticate him have only proved that he becomes dangerous with age, attacking human beings furiously. The bulls fight often among themselves, with resounding crashes of their horned heads. Wildebeests are the wariest of game and probably the speediest of African antelopes on the long run. Speed and wariness, however, cannot save them from the lion in the dark of night. He lies in wait or stalks them on the open plain, and in the many wildebeest kills I found. there was never any indication of even a struggle

DWELLERS IN VAST OPEN PLACES

Wildebeests live out on the wide plains where they can see great distances and any approach. They are the most conspicuous of the antelopes. They usually look black in the distance, but when headed away from the observer, their backs may appear white from the effect of the sunlight. If alarmed, wildebeests plunge and snort, wheel and gallop away, heads low, tails lashing, almost hidden in clouds of dust.

For countless ages the vast open spaces under the equator have been home to the wildebeests. As they graze, they follow the trails that cross and recross the plain. Some time each day they follow one or another deeply marked trail joined along the way by many other trails, all converging to some drinking place, where the ground has been worn bare by the pounding of hoofs. As I saw them at the drinking places, wildebeests were the most cautious of all game. They always went in the daytime, and if in a mixed herd, waited for the hartebeests or others to take the lead.

Each wildebeest herd has a limited range, perhaps three or four miles square. There is much interesting work to be done by field naturalists in finding out facts of big game migration. We do not know, for instance, all the causes that make wildebeests sometimes gather together thousands strong and travel long distances, or the conditions that enforce shifts in their range annually or at irregular times

THE GIANT ELAND OF THE EGYPTIAN SUDAN

The giant eland (*Taurotragus derbianus gigas*) is shy, rare, and difficult to collect. It is found only in this Nile country of the Egyptian Sudan and in a second small area westward two thousand miles on the Atlantic coast in Senegal—an instance of discontinuous distribution paralleled by the white rhinoceros. This species and the common eland are the largest antelopes of the world, attaining the size of an ox. The giant eland was named so from the great size of its horns, which it uses to break down high branches of trees to get the leaves. The group of antelopes (Tragelaphinæ) containing the eland, unlike the topi-hartebeest-wildebeest group, consists of closely related species, all having, for instance, not only similar twisted horns but also even the same color pattern. The species are separated mainly by relative closeness of twist of the horns and presence or absence of horns in the female, into bushbuck and sitatunga, greater and lesser kudu, and bongo and eland.

DOMESTICATED YOUNG MALE, AND A CALF, OF THE COMMON ELAND

This young East African eland (*Taurotragus oryx pattersonianus*, at the left) was tethered here and there to graze at Meru Station, Mt. Kenia. A full grown eland is a king of antelopes, stately, heavy-bodied, so large that at some distance away in sparse brush it may be mistaken for a rhinoceros. The species is easily tamed, is unusually mild-tempered, and a grass eater: it should be domesticated on a large scale not only in Africa but also transported for the purpose to America. Even in its wild state, I found a herd as easily rounded up as a herd of cattle on our Western Plains. One is greatly surprised, however, at the eland's agility in leaping, even high over its companions' backs, as the herd starts running. The flesh is particularly good, better than that of any other African antelope. We collected a series of this species at the Guaso Nyiro for the construction of a group in the National Museum

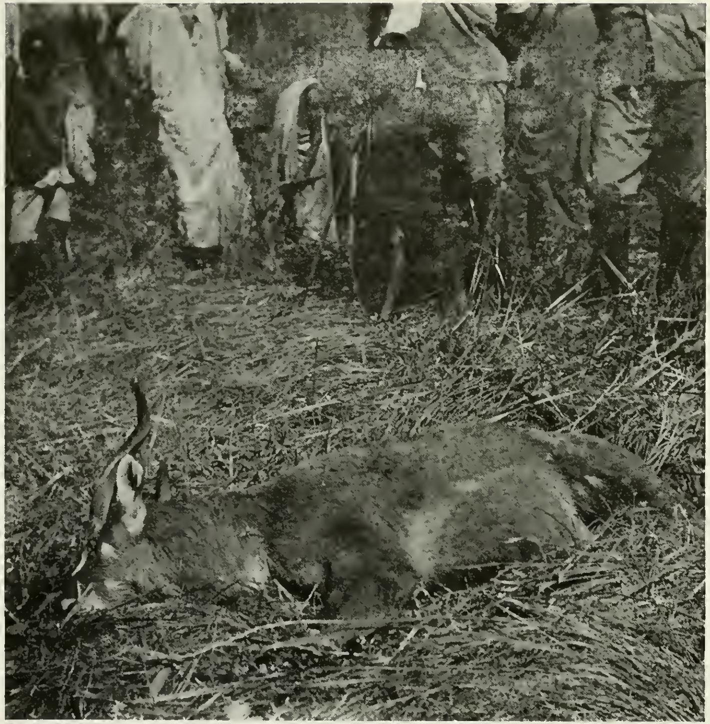
THE GREATER KUDU

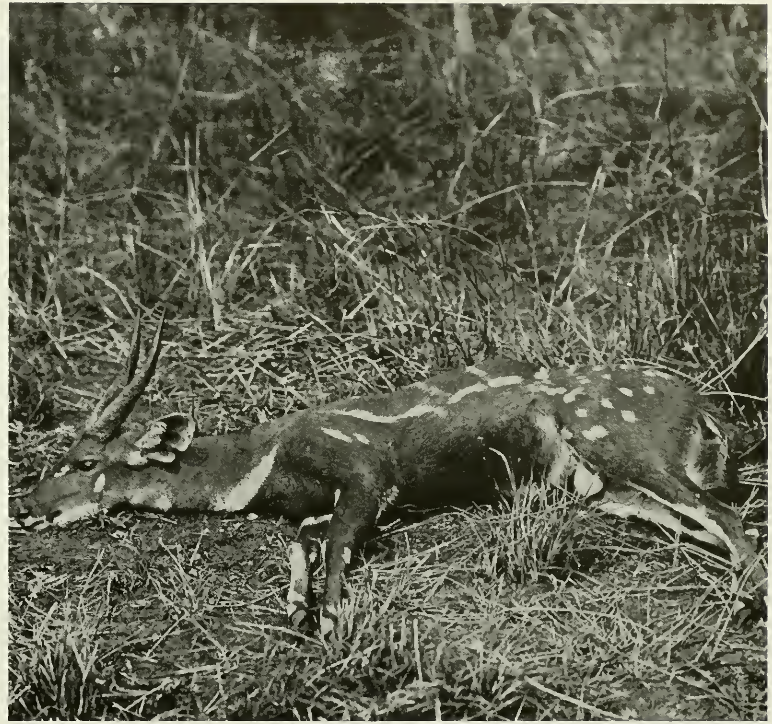
A female East African kudu (lacking the throat mane and the horns of the male), a distinct subspecies (*Strepsiceros strepsiceros bea*).—This specimen was used instead of the male as the type, because before it was described the male had been mounted in the National Museum. Collected by Kermit Roosevelt, on the escarpment east of Lake Baringo, after three days of the hardest labor

East African greater kudu horns measuring forty-seven inches along the curve.—The shy greater kudu, with its spiral horns, its striped coat, and graceful body lines, is considered the most beautiful antelope of the world. Kermit gave ten days' steady work to collecting the specimen that bore these horns, together with the female above. The species inhabits steep rocky hills where it feeds on the grass that grows among the thorn scrub and cactus. Because of its isolation in this type of country which occurs in Africa in small and scattered areas only, the distribution of the species is discontinuous and local

HORNS OF THE BONGO DISPLAYED BY 'NDOROBO HUNTER

In wet dark forests (Mau Escarpment, Uasin Gishu) six thousand feet above sea level, the elusive bongo follows its trails, hunted by the 'Ndorobo natives and the forest leopard. We may consider this antelope (*Boocercus eurycerus isaaci*) a highland representative of the eland. Both male and female bear the long sharp horns with which it is said they break down high branches to browse on the leaves. The color is bright chestnut with a dozen conspicuous white stripes across the back. Specimens for a United States National Museum group were shot by Kermit after five days' hunting through the almost impenetrable forest. The distribution of the species is as remarkable as that of the giant eland—it occurs only in the small area in British East Africa (from Mau Escarpment east to Mt. Kenia) and far over on the west coast along the Gulf of Guinea. Fewer than a half dozen white men have ever seen the bongo in its native haunt





SITATUNGA AND BUSHBUCK—MEDIUM-SIZED, BUT FIERCE FIGHTERS

The sitatunga (*Limnotragus spekei*, left figure, collected at Kampala) is rare and exceedingly shy. Very few have ever seen it. It differs from the bushbuck (right figure) in the less close spiral of the horns, the smaller ears, more shaggy hair, in a less pronounced color pattern, and most important and what does not show in the photograph, longer hoofs. These lengthened hoofs are an adaptation for traveling over the swampy ground. The sitatunga is the most water-loving of all the antelopes, sometimes frequenting even papyrus swamps where the water stands waist high on a man.

The bushbuck (*Tragelaphus scriptus bor*, right figure, collected on the 'Nzoia River, Nile Valley) is revealingly colored in a beautiful red, white-harnessed coat. It is a little larger than the sitatunga, about the size of our white-tailed deer. It is solitary in habit and most successfully hides, or skulks through its cover whether the dense forest in which we found it in East Africa, or the bush country of the Nile Valley. The bushbuck is of small size yet one of the most wicked fighters among the antelopes—an interesting fact when we consider that the closely related larger-sized eland and kudu are gentle-natured. (There are numerous geographical races differing in color and distinctness of the white harness)

WATER BUCKS AT HOME IN THIN WOODS BY THE RIVER

Water bucks are not particularly water-loving, although sometimes found in swampy land; they usually browse or graze in bush country or even open country, frequently joining the hartebeest herds.

The early morning time about our camps always had peculiar charm for me. There was usually much bird music. Perhaps there were tiny dik-dik antelopes which would run through the grass like rabbits. Once I found a wee hedgehog which cuddled snugly into my hand, snuffing with its funny little nose; I could not bear to sacrifice it even for science, so let it go. There were funny little long-snouted "elephant" shrews, and pretty "zebra" mice. We found more than one seven-foot cobra.

I gave many days to purely observation trips, often getting away by dawn. One day I had an opportunity to study the great nervous caution and wariness of a bull and four cow water bucks as one by one they drank. When I had seen them coming toward the bank of the river opposite me, I had lain down in the trail, my clothes matching it in color. They did not discover me although only fifty yards away across the stream. Another day a herd of this same wild water buck stood and stared tamely at me as I walked past. I had long before concluded, however, that many such striking differences in degree of wildness displayed by game at different times were individual, or characteristic of given herds, and not of specific significance. At noon I would lunch under the shelter of some large thorn tree, and study through my field glasses or telescope the game grazing or standing at rest in the heat haze a few hundred yards off. I could not but think what a multitude of joys and tragedies in the life of this great wilderness the tree had witnessed during the centuries it had been standing on the plain.

There are two species of water buck. The common, lacking the white rump, we found in eastern British East Africa, the defassa, as we went westward. The flesh of the water buck is poor eating

PORTRAIT OF DEFASSA OR WHITE-RUMPED WATER BUCK

Here is a big antelope (*Kobus defassa*) with lordly bearing which, although living nearly under the equator, has its bright reddish coat as long and shaggy as some great northern stag. Albino water bucks are not infrequently seen. At any given time we found water buck cows with calves of different ages, and believe that this species has no especial breeding time—a condition which seems to be true of most of the equatorial big game. Water bucks are closely related to the kobs, lechwis, and reedbucks (Kobinæ)

"TOMMIES"—ADULT MALE, AND FAWN, PET OF SETTLER'S BOY

Bands of Tommies, or Thompson's gazelles (*Gazella thompsoni*), live on the open plains, often mingling with the herds of hartebeests and zebra. Young Tommies are easily tamed. We found that many of the children of the Boer settlers had them about the houses. The contrasting black and white on the flanks of this gazelle (both sexes, young and adult) make it revealingly colored on the plain. A Tommy fawn, like the young of all antelopes and of most mammals, will crouch for protection from an enemy, but no adult Tommy ever tries to hide or skulk; he relies entirely on his vigilance and fleetness for escape. Unfortunately this fleetness does not save him from the cheetah, which is swifter in the race; but fortunately, on the other hand, his small size keeps him from being tempting prey to the lion.

All the large antelopes of Africa are kept on the alert by the lion and leopard and by crocodiles; and the gazelles and many kinds of small antelopes, by the cheetah, hyenas, and wild hunting hounds. It is fortunate that through frequent occurrence dread as an acute terror has become short-lived and that there is immediate rebound to the joy of living until the next alarm occurs. Life for all these antelopes is cruel. The normal ending for the most stately, most abounding in vitality, is death by violence.

(Grant's gazelle (*Gazella granti*) closely resembles Thompson's gazelle but is three times as large, somewhat exceeding the size of our white-tailed deer. This species is the most beautiful of all the gazelles)

FAWN THAT ADOPTED KERMIT ONE DAY ON THE GUASO NYIRO RIVER, AND A FALLEN IMPALLA BUCK

In the group with the gazelles (Antilopinæ) is the impalla (*Æpyceros melampus suara*), also about the size of our white-tailed deer. Personally I found the impalla a very great delight to the eye, with its ringed and spiral horns, its satin red and white coat, its extreme beauty of outline, and grace of movement. When the impalla in a herd are alarmed, they all bound into air and over one another and tall bushes with the lightness of birds. Impalla inhabit the thinly wooded areas along the rivers, like the water buck, and like it may wander out on the open plain in the cool of morning and evening.

Fights are of frequent occurrence between impalla bucks. The buck of the photograph at the right (impalla collected by Kermit at Lake Hannington) was carrying imbedded in its shoulder a ten-inch broken off end of the horn of a recent antagonist. This is visible in the photograph, the broken end showing hollow just in front of the base of the ear. The leopard probably takes the largest toll of this species. We found the hoofs of an impalla in a crocodile shot by Kermit (together with the claws of a cheetah and the large bones of an eland). I observed that impalla were especially wary at the drinking places, perhaps drinking from some shallow spot only, because of their fear of crocodiles

"BLACK" OR HOOK-LIPPED RHINOCEROS

I could see the rhinoceros (*Diceros bicornis bicornis*) miles away. He will always be among my African memories, as he stood alone, with the sunlight and the terrific heat about him, in the empty plain. The monstrous beast is what he

looks to be, a survival from the world's past. But something has evidently caused a retrogression in his brain power. We found him the stupidest of the big game. The routine of his days is simple: moving to a near drinking place, browsing the leaves and twigs of low bushes, sleeping during the noon hours, responding confusedly to unusual odors or sounds (he is very dull of sight). I think the rhinoceros the least dangerous of the four dangerous big game animals of Africa. Any given individual must be watched carefully, however, for his bewilderment may develop into temper and a prodigious charge. One of our porters was tossed and gored. Hook-lipped rhinoceroses are relatively plentiful—in the lonely wastes, never about the plantations. We saw perhaps two or three hundred altogether in British East Africa

"WHITE" OR SQUARE-MOUTHED RHINOCEROS

Cow in the shadow of the tree, calf lying down in the sun.—We found this rhinoceros (*Ceratotherium simum cottoni*) in the Nile Valley (Lado Enclave) and saw about fifty individuals altogether. It presents a strange case of discontinuous distribution, never having been reported during historic times from the eleven-hundred-mile stretch of country between the Zambezi at the south and this Nile Valley at the north. In very recent years it has become extinct in the Zambezi region, except for a few individuals in one game preserve. The species is not so solitary and not so irritable as the black or hook-lipped rhinoceros. It is purely a grazer

THE BONTE QUAGGA OR COMMON ZEBRA

The bonte quagga (*Equus quagga*) is the noisiest of big game, barking like a shrill-voiced dog (qua-ha! qua-ha!). In many localities the common zebra makes the staple food supply of the lion. I saw very many kills of zebra, the neck dislocated in most instances. The herds are always on the alert, especially at night, and their fear brings many unnecessary moments of terror and stampede, in addition to those of real tragedy. Zebras with hartebeests are likely to be most abundant of all game on the African plains and, with the exception of wildebeest and topi, are most easily seen, the sunlight bringing out the contrasting stripes in bold relief against the parched grass. The stripes vanish at three hundred yards, leaving a coat of flashing white in certain angles to the sun

THE GRÉVY ZEBRA

This larger species (*Dolichohippus grevyi*) associates with the common zebra where the ranges of the two overlap, but without hybridization. The grévy has a peculiar screaming whinny, very unlike the barking call of the common species. We saw grévy zebras only in the desert lands along the Northern Guaso Nyiro River. Here they mingle with herds of oryx as well as with the smaller zebra, the three showing similar habits in grazing, drinking, and resting. The stallions fight viciously with hoof and jaw.

Long lines of brilliant-coated zebras would stand and gaze at me, or file past perhaps so close that I could see the ripple of the muscles under the gleaming skin. They were always so beautiful that it was a pleasure to watch them and not easy to shoot even the necessary specimens for scientific purposes and the expedition's table (the porters liked the rather rank meat)

A small herd of elephant cows among mimosa trees and tall grass near the 'Nzoia River.—It was from this herd that I shot the two cows for the American Museum. This monarch of big game animals has a highly developed emotional and intellectual nature through coördination with the trunk. As I watched the herd test and move objects, gather small leaves and berries and eat them, guide and fondle the calves, I realized as not before the handlike value of this trunk. The sense of touch is at least equal to that of the hand of the higher apes. Elephants are not limited to the experiences of a single habitat. They wander much and far and are at home in all sorts of country. It was good to find out that a lion will flee from an elephant as fast as his legs will carry him

Ivory hunters have very nearly killed out the elephant in Africa except in out of the way places. Fortunately the species is now under protection. In British East Africa no cows can be shot except to safeguard life and property, and no bull with ivory weighing less than thirty pounds a tusk. That the great beast might be represented in our American scientific institutions for generations to come, we brought the two to the American Museum, and one to the University of California, in addition to those for a group at the National Museum. (To be fit for scientific use a skin had to be removed at once, and its preparation required ten days' steady work)

Heredity, Environment, and Civilization

ATTITUDE OF THE ANTHROPOLOGIST TOWARD EACH.—WORK IN HIS OWN ESPECIAL FIELD TRACES BACK THE HISTORY OF MAN CULTURALLY AND PSYCHOLOGICALLY AS RESPONSE TO CIVILIZATION

Extracts from an address on factors controlling human behavior as illustrated by the natives of the southwestern United States[1]

By A. L. KROEBER

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THE first of the several factors through which it is logically possible to explain the life and conduct and customs of the Indians of the Southwest is that of race or heredity, in other words, the inherited tendencies—physical and psychical, bodily and mental—which the people that carry these customs have or might have. The general attitude of anthropologists, at least those that are primarily concerned with modes of life, toward this factor of race or heredity as explanatory of the practices or conduct of peoples, is distinctly negative. At first sight it seems as if this element could not be left out of consideration. We know that peoples differ in inherited characteristics of body—complexion, features, hair, eye color, size, head-form, and the like. Theoretically, these bodily inherited peculiarities ought to be accompanied by mentally inherited traits: such as greater or less inclination to courage, energy, power of abstract thought, mechanical ingenuity, musical or æsthetic proclivities, swift reactions, concentrating ability, gift of expression. These racial mental traits, again, theoretically should be expressed not only in the conduct but also in the customs and culture of each people. Races born to a greater activity of the mechanical faculties should possess more and higher inventions, those innately gifted in the direction of music should develop more melodious songs, and so on.

Yet ethnologists rather consistently refuse to fall back on such explanations. When it comes to using heredity as a cause in the interpretation of human institutions or national attainments, their reaction is literally an aloof one. I think I can speak for at least a majority of my colleagues on this point. What they do unanimously hold is that if there are such hereditary differences between human groups we have not yet been able to determine them. We must assume racial differences, and we know that there are also great differences in culture; but we cannot yet in any particular case prove the connection between them. We cannot yet say that heredity is the specific cause of this accomplishment, of this point of view, or of this mode of life. We cannot say that heredity is the determining factor to such and such degree of such and such customs.

I should like not to be misunderstood here. I do not deny that there is every probability that such inborn differences exist between many of the races. The point I am making is that we have as

[1] Delivered before the New York Academy of Sciences, at the American Museum of Natural History, April 22, 1918. This was the culminating lecture of a monthly series before the New York Academy of Sciences, all treating some phase of anthropological problems in the southwestern United States. The other lectures were: "Cultural Problems of the Southwest," by Clark Wissler; "Archæology of the Southwest," by N. C. Nelson; "The Excavation of the Aztec Ruin," by Earl H. Morris.

yet found no way of telling what is and what is not due to the heredity factor. The problem of science in general is to tie up one cause or factor with certain effects. The problem in the present case is to tie up definitely the specific race factor with specific phenomena of culture or group conduct, such as settled life, architecture in stone, religious symbolism, and the like; to be able to say so much of this symbolic expression is instinctive in the race and so much of it is the result of other influences. That is precisely what we cannot do: nor has anyone yet been able to find a method which he can honestly affirm will enable us to do it. This is a great pity. But I think you will agree that under the circumstances a clean scientific conscience does not allow us to do anything but to adhere to our negative attitude. When we do not know, the best thing is to say we do not know, in science as in business and in personal relations; when we are baffled, to admit we are baffled.

We anthropologists do feel that the greatest contribution we can make at present to an understanding of this factor of race is to work with the other factors with which we can deal specifically, and to push those other factors as far as we can in analyzing the phenomena of group conduct or culture. Meanwhile students in other branches of science—biology and psychology—can operate with this factor of heredity, which is more directly amenable to their techniques. Then when both they and we have made some progress, and the unknown quantities are proportionately reduced, we may be able to begin to connect the two sets of studies.

For instance, when we try to apply to the mode of life which we know these Indians of the Southwest to have had, such biological or racial facts as are at our command, we find that physical anthropologists, classifying peoples into long-headed and short-headed types, encounter both among the Southwestern Indians. They have discovered that long-headed peoples occur among some of the settled Pueblos and also among some of the nomadic tribes; and round-headed groups are also found among the settled and nomadic tribes. The Pueblo Taos and non-Pueblo Pima are both long-headed, the Pueblo Zuñi and non-Pueblo Apache both broad-headed. Clearly, if the shape of the head has anything to do with the culture or mode of life of any of these peoples, the data that we possess fail to prove it. If there is any racial or hereditary reason for the differences in the mode of life, the reason is certainly a very much more subtle one than anyone has yet been able to establish.

So when we take up any other physical traits in regard to which we have information: results simply do not emerge. Dr. Hrdlička found in a considerable number of cases, almost universally, in fact, that the pulse rate of Indians was about ten beats per minute less than that of white people—about sixty instead of seventy. While we do not know the specific cause of this phenomenon, it does seem to be hereditary. And to me it seems quite inconceivable that the physiological workings of two groups of people like Indians and Caucasians could differ so greatly without there being some reflex in their mental habits. Yet there are nomadic tribes such as the Apache that are renowned for their warlike habits, who lived as it were by fighting, and, on the other hand, there are the Zuñi who are famous for their timidity and gentleness; and the pulse rates of such divergent tribes are the same. If slow pulse made for gentleness, as might be supposed, then we have the fact that the aggressive Apache has the identical pulse as the pacific Zuñi. The conclusion that we must draw is that whatever the hereditary basis may be for the difference between ourselves and the Indian, it is an exceedingly intricate one, because we find all types of behavior both among the slow-pulsed Indians and among the rapid-pulsed Caucasians.

When we come to the second factor by which we might theoretically explain culture—the factor of physical environment or geography—our knowledge is not very much greater. You have probably all come across the type of Greek history which begins by giving a picture of the country—the dotted islands, blue skies, rocky headlands, and so forth—and in which the author then goes on to say something about how these gifts of nature molded Greek civilization—how Greek art is a reflection of the clear and serene atmosphere, Greek speculation the result of segregations and clashes enforced by the rugged nature of the land, and the like. Usually, I suppose, this is done because the authors feel it necessary not to start too bluntly on the thread of their story. But it is certainly a mere literary and thoroughly unscientific procedure. This is clear from the fact that each author wends his own sweet way with his explanations—letting his fancy roam through the meadow picking pretty flowers at will, as it were; and however pleasing his speculations, the next writer in that field does the same sort of thing all over again.

It is the same with the theorists who derive the culture of the Central American Maya, the civilization of China and India, the origin of Mohammedanism, from alternating cycles of arid and humid climate. Such phantasies are best met by the recognition that whoever wishes to take the trouble can easily devise any number of conflicting but equally plausible theories.

It is of course obvious that a primitive tribe under the equator would never invent the ice box, and that the Eskimo will not keep their food and water in buckets of bamboo, although we can feel sure that if the Eskimo had had bamboo carried to him by the ocean currents, he would have been both glad and able to use it. Certain materials and opportunities are provided by nature and are made use of by every people. Other materials are not provided, and certain particular customs therefore cannot be developed as they might otherwise be. But all this is only negative. Two nations have ice and one invents and the other does not invent the ice chest; two of them have both bamboo and clay, and one draws water in bamboo joints and the other in pots. Obviously, natural environment does impose certain *limiting conditions* on human life; but equally obviously, it does *not cause* inventions or institutions or progress of civilization.

We know a great many nations that have wood and sinew and flint and could make bows and arrows, but do not use them. They employ something else instead. Either their civilization has not advanced to the point where they know enough to manufacture the bow; or it has advanced so far that the bow is no longer of real utility, as among ourselves.

The determining factor then is not nature which gives or withholds the materials, but the general state of knowledge and technology and advancement of the group; in short, historical or cultural causes and not environmental causes.

The greater part of the Southwest is arid. Fish are distinctly scarce. The result is that most of the tribes get little opportunity to fish. Now we also find that most of these Southwestern Indians will not eat fish; in fact, think them poisonous. So one might say: Nature does not furnish fish in abundance; therefore the Indians got out of the habit of eating them; and finally came to believe them poisonous. At first blush this may seem a plausible reason. But in other parts of the world fish are prized as a delicacy just because they are scarce, and people feel about them very much as we do about oysters.

Then, too, fish might gradually become more abundant, or some of these tribes might move to a place where there always were plenty of fish, so that they would be living in an environment which differed from that in which their customs were formed; and yet we find that often even then they adhere to their old customs in contradiction to the new or altered environment.

We have just such a case in the Jews. It is often said that the Jew's prohibition against eating pork and oysters and lobsters originated in hygienic considerations; that these were climatically unsafe foods for him in Palestine. It is likely that this explanation is more picturesque than true. Ancient Palestine was not a country in which hogs could be raised with economic profit, and so they were not raised; and the Philistine and Phœnician kept the Jew from the coast where alone he might have obtained shellfish. Eating neither food, he acquired an aversion for them; and having the aversion, he said to himself that it was dangerous and irreligious to run counter to the aversion—just like our Pueblo Indian; and ended up by announcing that the Lord had issued the prohibition. Surely this is taking us a long way from the starting point of natural environment. This environment may indeed be said to have furnished the first occasion; but the determining causes are of an entirely different kind—psychic or cultural, however we may want to call them. If any doubt remains, we need only look at the orthodox Jew of today in our country, where environment thrusts some of his tabooed foods at him as economically and hygienically satisfactory, and he still shudders at the thought of tasting them.

If this has happened among a civilized and intelligent people, the like must have occurred innumerable times among uncivilized tribes.

The invention of agriculture has often been associated with climatic factors. The first theory was that farming took its rise in the tropics, where agriculture came naturally. Only after people had acquired the habit and moved into other countries did they take their agriculture seriously on bringing it with them into these less favorable habitats. But it is just as easy to believe that the reverse happened. The attempt has actually been made to prove from the Southwest that it was the people of arid countries who invented agriculture, necessity driving them to it through shortage of natural supplies. McGee[1] has argued elaborately for this view on the basis of conditions among the Papago of Arizona and the Seri of Sonora.

Now it is plain that mere guessing is distinctly an unscientific procedure. In this particular case we can be reasonably sure that both guesses are wrong. Agriculture did not come to the Indians of the Southwest either because nature was favorable or because it was unfavorable. It came because, for reasons which we do not now need to examine, some people in southern Mexico or Guatemala or the northern part of South America turned agriculturists; and from them the art was gradually carried, through nation after nation, to our Southwestern tribes, and finally even to the Eastern Indians. The reasons for acceptance of this explanation are numerous. First, is the distribution of native agriculture. The farming region is about equally divided between the two continents, with its middle somewhere about Central America. Then there is the fact that in Central America and Mexico there was the greatest concentration of population, which normally accompanies agriculture. Then, pottery has evidently spread out from the same center, and the two arts seem to go hand in hand.

[1] W J McGee, The Beginning of Agriculture, *American Anthropologist*, Vol. VIII, 1895, pp. 350–375.

Other reasons might be adduced which are too lengthy to be pursued here: such as the indirect evidence of archæological exploration. It is when these various facts are linked together that the full strength of the evidence is borne in upon us.

Now what caused the first tribe in or about Central America to practice agriculture, we do not know. But we have at least done something. We have accounted for the prevalence of agriculture in our aboriginal Southwest for several thousand years; and accounted for it wholly by a cultural or human explanation without reference to climate or geography or the topography of the country. In short, the environmental factor proves to be so remote or indirect or elusive that we cannot seriously operate with it.

The third set of factors with which we have to deal is what we may call the practices or behavior of people themselves taken in the mass—their type of culture or civilization. I do not mean necessarily high civilization, but type or kind of civilization irrespective of its level. We may in this sense speak as fairly of a Hottentot or Apache civilization as of Greek or French civilization.

We have in the Southwest a rather good example of how the phenomena of civilization usually arrange themselves when we look upon them geographically. In the center of our area we find four groups of Pueblo Indians—the Hopi, Zuñi, Keres, and Tewa or Tano —who undoubtedly represent the *élite* of the native culture and, to a greater or less degree, of the aboriginal civilization of the United States. These four Pueblo tribes not only built towns of stone and lived almost wholly by agriculture, but they had worked out an exceedingly complex system of religion, with symbolic rituals, a kind of rude philosophy, and the like. When we leave these town-building people and come among the nomadic or semi-nomadic tribes, we first meet the Navaho, who, we find, have a good deal of the Pueblo culture. The great stone towns are lacking, but most of the noble religion persists. A little farther from the center, among the Apache and Pima, the religion has perceptibly diminished in elaborateness and fineness. As we radiate still more, the simplification of culture increases among the Mohave, most of whose cults are of a new and ruder kind. Still farther out, on the shores of the Pacific Ocean in southern California, among the Luiseño and Gabrielino, there are still a few distinctive but isolated Pueblo traits surviving. For instance, these Indians make ground paintings, symbolic representations or pictures of the universe, which are clearly based on the Pueblo type of altar. But for every such Pueblo-type trait which they possess, there are ten or twenty which they lack. In central California, which is still more remote, we find here and there a last bit of custom reminiscent of Pueblo culture; but always only a suggestive bit, so much is it whittled down. The Pueblo culture as such, the typical one of the Southwest, has vanished. In short, we get here a set of relationships in space very much of a kind with those which the evolutionary biologist works out in time in the study of organic life.

We might represent these conditions graphically very much as Mr. N. C. Nelson[1] recently represented his findings in regard to the ancient culture of the Southwest. Without reference to the living Indians but on the basis of investigations of the remains of the past, he constructed a step pyramid which had for its apex this very region where the Pueblos are now. As he passed to each lower step, the archæological remains were cruder and less notable, and each lower step was also so much nearer

[1] In an address on the "Archæology of the Southwest," delivered before the New York Academy of Sciences, February 25, 1918.

the periphery. As he mentally continued to descend the pyramid, he was simultaneously retrogressing in time, descending in the scale of culture, and spreading geographically; which is but another way of representing the same thing that I have been trying to picture in terms of space alone.

We can then accurately speak of the center and chief origin of our generic Southwestern Indian culture as being located among these four Pueblo groups. Even within the narrow Pueblo region it is practically certain that at some time in the past, perhaps a thousand years ago, the intensest focus or acme of the culture was in the San Juan drainage district, where there are no Pueblos at all now; and at some later time, but still before the discovery of America, this nourishing hearth had shifted eastward and become located among the Tewa on the upper Rio Grande, where its development was arrested by the arrival of the disturbing Spaniard.

Just as agriculture and pottery have spread out from the original great Central American center, and then spread afresh farther north from the minor Pueblo center, so undoubtedly many other elements of civilization have been diffused. Some day, for instance, we may be able to prove that the Southwestern clan system and type of religion have also in the main been shaped among some of the four Pueblo tribes or their ancestors; and that these in turn derived at least the rudiments or suggestions of these institutions from Mexico and Central America.

To designate Southwestern native culture as being outright Mexican would be slovenly, because it is plain that merely its basis or stimulus was derived from Mexico, and the great bulk of its content was reshaped on the spot. Just so the Mohave or Luiseño at the fringe of the Southwestern area undoubtedly got their cultural start from the Pueblos through the Pima or Apache, but are far from being mere dependents, because they have thoroughly worked over their cultural heritage from the Pueblos into something that is distinctively their own. They represent subcenters of development of civilization that stand in exactly the same relation to the Pueblo center as this stands to the Mexican supercenter; and the relation holds equally in space, in time, and in cause.

I believe that on the strength of this illustration I can claim that we anthropologists are working out some reconstruction of what happened. We are tracing back the history of man, not on the physiological or climatic side, but culturally; and showing, in some degree, how the civilization of the American Indian came to be. We have not gone so very far, it is true; but solid progress is not made by attempting to solve at one fell swoop all the problems that confront one.

There is one respect in which the culture of the Southwest is peculiar. It is constituted of two elements that are almost polar or opposites. We have the strictly agricultural Pueblos in their towns; and we have also the nomads that separate and surround them and show the same basic culture in a different form. The Navaho and Apache live scattered in small groups in temporary villages. Acoma and Zuñi were inhabited as permanent cities when the Spaniard first marched into the land. The difference between these two types of Southwestern natives is striking; and the two dwell sandwiched in between each other. In no other part of North America does there appear to be any such extreme contrast in so small an area. Ordinarily we find such differences only among tribes that are far apart, and we must travel hundreds of miles before we encounter like changes. The differences are apparently greater than those in mediæval Europe, and even there the case is not quite parallel, for the French noble and burgher and peasant were after all Frenchmen, whereas no such feeling of community of language or nationality unites the Navaho, Apache, Zuñi, and Acoma.

This difference cuts across the Southwest rather deeply and shows in minor ways that may be very significant. At Zuñi it is the custom for women to sit flat on the ground but for men not to do so. Sometimes the man uses an empty box; ordinarily he has built around the walls of his room a little ledge that forms a low sort of bench. In general, he no more thinks of sitting cross-legged on the ground than we do. The Navaho or Apache sits right down on the ground and crosses his legs. The various tribes are perfectly conscious of these customs. Once when I sat Turk-fashion, my Zuñi companion immediately said, "Ah, you are Apache-sitting." Now, trivial as this is, such a departure of habits might easily cause different methods of serving food, or create different types of implements or of etiquette. Even where such a minor peculiarity results in nothing further, it may often be deeply suggestive of much greater distinctions.

In the discussion of a recent address before the New York Academy of Sciences,[1] Dr. Pliny E. Goddard called attention to one of these greater distinctions. The Apache and Navaho fear the dead body as they would fear smallpox or any other contagious disease. A person that has no near kin is likely not to be buried. If a man dies in a house his people move off and abandon the vicinity. Even if he dies out of doors, his house is not lived in again. Among the Pueblos it is different. People die in their rooms and the building is not pulled down. The Pueblo's attitude toward his dead lacks entirely this element of horror that the ghost may come back and work an injury—he feels slightly or not at all certain powerful emotions to which so many other Indian tribes are intensely susceptible. Dr. Goddard suggested that somehow the ancestors of the Pueblos got rid of their dread and therefore were enabled to congregate in houses of stone. One obviously cannot build a town and then move half a mile away when the first inhabitant dies. My own interpretation would rather be the reverse of Dr. Goddard's. I should say that the Pueblos found it exceedingly inconvenient to leave their stone dwellings every little while, and unprofitable or dangerous to live in temporary ones. They therefore subdued their feeling of dread as best they could and finally got rid of it. That is, I should give the economic cause precedence over the religious one. But it matters very little whether I am right or Dr. Goddard is right. We agree, and I think all anthropologists would agree, that there is a connection between the two factors involved in this matter.

This connection is in a sense cultural, in a sense psychological. It refers to an attitude of mind bearing on other attitudes of mind or habits. And that brings us to the last aspect under which we must consider human civilization: namely, as a product of interacting cultural factors each with its peculiar psychological coloring. The mental attitude that fears the dead is more than a mere psychological phenomenon. It is something that can be formulated in terms of culture and connected with cultural elements. The Navaho's emotion is to us no longer a pure or abstract emotion, but something that we can bring into positive causal relation with directly institutional factors such as architecture in stone or wood.

For instance, in temperament the Pueblo Indians are gentle. They are an exceedingly amiable people, showing some reserve, but not the stubborn reticence characteristic of so many of our Indians. They do not evince the manly,

[1] By Dr. Clark Wissler, January 28, 1918, on "Cultural Problems in the Southwest."

upstanding incisiveness of the Indians of the Plains, their directness in personal intercourse, the interesting play of individuality.[1]

Now I think it is very clear that one reason why the Pueblo is less incisive and personal in his mentality, is that his culture is much more pervaded by the idea of organization. To give a brief example chosen from the field of religion, there are about sixteen hundred Zuñi, or a little more than three hundred adult males. Every one of these belongs to a communal religious society. At the head of this there are fourteen sets of four or five priests each, or one out of every six men. These are ranked and grouped, with certain divisions of function. In addition there is a head priest or sort of pope, one of a college of six cardinals, as they might be called, plus a speaker or sun-priest, a woman assistant, a grand dance manager, and two bow-priests or executive officers. The remaining Zuñi are divided into six groups; each of which has its own kiva or ceremonial chamber, practically also a club. Each of these clubs has its manager and keeper of costumes. All this is only part of the scheme of organization of the one communal society. Beyond this are thirteen fraternal societies, each usually containing several grades or orders, and each with its head, deputy, speaker, and medicine keeper.

Enough of such details. It is clear that on the side of religion alone the average Zuñi can hardly escape holding some office or function during his life because his scheme of ritual organization is so elaborate as to provide almost as many offices as there are possible incumbents. Among the Plains Indians there is nothing like this. Such simple forms of organization as they possess are absolutely rudimentary in comparison.

What I am trying to show is that these culture phenomena must have a reaction on the individual's psychology. The Zuñi does not think of an individual except as a part of a machine. Organization is so dominant in his life, so stamped all over himself and his associates, that personality is considerably stamped out of him; whereas the loosely organized Plains tribesman has every opportunity to foster his individuality and to be direct and frank in the expression of his character.

Just so, the Zuñi always inclines to think of the symbolic meaning of an act rather than of the act itself. His whole mythology, the history of his people as he tells it, is more or less in this symbolic form. What is not symbolic, he has left out. If he is forced by circumstances or induced by advantage to take up new things, such as sheep or wool or woolen cloth, he says to himself: "We are indeed using them, but they are unsymbolic and not old and therefore we will not use them in religion." Then he gradually begins to use these things nevertheless, because it is convenient, but he still denies employing them. Anything that is used in any ceremonial connection must contain nothing of Caucasian origin, is the rule; but actually there are few ritual paraphernalia that do not include something which has been produced by the white man. The Zuñi uses these paraphernalia but still tries to explain the fact away: again a psychological factor. After the innovation has been with him long enough, he finally manages to say to himself: "Of course we have always had this material. Our creation story tells how it came up out of the ground with us and was always Zuñi." So he has at last made the Caucasian importation a real part of his mythological and symbolic form which he loves so much. Again, a ten-

[1] Dr. Robert H. Lowie, of the American Museum, in his field study of North American Indians, has gone from the Plains to the Pueblos, and has several times dilated on this very striking difference.

dency of his civilization has dictated his personal and group conduct.[1]

I think these illustrations are perhaps enough to show that a mere interpretation according to the three sets of factors with which we began our consideration does not exhaust the field. The psychic aspects are also present. And they are in some measure utilizable in explanation as soon as we can bring them into definite relation with institutional phenomena. Most of what can be done along this line still belongs to the future; but it is important not to overlook the opportunities of the future.

The anthropologist works, then, not by denying the reality of the factors of heredity and environment but by going beyond them. He does not seriously operate with them because in his own field he has been able to accomplish nothing with them. The progress which he has made and which justifies his reliance in his method and technique, has been achieved by painstaking analysis of human cultures into cultural elements; by tracing the connection, first in space, then in time, then in cause and effect, between culture element and culture element, between culture and culture; by explaining phenomena of civilization not in terms of the underlying organic constitution or surrounding nature, but in terms of civilizational phenomena themselves; with human mentality never left out, but always regarded only as it is acted on by custom and institution and reacts on them.

[1] As a study representative of this more or less psycholcgical method of approach of culture, I might mention the famous historical novel "The Delight Makers" by Bandelier, the pioneer of Southwestern research. By no means of the highest rank as a piece of fiction, the book is nevertheless pervaded by a keener and more comprehensive insight into the psychic reactions accompanying the manifestations of Pueblo culture than any other work in the field. Of similar order, although formally much more scientific, is the essay by the late Dr. H. K. Haeberlin of the Museum, on the idea of fertilization among the Southwestern Indians. This monograph is misunderstood if it is regarded as an attempt to reduce the entire civilization of the Southwest to a single formula. It does endeavor, and on the whole with remarkable success, to view as much as possible of this culture in its relations to one of its dominant attitudes of mind.

EIGHT-YEAR-OLD ME-GIS-S'OO WHO LIVES IN THE FAR NORTH

Eskimo children differ from one another just as do white children. Some are very much prettier than others, and there are always some more unselfish than others. The family, among the Smith Sound Eskimo, is never large, but there may be four or even five children. They grow up in close companionship with their parents; the girl's great ambition is to be like her mother, the boy's to be a great hunter like his father. Me-gis-s'oo was a favorite at the headquarters of the Crocker Land Expedition at Etah (1913–17). She was very clever at making intricate "cat's cradle" figures which she taught to some of the scientists

Child-life among the Smith Sound Eskimos

By EDMUND OTIS HOVEY

CHILDREN are always welcome arrivals in the families making up the little tribe of Eskimos dwelling along the bleak shore of northwest Greenland between Melville Bay and Kane Basin. Childless couples, of which there are a few in the tribe, are objects of pity because they are looking forward with dread to old age, when the man will be stiff in the joints and not agile enough to hunt the seal, walrus, and polar bear, and the woman will be too slow and feeble to attend to the traps, to catch the little auks, and to prepare the skins needed for clothing. Large families are not found in the tribe, but many that we knew comprised four children, while several had five little ones in the igloo. Nor are the Eskimo children unmindful of the care that watched over their babyhood and youth, and they cheerfully support their aged parents.

The first Eskimo family with which I became acquainted was the one that formed the entire native population of Ip-soo-i-sook at the head of Parker Snow Bay during the winter of 1915–1916, when the auxiliary schooner "George B. Cluett," the first of the Crocker Land Expedition relief ships, wintered there on her way home after her unsuccessful attempt to reach Etah. The family consisted of Pood-lahq and his wife Ee-net-lee-ahq, and their three children, Ky-u-ti-kah, a boy of seven years, Ky-u-tahq, a boy of five, and Mer-k'oo, a little girl of about three. Pood-lahq's brother, Al-la-ko-tee-ahq, an irrepressible lad of eighteen, filled up the quota of the igloo. Pood-lahq had been a famous hunter in his prime, but snow blindness had injured his eyes so that he could scarcely see, and he had great difficulty in obtaining seals and other game for food, fuel, and clothing. Ee-net-lee-ahq, however, was energetic and faithful in her efforts to support the family and spent day after day tramping the hills in attendance upon the fox traps and hare snares. They joined harmoniously in caring for the children, and theirs was a model family for devotion to one another and to the common needs. I never heard one of the children cry, except when it was hurt through some mishap.

Like all the Eskimo children whom I saw, Ky-u-ti-kah, Ky-u-tahq, and Mer-k'oo were round-cheeked, healthy little animals, quiet in their demeanor and unselfish in their treatment of one another, although undemonstrative in the display of affection. Of course they were fond of candy, as soon as they learned what the pretty things were that we held out to them. Yet they would never offer to eat a piece until after permission had been signified, and if one of the boys happened to be alone on board ship, he would take his candy home to share it with his brother and sister. One day Mer-k'oo had nearly succeeded in removing the waxed paper from her stick of peanut brittle, when one of our men held out his hand and asked for it. Without a whimper she passed it over to him, but it was interesting to see the look of relief and joy that spread over her face when she got the coveted morsel back and was free to eat it.

The children are taught independence very early in life. When this family was moving from Ip-soo-i-sook in the spring of 1916, I made Ee-net-lee-ahq some trifling gifts, which she was not content to accept until after she had brought out and given me a little soapstone dish—"from Mer-k'oo."

There are no baby carriages or even baby sledges in the Far North, and

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Photograph by E. O. Hovey

AN ESKIMO FAMILY—HEALTHY, HAPPY, INDEPENDENT

Pood-lahq, his wife Ee-net-lee-ahq, and their two-year-old daughter, Mer-k'oo. An Eskimo baby is carried in the hood of its mother's coat from the time it is born until it is about two years old—and sometimes longer if there is no smaller baby to take its place. Compared with American children, it is said that Eskimo babies are backward, not beginning to stand alone until two years old. Carrying the baby in this way does not seem to inconvenience the mother greatly, and as for the baby, it is exceedingly comfortable. It is rocked as in a cradle when she moves and bends about her work; it is lulled to sleep as she laughs and chats with its father; and when she goes to the fox traps or journeys to some neighboring igloo, the child settles more snugly into the hood, soon becoming accustomed to the sting of frosty air on its face and to the sight of vast stretches of snow and ice

Me-gis-s'oo and Shoo-e-ging-wah amid grass and flowers at Etah.—There are no happier children in the world than the Eskimo, and when the dark winter is past and the sun has risen and begins to circle about the sky, never setting at all at night so that the days are long for play, they are happier than ever. As far north as this there are no trees to spread their leaves and give shade in which to play; but by June the ground is soft with moss, grass is growing green, and wild flowers blossom among the rocks, while the chirping of snow birds and the sound of running waters blend cheerily with the laughter of the children

when the babies travel, they must ride in the hood of the mother's *ahng-ma-oot*, a coat made from the skin of the common *poo-ee-zhee* or ringed seal. Mer-k'oo looked very cunning as she peered around from behind Ee-net-lee-ahq's head, her own little head being incased in a close-fitting sealskin hood with face roll of blue fox tails. But the baby wore almost no other clothing while in

Me-gis-s'oo and Shoo-e-ging-wah are playing with their pet dogs in the July sun at Etah. In the summer months, on days when the wind is not too strong, Eskimo mothers give their babies sun baths on bear or deerskins stretched on the ground. Needless to say the little people like it, and continue to like it until they are quite big boys and girls.

Eskimo children are inured to relatively low temperatures, and the igloo with its seal-oil lamp is so warm, even when the weather is bitterest outside, that they play about without their fur clothing. In summer they are glad indeed to cast aside the fur while they play back and forth within the toopik and out into the sunshine

the hood. A baby must have to cling to its mother like a cat or a monkey, for the mother seems to take almost any kind of exercise and to bend down to the ground freely without ever spilling out the child. One cold morning Ahng-ma-lok-to and his wife arrived at Ipsoo-i-sook after two days of sledging from Cape York. The latter's hood looked large and heavy, and on examination I found that it contained a naked baby only a few weeks old. Eskimo babies begin to travel young, and without much reference to temperature. I asked Ahng-ma-lok-to where they had spent the night and I learned that he had built a snow igloo for shelter at Sook-koon, ten or twelve miles south of the ship.

Soon after Christmas, 1916, Ah-wee-ah-good-loo, although but fourteen years old, presented her husband with a son at Etah, and two days after the baby's arrival she brought it into Borup Lodge, the official name for our headquarters house. The infant was simply rolled up in the white fur of an Arctic hare, a "rabbit skin"—a reminder of the old nursery rhyme. The baby was named Sohr-kahk among other names, in honor of his father's grandfather who was a noted hunter, so that he in turn might be successful in the chase when he grew up.

There are no family names in the tribe, but the children often receive the name of some near or remote relative, like Sohr-kahk whom I have just mentioned, or of some recently deceased friend. Mer-k'oo was named for Oo-tahq's wife, who had died shortly before the birth of Ee-net-lee-ahq's baby, and her receiving this name, thus perpetuating the woman's memory, allowed Nah-vrah-na, Peter Freuchen's wife, to resume it. Nah-vrah-na had always been called Mer-k'oo, but custom had forced her to drop the name when Oo-

An Eskimo baby.—It is spring. The little auks have come to their nesting cliffs in the Far North. Eskimo women are shouting as they sweep the long-handled nets in air. All the children are laughing. Little Tah-tah-rahq, too young to walk, is waiting among the rocks while his mother tries her skill with the net. (She has already caught one of the black and white birds, which lies on the rock near the baby's head.) Below them stretches the great white ice of Foulke Fjord with dark cliffs beyond, and in the air above swing and circle the flocks of little auks

Tah-tah-rahq, when about three years old (1917), cutting meat.—In Eskimo land one eats when he is hungry—if there chance to be any meat. The children soon learn that there are times of plenty and feasting, and times of want, or even famine. They learn early also one of the most highly developed of Eskimo virtues, hospitality: that no little boy or girl will ever be allowed to go without food as long as anyone in the tribe has some to be shared

Me-gis-s'oo listening to the Victrola taken north by the Crocker Land Expedition

tahq's wife died, and she could not use it again until after some subsequently born child had been named in specific honor of the deceased. Most Eskimo names are fantastical or without signification, but Mer-k'oo means a feather, Tah-tah-rahq a raven, Ee-wid-doo sinew (thread), Ahl-ning-wah a girl baby.

The Eskimo children have almost no playthings: a few bits of bone, sometimes rudely carved into representations of men, women, seals, or walrus, pieces of flat stone, occasionally a small *kah-moo-tik* (sledge) which can be used for coasting on the hard snow banks, rarely a modification of the stick-and-ball toy or game—the list is not long. As soon as the light came back in the latter part of the winter, Ky-u-ti-kah and even Ky-u-tahq spent every day practising with a dog whip that Pood-lahq made for them. I was surprised to see how well the older little boy could snap the lash, which was twelve or fifteen feet long even on the small-sized model that he used. The children grow up with the young dogs and are very fond of them. The consequence is that, when they grow large themselves, they know dogs thoroughly and can manage them well, the girls being almost as adept as the boys.

At Etah, there were several children around most of the time and we saw much of them at the expedition headquarters, where

A twelve-year-old girl helping to set a fox trap.—A little Eskimo girl begins very early to help with the traps, and with the sealskins, to tend the lamp, and help care for the baby. Her education comes entirely through imitation of her mother, and all her work and play concerns the serious matter of learning to be grown up like mother

About the Crocker Land Expedition's headquarters was such wealth of boards and boxes for making playhouses as these Eskimo children had never seen before. Wood is very scarce indeed in the Smith Sound region and all that can be obtained must go into sledges and toopik poles. Often narwhal horns have to be used for the toopiks. The older boys sometimes make snow playhouses, little igloos, exactly as their fathers build the big igloos in which they live

The hood of the Eskimo woman's coat has been the Eskimo baby's cradle for more centuries than history can tell. This is the little Eskimo boy, Tah-tah-rahq, when two years old (1916) with his mother Ah-nee-nah. The baby's bare body rests against his mother's back, he wears a short shirt of young blue foxskin and a tight-fitting sealskin hood edged around the face with blue fox tails. A family is especially proud of its boys, for they will grow into great hunters, the heroes of the Eskimo race

some of us always could find time to play with them. My little playmate was Me-gis-s'oo, eight years old. She would stand as much petting and kissing as any little American girl of her age, but I never could teach her to kiss me in return. The Eskimo substitute for kissing is rubbing of noses. Tah-tah-rahq and Ig-loo-suah-mi were three-year-old boys who loved to get underfoot, and many were the perfectly natural contests between them over blocks or other playthings that we let one or the other of them have.

The girls begin early to help their mothers. Almost the only item of housekeeping in an igloo (winter house of stones and turf) or toopik (summer tent of seal skin) that requires any skill is the tending of the flame of the native stove-lamp. This is a shallow, oval-triangular pan or dish, somewhat like a big clam shell in shape, although not so deep, from twelve to eighteen inches across carved out of soapstone. When in use it is propped up on edge on stone supports on a special platform at one side of the bed platform. It is provided along its lower edge with a wick improvised from dried moss, which sucks up the oil that gradually tries out of the lumps of blubber placed in the upper part of the contrivance. The object is to obtain the greatest possible amount of flame for light and heat, with the smallest possible amount of smoke, and it requires some knack and much training to pat the moss into proper shape for this with the curved branch of a willow bush that is used for the purpose. Then the girl must acquire skill in the use of the *oo-loo*, or woman's knife, shaped like an American chopping knife, which is used in cleaning, scraping, and cutting skins for the making of garments, and for all other purposes for which the Eskimo woman uses a knife.

Ah-nee-nah, Me-gis-s'oo's mother, had many fox traps placed along the hill slopes up Foulke Fjord from Etah, and she used to take the little girl with her when she went out to examine them. Thus was the child trained in knowledge of the habits of the *ty-ing-nee-ah*, or blue and white foxes, which furnish the best material for hooded coats and women's trunks. The hare snares, too, required frequent attention, and often on my walks did I meet the two picking their way homeward over the rough trail, Me-gis-s'oo staggering along under her furry burden.

Caring for the skins and making them up into clothing fall to the lot of the women. All seal and bird skins must be chewed to remove part at least of their inherent fat and to soften the fiber, as the Eskimo have no way of tanning hides. Me-gis-s'oo began on little auk skins destined for shirts. Chewing skins takes the place of embroidery and other fancy work with the female population, and occupies spare moments from early girlhood to old womanhood. Sometimes Me-gis-s'oo, Ah-nee-nah, and Ah-nah-dwah, Ah-nee-nah's mother, would sit in a row on one of our benches, each chewing vigorously on a skin of some sort. In appearance, it was not better than a chewing gum contest in the New York Subway, but it had the merit of producing valuable results.

Although the Eskimo garments have no surface ornamentation, skins of different colors are cut into certain conventional patterns and sewed together to produce pretty effects of design. A woman's *kah-pe-tah*, or hooded coat of fox skins, must show one combination of blue and white, while the man's *kah-pe-tah* must show another. The same is true of the *net'l* or hooded coat made from the skin of the *poo-ee-zhee*. The *kam-ik*, or sealskin boot, is likewise of different pattern for the man and the woman. All the garments are cut out with the *oo-loo* and sewed with sinew of narwhal or caribou, and a girl must learn to do all this work well before she becomes desirable as a wife. And girlhood does not last long, for a girl is usually only from thirteen to sixteen years old when she takes over the cares of an independent household.

The boy's education is more extensive and varied than the girl's. It runs mostly to hunting game and the making of apparatus and implements connected therewith. I have spoken of his early efforts at dog driving. He also must learn how to cut out and sew together the harness for his dogs, which preferably is made of polar bear skin, although sealskin is often used for the purpose. He must be able to make his own *kah-moo-tik* (sledge) but this has

Ee-nah-loo bringing home a white and a blue fox, obtained from her traps. She is wearing a sealskin coat, foxskin trunks, and sealskin boots

Tah-tah-rahq (three years old, 1917) with one of the sleds which the Crocker Land Expedition took north to the Eskimo children. An Eskimo boy does not often have a little sledge to play with because there is seldom more than enough wood to make the family's big sledge—nevertheless he sometimes has a great frolic sliding down hard snow slopes without a sled. Life for the Eskimo boy is more serious than for the American boy, and he is quieter. He must become self-supporting early and so must learn very much from his father: to make snow and stone igloos; to drive the dogs and make and mend the harness and the sledge; to use the rifle; to skin the game; to make harpoons, floats, kayaks; and finally when he is about fourteen, to hunt the seal, the walrus, and the polar bear

Photograph by E. O. Hovey

Oo-quee-ahq, with his wife, Ah-tee-tah, and their two children, beside their toopik at Ip-soo-i-sook, head of Parker Snow Bay, 1916. Oo-quee-ahq accompanied Peary to the North Pole become a comparatively easy task now, since he has been able to get boards and other wood from the white man and no longer is obliged to lash pieces of whalebone together for runners and to utilize caribou antlers for upstanders. The thick, tough skin of the *oog-jook*, or squareflipper seal, is used for making heavy line such as is needed for whips, dog traces, *kah-moo-tik* lashing, harpoon and float lines, and the like. Hence the boy must learn early how to use a knife skillfully in order to slit the *oog-jook* skin while soft into a long even strip about a half inch wide. This strip is then stretched and dried and is ready for use. For dog whips, a strip like this is trimmed down so that it tapers gradually throughout its length and a thin snapper three or four feet long of dried *poo-ee-zhee* skin is attached to its outer end.

The girls and women usually skin the birds, hares, and foxes, but the boys and men attend to the seals, walrus, narwhals, white whales, caribou, musk-oxen, and polar bears, although the walrus almost always is cut up with its skin on, especially when it is to be used as dog food. The children learn to do these and other tasks by constantly helping their elders.

The boy must learn how to carve good *ook-sools* or rings from walrus or narwhal ivory for dog harness; harpoon heads from ivory, using different sizes for the seal and the walrus and narwhal, and pointing them now with white man's iron; harpoon shanks from wood, although formerly from narwhal horn or walrus bone; floats and drags from sealskin; kayaks or sealskin boats for summer use; igloos or huts out of flat stones and turf for the winter home, and *ig-loo-ee-ahs* out of blocks of wind-compacted snow for temporary use when on the trail or a family journey. But the toopik or sealskin tent for summer occupancy falls to the woman's lot to make, on account of the sewing involved.

When a boy is about fourteen years old, he goes out on the seal hunt with the men and thus becomes an actively supporting member of the family. Shortly afterward he takes part in walrus hunting and the chase of the polar bear and the caribou. At about eighteen he wishes to become independent and the head of his own family, and he

Kah-ko-chee-ahq, an Eskimo boy.—He has put on the shirt of little auk skins inside out in order to show its beauty in the photograph. The feathers are worn next the body. This is not an outer garment, but is worn (or not worn according to the weather) underneath the coat of sealskin, foxskin, or caribou skin

marries—if there is a girl available. He is fortunate if he can have the girl who was picked out for him by the parents on both sides when the children were babies, because just now there are more boys than girls of marriageable age among these people of the Far North. But children are children no longer when they reach the age for setting up their own homes.

TYPICAL TIGER COUNTRY NEAR FUCHOW

In the narrow ravine beyond the rice fields—a wild place, appearing as if cut out of the mountain-side with two strokes of a mighty axe—the blue tiger hid himself away. The only entrance was by narrow tunnels twisting through the almost impenetrable growth of thorny vines and sword grass. The tigers frequently rush out and kill the natives while they are cultivating their fields

The Blue Tiger*

By ROY CHAPMAN ANDREWS

Illustrations from photographs by Yvette Borup Andrews

AFTER one has traveled in a Chinese sampan for several days, the prospect of a river journey in one is not very alluring, but we had a most agreeable surprise when we sailed out of Fuchow in a chartered house boat to hunt the "blue tiger" at Fu-tsing. In fact we had all the luxury of a private yacht, for our boat contained a large central cabin with a table and chairs, and two state rooms, and was manned by a captain and a crew of six men—all for $1.50 a day! In the evening we talked of the blue tiger for a long time before we spread our beds on the roof of the boat and went to sleep under the stars.

We left the boat shortly after daylight at Daing-nei for the six-mile walk to Lung-tao. To my great surprise the coolies were considerably distressed at the lightness of our loads. In this region they are paid by weight and some of the bearers carry almost incredibly heavy burdens. As an example, one of our men came into camp swinging a 125-pound trunk on each end of his pole, laughing and chatting as gaily as though he had not been carrying 250 pounds for six miles under a broiling sun.

The Chinese hunter, Da Da, employed by Mr. Caldwell,[1] lived at Lung-tao, and we found his house to be one of several built on the outskirts of a beautiful grove of gum and banyan trees. Although it was exceptionally clean for a Chinese dwelling, we pitched our tents a short distance away. At first we were somewhat doubtful about sleeping outside, but after one night indoors we decided that any risk was preferable to spending another hour in the stifling heat of the house.

It was probable that a tiger would be so suspicious of the white tents that it would not attack us, but nevertheless the first nights we were rather wakeful and more than once, at some strange night sound, seized our rifles and flashed the electric lamp into the darkness.

Tigers often come into this village. Only a few hundred yards from our camp site, in 1911, a tiger had rushed into the house of one of the peasants and attempted to steal a child that had fallen asleep at its play under the family table. All was quiet in the house when the animal dashed suddenly through the open door. The Chinese declare that the gods protected the infant, for the beast missed his prey and, seizing the leg of the table against which the baby's head was resting, bolted through the door, dragging the table into the courtyard.

This was the work of the famous "blue tiger" which we had come to hunt and which, on two occasions, had been seen by Mr. Caldwell. The first time he heard of this strange beast was in the spring of 1910. The animal was reported as having been seen at various places within an area of a few miles almost simultaneously, and so mysterious were its movements that the Chinese declared it was a spirit of the devil. After several unsuccessful hunts Mr. Caldwell finally saw the tiger at

[1] The Rev. Harry R. Caldwell represents the Methodist Episcopal Church as missionary at Yen-ping, Fukien Province, China.

* By the courtesy of Roy Chapman Andrews and Yvette Borup Andrews, this chapter from their book *Camps and Trails in China*, in preparation by D. Appleton & Co. for an early appearance, is given advance publication in the JOURNAL. Article and illustrations copyrighted, 1918, by Roy Chapman Andrews.

close range, but as he was armed with only a shotgun it would have been useless to shoot. His second view of the beast was a few weeks later and in the same place. I will give the story in his own words:

I selected a spot upon a hilltop and cleared away the grass and ferns with a jackknife for a place to tie the goat. I concealed myself in the bushes ten feet away to await the attack, but the unexpected happened and the tiger approached from the rear. When I first saw the beast he was moving stealthily along a little trail just across a shallow ravine. I supposed, of course, that he was trying to locate the goat, which was bleating loudly, but to my horror I saw that he was creeping upon two boys who had entered the ravine to cut grass. The huge brute moved along lizard-fashion for a few yards and then cautiously lifted his head above the grass. He was within easy springing distance when I raised my rifle, but instantly I realized that if I wounded the animal the boys would certainly meet a horrible death.

Tigers are usually afraid of the human voice, so instead of firing I stepped from the bushes yelling and waving my arms. The huge cat, crouched for a spring, drew back, wavered uncertainly for a moment, and then slowly slipped away into the grass. The boys were saved but I had lost the opportunity I had sought for more than a year.

I had again seen the animal, however, about which so many strange tales had been told. The markings of the beast are strikingly beautiful. The ground color is of a delicate shade of maltese, changing into light gray-blue on the underparts. The stripes are well defined and like those of the ordinary yellow tiger.

Courtesy of Harry R. Caldwell

In the "Big Ravine" at Lung-tao, where we hunted the blue tiger, the Reverend H. R. Caldwell killed this four-hundred-pound animal with one shot from his .22 caliber high-power Savage rifle

Before I left New York Mr. Caldwell had written repeatedly urging me to stop at Fu-tsing on the way to Yunnan to try with him for the blue tiger which was still in the neighborhood. I was decidedly skeptical as to its being a distinct species, but nevertheless, it was a most interesting animal and would certainly be well worth getting. I believed then, and my opinion has since been strengthened, that it is a partly melanistic phase of the ordinary yellow tiger. Black leopards are common in India and the Malay Peninsula, and as only a single individual of the blue tiger has been reported, the evidence hardly warrants the assumption that it represents a distinct species.

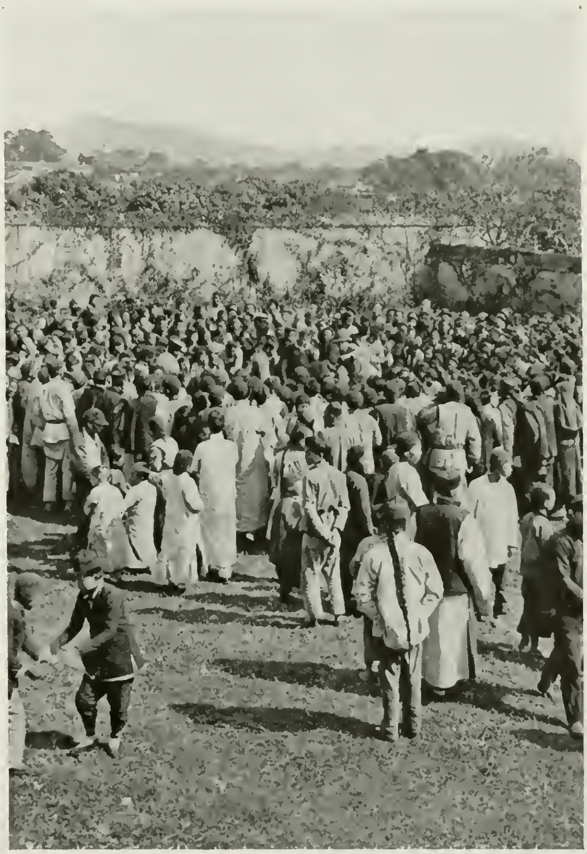
We hunted the animal for five weeks. The brute ranged in the vicinity of two or three villages about seven miles apart but was seen most frequently near Lung-tao. He was as elusive as a will-o'-the-wisp, killing a dog or a goat in one village and, by the time we had hurried across the mountains, appearing in another spot a few miles away, leaving a trail of terrified natives who flocked to our camp to recount his depredations. He was in truth the "Great Invisible" yet it seemed impossible that we should not get him sooner or later—but we never did.

Once we missed him by a hair's breadth through sheer bad luck, and it was only by exercising almost superhuman restraint that we prevented ourselves from doing bodily harm to the three Chinese who had ruined our hunt. Every evening for a week we had faithfully taken a goat into the "Big Ravine," for the blue tiger had been seen several times near this lair. On the eighth afternoon we were in the "blind" at three o'clock. As usual we had tied a goat to a tree near by, and her two kids were but a few feet away.

The grass-filled lair lay shimmering in the breathless heat, silent save for the echoes of the bleating goats. Crouched behind the screen of branches, for three long hours we sat in the patchwork shade,—motionless, dripping with perspiration, hardly breathing,—and watched the shadows steal slowly down the narrow ravine.

It was a wild place which seemed to have been cut out of the mountain-side with two strokes of a mighty ax and was choked with a tangle of thorny vines and sword grass. Impenetrable as a wall of steel, the only entrance was by the tiger tunnels which drove their twisting way through the murderous growth far in toward its gloomy heart.

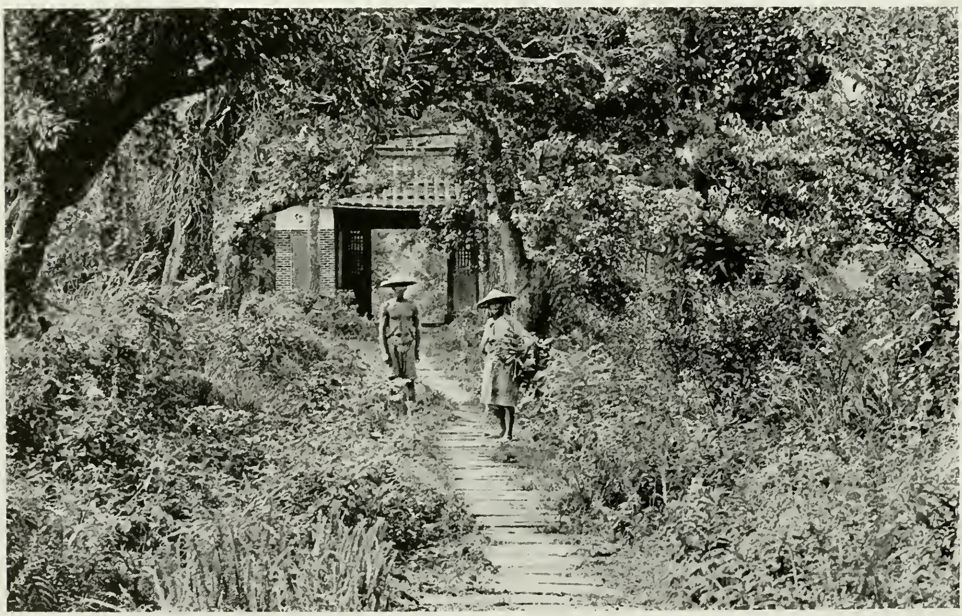
The shadows had passed over us and just reached a lone palm tree on the opposite hillside. By that I knew it was six o'clock and in half an hour another day of disappointment would be ended. Suddenly just at the left and



Courtesy of Harry R. Caldwell

Selling the meat of the tiger killed at Lung-tao.—The Chinese believe that the flesh, blood, and bones of tigers have great medicinal value, and they will pay high prices for them

A view of the valley from the steps of the Ling-suik monastery.—At the base of the hill beyond the rice fields was a tiger lair



Approach to the Ling-suik monastery, where the expedition lived while hunting the blue tiger. Only a short distance from this spot two tigers were killed just below us there came the faintest crunching sound as a loose stone shifted under a heavy weight; then a rustling in the grass. Instantly the captive goat gave a shrill bleat of terror and tugged frantically at the rope which held it to the tree.

At the first sound Harry had breathed in my ear, "Get ready, he's coming." I was half kneeling, with my heavy .405 Winchester pushed forward and the hammer up. The blood drummed in my ears and my neck muscles ached with the strain, but I thanked Heaven that my hands were steady. Caldwell sat like a graven image, the stock of his little .22 caliber high-power Savage nestling against his cheek. Our eyes met for an instant and I knew in that glance that the blue tiger would never make another charge, for if I missed him, Harry would not. For ten minutes we waited and my heart lost a beat, when twenty feet away the grass began to move again—but rapidly and *up the ravine*.

I saw Harry watching the lair with a puzzled look which changed to one of disgust as a chorus of yells sounded across the ravine and three Chinese woodcutters appeared on the opposite slope. They were taking a short cut home, shouting to drive away the tigers—and they had succeeded only too well, for the blue tiger had slipped back to the heart of the lair whence he had come.

He had been nearly ours and again we had lost him. I felt so bad that I could not even swear and it was not the fact that Harry was a missionary which kept me from it, either. Caldwell exclaimed just once, for his disappointment was even more bitter than mine; he had been hunting this same tiger off and on for six years.

It was useless for us to wait longer that evening and we pushed our way through the sword grass to the entrance of the tunnel down which the tiger had come. There in the soft earth were the great footprints where he had crouched at the entrance to take a cautious survey before charging into the open. As we looked, Harry suddenly turned to me and said, "Roy, let's go into the lair. There is just one chance in a thousand that we may get a shot." Now I must admit that I was not very enthusiastic about that little excursion, but in we went, crawling on our hands and knees up the narrow passage. Every few feet we passed side branches from the main tunnel, in any one of which the tiger might easily have been lying in wait and could have killed us as we passed. It was a foolhardy thing to do and I am free to admit that I was scared. It was not long before Harry twisted about and said, "Roy, I haven't lost any tigers in here; let's get out." And out we came faster than we went in. This was only one of the times when the "Great Invisible" was almost in our hands.

A few days later a Chinese found the blue tiger asleep under a rice bank early in the afternoon. Frightened almost to death, he ran a mile and a half to our camp only to find that we had left half an hour before for another village where the brute had killed two wild cats early in the morning.

Again, the tiger pushed open the door of a house at daybreak just as the members of the family were getting up, stole a dog from the "heaven's well," dragged it to a hillside and partly devoured it. We were in camp only a mile away and our Chinese hunters found the carcass of the dog on a narrow ledge in the sword grass high up on the mountain-side. The spot was an impossible one to watch and we set there a huge grizzly bear trap which had been carried with us from New York. It seemed out of the question for any animal to return to the carcass of the dog without getting caught and yet the tiger did it. With his hind quarters on the upper terrace he dropped down, stretched his long neck across the trap, seized the dog, which had been wired to a tree, and pulled it away. It was evident that he was quite unconscious of the trap, for his forefeet had actually been placed upon one of the jaws only two inches from the pan which would have sprung it.

One afternoon we responded to a call from Bui-tao, a village seven miles beyond Lung-tao, where the blue tiger had been seen that day. The natives assured us that the animal continually crossed a ridge thickly clothed with pines and sword grass just above the village, and even though it was late when we arrived, Harry thought it wise to set the trap that night.

It was pitch dark before we reached the ridge—carrying the trap, two lanterns, an electric flash lamp, and a wretched little dog for bait. We had been engaged for about fifteen minutes making a pen for the dog and Caldwell and I were on our knees over the trap when suddenly a low rumbling growl came from the grass not twenty feet away. We jumped to our feet just as it sounded again, this time ending in a snarl. The tiger had arrived a few moments too early and we were in the rather uncomfortable position of having to return to the village by way of a narrow trail through the jungle. With our rifles ready and the electric lamp cutting a brilliant path in the darkness we walked slowly toward the edge of the sword grass, hoping to see the flash of the tiger's eyes, but the beast backed off beyond the range of the light into an impenetrable tangle where we could not follow. Apparently he was frightened by the lantern for we did not hear him again.

A Chinese priest of the Ling-suik monastery. —These priests are often fugitives from justice and are extremely unprepossessing individuals

After nearly a month of disappointments such as these, Mr. Heller[1] joined us at Bui-tao with Mr. Kellogg.[1] Caldwell thought it advisable to shift camp to the Ling-suik monastery about twelve miles away, where he once had spent a summer with his family and had killed several tigers. This was within the blue tiger's range and, moreover, had the advantage of offering a better general collecting ground than Bui-tao; thus with Heller to look after the small mammals we could begin to make our time count for something if we did not get the tiger.

Ling-suik is a beautiful temple, or rather series of temples, built into a hillside at the end of a long narrow valley which swells out like a great bowl between bamboo-clothed mountains, two thousand feet in height. On

[1] Mr. Edmund Heller was a member of the American Museum's Asiatic Zoölogical Expedition; his efforts were directed particularly toward the collection of small mammals. Mr. Claude Kellogg was an instructor in the Anglo-Chinese College, at Fuchow, China, who rendered great assistance to the expedition.

his former visit Mr. Caldwell had made friends with the head priest and we were allowed to establish ourselves upon the broad porch of the third and highest building. It was an ideal place for a collecting camp and would have been delightful except for the terrible heat which was rendered doubly disagreeable by the almost continual rain.

Our stay at Ling-suik was productive, and the temple life interesting. We slept on the porch and each morning, about half an hour before daylight, the measured strokes of a great gong sounded from the temple just below us. "*Boom—boom—boom—boom*" it went, then rapidly "*bang, bang, bang.*" It was a religious alarm clock to rouse the world.

A little later, when the upturned gables and twisted dolphins on the roof had begun to take definite shape in the gray light of the new day, the gong boomed out again, doors creaked, and from their cell-like rooms shuffled the priests to yawn and stretch themselves before the early service. The droning chorus of hoarse voices, swelling in a meaningless half-wild chant, harmonized strangely with the romantic surroundings of the temple and became our daily matin and evensong.

At the first gong we slipped from beneath our mosquito nets and dressed to be ready for the bats which fluttered into the building to hide themselves beneath the tiles and rafters. When daylight had fully come we scattered to the four winds to inspect traps, hunt barking deer, or collect birds, but gathered again at nine o'clock for breakfast and to deposit our spoil. Caldwell and I always spent the afternoon at the blue tiger's lair but the animal had suddenly shifted his operations back to Lung-tao and did not appear at Ling-suik while we were there.

Our work in Fukien taught us much that may be of help to other naturalists who contemplate a visit to the province. We satisfied ourselves that summer collecting is impracticable, for the heat is so intense and the vegetation so heavy that only meager results can be obtained for the efforts expended. Continual tramping over the mountains in the blazing sun necessarily must have its effect upon the strongest constitution, and even a man like Mr. Caldwell, who has become thoroughly acclimated, is not immune.

Both Caldwell and I lost from fifteen to twenty pounds in weight during the time we hunted the blue tiger, and each of us had serious trouble from abscesses. I have never worked in a more trying climate—even that of Borneo and the Dutch East Indies where I collected in 1909–10 was much less debilitating than Fukien in the summer. The average temperature was about 95 degrees in the shade, but the humidity was so high that one felt as though he were wrapped in a wet blanket.

In winter the weather is raw and

The monastery of Ling-suik is a beautiful temple, built into the hillside at the end of a long valley which swells out like a great bowl between bamboo-clothed mountains two thousand feet in height damp, but collecting then would be vastly easier than in summer, not only on account of climatic conditions but because much of the vegetation disappears and there is an opportunity for "still hunting."

Trapping for small mammals in Fukien is especially difficult because of the dense population. The mud dykes and the rice fields usually are covered with tracks of civets, mongooses, and wild cats, which come to hunt frogs or fish, but if a trap is set, it either catches a Chinaman or promptly is stolen. Moreover, the small mammals are neither abundant nor varied in number of species, and the larger forms, such as tiger, leopard, wild pig, and serow, are exceedingly difficult to kill.

While our work in the province was done during an unfavorable season and in only two localities, yet enough was seen of the general conditions to make it certain that a thorough zoölogical study of the region would require considerable time and hard work, and that the results so far as a large collection of mammals is concerned would not be highly satisfactory. Work in the western part of the province among the Bohea Hills undoubtedly would be more profitable, but even there hardly worth while with limited time and money.

The language of Fukien is a greater annoyance than in any other of the Chinese coast provinces. The Fuchow dialect (which is one of the most difficult to learn) is spoken only within fifty or one hundred miles of the city. At Yenping Mr. Caldwell, who speaks Fuchow perfectly, could not understand a word of the "southern mandarin" which is the language of that region, and near Fu-tsing, where a colony of natives from Amoy have settled, the dialect is unintelligible to one who knows only Fuchow.

Travel in Fukien is an unceasing trial, for transport is entirely by coolies who carry from eighty to one hundred pounds. The men are paid by distance or weight; therefore, when coolies finally have been obtained, there is the inevitable wrangling over loads so that from one to two hours are consumed before the party can start. But the worst of it is that one never can be certain when his entire outfit will arrive at the new destination. Some men walk much faster than others, some will delay a long time for tea or may give out altogether if the day be hot, with the result that the last load will arrive perhaps five or six hours after the first.

As horses are not to be had, if one does not walk, the only alternative is to be carried in a mountain chair, which is an uncomfortable, trapeze-like affair and to be found only along the main highways. On the whole, transport by man-power is too uncertain and expensive for a large expedition.

It was hard to leave Fukien without the blue tiger, but we had hunted him unsuccessfully for five weeks and there was other and more important work awaiting us in Yunnan. It required thirty porters to transport our baggage from the Ling-suik monastery to Daingnei, twenty-one miles away, where two house boats were to meet us, and by ten o'clock in the evening we were lying off Pagoda Anchorage awaiting the flood tide to take us to Fuchow. We made our beds on the deck house, and in the morning opened our eyes to find the boat tied to the wharf at the Custom House on the Bund, and ourselves in full view of all Fuchow had it been awake at that hour.

The week of packing and repacking that followed was made easy for us by Mr. Kellogg, who acted as our ministering angel. I think there must be a special Providence that watches over wandering naturalists and directs them to such men as Kellogg, for without divine aid they never could be found. When we last saw him, he stood on the stone steps of the water front, waving his hat as we slipped away on the tide, to board the ship for Hongkong.

Discovering Promethea cocoons where they swing from the bare twigs

Quick Key to a Knowledge of Common Insects [1]

A REVIEW OF THE FIRST GENUINE FIELD BOOK PUBLISHED ON THE FAMILIES OF INSECTS OF THE NORTHEASTERN UNITED STATES [2]

By WILLIAM MORTON WHEELER

Dean of the Bussey Institution, Harvard University

WHEN this charming little volume, which fits the hand and the pocket so comfortably, was sent me by the publisher, it set me to thinking rather enthusiastically about the recent splendid progress of American entomology and somewhat regretfully about the state of the science when forty years ago I first became interested in the insects of my native state, Wisconsin. In those days what would I not have given to have possessed such a volume? But, of course, such a work could not have been written at a time when American entomology was, if not in its infancy, at any rate in its childhood. Where now the public library shelves devoted to entomology are loaded with beautifully illustrated works on our moths, butterflies, beetles, flies, and spiders, there was then only a meager array of European volumes, with Packard's *Guide* and Harris' *Insects Injurious to Vegetation*, and the two latter works—especially Packard's *Guide*—seemed never to contain any information one happened to be seeking. Perhaps there were compensations in being compelled to rely on one's own efforts, but I remember often repeating to myself an aphorism of Goethe, learned from one

[1] The JOURNAL expresses gratitude to G. P. Putnam's Sons for their courtesy in allowing use of the eight color plates which follow the review.

[2] *Field Book of Insects, with Special Reference to those of Northeastern United States, Aiming to Answer Common Questions*, by Frank E. Lutz. G. P. Putnam's Sons, New York and London, 1918.

of my teachers: *"Wie schwer sind doch die Mittel zu erlangen, womit man zu den Quellen steigt!"*

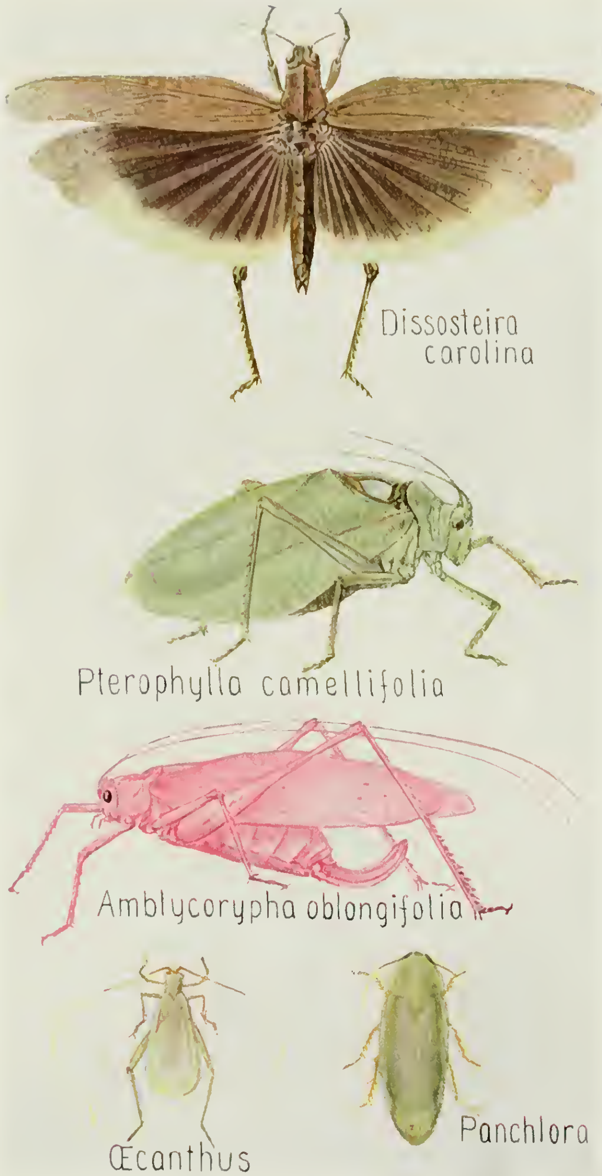
In view of the present development of entomological literature, both European and American, it seems strange that Dr. Lutz should be the first to publish a genuine field book of the common insects of the northeastern United States. He owes the idea, no doubt, to the exigencies of his office as curator in a large metropolitan museum where the needs of the beginner in any branch of natural history are very clearly and urgently revealed. Both young and old are continually asking him questions and his endeavors to supply information have enabled him to produce just the kind of book that the entomological specialist, who is interested in rare and new species, cannot produce. The latter may be able to write monographs for select esoteric circles of professionals, but he is usually too tired of the common forms to care to write about them in a spirited and instructive manner. Dr. Lutz not only manages to be entertaining but he at the same time accomplishes the more difficult feat of condensing into fewer than five hundred small pages an enormous amount of valuable information about our common insects. He often summarizes in a sentence a fact which it has taken the plodding specialist months or even years to establish. And if the reader happens to be a plodding specialist and comes upon such a brief summary of his work, he experiences a startling, and perhaps also a rather salutary realization of the feebleness of his own efforts and the immensity of entomological science.

Several parts of the volume will be of considerable use even to the specialist, for example, the tables of the common muscid flies, of the Bombinæ and other Hymenoptera, and especially the chapter on galls. The beautiful plates, of which there are 101, many of them in color, are the work of Mrs. E. L. Beutenmüller, whose skill in depicting insects is well known.

Dr. Lutz's book seems to me, as a teacher, to be particularly timely and valuable, because it covers the very ground I believe should be covered in elementary entomological instruction. In most institutions that attempt to provide such instruction, the time set apart for it is very limited and is usually devoted to the dissection of a cockroach or a grasshopper, with the result that the pupil acquires some knowledge of the integument and viscera of a single insect but can make no use of his knowledge in the field, in the garden, or in the household. After some years of experience with this method of teaching entomology I have reached the conclusion that it is far better to let the beginner devote his time to a large number of common insects of all orders. He will, of course, know little about any one species, but he will be kept attentive and enthusiastic and incidentally and unconsciously will be rearing a scaffolding of knowledge on which he can build with ever increasing assurance and profit. Dr. Lutz's volume may be heartily recommended both as a text for the classroom work and as a *vade mecum* for the field excursions which would, of course, form an essential part of such a course of instruction.

There are in the work a few matters of detail that one might be inclined to criticize. For instance, the dipterist will probably object to the insertion of the Coleoptera between his favorite insects and the Hymenoptera.

The work is fortunate even in the season of its publication, for after the very trying winter we have endured it is just the book we need to induce us to get out into the woods and fields, as far as possible from the environment in which we have been daily confronted by the scarcity of coal, sugar, and wheat bread, and to commune with the insects—although they also, to be sure, have their economic difficulties.



FROM FAMILIES OF INSECT MUSICIANS

Dissosteira belongs to a subfamily, Œdipodinæ, of which many species have colored hind wings. Attention is called to this adornment by the rattling of the wings as the insects fly.

P. camellifolia is the creature that apparently is so interested in the question as to whether Katy did or didn't that is, the male is; the female keeps quiet. This picture of *A oblongifolia* shows a not uncommon color "sport," or aberration, of green insects. Normally this insect is as green as the *camellifolia* shown above.

Œcanthus is a genus of tree crickets. The illustration shows a male. The wings of this sex are greatly broadened, thereby increasing the volume of the sound made by rubbing them together.

Species of the tropical genus *Panchlora* sometimes come north in shipments of bananas. We see from the illustration that not all roaches are dull-colored

SUCCESSFUL CAMOUFLAGE

Because of the position of the front legs when at rest, *Stagmomantis* and others of the same family, Mantidæ, are called "praying mantids"—but it is prey that they seek. Other names are "devil's rear horses" and "soothsayers." In the South they are believed, erroneously of course, to poison stock with the brownish fluid from their mouths and are called "mule-killers." They are the only insects that can look over their "shoulders."

Some Phasmidæ appear to be sticks that walk, hence the common name of "walking sticks." Our northern species have no wings but in the tropics many species are "flying sticks." The species illustrated above is fairly common as far north as New York City

A STORY OF COMMON BUTTERFLIES

Anosia plexippus is supposed to be distasteful to birds and to advertise this fact by its "warning" reddish color. Birds are supposed to like the taste of species of *Basilarchia* and the resemblance of *archippus* to *plexippus* is explained on the ground that it "mimics" that species and the birds are deceived. The departure of *archippus* from the color of its relatives is indicated by a comparison with *arthemis*. It is believed that this mimicry has been brought about by natural selection, not by conscious intention of *archippus*. *Anosia plexippus* is the "monarch" or milkweed butterfly. The latter name indicates the food of its larva, which is shown together with the pupa in its "green house with golden nails." The other larva and pupa belong to *archippus*, and they show that the mimicry exists only in the adult

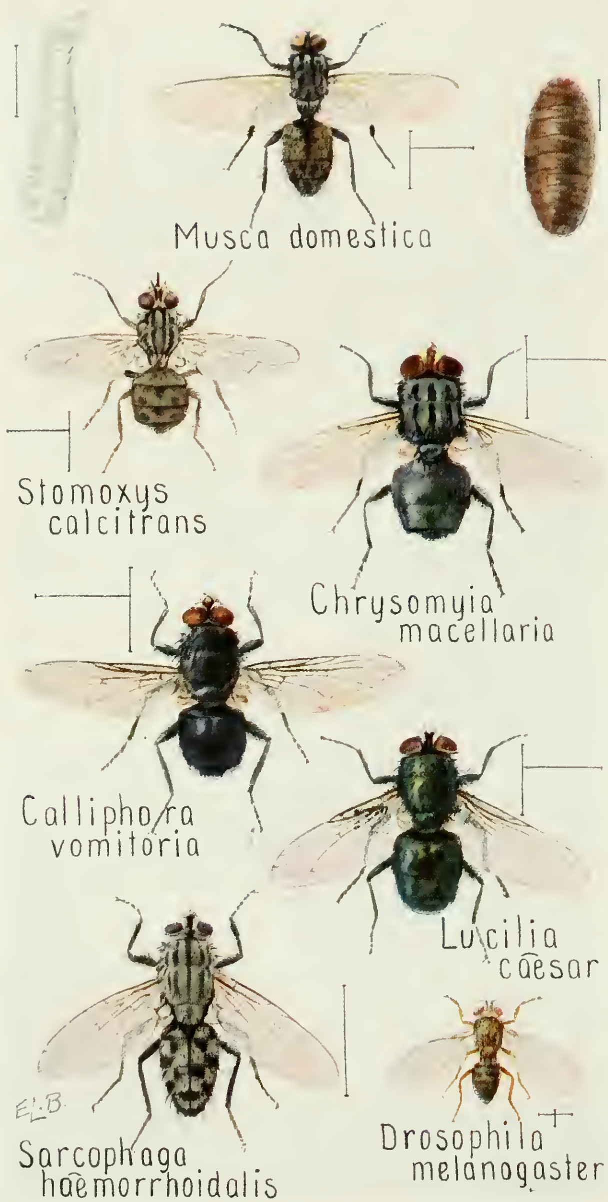
BEAUTY IN A COMMON MOTH

The "luna" moth is rather generally considered to be our most beautiful insect, but its lovely green fades rapidly to a light gray. In some sections of the country it is at least double-brooded. The early spring adults usually have purple outer margins on the wings; later individuals lack these. It is rather common and, once seen, is rarely forgotten. The larva feeds on walnut, hickory, sweet gum, persimmon, and other trees. The cocoon is very thin and rattles when pressed or when the pupa moves; it is usually made between leaves on the ground

TWO MOTHS AND THEIR CATERPILLARS

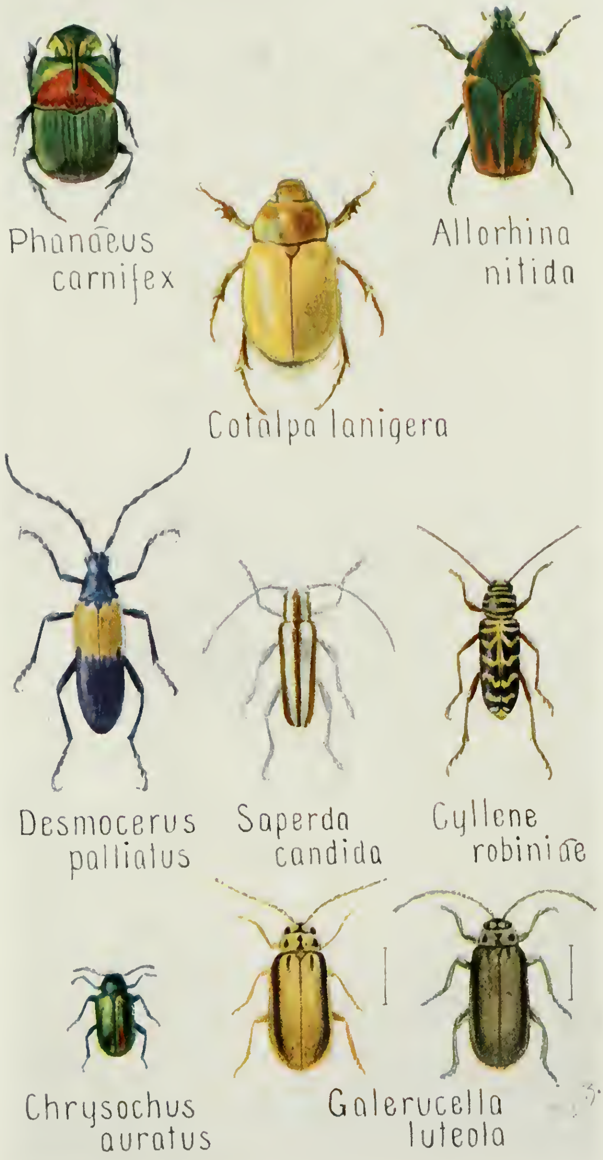
The io moth is related to the luna, cecropia, and other large moths. It is not very large, however, as the illustration shows. The sexes differ greatly in color. The larvæ should be handled carefully, as their spines are sharp and are connected with glands which secrete an irritating fluid. They feed on a great variety of plants, including corn, and, when young, "follow the leader," spinning a silken path for the guidance of those which are behind. The thin, semitransparent, brown cocoon is spun among leaves on the ground.

Although variable in color, the rosy maple moth, *D. rubicunda*, may be known by its being a fluffy combination of rose color and pale yellow, often tinged with pink. The larva feeds on maple and pupates underground



FLIES COMMON ABOUT HOUSES

Here are shown some of the more important flies which are common about houses in districts where the entomological side of sanitation is not given proper attention. *M. domestica* is the so-called house fly—better called filth fly or disease fly, because it breeds in filth and carries disease germs to our food. *S. calcitrans* is the biting house fly. Its superficial resemblance to *M. domestica* and its biting habits have given rise to the error in supposing that the latter species is adding to its many sins by sucking blood. On account of *calcitrans* being more troublesome during rains, it is sometimes called the storm fly



SOME BEETLES OF BEAUTIFUL COLOR

The three beetles shown at the top belong to the family Scarabæidæ and so are related to the sacred scarab of Egypt. Of these, *P. carnifex* is the most nearly related to it and has the same habit of feeding on dung. *C. lanigera*, as its specific name indicates, bears "wool" on its under side. It is a glorified May beetle or "June bug." *A. nitida* is called figeater in the South. Like *lanigera*, its larva feeds on the roots of grasses and other plants.

The three beetles in the middle of the plate are Cerambycidæ, or long-horns. Their larvæ bore in twigs. The beetles at the bottom are Chrysomelidæ, relatives of the ordinary potato beetle. *C. auratus* is an iridescent insect gem. It is fairly common on dogbane and may be had in one's garden by cultivating its food plant. *G. luteola* is not wanted. It is the elm leaf beetle, an undesirable immigrant from Europe

INSECTS TO BE HANDLED WITH CAUTION

Species of *Mutilla* are known as velvet ants, the reason being evident. They are not ants, however, but wasps, and the wingless female should be handled with care. If insects are known by their works, the nest of the potter wasp, *Eumenes*, should recommend it. *Chrysis* is beautiful in appearance but lazy; it is a cuckoo wasp and lays its eggs in the nests of other wasps. *Odynerus* and *Monobia* are related to *Eumenes*. *Vespa maculata* is the black hornet that makes the large paper nest on trees. *V. communis* is a yellow jacket that makes a smaller but similar nest underground. *V. crabro* has been introduced from Europe

A Naturalist's Notes on a Trip up the Orinoco

By GEORGE K. CHERRIE

THE naturalist might travel far before finding as interesting a region for research as that along the middle stretches of the Orinoco River in Venezuela. Plant and animal life abound in great variety, although the vegetation is less luxuriant than in the delta of the river, where a tropical growth of forest replaces the llanos or plains which, through the middle section, form the great grazing lands for which Venezuela is famous.

Contrary to popular belief, the Orinoco is a very large river. A little below Caicara, which is about four hundred miles above the mouth, I have sometimes spent a whole day in crossing, zigzagging among the innumerable islands. This was during the rainy season when the water was at its highest point. Undoubtedly at that place the river was then forty miles wide. The annual rise varies from sixty to eighty feet, and the banks being low, the water spreads over an immense territory, inundating hundreds of thousands of acres. At such a time—when one is pushing his canoe up stream—many of the apparent islands are really only the tops of tall trees, from fifty to sixty feet high, protruding above the water. It is difficult to comprehend that these are not islands in fact. Even the birds do not always seem to realize how rapidly the waters rise, for many build their nests on dry land which is later submerged. Consequently a great number of these nests with their eggs and young are lost. Often I have noted orioles building their homes twenty-five feet above the water, yet by the time the eggs were hatched the nests were washed away and the young drowned.

As the floods begin at the headwaters of the river and its tributaries about the last of April, and continue to rise steadily until about the first or middle of September, one can see the level of the water increase day after day. Rats and other creatures have a chance to get back out of harm's way; but even these sometimes are compelled to stay where they are, because they have not taken advantage of the gradual rise of the water and, perhaps being on a little higher ground or a knoll, are surrounded before they know it.

We spent four months making the ascension of the Orinoco. Steamers are available now, but in those days, seventeen or eighteen years ago, the only reliable mode of travel was by canoe or native boats of one kind or another. The few steamers then on the river had no regular schedule, running only when they had a sufficient cargo—or some other particular reason. We had our own canoe, manned by native men. It is always advisable to employ men who are familiar with the river. While there might not be any particular risk in pushing one's own canoe up stream, there is possible danger of being swept across rapids and falls. For instance, if one's canoe were on the wrong side of the river and, while being pulled through a small rapid or waterfall by means of ropes, should encounter some obstruction, such as a large rock in the middle of the rapid, the prow might be forced out into the river and the canoe capsized. I prefer a native Indian or Spaniard for manning the dugout canoe. The Indians are semicivilized and lazy, but even so they are better than a large percentage of the half-breeds. Indians in Venezuela, except those at the headwaters of the rivers in the interior, all speak more or less Spanish. Even when they cannot speak the language, they sometimes understand it.

Our canoe, or bungo, which was a

large dugout made from a single tree trunk, was a little more than five feet wide, from thirty to thirty-six inches deep, and thirty-four feet long. It was so solid and heavy that we could scarcely turn it over, although as a matter of fact we did drag it over a great many rapids, the first of these at Cariben, where there is a swift and dangerous cataract foaming between immense sentinel-like masses of black granite. For about one third of its length the bungo was covered with a *carroza,* or awning, which resembled in shape the old "prairie schooner" coverings, but the *carroza* was thatched with reeds. Under this we slept, and also stored such articles as needed to be kept dry.

Arrangements for cooking in the canoe included a box of dirt upon which a fire could be built. Firewood in sufficient quantity was gathered at one place or another, and sometimes several days would pass without our touching land at all. When night came we would simply tie up in the tree tops. We found it advantageous to take with us such articles of food as sugar, salt, coffee, rice, and beans, for while some of these could be purchased *en route,* the prices were excessively high. For meat we depended upon wild game; ducks and geese were abundant, also squirrels, a species of raccoon, the iguana, and other animals which we esteemed as food. Plantains, yams, and corn we often were able to obtain from the natives in exchange for coffee, pepper, and salt, supplies of which we always took with us for trading purposes. Natives and half-breeds who had been in the settlements and learned the use of black pepper, were almost wild in their desire to obtain this condiment; so with a little of that article we frequently made advantageous trades; occasionally we traded a little salt for some of their hot red peppers.

We were very snug and comfortable in our canoe, where a few chickens in the prow gave an added touch of homeliness, besides furnishing us with occasional fresh eggs. It was interesting to note that whenever the canoe touched shore these chickens would clamor loudly to get out, whereas while on the water they stayed very contentedly in their quarters. When we landed, and the top of the coop was thrown open, they would immediately fly out, although they never wandered very far from camp. In spite of this, however, one of them flew squawking home one evening with two toes missing, probably nipped off by a turtle or a man-eating fish.

We camped in one spot from a day to a week or more, depending on its suitability as a place for collecting specimens. On moving days we made an early start, usually about four o'clock in the morning, stopping when we reached a favorable place for a new camp. In the vicinity of rapids or falls, we were greatly troubled by black flies and other insect pests. Above the falls of Atures and Maipures the black flies were a great plague. They are tiny little fellows but have a very big bite which produces an intolerable itching. Frequently I found it necessary to work under the hammock net while preparing my specimens; otherwise the attacks of the swarms of biting, blood-sucking insects on my hands and face would drive me almost frantic. Mosquitoes, during the dry season, were no more abundant than they are in New Jersey or Long Island.

A very curious bird found in this region is the "hoactzin." It is said to be a distant relative of reptiles, which in its immature stages it somewhat resembles. It is provided with claws near the wrist-joint; by means of these, its feet, its bill—and often by hooking the head over a twig or branch—it climbs about its nest in the tree tops after the manner of a quadruped. The nest is a very frail affair, consisting of a platform of sticks and twigs so slight that the eggs can be seen from below through the meshes. The nest is always built over the water, usually within four or five feet of the surface. But in spite of being so placed, it may nevertheless be in the top of a tree on submerged land, and should the waters subside, would be fifty or sixty feet from the ground. Within twenty-four hours after the eggs are hatched the young leave the nest, dropping into the water at the least alarm. Although they are tiny birds, they swim and dive wonderfully well, continuing this semi-aquatic life until they are about one third grown and their feathers begin to appear; just when they cease this practice I do not know. If I sat quietly in my canoe, after startling a young bird from the nest, I would presently see it emerge from the water and creep up the branch on which the nest was placed; if undisturbed it would go into the nest and settle down, but if again alarmed, it would swim under the water to the protection of thickly growing twigs or drift where, thrusting only the head above the surface, it might breathe and watch the enemy. The adults never go into the water. This may be on account of their heavy plumage, which if wet would make getting about very difficult. In color they are reddish brown with a yellowish crest, giving them somewhat the appearance of a peafowl. The body is as large as that of a crow. They have a strong musky odor which may account for their common English name, "stink pheasant." The carpal claw persists in the adult bird, but it is so small that it can hardly be said to be functional.

In the tree top islands we frequently found wood rats and mice concealed in natural cavities or occupying deserted birds' nests. During the dry season these animals are mainly terrestrial in their habits. The fact of their living in the tree tops during the rainy season merely shows their power of adaptation to a changed environment. A good many of the wood rats found in this region have the hair on the upper parts very stiff and harsh, in some cases developed into sharp spines. I believe they feed entirely on vegetable matter —fruits, buds, and leaves—and they lack the disagreeable odor of the house mice and rats. Consequently, we were not surprised to find that many of the natives consider their flesh, which is white and tender, very good eating—an opinion in which we concurred after a trial.

Another rodent esteemed for its flesh is the capybara or "water-hog." As the English name would indicate, it is always found near the water, making its home amid the reeds or in the thickets of marsh or swamp. During the day it is usually wary and shy, but in the dusk of the evening, or on moonlight nights, numbers may be seen disporting themselves along the sandy beaches or playing in the water. When hunted, the capybara frequently attempts to escape by swimming or making long dives. A full-grown animal weighs from one hundred and fifty to two hundred pounds—it is the largest of living rodents. Like the wood rat, its food is exclusively vegetable. The flesh is frequently cut into narrow strips by the natives, salted, and sun-dried for future use.

During our journeying on the Orinoco, we found it always unwise to go into the water for a swim on account of the man-eating fish, the *caribe*. When we were collecting, it often happened that shore birds and other specimens fell wounded into the water. These were immediately attacked by the voracious fishes, and in an incredibly short space of time were completely torn to bits. One of Mrs. Cherrie's chief pastimes was to fish for these *caribe*. Taking a line with a bit of rag for bait, she would throw it out as far as she could and immediately draw it back. Four times out of five there would be a *caribe* on the hook. One does not dare to touch these fish while they are alive, as they snap and bite viciously. Therefore, before attempting to remove the hook, Mrs. Cherrie would take the precaution to kill the fish with her hunting knife. These fish vary in weight from one quarter of a pound to five or six pounds, the average weight perhaps being three quarters of a pound.

When collecting waterfowl in ponds adjacent to the river, I have often waded out up to my waist and shot the birds. Sometimes a wounded bird floating about would attract the crocodiles by its cries of distress, and four or five would start for the bird, which I sometimes had difficulty in rescuing. The only thing I could do was to fire at the crocodiles one after another; one shot was usually sufficient to discourage them. They are extremely abundant in that region, particularly along the tributaries of the river and the small, sluggish streams, where they congregate by thousands on the mud banks. It is rare to see crocodiles on a sandy or gravelly beach. During the flood season comparatively few are seen, but along the smaller streams in midsummer they are found in great numbers. When the waters recede at the beginning of the dry season, one species of small alligator, called *jacare,* measuring in length about four or five feet, buries itself in the mud. It remains in a semitorpid condition throughout the summer months, during which the swamps are covered with a thick crust of baked earth. On breaking through this dried marsh I have found the small animals enclosed within mud walls, but with sufficient room left to turn about. While in this hibernating state they nevertheless were quite lively and, upon being aroused, were decidedly ugly, snapping viciously whenever touched.

A very terrifying and awe-inspiring sound at night is the roar of the jaguar, which can be compared only with that of a lion or possibly the tiger. The air seems to vibrate with the bloodcurdling noise. The jaguar is common along the Orinoco, especially in the vicinity of cattle ranches where it preys upon the stock; a full-grown animal often will attack and pull down an ox. At one of our camps on the upper Orinoco I had a couple of big mules. About daybreak one morning while I was stirring up the ashes preparatory to starting breakfast, I heard a terrific crashing of the bushes and a moment later one of the mules burst into camp. He was streaming with blood and had long scratches over the flanks and across the face and nostrils. A jaguar had sprung upon him, but he had been able to shake the animal loose and outrun him into the safe shelter of camp. I immediately took my gun and went to the spot where the struggle had taken place, but the jaguar had disappeared. Thereafter, I can assure you, the mule never strayed more than a hundred feet away from camp.

We had several similar experiences without actually encountering the animal itself, which rarely attacks man unless it is wounded or cornered. On one of these occasions we were camped at a little native village known as Las Bonitas. This village is situated on a small knoll quite close to the river, the country about being more or less open savannah thinly sprinkled with clumps of trees. When I left camp every morning, it was Mrs. Cherrie's custom to watch me until I was out of sight. One day as usual she, together with several native women, was looking after me. I went down toward the river, following a strip of brush close to the water's edge, and finally turned into a narrow path leading to the bank. At this point those who were watching saw a jaguar emerge from the thicket, turn, and walk along behind me. An alarm was given and men immediately started out, but on reaching the river they could find no trace of either me or the jaguar. All unsuspecting of danger, I returned to camp a few hours later, and found great excitement there, every one supposing that the jaguar had carried me away.

Some months later, accompanied by Mrs. Cherrie and our three months' old baby, I ascended the Orinoco during the height of the rainy season. As I have previously said, during this season it was very difficult for us to find dry land on which to make our camp. Consequently, from midday onward, we were on the lookout for a suitable place to stop for the night. On one occasion, when we had almost despaired of finding dry land, just before dusk we came to a point where the land was only a few inches above the level of the water. Seeing no prospect of finding a better place, we decided to try it there. We were tired of pulling the heavy boat up stream, it being always difficult to get the necessary number of men to help us. When we landed we found that the water had subsided, probably within the last few hours, leaving a layer of silt which was still like soft mud. I picked up my gun and got out of the canoe, telling the men to make camp and prepare our evening meal. As soon as I stepped ashore I saw some jaguar tracks, and saying to Mrs. Cherrie that I would walk back into the forest and try to find something to shoot, I followed the trail. For quite a distance the tracks seemed to grow fresher, and, making as little noise as possible, I peered here and there on each side expecting at any moment to see the jaguar which I felt was only a short distance ahead of me. Presently, however, the tracks seemed to turn toward the river, and much to my surprise I found that I had made a circuit and was crossing my own trail, as well as the jaguar's. But the thing that startled me not a little was, on looking down, to find by the side of my own track the footprints of a second jaguar. It was rather disquieting, I assure you, and although I kept on for a little distance I often looked back, not liking the idea of having a jaguar both behind and in front of me. Meeting with no success in my search I went back to camp. When I arrived I saw by the actions of my men that something had occurred to alarm them. One of them approached and told me that it was dangerous to hear that "young animal" crying. At first I did not understand his allusion so I asked him what young animal he was talking about. He replied, "The baby is crying and there are many jaguars about camp." The canoe men had seen the jaguar tracks and were very uneasy, saying that if the baby cried, the jaguars would attack in an attempt to steal it. They were so much alarmed, not only for the sake of the baby but also for their own, that they had actually ceased all preparation for camp or dinner. I took another short walk, looking carefully for further signs of the animal but could see none. Returning, I found that the men had, without orders, put back the cooking utensils and were standing by the canoe, much to the disgust of Mrs. Cherrie who was not aware of any danger. Explaining the situation, I told her that owing to the action of the men and also from the fact that I, too, felt a little uneasy, not having been able to trace the jaguar, it would be better for us not to make camp there even if we had to spend the night in the tree tops. So we put everything back into the canoe and pushed off. In a couple of hours we came to an open space on a sandy island, covered with rushes and reeds, and there we built our camp on the shore.

Most of our time in Venezuela was spent on the Orinoco and its tributaries, particularly the Caura, the Apure, and the Meta, where some of the most thrilling events connected with my explorations have occurred. Danger has not always been from wild animals; man also has been an enemy. Natives employed as boatmen have sometimes proved untrustworthy, especially in that part of the high interior known as the *Territorio Amazonas,* which is a place of refuge for criminals from Colombia and Brazil, as well as from other parts of Venezuela. On one of my journeys into that region, after we had arrived above the falls of Atures, two of the members of my crew began to make trouble and, one evening, I overheard them discussing the value of the cargo we carried and incidentally bargaining about the different articles that would fall to one or the other of them. Evidently they were plotting to rid themselves of me and take possession of the outfit. Fortunately, however, one of the crew remained faithful, and on that same evening he came to me and revealed the whole plot. Prompt action thereupon not only saved myself but the rest of my men from possible destruction, and at the same time relieved us of the two conspirators.

An expedition into the interior of any of the South American countries requires quick wit and resourcefulness on the part of its leader. He must be able to handle cross-grained human beings as well as ill-natured, bucking pack mules, and while it is rarely necessary to use force, firmness and a readiness to act are absolutely essential. Much more can be accomplished by making friends of the people than by assuming an air of superiority, which usually antagonizes them.

An invitation to the delights of the field.—Mr. Cherrie in South America, photographed by Kermit Roosevelt, as they waited for the rest of the party to catch up. This was during the Roosevelt Expedition, the early part of the journeying down the "River of Doubt," while clothing was still in a good state of repair

Collecting a fossil skeleton in the Bighorn Bad Lands of Wyoming. Mr. William Stein, of the American Museum Expedition of 1910, is taking up a skeleton of the four-toed horse *Eohippus*, not far from the locality where he discovered the skeleton of the giant bird six years afterward

A Fortunate Collector

IN THE October JOURNAL for 1917 was a short account of the gigantic bird skeleton discovered by Mr. William Stein in the Bighorn basin of Wyoming. Our files show one picture of Mr. Stein taken in the rough field clothes that the fossil collector wears (it is not a kid glove business). He is standing in front of the wagon which he used on the trip into the Bad Lands when he collected the *Diatryma* skeleton. In a second photograph he is shown collecting a skeleton of the little four-toed horse *Eohippus*, another important find made some years before, and now mounted in the Tertiary mammal hall. This picture gives a characteristic view of Bad Land scenery and fossil collecting.

The *Diatryma* skeleton was found only a few miles from this locality, on the far side of the ridge in the background of the picture. This magnificent bird was larger than an ostrich and more impressive because of its huge head and thick neck. The finding of the skeleton in an almost complete and unusually well-preserved condition is one of the few really important discoveries which have been made among fossil birds.—W. D. M.

Mr. William Stein, the discoverer of the fossil skeleton of the giant bird *Diatryma* in the Bighorn basin, Wyoming. At the left Mr. Stein is seen in field costume, standing in front of the wagon which he used on the expedition

Second Thule Expedition under Rasmussen

DURING the stay of the Crocker Land Expedition in the Arctic, the JOURNAL was privileged to report from time to time various courtesies extended to this expedition by Mr. Knud Rasmussen, Danish explorer. It now wishes to call attention to the Second Thule Expedition, under Rasmussen, which has returned to its base in Northwest Greenland, reporting successful explorations of the fjords of the North Greenland coast.

A telegram received on May 27 by President Henry Fairfield Osborn at the American Museum reads: "Knud Rasmussen on his way back from Greenland. Carried out his expedition and reached DeLong's Fjord. Has mapped all great fjords [extreme North Greenland coast]. No traces found of former [Eskimo] immigration. No game and generally very bad conditions. The Swedish Dr. Wulff and one Greenlander perished." A Reuter's Copenhagen correspondent transmits a further telegram in which the Danish explorer says that his advance was attended with greatest difficulties; that after Hendrik Olsen's death "we started on our homeward journey and reached land on August 24 at Cape Agassiz, in bad plight, without provisions." After Etah was reached sledges with supplies were sent back to the rest of the party but too late to save Dr. Wulff.

The telegrams have been sent out by Mr. M. Ib Nyeboe, chairman of the committee in charge of the Thule Station, Northwest Greenland, and imply that Rasmussen returned from his expedition in the fall of 1917 and probably wintered at Thule, sending letters from there to Copenhagen. Letters sent out from Thule in January by Eskimo messenger across Melville Bay to Upernivik, would catch the regular mail sledge going southward through the Danish colonies to Holstensborg and the steamer there for Copenhagen. Thule, situated on North Star Bay, Northwest Greenland, is the northernmost trading station of the world, and was established by Mr. Rasmussen in 1910 for special service to the Smith Sound Eskimos as well as a scientific base for Danish polar exploration.

The First Thule Expedition under the leadership of Rasmussen left this station in 1912. It crossed the inland ice cap of Greenland, somewhat south of the routes fol-

Courtesy of E. O. Hovey

View of North Star Bay, northwest coast of Greenland.—At the right Dundas Mountain rises 700 feet above the sea level. About one mile from its base can be seen the houses of Thule Station, scientific base for Danish Arctic exploration and trading station established by Mr. Knud Rasmussen for the Smith Sound Eskimos in 1910. Mr. Peter Freuchen is resident manager of the station

lowed by Peary in 1892 and 1895, and reached Danmarks Fjord (just south of Independence Fjord at the northeast corner of Greenland). This expedition made surveys at the head of Independence Fjord, which enforced the 1907 discovery of the unfortunate Mylius Erichsen that "Peary Channel" of the maps was nonexistent, Independence Fjord a fjord only, and Peary Land not a separate "land" but a part of the coast of North Greenland.

Rasmussen planned a Second Thule Expedition for the summer of 1916 to complete the surveys of this region, particularly the inlets and fjords of the coast between Independence and Sherard Osborn fjords. For the second expedition he left Copenhagen in April, 1916, by the mail steamer to Holstensborg. From there he traveled by sledge northward and across Melville Bay to North Star Bay. He reached this point too late, however, to complete the necessary preparations and start northward across the ice cap by June 1, as planned. It was therefore necessary to postpone the work until 1917, spending the winter of 1916–17 at Thule. This led to the great advantage, however, of affording opportunity to make a very early start in 1917, when the sea was still frozen over. Thus the original plan of crossing the inland ice cap to reach the unexplored areas, following the route of the First Thule Expedition, was abandoned, and the sea-ice route determined upon, northward through Kennedy Channel to Fort Conger, across Robeson Channel to the Greenland coast, thence northeastward, mapping the coast with its fjords to Peary Land.

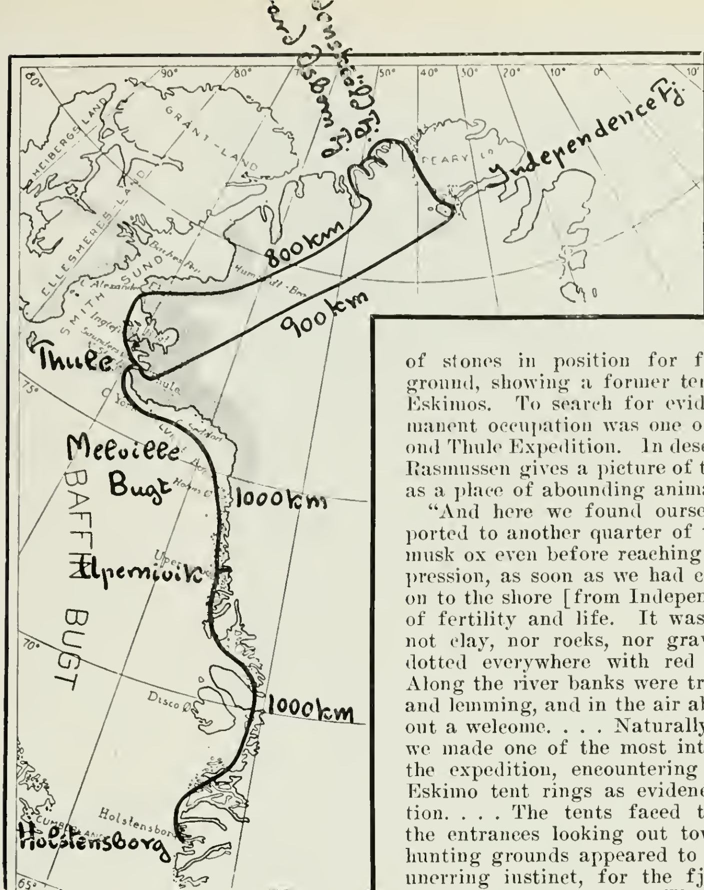
The expedition left Thule April 4, 1917, as reported by Dr. E. O. Hovey who, as a member of the first relief ship sent northward for the Crocker Land Expedition, was wintering at North Star Bay at the time. Rasmussen visited MacMillan at Etah on the way northward about April 10. He was accompanied by Dr. T. Wulff, Swedish botanist, Lauge Koch, geologist and cartographer, several Smith Sound Eskimos, and by Hendrik Olsen, a Greenlander who had been a member of the early Danmark East Coast Expedition. Rasmussen's plans included living on the supplies furnished by the coun-

Courtesy of Donald B. MacMillan

Hendrik Olsen, the Greenlander, with a loaded sledge of the Second Thule Expedition, 1917, photographed on the ice of Foulke Fjord in front of the headquarters of the Crocker Land Expedition. Rasmussen reports the death of Hendrik Olsen on this expedition

Courtesy of Donald B. MacMillan

Eskimos and sledges of the Second Thule Expedition, in front of Crocker Land Expedition headquarters, just before starting northward on the sea ice



Map of a part of Greenland, on which Rasmussen outlined in 1916 the intended route to Peary Land over the inland ice cap. The expedition was delayed until 1917, when an early start in April allowed the sea ice route to be followed instead. The fjords and inlets explored are supposed to be those along the North Greenland coast between Independence and Sherard Osborn fjords

try. It is reported that he took only sufficient pemmican to insure safety on the return trip which was to be made over the inland ice cap.

One of the most interesting items in the report of the 1912 expedition was a discovery of "tent rings," circles of stones in position for fastening tents to the ground, showing a former temporary occupation by Eskimos. To search for evidences of previous permanent occupation was one of the aims of the Second Thule Expedition. In describing these tent rings, Rasmussen gives a picture of the isolated Peary Land as a place of abounding animal and plant life.

"And here we found ourselves as it were transported to another quarter of the globe. We sighted musk ox even before reaching land, and our first impression, as soon as we had crossed the ice limit up on to the shore [from Independence Fjord], was one of fertility and life. It was a real delight to see, not clay, nor rocks, nor gravel, but earth; mould, dotted everywhere with red blossoming saxifrage. Along the river banks were tracks of musk ox, hare, and lemming, and in the air above, the skuas shrieked out a welcome. . . . Naturally also, it was here that we made one of the most interesting discoveries of the expedition, encountering at several places old Eskimo tent rings as evidence of previous occupation. . . . The tents faced towards the northeast, the entrances looking out towards the fjord. The hunting grounds appeared to have been chosen with unerring instinct, for the fjord was full of seals basking in the sun. . . . Those [tent rings] on the eastern side were of unusually small circumference. . . . The tent rings on the western side of the Fjord, numbering five in all, were considerably larger. . . . The largest of the best preserved rings measured 4 m. long by 2.70 broad. The ground outside each of them was strewn with bones of musk ox and seal, showing that the tent-dwellers had not lacked meat."

The following outline by Mr. Rasmussen giving the original plans for work will be of especial interest for comparison with the accomplished results when these are known in detail.—The Editor.

Plans for the Second Thule Expedition to North Greenland

By KNUD RASMUSSEN

It may be remembered that in 1912, on the First Thule Expedition, Freuchen and I found ourselves obliged to shape our course for home without having been able to penetrate entirely through the newly discovered Adam Bierings Land to the neighborhood of Nordenskiöld Inlet and Sherard Osborn Fjord. When we made the decision to return, we had been out for more than four months on a continuous march of very arduous nature through unknown country. As soon, therefore, as we had succeeded in surveying the base of Independence Fjord with its immediate surroundings, and thus definitely ascertained that Peary Land was connected by land with Greenland, it was necessary, both for our own sake and that of the dogs, to make our way back over the inland ice, postponing the exploration of the last unknown regions in Greenland until a more

Courtesy of Donald B. MacMillan

LEADER AND TWO MEMBERS OF THE SECOND THULE EXPEDITION

Mr. Knud Rasmussen (in the middle) reports his safe arrival at Thule Station, Northwest Greenland, after several months' work in the spring and summer of 1917 along the unexplored coast of North Greenland.

Mr. Lauge Koch (at the left), Danish geologist, accompanied Rasmussen as cartographer and geologist of the expedition.

Dr. Thorild Wulff (at the right), Swedish botanist, is reported to have lost his life on this expedition convenient time, when the work could be entered upon with renewed strength.

In the winter of 1914 the first attempt to carry out this plan was made, with Freuchen as leader; owing to a fall through a fissure, however, during the ascent to the inland ice, he was obliged to turn back, and has not since been able to set out again. Thus the expedition in question still remains an unredeemed promise on the part of our Thule Arctic station, and I shall make an attempt to realize it this year [1916]. The plan may be briefly stated as follows:

I shall leave Copenhagen April 1, arriving at Holstensborg, in South Greenland, about April 20. From here, by forced marches through the Danish colonies up to Upernivik I hope to reach Thule in time to begin the ascent of the inland ice by June 1 at the latest. We shape our course from Clemens Markham Glacier toward Sherard Osborn Fjord, about 600 km. over the inland ice, and if able to descend here, will push on to Nordenskiöld Inlet and the country between there and Independence Fjord.

Should we be unable to get down at Sherard Osborn Fjord, we shall then make directly for Adam Bierings Land, endeavoring to find a route thence to the unknown regions which are to be surveyed. By the tenth or fifteenth of August we must be ready to start back over the inland ice, so as to reach Thule in time to begin the homeward voyage on board the "Kap York," leaving there early in September.

The main object of the expedition will be the exploration and survey of the country between Independence Fjord and Nordenskiöld Inlet, Victoria Inlet and Sherard Osborn Fjord.

The investigation of these regions offers, in addition to geographical results, also ethnographical problems of very considerable interest; it will be important to ascertain, for instance, with regard to the theory of Eskimo migrations, whether winter houses of the Eskimo exist in the great fjords mentioned. It will be remembered that in Peary Land tent rings have been found but no winter houses, the northern limit of which, on the east coast of North Greenland, lies at Sophus Müllers Ness and Eskimo Ness, in Amdrup Land and Holms Land respectively, whereas the northern limit on the west coast of Greenland is in the vicinity of the Humboldt Glacier and Hazen Lake in Grant Land. In order to obtain thorough knowledge of the Eskimo migrations, therefore, we have still to investigate the great fjords of Nares Land and the northwest coast of Peary Land.

Among the geological questions to be dealt with by the expedition, it will suffice to mention the following:

During the course of the last century, the whole of West and East Greenland has been geologically investigated by various expeditions; the range from Sherard Osborn Fjord to Peary Land, however, with the large unknown fjords of the latter country, most difficult of access, still remains as a missing link between the east and west coasts, and until explorations have been made here it will be impossible to form a complete geological picture of Greenland. As the coasts and fjords of this, the most northerly region, still remain to be surveyed geographically, so also, from a geological point of view, the investigations hitherto made have yet to be completed by investigation of these regions, and it should be a point of honor with us to see that this work is accomplished by a Danish geologist.

We know that there is a range of mountains in Peary Land presumably forming a continuation of the system discovered in Grinnell Land. It will therefore be one object of the expedition to ascertain the extent and age of this range. It will be remembered that Peary Land runs out as an ice-free and partly snow-free alpine country north of the inland ice, which remarkable feature offers a peculiarly favorable field for geological work generally, such as is rarely encountered in these latitudes.

The entire journey out and home over the inland ice amounts to something like 2000 km. and there will thus be opportunities for making various investigations as to the physical condition of the inland ice itself.

In addition to the work here mapped out, the expedition will include careful noting of meteorological conditions and the collecting of botanical and zoölogical specimens.

As in the case of the First Thule Expedition, our equipment will be based throughout on Eskimo principles, food being procured by hunting carried on simultaneously with the scientific work.

The expedition is equipped and financed by the station at Thule, the administration of which is in the hands of a committee, with Mr. M. Ib Nyeboe, civil engineer, as chairman. The scientific work hitherto carried out, and further contemplated by the station, has, however, rendered it advisable that we place ourselves in more direct connection with scientists, and a committee has therefore been formed, consisting of the following gentlemen, representing different branches of science: H. Jungersen, Ph.D., professor at the University of Copenhagen (zoölogy); I. P. Koch, captain in the Danish Army (Arctic Exploration); O. B. Bøggild, professor at the University of Copenhagen (geology and mineralogy); H. P. Steensby, professor at the University of Copenhagen (geography and ethnography); C. H. Ostenfeld, Ph. D., manager of the Museum of Botany in Copenhagen (botany).

Finally, I should mention, that the plan of the Second Thule Expedition is but a link in the chain of various scientific investigations which it should be possible to carry out from the station at Thule as a base. This fact is not least among the considerations that have led to the desire for coöperation with a permanent scientific committee, so composed as to include our most distinguished experts in the various branches of science represented.

The Monk Seal of the Southern Pacific[1]

DISCOVERY OF ITS BREEDING GROUNDS AMID THE TREACHEROUS SHOALS OF PEARL AND HERMES REEFS, THE HAWAIIAN ISLANDS

By ALFRED M. BAILEY

(Louisiana State Museum)

DURING the winter of 1912–13, I had the pleasure of being one of a party from the Biological Survey, United States Department of Agriculture, to visit the leeward group of the Hawaiian Islands. We made as complete a survey as possible of the different rocks, sandspits, and shoals which extend northwest from Honolulu, a distance of about fifteen hundred miles. Our party, under the leadership of Commodore G. R. Salisbury of the United States Navy, was taken among the islands on the revenue cutter "Thetis." Mr. G. R. Freer, the Governor of the Hawaiians, and Judge Lindsay, the Attorney General, accompanied us on the trip.

On the outgoing voyage, we stood off the volcanic bluffs of Necker and Bird Islands, but the huge swells that frothed against the steep walls prevented our making a landing. Mr. G. Willett, the ornithologist, succeeded in gaining shore by swimming, a somewhat hazardous feat, considering the nature of those waters.

We made a careful study of French Frigate Shoals, so named from the schooner-like appearance of the rock that stands sentinel over the crescent-shaped string of small sandspits gleaming a few feet above high-tide mark. All these little islands and shoals are famed for their stories of shipwrecked sailors. We landed on a small grass-crowned spit by wading among the beautiful head corals left partly exposed by the outgoing tide. On the highest point of land, surrounded by a colony of albatrosses, screaming boobies, and graceful terns, was a little excavation; four pegs with tattered canvas flapping listlessly marked the remains of a shelter, and the numerous bleaching turtle bones told plainly the main source of food. A half-rotted turtle shell turned bottom to the sky seemed still to ask for rain, and a broken oar blade lay half buried in the coral sand. The most unimaginative could read those few lines.

The "Thetis" landed our party on Laysan Island and went back to Honolulu, returning for us three months later. We had an enjoyable time during those three months, for Laysan is justly famed for her wealth of bird life, in spite of inroads made by feather hunters. The wonderful colony of albatrosses, the thousands of trim-rigged man o' war birds, terns, tropic birds, and waders make Laysan a real bird paradise. Unfortunately, rabbits have been introduced there, and the destruction of the grasses has allowed the sand to drift, so that thousands of young birds are smothered by the shifting dunes. We killed more than five thousand rabbits and, unless something more is done to exterminate them, I fear for the results. A strict watch was kept at all times for rare or new forms, and most of all, we wanted to take the Laysan seal. We patrolled the beach every day, and our efforts were finally rewarded by the taking of a large male specimen. We made careful notes and preserved the skin and skeleton for mounting.

We looked forward to our visit on Lisiansky with high hopes for, after taking one specimen on Laysan, and having reason to believe that Palmer had killed two on Lisiansky, we considered our chances were good of finding stragglers there. The "Thetis" took us directly to the island, which is only

[1] A species of seal was reported as inhabiting the warm waters of the Pacific near the Hawaiian leeward group, and although nine specimens had been collected on Laysan Island in fourteen years' time, none of the skins or skeletons had been saved for scientific purposes. This warm-water seal was described by Dr. Matschie as *Monachus schauinslandi* (*Sitz. Ber. Ges. Naturf. Freunde*, Berlin, p. 254, 1905). I believe that a Mr. Palmer collecting in that region for Rothschild, obtained two specimens on Lisiansky, but these were reported as lost overboard. As I have had experience in trying to cure a large seal without adequate instruments, in a tropical climate, I can readily understand the reason these skins were lost.—THE AUTHOR.

Courtesy of Commodore G. R. Salisbury

The Biological Survey of the United States Department of Agriculture sent an expedition on the revenue cutter "Thetis" to the leeward group of the Hawaiian Islands in 1912–13. One point of special interest lay in observation of the "Laysan seal," the real habitat and breeding grounds of which have always been a mystery since the finding of the first specimen on Laysan Island in 1905. Although strict watch was kept at all times for the rare Hawaiian seal, the expedition of 1912–13 saw only one specimen in the waters or on the beaches of Laysan during a three months' stay. This was a fine male, of which both skin and skeleton were saved for the United States National Museum. On Lisiansky Island, northwest of Laysan, two specimens were seen; but it was on Pearl and Hermes reefs, still farther north and never before visited by scientists, that the main rookery was found. The seals were so tame that they allowed approach to within a few feet. When approached too closely, however, they took to the water, although the old females showed a disposition to fight in protection of the young

Courtesy of Governor G. R. Freer

At the main breeding colony of these seals, on the treacherous Pearl and Hermes reefs—so named from ships wrecked there—we saw about sixty specimens altogether, including twenty females with pups, but the expedition was able to give only one day to investigation. There is urgent need for further study of the species, as the small number of seals in the rookery seems to indicate that they are rapidly becoming extinct ninety miles to the northwest of Laysan, and we were not disappointed, for we found two specimens on the beach. We killed the female, but the other, presumably a male, escaped. The kill was a fine specimen, but was so heavy and cumbersome that we found it very difficult to drag it from the shallow water on to the shelving beach.

We then visited Midway, so well described in Stevenson's *The Wrecker*. The cablemen on Midway told us that seals occasionally wandered ashore, but that the visits were irregularly timed, and there was likely to be a straggler in summer as well as in winter. We made a survey of the islands, and enjoyed the hospitality of Captain Morrison, the head of the colony of cablemen. The captain took us around the reefs in his power launch, and pointed out the bones of the famed ship, "The Wandering Minstrel." "Wandering Minstrel,"—what an appropriate name for a boat cruising in those dreamy, beautiful waters! And the captain showed us the graves of two sailors who had not been able to stand the fourteen months of starvation and thirst that the survivors were forced to endure. We obtained additional data on the nesting birds, but no information relative to the seals.

We considered that our chances of success rested finally on Pearl and Hermes reefs, for these never had been visited by a scientific party so far as we knew. And there we found the main breeding colony. The place consists of numerous sandspits and shoals, surrounded by extensive barrier reefs, over which combers and white-topped breakers tumble with a continuous roar. These treacherous reefs are exceedingly dangerous to navigation, and received their names from the two ships, the "Pearl" and the "Hermes," which were wrecked within a week of each other. Because of storms, it was thought inadvisable to stay in that vicinity longer than necessary, so we decided to spend the one day only.

Mr. Willett visited the largest of the spits while I took another cutter and started for one charted about five miles off. Unfortunately, the spit seemed to have disappeared, for we could not find it, although we tacked back and forth through the reefs for several hours. The crystal-like water mirrored the bottom, and the beautiful many-colored coral fishes so characteristic of Hawaiian waters darted to and fro among the head coral, and the small reef sharks slid stealthily from one deep lead to another. A school of porpoises played off our bow and came in so close as almost to splash in the boat as they cut water, and huge loggerhead turtles slept lazily on the sandy keys. Sooty-backed terns winged close to the surface, their white breasts green with reflected light, and their shrill call, "wide-a-wake," seemed entirely out of place in those sleepy tropical seas.

Photograph by A. M. Bailey

We found two seals asleep on the beach at Lisiansky, and shot one of them, a large female. This warm-water seal is a huge, cumbersome creature, and difficult to handle in a tropical country, without adequate instruments

Photograph by A. M. Bailey

We saw numerous seals flopped out on the beach at Pearl and Hermes reefs, but the number of pups made a pitiful showing when we consider that this is the main breeding colony

Courtesy of George Willett

We took a pup alive back to the ship, a glossy black little fellow, which ceased its childlike cries only when held in our arms

We saw seals playing in the water or flopping out on the shining bars, but did not molest them. They were so tame that we approached within a few feet, and one half-grown pup lying out on a bar, flat on his back, rolled over and beat a hasty retreat only when I tickled him with the toe of my boot. The old females, however, were a little touchy when we approached too near the pups, and one of the sailors had a close call when an irate old lady slid down a bank—under which the sailor had been boredly awaiting our departure and where only a sailor's agility saved him from a drubbing.

The main rookery was located on the large island visited by Mr. Willett. It was topped with a scanty growth of tough wire grasses, just enough to keep the sand from drifting before the steady trade winds. Here we found about twenty females with pups, glossy black little fellows, a few half-grown ones and a very small number of bulls, probably fewer than sixty individuals in the rookery. It would be folly, of course, even to estimate the number of individuals at sea, but they must be few when we consider the pitifully small showing of young in the main breeding colony.

We took a pup back to the ship, and kept it alive for some time, but its distress was so great and its almost childlike cries so distracted the officers that we finally were obliged to kill it. The only time the little fellow would stop crying was when we held him in our arms.

We considered ourselves fortunate to have discovered the breeding colony of these seals whose real habitat has been a sort of mystery so long, and we contented ourselves with taking the three specimens I have mentioned. We felt that even with the favorable conditions which they have for their mode of life, the colony seems far from successful, and that an intimate study of their home life during the breeding season is very desirable.

The Laysan Seal

By J. A. ALLEN

THE observations on the monk seal of the Laysan Islands here recorded by Mr. Bailey furnish highly interesting information respecting a hitherto little-known mammal, the existence of which, as he states, was first made known in 1905, when a skin and skull, parts of two other skulls, and a headskin were brought to the natural history museum in Bremen by its director, Dr. Schauinsland. These were described by Dr. Matschie of the Berlin Museum, by whom the species was named *Mo-*

nachus schauinslandi, after its discoverer. He found that it differed little from the two other known species of the genus, inhabiting respectively the Mediterranean and Caribbean seas. No other specimens appear to have reached any other museum until the return of the "Thetis" from the Laysan Islands in 1913, when the three specimens obtained by Mr. Bailey were received at the United States National Museum in Washington.

The genus *Monachus* is of especial interest on account of the isolation of its three modern representatives, all of which seem doomed to early extinction. The monk seal of what we may call the Mediterranean area appears not to have been very numerous within historic times. It is known to have occurred formerly in small numbers on both the European and the African coasts of this inland sea, and it also has been taken at the Madeira and Canary islands. The early naturalists appear to have had only scanty knowledge of it, and few modern museums can count it among their treasures. It was first formally introduced into technical natural history as *Phoca monachus* by Hermann in 1779, and separated generically from *Phoca* by Fleming in 1822 as the sole representative of his genus *Monachus*.

The only known West Indian seal forms the second species (in respect to its introduction into scientific literature) referable to this genus, it having been described by J. E. Gray, of the British Museum, in 1850, from an imperfect skin "from Jamaica," as *Phoca tropicalis*, and referred by him sixteen years later to the genus *Monachus*. This species, however, remained virtually unknown scientifically for the next twenty years, but nevertheless it has a most interesting and unique history, inasmuch as it was met with by Columbus near the end of August, 1494, as he approached the southern coast of Hispaniola, where his sailors killed eight of them for food.[1] Although this seal was abundant in the sixteenth and seventeenth centuries in the Caribbean Sea and southern part of the Gulf of Mexico, from the Bahama Islands westward to the islets off the coast of Yucatan, it was nearly destroyed for its oil in the eighteenth century and has since been on the verge of extermination throughout its former range.[2] It is still reported as occasionally seen or captured near Cuba and among the keys and islets southeast of the Bahamas.

The third species of *Monachus* was first made known, as stated above, from the Laysan Islands, and an account of its distribution and habits, so far as known, is given by Mr. Bailey in the present number of the JOURNAL.

These three forms of monk seal present a striking similarity in size, coloration, and structure, and thus show the strong persistence of characters inherited from a remote ancestor. As their present distribution is restricted to warm temperate and subtropical latitudes, interest is added to the question of how the Laysan seal reached the Pacific Ocean.

All the nearest relatives of *Monachus* are northern, inhabiting at present only north temperate and arctic littorals; it seems, therefore, unquestionable that its place of origin is northern, and probably not far from the present Mediterranean region. The Caribbean species beyond doubt was derived from North Atlantic stock. In what way it reached the West Indian region is open to speculation, where its presence has been assumed as evidence of a former land bridge between the Antilles and the Mediterranean region, before, however, it was known that still anotner species existed in the Pacific Ocean. It was suggested by its describer that the Laysan seal had reached its present home by way of a "northwest passage," or arctic route, which appears wholly improbable. It seems more reasonable to assume its derivation from the Caribbean area, it finding a way westward into the Pacific during a temporary submergence of the Isthmian region of Central America, probably in pre-Glacial times.

[1] See *Bulletin* Amer. Mus. Nat. Hist. II, p. 23, April, 1887.

[2] The known general history of this seal will be found summarized, together with a detailed account of its structure and relationships, based on the fine series of specimens exhibited in the mammal hall of the American Museum, collected at The Triangles, a group of rocky islets off the coast of Yucatan, in an article by the present writer, entitled: "The West Indian Seal (*Monachus tropicalis* Gray)." *Bulletin* Amer. Mus. Nat. Hist., Vol. II, pp. 1–34, pls. i–iv, April 25, 1887. (Adult and young, skull and principal parts of skeleton figured.)

Notes

Since the last issue of the Journal the following persons have been elected members of the American Museum:

Associate Benefactor, Mrs. Grace E. Kitching.

Fellows, Messrs. Stanley G. Middleton and James Shewan.

Life Members, General Warren M. Healey, Captain Edward B. Close, Messrs. John B. Dennis, Robert Hendry Kelby, Horatio S. Rubens, Jacob Ruppert, Theodore Peters, M. F. Savage, W. K. Vanderbilt, Jr., and C. W. Watson.

Sustaining Members, Mesdames Wm. Fox, August Heckscher, and Messrs. Le Roy Frost, Chas. J. Graham, and Samuel Sachs.

Annual Members, Mesdames Rose O. Bear, Anson W. Burchard, Hugh J. Chisholm, R. J. Collier, William Constable, John J. Corning, Clarkson Cowl, R. J. Cross, Horace E. Deming, Louis J. Ehret, Abram I. Elkus, A. R. Estey, Leopold Fredrick, Morrill Goddard, H. Winthrop Gray, Simon Guggenheim, J. R. Harbeck, Harold Ames Hatch, Henry S. Herrman, Percy Hall Jennings, Garrett B. Kip, Gertrude W. Kohlman, W. J. Matheson, Henry L. Moses, Carl Muller, Henry Parish, Edward Potter, L. Rossbach, William F. Sheehan, L. Graeme Scott, Pierre J. Smith, Henry M. Tilford, Francis M. Weld, Howard F. Whitney, Miss Helen A. Peabody, Doctors James A. Corscaden, Jas. F. McKernon, Felix von Oefele, Messrs. Fridtjov Andersen, C. C. Auchincloss, J. L. Bell, Arthur Bodanzky, John S. Clarke, F. G. Cooper, Richard Varick Dey, Ellis P. Earle, Howard Elliott, Frank J. E. Fitzpatrick, B. Frankfeld, Fred Frese, John H. Fulle, William H. F. Gade, Eugenio Galban, Eugene C. Harding, Clarence L. Hay, Samuel A. Herzog, R. H. Higgins, Harry L. Hoffman, Ernest Hopkinson, Chris. G. Hupfel, A. S. Hutchins, Robt. H. Ingersoll, Otto Isenstein, William B. Isham, George S. Jephson, Eli Joseph, Daniel Kops, Sigmund Klee, William W. Lawton, Henry Goddard Leach, William McNair, Alexander J. Marcuse, Wm. Wallace Mein, Jan W. Paris, Henry B. Platt, Elwyn W. Poor, Samuel Pratt, Walter N. Rothschild, Louis B. Schram, Arthur A. Schwarz, Edw. W. Sparks, Emil M. Sperling, the Scoville School, and the Sisters of the Good Shepherd.

Associate Members, Mesdames Gordon T. Beaham, Esther A. Horr, Lucy H. Robertson, the Rt. Rev. Edwin G. Weed, the Rev. Robert Wilson, D.D., General Wm. Verbeck, Colonels John Millis, Frederic J. Paxon, Henry Lee Valentine, the Hon. George A. Parker, Doctors J. M. Francis, St. Geo. T. Grinnan, H. F. Harris, Hugh Nelson Page, Chas. P. Neill, Joseph A. White, Robert Wilson, Jr., Professors Alfred E. Burton, Melville T. Cook, Arthur S. Eakle, Messrs. Wm. A. Adams, L. H. Bailey, E. A. Boardman, J. J. Goodrum, Jr., Chas. C. Hanmer, N. A. Hardee, Henry K. Jones, Robinson Locke, C. G. Memminger, Chas. C. Moore, Edwin C. Northrop, Joseph Ripley, William Randolph Robins, Simon W. Rosendale, Earle Sloan, J. P. Stevens, Thos. W. Synnott, Francis J. Torrance, Seymour van Santvoord, and Robert F. Welsh.

Two bequests to the American Museum were announced at a meeting of the executive committee of this institution on April 17. One is under the will of Ludwig Dreyfuss for $10,000, the other under the will of Mrs. Louisa Combe, who became a life member of the Museum in 1894. The amount of the latter gift has not yet been made public.

The illustrations which accompany the review of Frank E. Lutz's *Field Book of Insects* appearing in this issue of the Journal were printed in color by the American Museum press from plates loaned through the courtesy of G. P. Putnam's Sons.

Mr. Herbert P. Whitlock, of the New York State Museum, was appointed curator of the department of mineralogy in the American Museum of Natural History at a meeting of the executive committee on April 17. Mr. Whitlock was graduated from the Columbia University School of Mines in 1901 and acted as assistant in mineralogy at the University until 1904, when he became connected with the New York State Museum as mineralogist. He is especially interested in methods of museum installation. His resignation from the State Museum will take effect on June 1, at which date he will become officially connected with the scientific staff of the American Museum.

The sum of $10,000 has been added to the permanent endowment fund of the American Museum of Natural History, through the will of a friend of the institution, for use in the department of anthropology. It is planned to utilize the income for the development of physical anthropology.

In his new book, *When the Somme Ran Red*, A. Radclyffe Dugmore relates his experiences in the trenches and on the battlefield as simply and forcefully as he has told *The Romance of the Beaver* or *Camera Adventures in the African Wilds*. Before the great war began, Captain Dugmore's life was devoted to the study of natural history and his shooting was done chiefly with the camera. He went to Belgium after the German invasion, to see and record what the Germans had done there. He was wounded and made prisoner. Later, he offered his services to the English army; he was several years past conscription age. His account of life at the front and the first days of the Battle of the Somme (to the time when he was gassed) is graphic and convincing. He leaves no doubt in the mind of the reader that where such indomitable spirit and courage have been displayed the final outcome of the great struggle now waging over the same ground is unquestioned.

It is reported[1] that the fields over which the battle of the Somme raged during the late summer and autumn of 1916 were thickly carpeted with blossoming plants less than a year later. July of 1917 saw vast stretches of scarlet poppies, interspersed with acres of chamomile (*Matricaria chamomilla*, L.) and large patches of yellow charlock, glorifying what had been but a dreary waste of mud and water throughout the preceding winter. Half hidden within this luxuriant growth white crosses mark the graves of the dead. Where shells left yawning holes, water has gathered and formed ponds, which are rendered more or less permanent by the nature of the soil. In and around these flourish the annual rush (*Juncus bufonius*), the smartweed (*Polygonum persicaria*), and numerous water grasses. Dragon flies hover about the pools, which teem with water beetles and various other forms of pond life. The woods which once covered the uplands have been destroyed almost entirely by the heavy shelling. Only at Aveluy Wood a few badly broken trees still live, and these rise from a dense growth of the rosebay willow-herb (*Epilobium angustifolium*). The extraordinary method of cultivation of the soil apparently has increased its productive power. The underlying chalk formation has been broken up, mixing with the subsoil and the old surface soil, thus forming a new and very fertile combination, from which the various seeds, many of them perhaps long buried deep in the ground, have sprung with great vigor. Patches of oats and barley and occasionally of wheat are to be seen. These may have been sown by the Germans, or they may have lain dormant in the ground since before the war when this land was all under cultivation. Along the roadsides are traces of the old permanent flora; while here and there remains of currant and other bushes show where had stood a cottage with its garden.

[1] Capt. A. W. Hill, Assistant Director, Royal Botanic Gardens, Kew, England, in the *Kew Bulletin of Miscellaneous Information*, Nos. 9 and 10, 1917.

The following letter, dated May 5, from Dr. Jean B. Charcot, physician, Antarctic explorer, and at present lieutenant in the French Navy, comes to us through the courtesy of Mr. Herbert L. Bridgman, business manager of *The Brooklyn Standard Union:*

"How far the Antarctic is now! And what different work I am engaged in! It is still oceanography, but of a special sort, as I am running after *tin-fish*. For about a year I was medical doctor in the French Navy, but later obtained the command of an auxiliary cruiser under British Admiralty orders. The work we did north of Scotland in winter was very hard, and after eight months of this I fell dangerously ill, in fact nobody knows how I outlived it; nevertheless after six months I obtained another ship and for more than a year I have been running after the Huns in the Atlantic and Channel. I cannot say that my health is good, as one third of my lungs is useless, but I hope to go to the end of the business and play my part in the big adventure. I am the oldest of the commanders of small ships and I have with me part of my good old Antarctic crew, who asked to serve under my orders; some too old for conscription have engaged to come with me and it is a real satisfaction. I have lent my good old 'Pourquoi Pas' to the Government and it is doing good work as a training ship. The Stars and Stripes are working with us in a splendid way and they are naturally very popular. They are saving my dear old country and *this we shall never forget.*"

Through the gift of the Peary Arctic Club, the library of the American Museum contains the complete series of reports, so far as issued (33 numbers) by Dr. Charcot, on his two Antarctic expeditions, 1903–05 and 1908–10.

At the session of the Royal Irish Academy on the sixteenth of March, 1918, Professor Henry Fairfield Osborn was elected an Honorary Member of the Royal Irish Academy, in recognition of his distinguished services in the Department of Science.

At a meeting of the executive committee of the American Museum on April 17, Mrs. Frank W. Kitching, as the sole beneficiary under the will of her husband, was named an associate benefactor; Mr. Stanley G. Middleton was elected fellow in recognition of his gift to the Museum of an oil painting of Professor Albert S. Bickmore; and Mr. M. F. Savage a life member in appreciation of his gifts to the department of anthropology.

The third Liberty Loan met with a hearty response from the American Museum of Natural History, where two hundred employees subscribed for $20,000 worth of the bonds. In the Liberty Loan parade of April 26, the Museum was represented by its full quota. On that day flags were unfurled for the first time from the new poles in front of the Museum building.

The Angrand Foundation of France has awarded a prize of five thousand francs to Dr. Herbert J. Spinden, assistant curator in anthropology at the American Museum, in recognition of his memoir on *Maya Art*, published by the Peabody Museum of Harvard University. This prize is awarded once in five years for original investigations in the anthropology of North and South America. Dr. Spinden is engaged at present on reconnaissance work in South America.

A meeting of the American Geographical Society was held at Carnegie Hall on May 15, for the purpose of awarding the David Livingstone Centenary medal to Colonel Candido Mariano da Silva Rondon in recognition of his valuable work of exploration in South America. President John Greenough made the presentation speech, and the medal, in the absence of Colonel Rondon, was officially received by the Brazilian ambassador, Sr. Domicio da Gama. Colonel Roosevelt in an address commended the Brazilian government for the great amount of geographical exploration which has been conducted throughout the difficult region of Central Brazil, with particular reference to the work done by Colonel Rondon and under his direction in connection with the running of lines for telegraphic communication between different parts of the country. In the course of this work many streams were crossed, some of which, although indicated on maps in circulation, were incorrectly placed, and many had not been noted at all. The connection of these streams with known affluents of the Amazon was entirely unknown. Following the address by Colonel Roosevelt several remarkable reels of motion pictures were shown, illustrating not only the accessible parts of Brazil but also some of the almost inaccessible regions visited by the Roosevelt expedition, and including pictures of the savage tribes in their home life and surroundings. These films have been prepared by the Brazilian government and sent to this country for the purpose of acquainting Americans with some of the features of the great South American Republic.

The story of six years' exploration in Colombia, Venezuela, Peru, Bolivia, Paraguay, and Brazil is given in a volume soon to be issued by Charles Scribner's Sons, entitled *In the Wilds of South America*, by Leo E. Miller. Mr. Miller, who is now a lieutenant in the Aviation Corps of the United States Army, is an assistant in the department of ornithology at the American Museum of Natural History, and it was in the interests of this institution that his work in South America was undertaken. An introduction to the account of his travels is written by Colonel Theodore Roosevelt, with whom he was associated as field assistant in the Roosevelt expedition to Brazil, 1913–14.

A resolution was passed at the meeting of the board of trustees held on May 6, to the effect that Mr. Robert Hendry Kelby be made a life member of the American Museum in appreciation of his long and efficient service as librarian of the New York Historical Society, to which he has devoted himself for fifty years, and of his friendly spirit of coöperation, which has materially assisted the American Museum in developing its educational work.

THE National Academy of Sciences at its April meeting awarded to Dr. Frank M. Chapman, curator of ornithology at the American Museum of Natural History, the first Daniel Giraud Elliot medal and honorarium. These are to be bestowed annually for preëminence in zoölogy or palæontology under the terms of the gift to the Academy, in 1916, of $8000 by Miss Margaret Henderson Elliot to establish a fund in memory of

her father. The conditions governing the administration of the gift are:

> One such medal and diploma shall be given in each year and they, with any unexpended balance of income for the year, shall be awarded by the said National Academy of Sciences to the author of such paper, essay or other work upon some branch of zoölogy or palæontology published during the year as in the opinion of the persons, or a majority of the persons, hereinafter appointed to be the judges in that regard, shall be the most meritorious and worthy of honor. The medal and diploma and surplus income shall not, however, for more than two years successively, be awarded for treatises upon any one branch of either of the sciences above mentioned. Professor Henry Fairfield Osborn, of New York, the scientific director of the American Museum of Natural History in New York City, and the secretary of the Smithsonian Institution at Washington for the time being, are appointed as such judges. . . .
>
> As science is not national the medal and diploma and surplus income may be conferred upon naturalists of any country, and as men eminent in their respective lines of scientific research will act as judges, it is the wish of the said Margaret Henderson Elliot that no person acting as such judge shall be deemed on that account ineligible to receive this annual gift. . . .

The result of Dr. Chapman's valuable contribution to zoölogy, "The Distribution of Bird Life in Colombia; A Contribution to a Biological Survey of South America," was published in 1917 as Volume XXXVI of the *Bulletin of the American Museum of Natural History.* Although Dr. Chapman described therein a very large number of species and subspecies of South American birds, it was for the scientific value of his deductions and the establishment of zonal and faunal boundaries over a wide geographical range that the decision was made in his favor.

THE annual garden party of the New York Zoölogical Society, which included the reception of the Board of Managers and of the Ladies' and Junior Auxiliaries, took place on May 16 in the Zoölogical Park. Of the special exhibits arranged to translate into concrete form some phases of the war, probably the chief in interest was one of the latest type anti-aircraft guns from the Brooklyn Navy Yard, which was loaned through the courtesy of the Secretary of the Navy and Rear Admiral McDonald, Commandant of the Navy Yard. Three members of its crew explained its purpose and operation. A second exhibit consisted of war relics gathered on the battlefields of France by Mr. William Beebe. One hundred and fifteen books on natural history, including many rare and costly editions representing all branches of zoölogy, the gift of Mr. John Jay Paul of Watertown, Florida, a patron of the Society, were also exhibited. The reception was preceded by a luncheon and meeting of the Board of Managers, presided over by Henry Fairfield Osborn, president of the Zoölogical Society.

Colonel Theodore Roosevelt, whose article "My Life as a Naturalist" appears in this number of the Journal, was a trustee of the American Museum from 1886 to 1891. In his article, on page 323, appears a portrait of the late Theodore Roosevelt, Sr., father of Theodore Roosevelt, whose name is closely interwoven with the early history of the American Museum. When the project for establishing such an institution was first urged by its friends, he was one of the most vigorous supporters, and at the meeting on January 19, 1869, which was considered the actual foundation of the Museum, he became one of the founders and first trustees. With Mr. Haines, he managed the first private view of the collections in the Arsenal Building, in 1871, and three years later assisted at the laying of the corner stone of the present building, the plans for which he had been instrumental in selecting. Theodore Roosevelt, Sr., devoted a large part of his time to public affairs. The Roosevelt Hospital, in New York City, is a lasting memorial to his interest in the work of ameliorating human suffering. During the Civil War he took a leading part in organizing and equipping regiments for service, and at the close of hostilities he was equally active in the work of reconstruction.

The Galton Society for the Study of the Origin and Evolution of Man was organized at the American Museum of Natural History on April 16, 1918. The objects of the Society are the promotion of study of racial anthropology, and of the origin, migration, physical and mental characters, crossing and evolution of human races, living and extinct. The charter members of the Society are as follows: Madison Grant, Henry Fairfield Osborn, John C. Merriam, Edward L. Thorndike, William K. Gregory, Charles B. Davenport, George S. Huntington, J. Howard McGregor, Edwin G. Conklin.

The first formal meeting of the Society was held at the home of Professor Henry Fairfield Osborn on the evening of April 17. Professor Osborn outlined the object of the Society and emphasized the importance of a union of effort on the part of specialists, working in close coöperation and harmony with one another but from widely diverse lines of approach. Dr. C. B. Davenport was elected chairman and Dr. W. K. Gregory secretary. The following men were elected as Fellows: Mr. L. R. Sullivan, American Museum of Natural History; Dr. Ernest A. Hooton, Peabody Museum; Dr. Frederick Tilney, New York; Mr. Gerrit Smith Miller, United States National Museum; Dr. Clark Wissler, American Museum of Natural History; Professor Harris H. Wilder, Smith College; Dr. Raymond Pearl, United States Food Administration, Washington, D. C. Two patrons were elected: Mrs. E. H. Harriman and Mr. M. Taylor Pyne, New York.

The first regular monthly meeting of the Society was held in the Osborn Library at the American Museum of Natural History on May 14. At this meeting Professor McGregor demonstrated his reconstruction of the skull of a typical adult Crô-Magnon man, based on all known remains of the race.

Mr. L. R. Sullivan, in giving an account of his researches on the races of the Philippine Islands, showed that at least three physical types are present there, characterized by differences in skin-color, hair, stature, head-form, and form of nose; first, the negritos, long recognized as a distinct race, who are short in stature, with a very dark brown skin, wide open dark brown eyes, black kinky hair, short head, and short wide nose; second, the Malayan tribes, tallest of the island groups, with skins of varying shades of brown, dark brown Mongoloid eyes, straight black hair, and relatively narrow nose; and third, a group which is often confused with the second but belongs to the Indonesian racial type. This type stands between the negritos and Malays in point of size, is less Mongoloid in appearance, has the longest head on the islands, and straight or wavy dark brown hair.

A point of interest brought out by Professor Davenport is the wide field for the labors of the Society afforded by the presence in New York of representatives of many of the living races of Europe and Africa, and by the existence of various organizations which will gladly coöperate in the study of the races of Europe. Vast material is also available for the study of inheritance and hybridization.

WE quote the following from *Nature:* "Dr. Hugo de Vries, professor of botany in the University of Amsterdam, has just completed his seventieth year. His long connection with the University has been marked by patient and successful investigations on 'sporting' among plants, especially in *Œnothera Lamarckiana,* a plant which had become naturalized in Holland. His work with *Œnothera* began in 1895, and an article upon it appeared in NATURE of November 26, 1908 (vol. lxxix, p. 101), when the Hortus Botanicus at Amsterdam was the subject of a contribution to our series of 'Scientific Centres.' Out of the work and the experiments that had led up to it the 'mutation theory' of evolution originated and developed. Professor de Vries gave an account of this theory and of his researches in the Masters memorial lectures, which he delivered before the Royal Horticultural Society in 1909 (he was the first Masters memorial lecturer), and his great book, *Die Mutationstheorie,* has been ably translated into English by Professor J. B. Farmer and A. D. Darbyshire. The fundamental idea of unit characters upon which the whole argument rests has been at the back of almost all recent research into heredity in plants, and the development of Mendel's work, which had been so long overlooked, was prepared for, and aided not a little by, the researches de Vries made with *Œnothera* and other plants. This work has had a profound effect upon our outlook towards, and knowledge of, the origin and development of horticultural varieties of plants. In order to mark its appreciation of the great value of this work the council of the Royal Horticultural Society has conferred upon Professor de Vries one of the Veitch memorial medals—a gold medal awarded only to those whose researches have had, or are likely to have, great influence in the advancement of horticulture."

THE following additions to the American Museum library are worthy of note:

A valuable collection of works, largely in the Spanish language, dealing with the history and archæology of Peru, Bolivia, Central America, and Mexico, comprising the library of the late Adolf Bandelier. In the neighborhood of four hundred volumes are included in the lot.

A 1785 edition of Cook's Voyages, entitled *A Voyage to the Pacific Ocean, Undertaken by the Command of His Majesty for Making Discoveries in the Northern Hemisphere.* Volumes I and II were written by Captain James Cook, Volume III by Captain James King. An atlas accompanies the edition, which is the gift of Dr. T. Mitchell Prudden.

Illustrations of the Nests and Eggs of the Birds of Ohio, by Dr. Howard Jones and Mrs. N. E. Jones. This book was prepared after eight years of costly and painstaking labor. It contains much valuable information about Ohio eggs and nests, which is equally true for those of all northeastern North America. The full size illustrations are drawn with great accuracy and beauty.

A first edition (1837), in six volumes, of a *History of the Indian Tribes of North America,* with Biographical Sketches and Anecdotes of the Principal Chiefs, by Thomas L. M'Kenney and James Hall. This unusual work is embellished by 120 large colored portraits from the Indian Gallery in the Department of War at Washington.

Through Dr. Herbert J. Spinden has come a notable collection of about twenty volumes concerning the language of the natives of the Mosquito Coast.

The Grammar of Ornament, by Owen Jones, published in London in 1868, covers all stages of decorative designing, from the work of savage tribes to the most ornate productions of European peoples. It is fully illustrated with 112 colored plates.

A Check List of North American Amphibians and Reptiles, by Leonard Stejneger and Thomas Barbour, issued by the Harvard University Press, fills an urgent need in the field of herpetology. The list includes all the species and subspecies which the authors deem valid and of unquestioned occurrence in North America, north of the Rio Grande, and in Lower California, Mexico. The names of the two foremost students of the subject in North America appearing on the title-page make of this list a work of authority—one which should be but the first edition of a permanent check list.

THE black walnut is now being called the "Liberty Tree," and all patriotic landowners who possess such trees have been urged to offer them to the United States Government. Builders of aircraft have learned that there is no wood so suitable for propellers, and it has long been the wood employed in the manufacture of gunstocks. Timber for aëroplane propellers must be absolutely straight-grained, not too hard or too heavy, capable of standing the enormous air resistance involved in revolutions up to fifteen hundred or more a minute. No other wood meets these requirements except mahogany, and to import this would necessitate the use of ships which cannot well be spared. Although black walnut trees are widely distributed over the United States, from the Atlantic to the Pacific, they are likely to occur only in small scattered groups. It is important that all these walnut stands be discovered at the present time; to aid in this work President Wilson has called upon the Boy Scouts of America to report to the United States Forest Service every black walnut tree which they are able to locate. Also, in order that the demands of war may not destroy our forests, farmers and boy scouts are urged to plant new trees in the places of those removed.

An appeal recently came to the American Museum from the War Council of the Young Men's Christian Association for lantern slides which would help to give expression in France to the true character of America and Americans. Largely through volunteer service on the part of the assistants in the educational department of the Museum, about four thousand slides of geographic and industrial subjects have been prepared. The collection was shipped at once to France, where it is now being used in both the American and French armies. In addition to these miscellaneous slides the department has completed four illustrated lectures for army use and delivered two sets of each with their accompanying slides to the Young Men's Christian Association. The American Museum bears the cost of preparing these lectures and making the first two sets of slides. The expense thereafter is borne by the Young Men's Christian Association.

In the May drive to obtain funds for the Red Cross, the American Museum contributed to the full extent of its force, 313 members.

At the general meeting of the Linnean Society of London held on April 18, Professor J. P. Hill, F.R.S., F.L.S., gave an account of his expedition to Brazil in 1913 to obtain material for studying the development of American marsupials, in particular the opossum. It was desired to settle certain conflicting statements about these animals and to determine the development of those genera regarded on anatomical grounds as nearest the base of the didelphyd series, namely, *Marmosa* and *Peramys,* two small ratlike creatures, remarkable for the entire absence of the pouch so characteristic of other members of the order. The party arrived at Rio de Janeiro on July 6, 1913, well equipped with traps, tents, preservatives, and provisions. By permission of the Brazilian Minister of Agriculture, and at the invitation of Dr. J. C. Willis, then director of the Jardim Botanico at Rio, use of the large laboratory attached to the gardens was obtained. Collecting started immediately and dissecting began with the first specimen obtained—the Brazilian opossum, *Didelphys aurita.* Five species of didelphyds, belonging to four genera, were secured within range and sound of the electric tramways of Rio de Janeiro and about eight miles from the center of the city. Other specimens were taken on the Itatiaia Range at the borders of São Paulo, and northward in the states of Espiritu Santo and Minas Geraes. The party afterward visited Therezopolis, in the Serra dos Orgaos north of Rio, about 900 meters altitude, an ideal spot, with fine bracing climate, rich fauna, and beautiful scenery.

The American Museum Building Folder Series, No. 5, contains complete plans and illustrations of the new type of ward for wounded soldiers, designed by Professor Henry Fairfield Osborn. The plans, which were suggested through the remarkable results obtained in the First Eastern General Hospital of Cambridge, England, in effecting rapid cures by direct exposure of the wounded to air and sunshine, are presented to the country as one of the contributions of the American Museum to the national service.

In the Sixth National Textile Exposition, held in the Grand Central Palace, New York, from April 29 to May 11, the American Museum was represented by a case of prehistoric Peruvian garments and cloth and two cases of clothing from various primitive peoples. The specimens selected for this purpose have been favorites with professional designers who visit the Museum's collections for inspiration. The influence which these collections have exerted on textile art was clearly shown by the Exposition. In the section occupied by the Fairchild Company, Inc., in which about one hundred and fifty broad silks and silk ribbons were displayed, it was surprising to find so large a number with design motives taken from Museum specimens. The artists had drawn from our birds and butterflies, and from the Peruvian, Colombian, Mexican, Philippine, Amur River, Chinese, Japanese, and Northwest Coast collections. The designs appeared on silks manufactured in Paterson, Lodi, and Hoboken, New Jersey; in Columbus, Ohio, and in Boston, Philadelphia, and Chicago.

This sixth exposition by the National Textile Association was the largest and broadest in its scope of the series. All processes of the manufacture of textiles, from the raw fiber to the finished product, were shown with the machines actually in operation. There was also an exhibition of hand loom weaving and spinning and a very extensive exhibition presented by the dye manufacturers to demonstrate the progress of the dye industry which is new in America, dating from the beginning of the war. A little playlet was staged twice daily, using fashions designed by American designers, and executed in American materials. More than $15,000,000 worth of machinery was sold to manufacturers in this country, and orders were taken from Europe to be delivered after the war. The greatest interest attaches to the orders taken by Mrs. Annette Sterner Pascal for hand-woven tapestries. They aggregate 16,330 square feet, to be used chiefly for church decorations in this country. A new exhibition is already being planned in which greater attention will be paid to the finished product and in which documents from the American Museum will be shown in the proportion which the immense amount of material available demands.

WHALE meat has lately been put into the municipal markets in the city of Portland, Oregon, and Seattle, San Francisco, and other coast cities are promoting its use energetically. As a result, all whaling factories on the Pacific Coast will be equipped this year to utilize, either canned or in cold storage, the meat of whales for food. In fact, the Victoria Whaling Company already has placed the entire output of one cold storage plant, and other orders are coming in rapidly. It is probable that the demand on the Pacific Coast will be so great that little of the meat will be sent to eastern cities. The British Government also is considering the use of whale meat, and communications have been addressed to the American Museum regarding its utilization. Using whale meat for food is not a new departure. For centuries the islanders of Scotland have included it in their diet, and the same may be said of the Japanese. As early as 1261 whales' tongues were an important article of commerce, subject to special tax, in the Basque provinces and Gascony, on the Bay of Biscay. In Japan the wholesome meat is eaten either fresh or canned, a single whale sometimes supplying as much as eighty thousand pounds. The seven whaling stations on our Pacific Coast, together with the one on the Atlantic side of the continent, have a combined catch during the summer of about one thousand whales, which, if fully utilized, would make available for distribution throughout America a yearly supply of nearly fifty million pounds of palatable and nourishing food. The meat is darker colored and somewhat coarser grained than beef, but has no fishy flavor, and when properly cooked tastes much like venison. An analysis of the canned meat made recently by the Bureau of Fisheries at Washington showed its protein value to be thirty-four per cent as against thirteen to fourteen per cent in beef, mutton, or pork. The "Whale Steak Luncheon" at the American Museum on February 28 contributed largely toward the publicity which has been given to the use of whale meat as food since the first of the year.

Tales from Birdland, by T. Gilbert Pearson, secretary of the National Association of Audubon Societies, has just been issued from the press of Doubleday, Page and Company. These ten short stories about birds are equally fascinating reading for young or old. The scenes are laid in many parts of the country, from the rocky shores of Maine to the cactus-covered plains of Arizona and from Florida to Oregon. A true picture is drawn of each region and its wild life, with added human experiences both grave and humorous. The illustrations, fifty in black and white, with frontispiece in color, are by Charles Livingston Bull, and add greatly to the attractiveness of this small volume.

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 1917:

Attendance in Exhibition Halls	786,151
Attendance at Lectures	115,802
Lantern Slides Sent out for Use in Schools	63,111
School Children Reached by Nature Study Collections	1,104,456

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 the JOURNAL. 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.

The various Classes of Membership are as follows:

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

They have the following privileges:

An Annual Pass admitting to the Members' Room
Complimentary tickets admitting to the Members' Room for distribution to their friends
Services of the Instructor for guidance through the Museum
Two course tickets to Spring Lectures
Two course tickets to Autumn Lectures
Current numbers of all Guide Leaflets on request
Current copies of the AMERICAN MUSEUM JOURNAL

Associate Membership

In order that those not living in New York City may associate with the Museum and its work, the class of Associate Members was established in 1916. These Members have the following privileges:

Current issues of the AMERICAN MUSEUM JOURNAL—a popular illustrated magazine of science, travel, exploration, and discovery, published monthly from October to May (eight numbers annually), the volume beginning in January
A complimentary copy of the President's Annual Report, giving a complete list of all Members
An Annual Pass admitting to the Members' Room. This large tower room on the third floor of the building, open every day in the year, is given over exclusively to Members, and is equipped with every comfort for rest, reading, and correspondence
Two complimentary tickets admitting to the Members' Room for distribution by Members to their friends
The services of an Instructor for guidance when visiting the Museum

All classes of Members receive the AMERICAN MUSEUM JOURNAL, which is a magazine issued primarily to keep members in touch with the activities of the Museum as depicted by pen and camera; also to furnish Members with reliable information of the most recent developments in the field of natural science. It takes the reader into every part of the world with great explorers; it contains authoritative and popular articles by men who are actually doing the work of exploration and research, and articles of current interest by men who are distinguished among scientists of the day. It takes the reader behind the scenes in the Museum to see sculptors and preparators modeling some jungle beast or creating a panorama of animal life. It shows how the results of these discoveries and labors are presented to the million public school children through the Museum Extension System. In brief it is a medium for the dissemination of the idea to

which the Museum itself is dedicated—namely, that without deepening appreciation of nature, no people can attain to the highest grades of knowledge and worth.

Publications of the Museum

The Scientific Publications of the Museum comprise the *Memoirs, Bulletin* and *Anthropological Papers,* the *Memoirs* and *Bulletin* edited by Frank E. Lutz, the *Anthropological Papers* by Clark Wissler. These publications cover the field and laboratory researches of the institution.

The Popular Scientific Publications of the Museum comprise the *Handbooks, Leaflets,* and *General Guide,* edited by Frederic A. Lucas, and the JOURNAL, edited by Mary Cynthia Dickerson.

POPULAR SCIENTIFIC PUBLICATIONS[1]

HANDBOOKS

NORTH AMERICAN INDIANS OF THE PLAINS
By Clark Wissler, Ph.D. — Paper, 25 cents; cloth, 50 cents

INDIANS OF THE SOUTHWEST
By Pliny Earle Goddard, Ph.D. — Paper, 25 cents; cloth, 50 cents

ANIMALS OF THE PAST
By Frederic A. Lucas, Sc.D. — Paper, 35 cents

DINOSAURS
By W. D. Matthew, Ph.D. — Price, 25 cents

TEACHERS' HANDBOOK, PART I, THE NORTH AMERICAN INDIAN COLLECTION
By Ann E. Thomas, Ph.B. — Price, 10 cents

TREES AND FORESTRY
By Mary Cynthia Dickerson
A new edition in course of preparation.

HEALTH IN WAR AND PEACE
By C-E. A. Winslow, M.S., M.A. — Price, 25 cents

ANCIENT CIVILIZATIONS OF MEXICO AND CENTRAL AMERICA
By Herbert J. Spinden, Ph.D. — Cloth. Price, 75 cents

ILLUSTRATED GUIDE LEAFLETS

THE COLLECTION OF MINERALS
By Louis P. Gratacap, A.M. — Price, 5 cents

NORTH AMERICAN RUMINANTS
By J. A. Allen, Ph.D. — Price, 10 cents

THE ANCIENT BASKET MAKERS OF SOUTHEASTERN UTAH
By George H. Pepper — Price, 10 cents

THE MUSICAL INSTRUMENTS OF THE INCAS
By Charles W. Mead — Price, 10 cents

THE SAGINAW VALLEY COLLECTION
By Harlan I. Smith — Price, 10 cents

PERUVIAN MUMMIES
By Charles W. Mead — Price, 10 cents

[1] Prices net; postage extra

THE METEORITES IN THE FOYER OF THE AMERICAN MUSEUM OF NATURAL HISTORY
By Edmund Otis Hovey, Ph.D. — Price, 10 cents

PERUVIAN ART
By Charles W. Mead — Price, 10 cents

SYLLABUS GUIDE TO PUBLIC HEALTH EXHIBITS IN THE AMERICAN MUSEUM OF NATURAL HISTORY
By Lawrence V. Coleman — Price, 10 cents

THE HABITAT GROUPS OF NORTH AMERICAN BIRDS
By Frank M. Chapman, Sc.D. — Price, 25 cents
Second edition issued May, 1916.

THE INDIANS OF MANHATTAN ISLAND AND VICINITY
By Alanson Skinner — Price, 20 cents

PLANT FORMS IN WAX
By E. C. B. Fassett — Price, 10 cents

THE EVOLUTION OF THE HORSE
By W. D. Matthew, Ph.D. — Price, 20 cents

MAMMOTHS AND MASTODONS
By W. D. Matthew, Ph.D. — Price, 10 cents

HOW TO COLLECT AND PRESERVE INSECTS
By Frank E. Lutz, Ph.D. — Price, 10 cents

OUR COMMON BUTTERFLIES
By Frank E. Lutz, Ph.D., and F. E. Watson — Price, 15 cents

THE BIG TREE AND ITS STORY — Price, 10 cents

THE INSECT GALLS OF THE VICINITY OF NEW YORK CITY
By William Beutenmüller — Price, 15 cents

SOME REPRINTS

THE GROUND SLOTH GROUP
By W. D. Matthew, Ph.D. — Price, 5 cents

THE WHARF PILE GROUP
By Roy W. Miner, A.B. — Price, 5 cents

THE SEA WORM GROUP
By Roy W. Miner, A.B. — Price, 10 cents

THE ANCESTRY OF THE EDENTATES
By W. D. Matthew, Ph.D. — Price, 5 cents

THE STORY OF MUSEUM GROUPS
By Frederic A. Lucas, Sc.D. — Price, 10 cents

THE NEW AFRICAN HALL
By Carl E. Akeley — Price, 5 cents

GENERAL GUIDE TO THE EXHIBITION HALLS

New edition issued January, 1918, illustrated, 136 pages. — Price, 25 cents

SOUVENIR STAMP ALBUM

A series of 100 subjects printed from four color plates, each stamp $2\frac{1}{8} \times 3$ inches. Sold in sets of 15 stamps for 10 cents. Album providing space for the entire series including 10 stamps, 15 cents. Album and complete series of 6 sets of stamps, 75 cents; postage, 4 cents.

GUIDE TO THE NATURE TREASURES OF NEW YORK CITY
Price, 75 cents

The purpose of this illustrated guide is to render accessible under one cover an account of the public scientific institutions of Manhattan, the Bronx, and Brooklyn.

The American Museum of Natural History

Scientific Publications

MEMOIRS

Volume I.—Zoölogy and Palæontology.

Volumes II–VIII.—Anthropology.

Volume IX.—Zoölogy and Palæontology.

Volumes X–XIV.—Anthropology.

Volumes II, IV, V, VII, VIII, X–XIV, and an Ethnographical Album form the Memoirs of the Jesup North Pacific Expedition, Volumes I–X.

MEMOIRS—NEW SERIES

Volume I.—Zoölogy and Palæontology.

BULLETIN

Volumes I–XXIV; XXV, parts 1 and 2; and XXVI–XXXVII.

ANTHROPOLOGICAL PAPERS

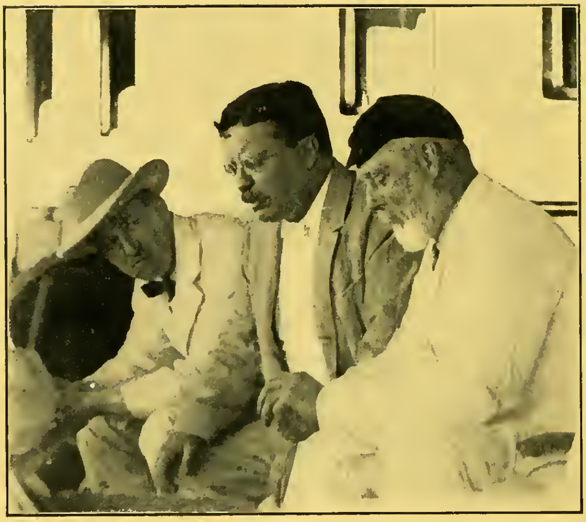
Volumes I–IX; X, parts 1–6; XI; XII, parts 1–5; XIII; XIV, parts 1 and 2; XV, part 1; XVI, parts 1 and 2; XVII, parts 1–4; XVIII, parts 1 and 2; and XIX, part 1.

MONOGRAPHS

A Review of the Primates. By D. G. Elliot. 3 volumes.

Hitherto Unpublished Plates of Tertiary Mammals and Permian Vertebrates. By Cope and Matthew.

A more detailed list, with prices, of these publications may be had upon application to the Librarian of the Museum.



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THE AMERICAN MUSEUM JOURNAL

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

October, 1918

Volume XVIII, Number 6

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 members 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 AMERICAN MUSEUM JOURNAL

THE AMERICAN MUSEUM JOURNAL, 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 One Dollar and Fifty Cents a year. The JOURNAL 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 the JOURNAL. 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 the JOURNAL. Price lists and complete data may be obtained from the Librarian.

The American Museum Journal

CONTENTS FOR OCTOBER

MARY CYNTHIA DICKERSON, *Editor*

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

The Journal 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.

Courtesy of State of New York Conservation Commission

SUCH IS THE DESOLATION IN NORTHERN FRANCE

A tree—unlike a man—receives unprotected the full storm of gunfire. Thus the trees which chanced to be along the firing line in France have given themselves for freedom. Their presence has allowed triumph with the least bloodshed in both offensive and defensive attacks,—but it will take a century to restore these forests of the battle front. Not only are the trees dead but the exposed forest floor also has been destroyed, tortured into hills and hollows and filled with fragments of metal and with shells that did not explode. The photograph shows a small part of the famous Height of Hartmannsweilerkopf in Alsace, captured and recaptured a dozen times by French and Germans. Many forests on the Alsatian slope of the Vosges Mountains are totally destroyed. Over slope and hilltop there is nothing to be seen but dark skeletons of trees, shell holes in the ground, and the countless crosses that mark the graves of the dead. The country about Verdun is described as "the dead hills of the Meuse," for the majestic trees of the Forest of Argonne stand today mere bullet-pitted stumps. This forest, thirty miles long and from one to eight miles wide, in the region of the Meuse and the sources of the Aisne, has seen more bloodshed than any other part of the wide battle fields of the Western Front. It saved Verdun, but the fighting transformed green hills and valleys into a place of death, into square mile upon square mile of desolation

The American Museum Journal

Volume XVIII October, 1918 Number 6

Our American Forest Engineers in France

By LIEUTENANT COLONEL HENRY S. GRAVES

Chief Forester, United States Department of Agriculture

FORESTRY is playing an important part in the great World War. The vast requirements of the army for lumber and other forest products are placing a critical burden on the forests of this country and of our Allies in Europe; and foresters and lumbermen are called upon for the highest skill to produce the needed materials promptly and in adequate quantities. For the first time in history forestry regiments have been organized as a part of the army, to extract the raw material from the forests and to manufacture it in Government mills. It is a new thing for soldiers to carry on logging operations and to run sawmills. It is a new thing for soldiers to be practicing forestry. And yet this is exactly what is being done in this country, in Great Britain, and in France.

We are accustomed in the United States to a large production of lumber and other forest products. Our forest resources are still very great; and the first extensive demands for lumber for training camps, for shipbuilding, for boxes, for vehicle stock, for aëroplanes, and a variety of other war purposes, was met by the existing lumber industry, equipped as it is with many thousand sawmills scattered throughout the country. Later, that industry was unable adequately to meet the special demand for aircraft material without Government help. How the army is now handling the aircraft production with organized soldier help, how the American forests are being drawn upon for war materials, how the forest industries are being organized to meet the situation, and how the foresters are doing their part to furnish scientific information regarding the American woods, is a separate story of keen interest.

This war has often been spoken of as a war of engineering. Certain it is that the swift movement of men, equipment, and supplies depends on engineering skill of the highest character. Much of the engineering work must be constructed swiftly and it is often of a temporary character. This means that lumber, piling, round logs, poles, as well as small forest products, are required in great quantities by the armies at the front.

In the early part of the war the armies in France imported a great deal of lumber from England, Scotland, the Scandinavian countries, Russia, Canada, and the United States. To be sure, the forests of France immediately behind the lines were drawn upon heavily, and the French lumber mills throughout the country produced what they could, although handicapped by shortage of labor. Very early Great Britain was forced to cut heavily in the limited forests of England and Scotland. Owners of private estates patriotically sacrificed their woodlands and groves to meet the needs of the armies, for temporary structures at home, for the war industries, and for the forces in

France. To exploit these forests, battalions of skilled forest and sawmill workers from Canada were organized and equipped. It was to aid in this work that in 1917 several patriotic men in New England financed and sent over to "Old England" ten fully equipped sawmill units. It was a gallant act and deeply appreciated by the British authorities.

But the shipping of forest material to France was largely stopped in the spring of 1917 on account of the reduction of tonnage by the German submarine. It was then that France opened her forests to the Canadian forestry troops, to produce material for the British armies and to help the French engineers to increase the production of material needed by the French armies.

The entry of America into the war placed a new burden upon the French forests. At the beginning, a certain amount of lumber, piling, and crossties was shipped from this country. But the need of ship space for men and for equipment and supplies that could not be obtained in France was so great that the French Government itself requested that we send forestry troops to obtain our lumber and other general forest products from the French forests. Only those familiar with the French forests, with the long years of careful forestry that has been necessary to build them up, and with the sentiment of the French nation for its forests, can appreciate the great sacrifice involved in this action.

It was to prepare for the forestry

Courtesy of Underwood and Underwood and American Forestry

Trench mats for the comfort of the boys who stand day in and day out in the trenches during the rainy season.—Wood as an essential enters on a tremendous scale into the warfare of today, not only for aëroplanes and hangars, wooden ships and docks, not only for hospital and camp buildings, but also for trench timbers and *camouflage* materials, for temporary railroads, telephones, and bridges just back of the battle line. The miraculous must be accomplished in transportation of ammunition and food; there must be instantaneous communication with all parts of a long battle line. Therefore the forestry soldier sings as he pushes the work ahead, perhaps to the accompaniment of bursting shells and in sight of aëroplane fighting,—as one soldier writes: "If what we produce here is going to put the Sammies across the Rhine, you can all prepare to read soon that they have crossed over, for we are not going to let anything interfere with pushing things to the very limit" work that the author of this article was sent to France in the summer of 1917. He was accompanied by Captain Barrington Moore who is connected with the American Museum of Natural History, and who rendered very valuable service both in this preliminary work in France, and since in handling important work as a member of the forestry staff there.

Today there are in France about 9000 skilled forest workers in addition to several thousand men organized as highway engineers and as labor troops to aid in the forestry operations. The forestry troops are organized as a part of the Corps of Engineers. The senior officers of the regiments are regular army officers, Colonel J. A. Woodruff, Colonel Mitchel, and Lieutenant Colonel Marks. The other officers were selected for their skill and experience in forestry and lumbering. In the headquarters office one finds such distinguished foresters as Lieutenant Colonel W. B. Greeley and Major T. S. Woolsey, Jr., and such experienced lumbermen as Majors G. A. Kelley and R. A. Johnson, of Oregon. It has proved possible to adapt the military organization to the industrial needs of lumbering, so that one finds the commissioned officers filling the various supervisory positions in charge of logging and milling operations, and the noncommissioned officers and privates acting as sawyers and edgers in the mill; or as sawyers, swampers, and drivers in the woods; or as blacksmiths, stablemen, and supply men at the camps.

Courtesy of Underwood and Underwood

Roadside trees near the French battle front, somewhere between the Marne and the Ourcq, afford shelter for American cavalry

These are the men who are producing the piling for our great dock extensions at several of the ports placed at our disposal by the French, the hundreds of thousands of railroad ties for the main lines of communication and the temporary lines behind the battle front, the many thousands of telephone poles needed to perfect the communications between our different fighting units, the almost limitless quantity of heavy road planks used in repairing roads for the movement of artillery, the millions of board feet of lumber used in constructing training and rest camps, hangars for aëroplanes, temporary hospitals, emergency buildings of all kinds, and for miscellaneous general use at the front and in the rear; also the poles and other material used in trench construction, the excelsior to fill the bed sacks of the troops, and the thousands of cords of fuel needed for cooking, for heating, and for sanitation.

The forestry troops are located at many different points throughout central, eastern, and southern France. In several places there are as many as 750 to 1000 men logging for and operating from three to five sawmills. More often a single company of 250 men, or a detachment of from 80 to 125 men, constitutes the unit. The size of the unit depends on the quantity of available timber at any given point. In general it has been the policy to scatter the operations. It makes less of a burden upon transportation, since there is need for material at many different parts of the rear as well as of the front; and with comparatively small units it is possible to do better work in the forest.

The forests of France in which the Americans are operating are in part national, in part owned by communities or institutions, and in part private. The cutting rights are obtained through an interallied council for acquiring forests, called *Comité interallié des Bois de Guerre*. Through this council the available resources are assigned to the French, the British and Canadians, the Americans, and the Belgians. Where private lands are acquired the prices are stabilized, thus preventing speculation or competition between the allied nations. The procedure is one of many examples of the harmonious and unified action between the several Allies.

There are in France several forest

Photograph by H. S. Graves

Forests for cutting (the illustration shows young Scotch pines) are being obtained partly through grants from the French Government and partly through purchase from private owners. A tour of the forests in autumn brings to the eyes of the American vivid pictures of the beauty of the French landscape, with its splendid roads bordered everywhere with trees,—especially beautiful is the gold of road sycamores against the green of the pine forests regions of considerable extent, each carrying an amount of standing timber astonishing to the average American. The most extensive forest regions are in the Jura and Vosges mountains of eastern France, and the extensive pine plains between Bordeaux and the Pyrenees Mountains. There is also a certain amount of timber in the Savoy and the Maritime Alps, and in the Pyrenees Mountains. In addition there are throughout central France scattered woodland tracts each of from a few acres to several thousand acres in extent, which have been cared for during many years and which offer favorable opportunities for lumber operations even from the American standpoint. We may well be proud of the natural forest resources in our own country. France, however, is proving that by years of thrift and scientific management she can now furnish the raw forest material that is essential for all the armies fighting on her soil. France has been furnishing the most striking proof of the value of forest protection and culture.

If one should drive through the Jura Mountains today, the forest would at first glance seem to him unchanged. He would see the slopes, the high ground, and the poorer soils covered with dense coniferous forests, some areas of forest large in extent, some occurring in smaller tracts, separated by fields, with here and there a village. His attention might be attracted, however, to a load of logs on one of the excellent forest highways, the logs cut about sixteen feet long and conveyed on an American lumber wagon; this in contrast to what he might have seen before the war, when a team of oxen would have laboriously drawn out the long trunk of a single tree, to be cut into shorter lengths at the mill. If the observer should go back to the forest from which this load of logs came, he would find a detachment of hardy American lumberjacks in khaki felling trees and drawing the logs to the skidways in American fashion. Yet there would soon appear a difference. The sawyers are cutting the stumps virtually at the ground. They are selecting trees marked by French foresters, leaving many standing that are not yet ripe. The lumberjack is exercising scrupulous care not to injure any of the young trees or the small reproduction. And when he has finished, there still stands a forest—reduced in volume of merchantable timber but in good productive condition. The lumberjack is practicing French forestry.

In the Jura Mountains occur some of the finest examples of French Government forests and forestry. The pre-

Photograph by H. S. Graves

Establishing camp in a Maritime pine forest in southern France, where logging conditions are about the same as in the long-leaf pine forests of Georgia. In the cold mountainous districts of France comfortable barracks are put up; otherwise tents with board floors are used. At times the sawmills run under pressure night and day, and always the lumberjacks work from sunrise to sunset

Courtesy of Underwood and Underwood

After the rain of shell and shrapnel fire which has mowed down enormous trees, some blackened and shattered trunks still stand as evidence of the fierceness of the battle. These may be pulled down by the troops and used for firewood in the trenches. They have little timber value, as the bullets and fragments of shell embedded in them render sawing difficult

Courtesy of Underwood and Underwood

Long columns of American soldiers march to the firing line. It is for the support of these that the American Forestry Engineers work, sacrificing their own desire to get into the thick of the fighting, knowing that the harder they work the less difficult it will be for the boys at the front dominant species is the silver fir, with a sprinkling of beech and spruce. Even American lumbermen, accustomed to the great size of the trees in American forests, must admire the stately silver fir, for it is a tree that reaches dimensions rivaling our eastern white pine. Many of the mature trees are from 2 to 3 feet in diameter, and produce from 1200 to 1500 feet of boards, and occasionally from 3000 to 4000 feet. One splendid example occurs in the forests where the Americans are working,—a tree more than 150 feet in height, exceeding 4 feet in diameter, with a stem clear of branches for 90 feet.

If our observer should go to the village near by he would find an American portable sawmill manufacturing the logs into lumber for army use. He would find the camp stables for the horses, the blacksmith's shop, comfortable buildings for the men, and all else that is necessary for logging and milling enterprise,—all, however, under military discipline. Further observation would show the manner in which these men are doing their work, both in the woods and at the mill. Not only is there the precision of a well-organized enterprise, but the men are working with a spirit not commonly seen. They know that the material they are producing is urgently needed by the army, that the success of the fighting depends on the result of their labor. Hours of work mean nothing to them. It is only the results that count. They themselves are an essential part of the fighting force. Their output is a fighting output. It is this spirit that is securing from mills of 10,000 board-feet capacity more than 30,000 feet in 24 hours, and is demonstrating that an industrial unit under war organization can produce far more than with the usual peace-time effort.

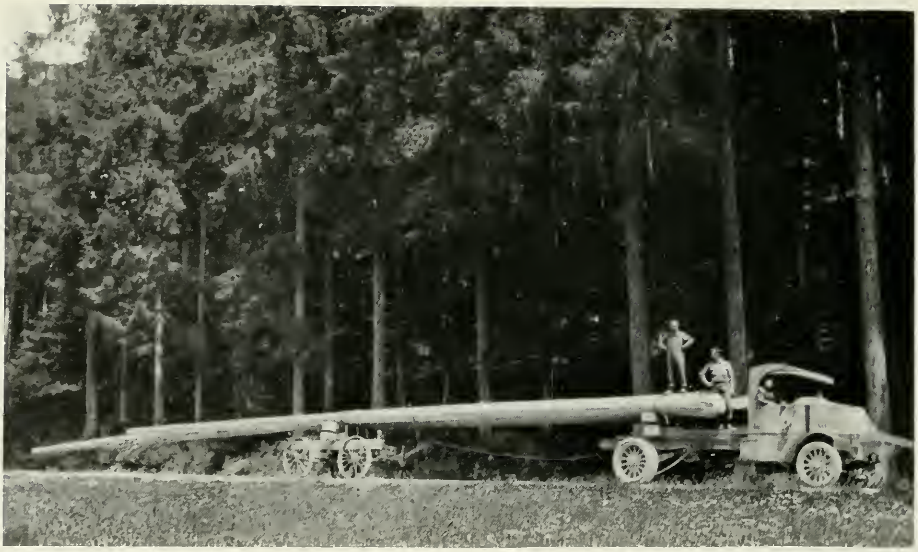
This is but an example of what is occurring throughout the forests of France. Similar conditions would be found at the four or five other locations of American forestry operations in the Jura Mountains, and at several locations in the Vosges Mountains, where the forests have much the same general character as in the Jura.

In central France the forests are chiefly oak and Scotch pine with a certain quantity of beech, ash, and other species of less importance. Some logging and milling units are cutting almost wholly in oak and beech, using the product for railway ties, bridge material, and road plank. It is interesting to see the adaptability of the American woods workers to French conditions. Some units made up chiefly of Pacific coast lumbermen, accustomed to the giant sugar pine or to the Douglas fir, are working in hardwood forests. They work up the logs into ties and other products. Then they cut the branches into fuel, and finally bind the twigs into fascines for use at the front in repairing roads.

Some of the oak and beech is of excellent size and quality. In one forest an American unit is cutting oak timber about 200 years old, with many trees 2½ feet in diameter, tall, straight and as clear as any oak of the southern Appalachians. In some other cases the bulk of the oak is smaller and chiefly useful for railroad ties.

In central France, too, the French foresters have encouraged the growth of Scotch pine, by planting and by natural reproduction. It is careful forestry that has produced stands of this species, which at only 60 to 80 years of age carry 20,000 feet to the acre. A number of small mills are cutting lumber from such stands, while in the younger stands the forestry troops are producing hundreds of thousands of poles for telephone lines, and short pieces for trench material.

Still a different condition prevails in southwestern France. North of the Pyrenees Mountains stretches a great plain largely covered with a pure forest of Maritime pine. It is, to be sure,



Photograph by H. S. Graves

The trees of France are proving themselves silent defenders of the nation. After America entered the war one of the first demands on the Western Front was timber for piling, because new docks and extensions to old docks had to be constructed in haste to accommodate rapidly arriving troop ships and ships loaded with ammunition, military equipment, and food. Fortunately, the silver fir forests of France correspond with what American forests of white pine were in the past. At once, under the work of the American Forestry Engineers, these forests yielded straight and flexible trunks from sixty to ninety feet long, in the necessary quantities

Photograph by H. S. Graves

A silver fir forest in the Jura Mountains, from which the American Forestry Engineers have cut the old ripe timber, using all possible care to leave the young trees uninjured and the whole in condition for prosperous future development. Logging conditions in these forests are much like those in the Adirondacks, except that the trees are of larger size. Dense stands of mature silver fir, especially in the Vosges Mountains, arouse the enthusiasm of even those American lumberjacks who have worked among the great trees of the Pacific Coast

Photograph by H. S. Graves

The American forester will come home after the war with a new respect for conservation. He is learning to appreciate the need for complete utilization of every tree cut. Even the smallest branches are put to use, thus preventing the necessity of cutting young trees for small timber. The German army in the French forests on conquered territory have ruthlessly destroyed hundreds of thousands of small trees for corduroy roads, fuel, wire entanglements, and screens for their trenches and guns

Photograph by H. S. Graves

German prisoners are often employed by the French to help get out fuel and small timber for the uses of the Allied armies

As director of the Division of Forestry with the Expeditionary Forces, the writer was one of the first Americans seen in our uniform in portions of the western war zone. The welcome in the villages that this uniform received from the children and the older people was tremendously affecting. Everywhere the French realized that a nation was coming across the sea to fight with them in a common cause broken by small farms and communities, but in many areas fully 75 per cent of the land is in forest. It is this pine that furnishes the French turpentine. It is here that we have the example of how we should develop the turpentine industry of our own southeast.

The Maritime pine is not a large tree. It is very commonly from 18 to 28 inches in diameter at 70 years of age, with a height of from 70 to 80 feet. It is, however, furnishing a basis for the operation of a number of the American forestry units, yielding lumber, piling, poles, and railroad ties.

The scale of the American forestry operations in France is a large one. For the first half of July there were produced for American needs about 13,000,000 board feet of lumber, 155,000 railroad ties, more than 1200 piles, and a great quantity of fuel. This does not include the product of one American forestry battalion working for the French, and one battalion working for the British.

Necessity has forced the extensive use of the French forests in order to win the war. Every effort is being made to carry on the woods operations in a way that will leave the forests in a good productive condition. The French foresters mark the trees to be cut and indicate the other restrictions necessary to secure good forestry. It is hoped also that the forest roads will be left in as good or better condition than when the Americans began their work. Whether the American foresters can undertake any actual work of planting on the areas where they have worked or on the devastated areas of the war zone remains a question to be settled later. It is hoped that assistance can be given on both classes of land. Back of the lines the forests cut under forestry principles will recover very rapidly. In the zone of devastation the forests have been crushed down and ruined.

Still again one of the tragic injuries to France is the destruction of many of her roadside trees. All have heard of the destruction of the trees in the line of fire, and of the wanton felling of trees by the Germans. But in many places in the rear the French themselves have cut down the old poplar trees lining the highways. This has been done to supply local needs for lumber. It is hoped that the United States may be able to assist France in the replacement of her forests destroyed or injured during the war, and also of her highway trees, which have always furnished one of the picturesque features of the French landscape.

Courtesy of Underwood and Underwood

SUNSHINE ON A FOREST ROAD IN FRANCE

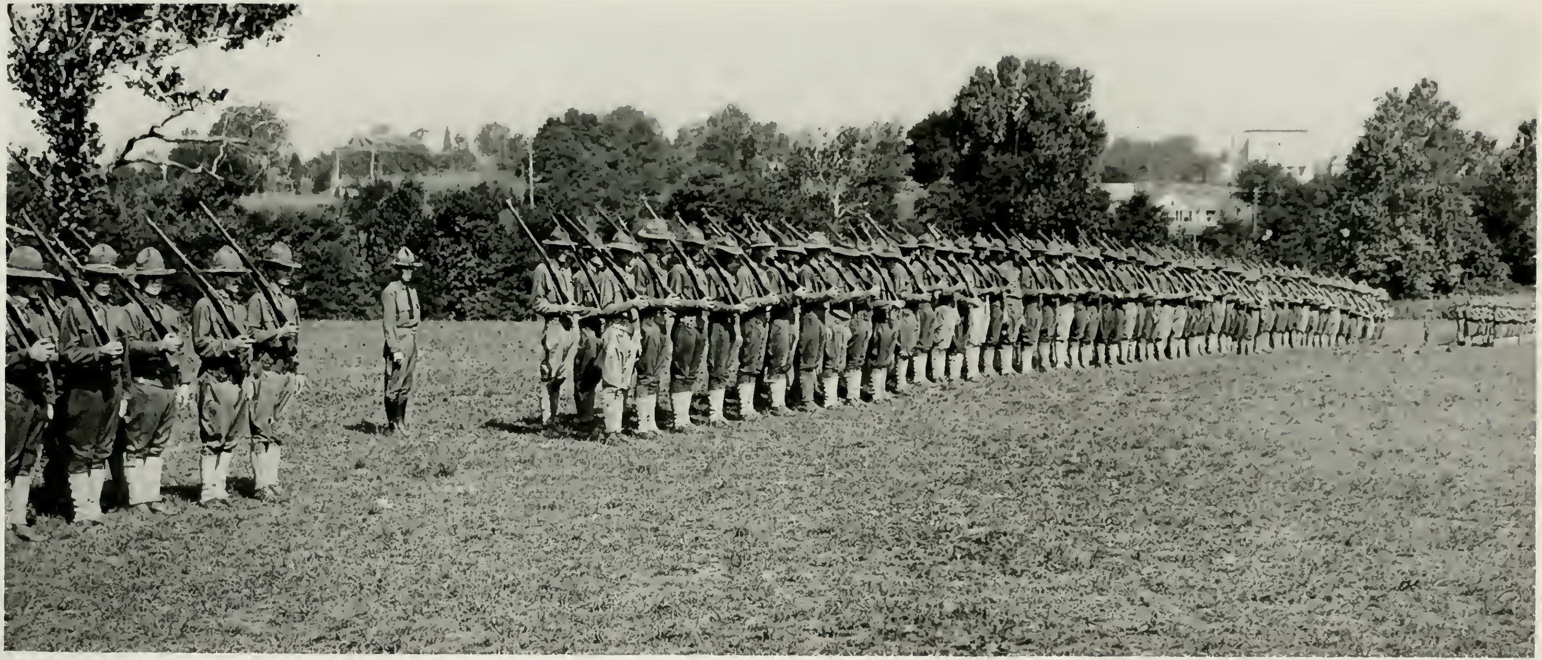
France has provided, by long years of thrifty and scientific forest management, a timber supply which, though insufficient for her own peace-time needs, is now meeting the demands not only of her own armies but also those of England, America, Canada, and Belgium. The depletion of their cherished forests, which is thus imposed upon the French nation, is a heavy but necessary war sacrifice. It is made with the same courage and solidarity with which the French people have met the enemy from the first and have borne the suffering and personal and national loss that have come with the years of fighting on their home soil. The American Forestry Engineers go to their work daily with rejoicing that they have the privilege to help France win the war.

The most extensive forest regions of France are to be found (1) in the northeast, between Alsace and France in the Vosges Mountains, and along the Swiss border in the Jura Mountains, (2) in the southwest, along the Spanish border in the Pyrenees and on the plains between Bordeaux and the Pyrenees, and (3) in the southeast, along the Italian border in the Maritime Alps and in Savoy. There has been great fear for the historical forest of Fontainebleau near Paris, but that fear is now past. After the war, timber from other countries will come to aid in the rebuilding of the devastated areas. Russia, the "Land of Forests," for instance, has had small loss of timber. The United States may be able to help materially in the work of reforestation

Courtesy of Underwood and Underwood

DESTRUCTIVE WORK OF THE GERMAN ARMY AT CAMBRAI

The Germans in trying to put every hindrance in the way of the advancing British Army at Cambrai, felled great trees to block the road (the size of the trees can be estimated by comparison with a soldier walking at the left). The war has converted much of the country of the war zone into a man-made desert. One of the most evident losses is that of the street and roadside trees. Where these have not been sacrificed for military purposes, they have, in many cases, been cut down by the French civilians to meet home needs. The tall picturesque Lombardy poplars of the highways have gone this way. It is reported that great quantities of timber cut by the Germans from the French forests in their possession have been shipped back to Germany. The Germans have cut down or girdled fruit trees over vast areas—apple, peach, plum, and cherry, which had been growing for years. In some cases the foresters and tree surgeons have succeeded in saving such trees by careful work in grafting



THIS IS A WAR OF RESOURCES: IT IS A NEW THING IN HISTORY FOR SOLDIERS TO ENTER EXTENSIVELY INTO LOGGING OPERATIONS IN A WAR ZONE

The 10th Forestry Engineers, a company of which is here shown on final inspection in America, have been in France since the early autumn of 1917. This regiment was the response of the lumber industry and the forest service of the United States to the need in France for skilled selection of trees and their swift conversion into timbers for the battle front. Company F of the 10th has the honor of having manufactured the first board made by the American troops in France. An industrial unit on the basis of a military organization, this regiment has brought forth results quickly; for there is never failure for a soldier and a thing is accomplished because it must be.

Various companies of the 20th Engineers (Forest) were soon added to the 10th—with the exception of the ninety-five men who were lost on the "Tuscania" when it was sunk by a German U-boat off the coast of Ireland. This second regiment was planned as the largest in the world, nineteen battalions, ten of foresters and lumberjacks, and nine of laborers to coöperate with them. It was increased by three new battalions of experienced road and bridge builders, giving a military organization of twenty thousand men. The personnel of these regiments is very high. If lumber will help win the war, these men are in France to stay until there is no longer any need for the boys on the battle line to go "over the top"

"Photosynthesis," or Sugar and Starch Manufacture

THE GREEN PLANTS OF OUR WAR GARDENS STAND FOR THE MOST FUNDAMENTAL OF ALL THE WORK OF THE EARTH: THEY ALONE CAN MAKE FOOD FROM THAT WHICH IS NOT FOOD—FROM EARTH AND AIR

By JOHN M. COULTER

Professor and Head of Department of Botany, University of Chicago; President of the American Association for the Advancement of Science; Founder and Editor, *Botanical Gazette*

AT THIS time we are much concerned with our national resources. Much of our business has been reorganized to supply the materials needed, and as a consequence, we think of the essential work in terms of manufacture and transportation, work that depends upon the activities of men. Of course all this work is essential, but it is made possible by a still more fundamental process which should be realized. Men could not work without food and materials, but few realize how these are produced. In fact, so little thought was given to food production before the war that our population was increasing very much faster than our food production. This was the most important material problem this nation was facing before the war, and it became very acute as soon as we entered the war.

If men cannot work without food, neither can they work without materials, and fundamental among materials are wood and coal. Food and wood and coal may be regarded as the basis of our activities, and still very few know how these essential things are produced. *They are made by green plants!* The results of the work of green plants are food used directly or transformed in the bodies of food animals, coal deposits, forests of timber. Green plants have sometimes been characterized as the mediators between death and life, and this is true, in that through their work a dead world is transformed into a living world. They stand at the threshold of our life, of our resources and activities.

The word photosynthesis may not suggest its meaning to many people, but it stands for the most important process in the world. It is primarily the fundamental process of food production without which the world of organisms, including ourselves, could not live. Photosynthesis is chiefly the work of the foliage, because the leaves represent the greatest display of green tissue. To most of us foliage is simply a thing of beauty in a park or a landscape, but we must realize that it is also a laboratory for food manufacture, upon which the world depends. In this laboratory inorganic materials are built into organic substances, and upon these organic substances the green plants live and provide an excess sufficient to feed animals—and also those plants which are not green, such as the mushrooms and other fungi.

There are several general kinds of food as man classifies them, but the work of green plants has to do first and foremost with carbohydrates, such as sugar and starch—which, however, are in turn the basis for the manufacture of other foods.

The raw materials used in carbohydrate manufacture are about the most widely distributed materials on the earth; namely, water and carbon dioxide. The occurrence of water needs no explanation, while carbon dioxide is everywhere in the air. Green plants can manufacture food therefore wherever air and water are available. The land plants, with which we are chiefly concerned in the production of food for the human race, obtain water from the soil, and carbon dioxide directly from the air in contact with the leaves. An interesting fact in reference to these raw materials is that they are also "ultimate wastes" when food is being used. This means that when living bodies are using foods, carbon dioxide and water are excreted because they cannot be broken up in the body as a preliminary step to the formation of new combinations. From food to waste is the work going on in all living bodies; from waste to food is the added work going on in all green plants.

The active agent in the manufacture of carbohydrates is the "chloroplast," which needs definition. Chloroplasts are minute green bodies within the cells that give green color to foliage. As the name suggests, they comprise two conspicuous substances: the plastid is the living substance (protoplasm), while the chlorophyll is a green pigment. The living plastid does the work, while the chlorophyll supplies the conditions for work; in fact, the chloroplast may be thought of as a chemical laboratory which uses raw materials in the manufacture of carbohydrates.

In order to work, the chloroplast must have a supply of energy, and this is obtained from sunlight. It is known that chlorophyll is able to absorb energy from light, for when light passes through it, certain rays are retained, and it is these retained rays that supply the energy with which the chloroplast works. It is an interesting fact that the rays of light not absorbed give a green color; that is, leaves are green because the green-producing rays are not being used. If the energy for photosynthesis is obtained from sunlight, it is evident that at night the process is suspended; in fact, many plants live through the winter without any opportunity to manufacture carbohydrates. It must be evident that a process which is suspended for a considerable period during every twenty-four hours, and which may be suspended for months, is not a process of living, for living must go on continuously. It is simply a manufacture that provides material used in the process of living.

The process of carbohydrate manufacture has been called "photosynthesis" because the word means "putting together in the presence of light." The first step in the process is the breaking up of water and carbon dioxide into their constituent elements. Water consists of hydrogen and oxygen, and carbon dioxide of carbon and oxygen. To break up these two substances in our university chemical laboratory requires a great display of energy in the form of heat or electricity, but it is accomplished by the chloroplast in the laboratory of the leaf without any unusual display of energy. Following this breaking up of the raw materials, the freed elements are put together in new combinations, this being the "synthesis" referred to in the name. It must not be supposed that a carbohydrate is the result of the first synthesis, for it is reached only after a series of chemical changes.

The final product of photosynthesis is reached when a carbohydrate is formed. In the production of a carbohydrate, not all of the elements of the raw materials are used. As much oxygen is left over as entered with the carbon dioxide, and this oxygen is a by-product which is being given off when green plants are engaged in photosynthesis. (The name carbohydrate, meaning carbon and water, is given because it contains carbon and also hydrogen and oxygen in the same proportion as in water.) The total result seems to be to get the carbon out of the carbon dioxide and combine it with water, and therefore the process is often called the "fixation" of carbon; that is, getting carbon out of a gas and "fixing" it in a solid. Since hydrogen and oxygen are both gases, carbon is the only solid that enters into the fabric of the plant, and this solid is obtained from a gas that exists in the air.

The carbohydrates thus formed in the plants are usually starches or sugars, and they are freely transformed into one or the other. Starch is spoken of as the storage form, but when the carbohydrate is being used and is moving through the plant, it is in the form of sugar, for a substance must be in solution to be carried about, and therefore sugar is spoken of as the transfer form of a carbohydrate.

When it was first discovered that green plants take in carbon dioxide and give out oxygen, it was natural to suppose that this gas exchange represented the respiration of plants. Since the gas exchange in the respiration of animals is just the reverse, the opinion became current that plants and animals differ in their "breathing." Since this impression is still current, its correction should be emphasized. It is clear that photosynthesis has nothing to do with respiration, for respiration is associated with what may be called the act of living, and therefore is carried on by every living thing all of the time. If respiration stops, the plant or animal is dead; in fact, we use respiration as a sign of life. Therefore plants and animals "breathe" alike, both taking in oxygen and giving out carbon dioxide; but green plants carry on the process of photosynthesis also, in connection with which carbon dioxide is taken in and oxygen is given out. The confusion arose from the fact that during the day, when photosynthesis is going on, the amount of gas exchange involved in the manufacture of carbohydrates is so much greater than the amount involved in respiration, that the latter was not noticed. If the observation had been extended into the night, however, it would have been discovered that only the gas exchange of respiration was being carried on.

Carbohydrates are by no means the only foods that plants make, and therefore photosynthesis is not their only process of food manufacture. Another conspicuous group of foods is the group of proteins, which may be regarded as foods in the most advanced stage as living protoplasm is largely composed of proteins. Carbohydrates, therefore, may be thought of as the first stage of food, and protein as the last stage. It is known that neither light nor chlorophyll is required for the manufacture of protein, for the process goes on in living cells removed from light, and in plants containing no chlorophyll. It is known, however, that carbohydrates are used, and that to the carbon, hydrogen, and oxygen supplied by them, the elements nitrogen, sulphur, and often phosphorus are added, and these elements are obtained from their combinations in the salts of the soil.

The rôle of green plants in the world, therefore, is evident. It is only by them that food can be made from that which is not food. For this reason they are the only independent organisms, that is, independent of the work of other organisms. When we see the phrase "nothing but leaves," with its implication of failure, we must realize that leaves stand for the most fundamental of all the work of the earth, without which there would be no world of living beings.

Racial Types in the Population of the United States

THE "MELTING POT" MAKES AMERICANS OF US ALL AND PRODUCES RAPID CHANGES IN CUSTOMS AND LANGUAGE, BUT IS SLOW IN BREAKING DOWN THE BARRIERS BETWEEN DIVERSE BIOLOGICAL RACES

By L. R. SULLIVAN

NOW that the great World War is doing so much toward breaking down nationalistic feeling between the different elements of our population and making Americans out of citizens who heretofore have prided themselves on birth in some foreign land, it is interesting to inquire into the biological significance of the term "American."

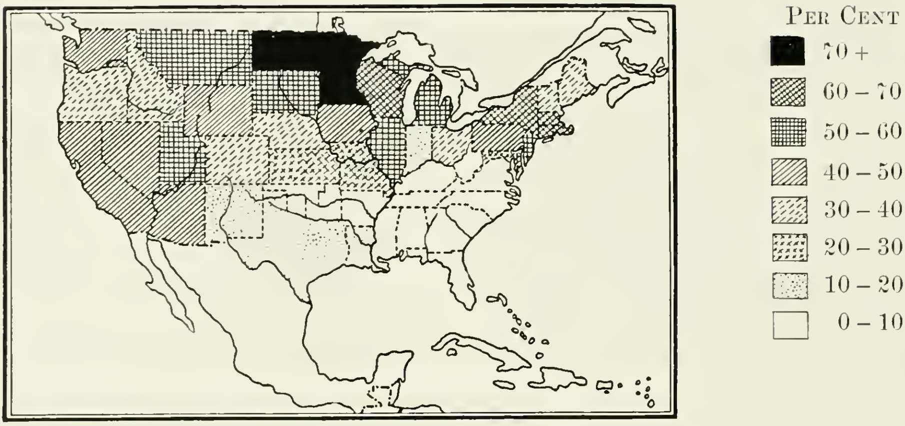
It is no new thing to say that in the United States we have an unusually large number of nationalities, each represented by thousands of individuals, living side by side. In fact, so accustomed are we to hear America spoken of as the "Melting Pot" that few of us stop to consider the significance or applicability of the term. To most of us it invariably provokes the conception of a very badly jumbled and thoroughly mixed condition of people and affairs, in fact a sort of biological hash. A little investigation into the matter seems to indicate that the mixture is more truly cultural and linguistic than biological.

No nationwide anthropometrical investigation has been made in the United States. How then can we get any light on the racial characters of our population? Obviously the only resource in lieu of a badly needed survey is to trace our population to its original sources and study the results of anthropological surveys of these countries. While such a method cannot give the desired accurate information, it should at least help us to form some conception of the probable status of the various racial types in our country.

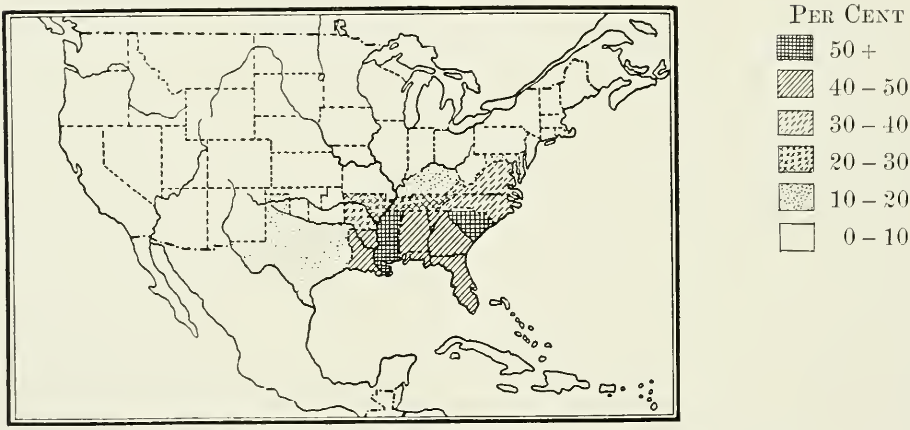
Foreign Stock or Different National Groups in the United States

While it would be next to impossible to trace accurately the sources of our entire population, it is a comparatively simple matter to obtain the origin of a very large sample. I refer to the so-called "foreign stock" of our census. "Foreign stock" includes all those individuals born in a foreign country or having one or both parents born elsewhere than in the United States. Some idea of the size of this sample will be obtained from the fact that this foreign stock comprised 35 per cent of our total population at the time of our last census. Add to this the fact that about 11 per cent of our entire population of 93,000,000 are Negroes and we have accounted for nearly half our population. A sample which includes 46 per cent of a group of 93,000,000 individuals is surely sufficiently large to throw some light on the true status of affairs.

One disconcerting fact about this sample is that it is not evenly distributed throughout the various states. The proportion of foreign stock varies from less than 1 per cent of the total population in North Carolina to 72 per cent in Minnesota (see map 1). Very few of the states contain less than 10 per cent while the greater number contain more than 30 per cent. It is noticeable that just those states which



Map 1.—Percentage of Foreign Stock in Total Population by States



Map 2.—Percentage of Negroes in Total Population by States

Foreign stock includes all foreign-born individuals and also persons having either or both parents born in a foreign country. Of the total population of the United States 34.6 per cent are of foreign stock. The proportion varies considerably from state to state. It ranges from less than 1 per cent in North Carolina to 72 per cent in Minnesota. It will be noted that map 2, showing the distribution of Negroes in the United States, is to a certain extent complementary to map 1. The highest percentage of Negroes is found in Mississippi and South Carolina where they form 55 per cent of the total population. The foreign stock and Negroes make up 46 per cent of our total population contain the smallest proportion of foreign stock accommodate the largest proportion of the Negro population (see map 2). So then, even with this unequal distribution of our foreign stock, the samples for the most part remain of sufficient size for a working basis.

Another objection to the method is the common belief that immigration is rather irregular and spasmodic in its actions. A careful study of our immigration records from 1820 to 1917 does not uphold this conception. Immigration advances comparatively slowly and steadily along very definite and well-beaten paths. Marked changes in the source or direction of migration are slow in gaining momentum and equally slow in being retarded. It is true that in the last fifty or one hundred years changes have occurred, notably in the increase of immigration from Russia, Italy and Austria, yet such are slow in effecting marked differences in the total population.[1]

First in numerical importance as a source of our foreign population is Germany, which contributed a little more than 25 per cent of that element of our population. With the exception of the New England states and a few of the mountain states individuals of German origin outnumber all other nationalities. However, were we to regard the natives of the British Isles as a unit the honors would be about equally divided between them and Germany. Since the proportions furnished by Ireland, England, Scotland, and Wales are so unequal it has seemed better to treat them as independent sources.

Ireland is the second great source of our immigrants, furnishing 14 per cent of our foreign stock. They, too, form a very important element in the greater number of our states. Canada is third with 9 per cent. Of late years Canada has formed an intermediate station for immigrants of English, Irish, Scotch, Welsh, and French descent. As yet they have not penetrated very far to the south and indeed they are unlikely to do so.

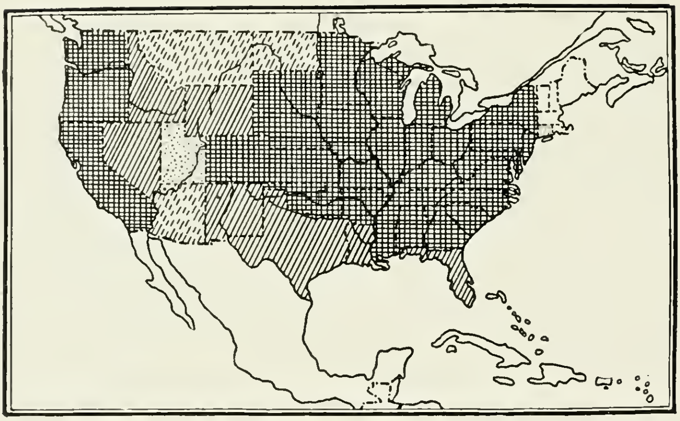
Russia is one of our most recent sources of population. In 1910 natives of Russia formed 8 per cent of our foreign stock. As yet the Russians have not penetrated very far inland, being distributed for the most part along the eastern coast. It seems reasonable to say that they have not yet reached the final stage of their migration but ultimately will present an entirely different distribution.

Direct immigrants from England are becoming fewer in number although many of our Canadian immigrants are of English origin. The English formed 7 per cent of our foreign stock, however, at the last census and their distribution would indicate that they have penetrated all parts of our country.

Map 8, indicating the distribution of Italians, does not really convey the actual importance of this element of our population. The total of 6½ per cent is widely distributed but is concentrated only in the states indicated. This is one of the few cases in which the immigration reports distinguish between different geographical areas in a foreign country and designate the proportion of north and south Italians. The south Italians are much more numerous among our immigrants than are the north Italians.

Austria also furnished more than 6 per cent of our foreign stock. The greater number of the Austrians seem to be concentrated in the north central states.

[1] On maps 3 to 14 I have plotted the principal sources of our foreign population by nationality and indicated the relative numerical proportion of each nationality in the various states. To avoid confusion in shading, only the four most important nationalities in each state are indicated. Almost invariably these first four nationalities comprise 50 per cent and in some instances as much as 85 per cent of the foreign population. More than that, in each state some one nationality leads all others by a generous margin, individuals of German, Irish, or Canadian origin often making up more than 50 per cent of the foreign population in different states.



Map 3

GERMANY

Rank:

First

Second

Third

Fourth

Map 4

IRELAND

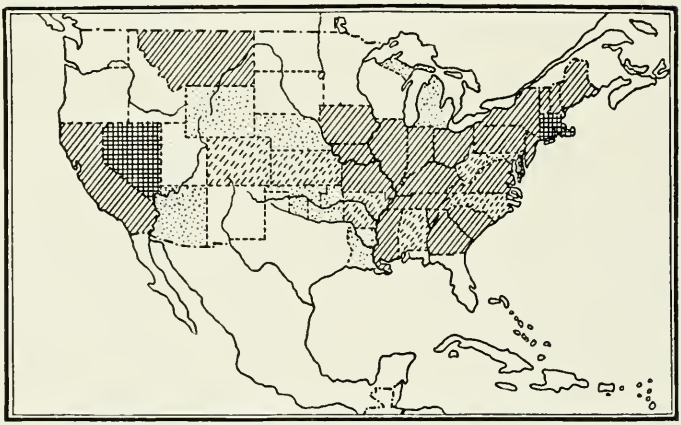
Rank:

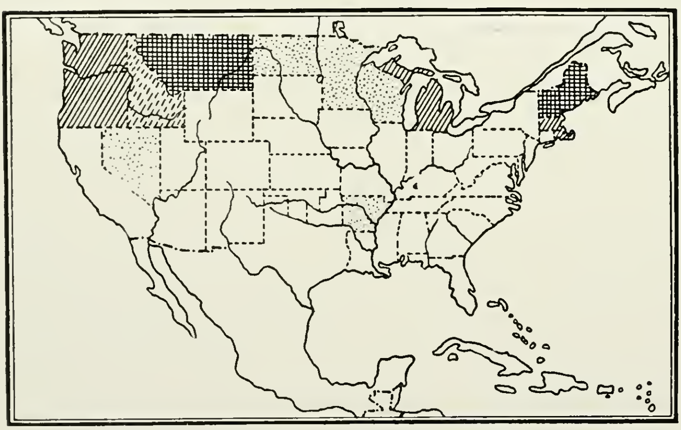
First

Second

Third

Fourth





Map 5

CANADA

Rank:

First

Second

Third

Fourth

PRINCIPAL SOURCES OF OUR FOREIGN STOCK

Germany furnished 25 per cent of the foreign stock in the United States in 1910 and the Germans numerically were most important in the greater number of the states. Ireland furnished 14 per cent and holds second place in the greater number of the states. Canada is third in importance as a source of our population

Map 6

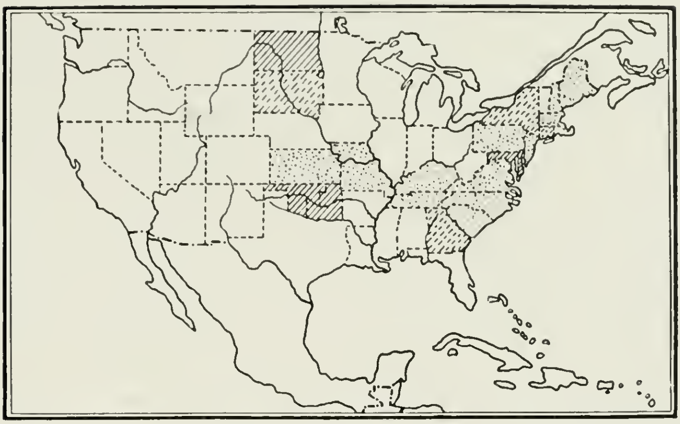
RUSSIA

Rank:

Second

Third

Fourth



Map 7

ENGLAND

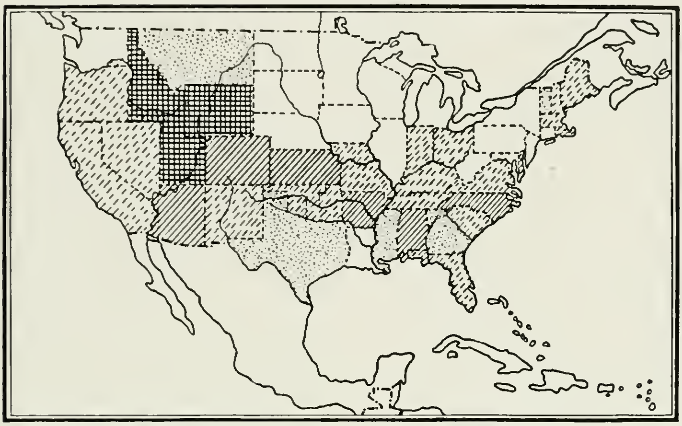
Rank:

First

Second

Third

Fourth



Map 8

ITALY

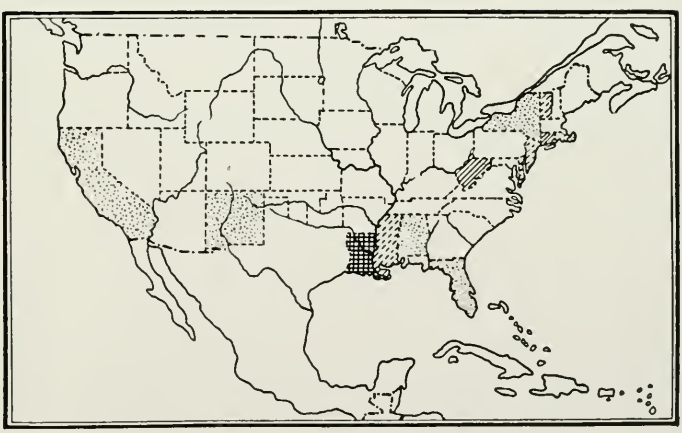
Rank:

First

Second

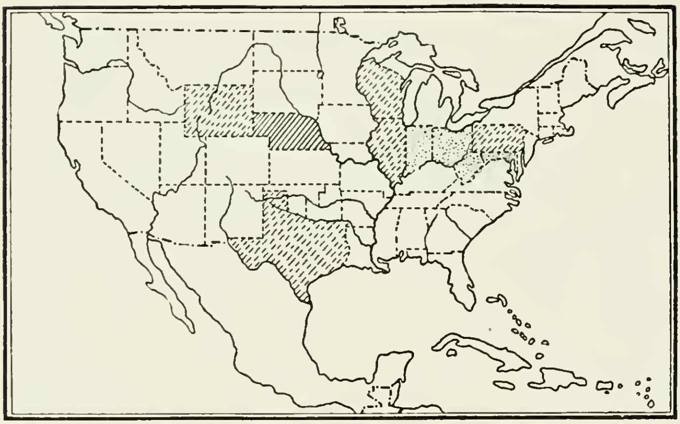
Third

Fourth



OTHER PRINCIPAL SOURCES OF OUR FOREIGN STOCK

Fourth, fifth, and sixth in importance, judging by the relative numerical ranking in each state, are Russia, England and Italy. The importance of Italy and Russia as sources of population is due to a relatively recent and increasing tendency to emigrate from these countries. England is gradually becoming less important as a direct source of population for this country



MAP 9

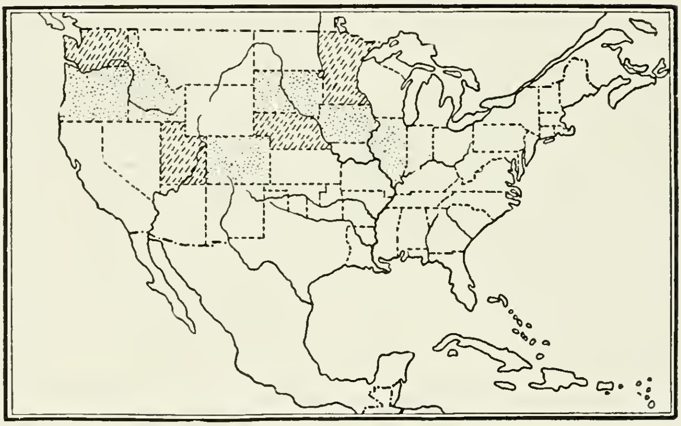
AUSTRIA

Rank:

Second

Third

Fourth



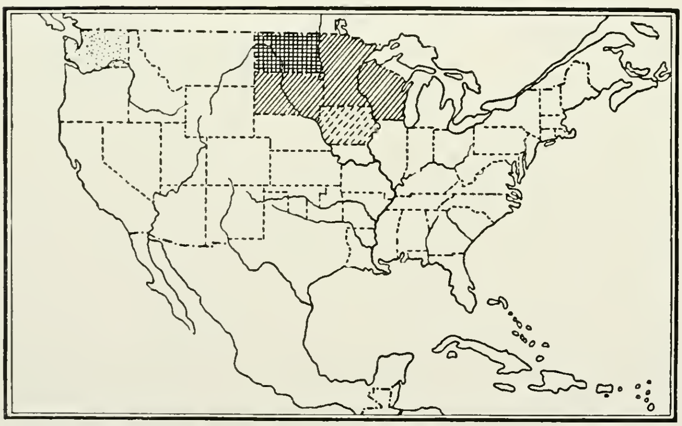
MAP 10

SWEDEN

Rank:

Third

Fourth



MAP 11

NORWAY

Rank:

First

Second

Third

Fourth

STILL OTHER SOURCES OF OUR FOREIGN STOCK

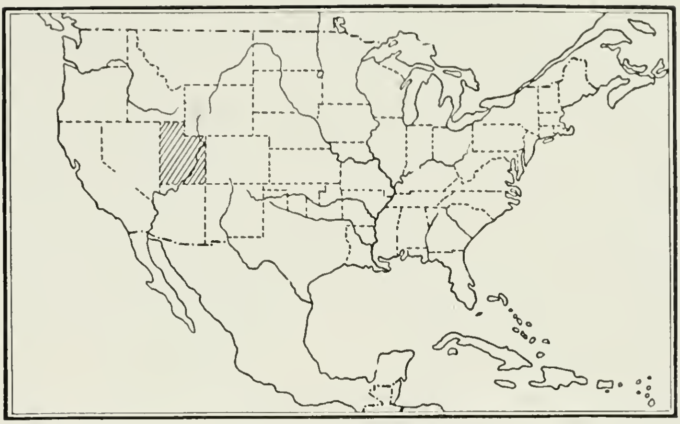
Emigration from Austria was increasing very rapidly before the present war. In 1914, Italy alone surpassed Austria as a source of foreign stock. Of late years immigration to the United States from Sweden and Norway has been on the decline

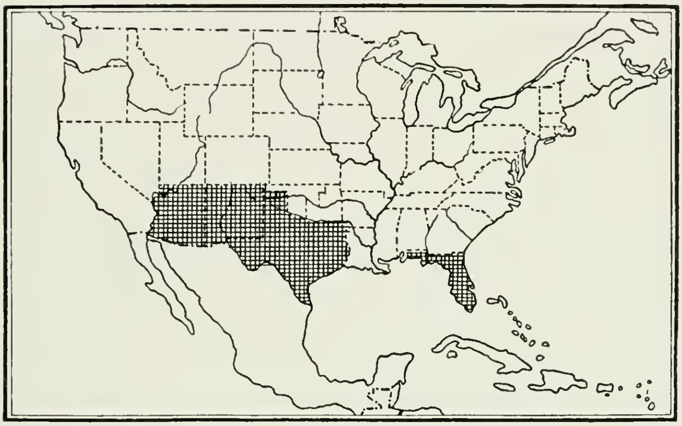
Map 12

DENMARK

Rank:

Second





Map 13

MEXICO AND CUBA

Rank:

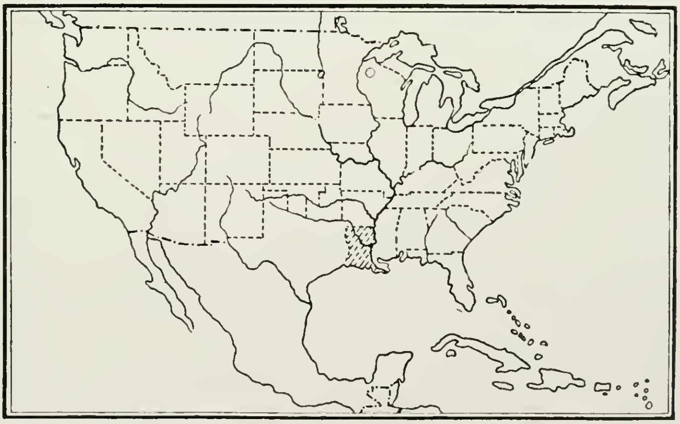
First

Map 14

FRANCE

Rank:

Third



MINOR SOURCES OF OUR FOREIGN STOCK

These maps show the relative numerical ranking of various national groups in each state. Immigrants from Denmark, Mexico, or France are fewer in number than those from Scotland, but the Scotch are not sufficiently concentrated in any one state to rank among the first four nationalities in numerical importance. The immigrants from Canada shown on map 5 include many people of French, English, Irish, and Scotch descent

Sweden and Norway have made important contributions to the north central and northwestern states. Utah is the only state in which the Danes are sufficiently concentrated to rank among the first four nationalities in importance.

Through Mexico and Cuba we have received a rather important Spanish element in some of our southern states. Since the outbreak of the war we have had an increase of Spaniards from other sources.

Louisiana is the only state in which immigrants directly from France are sufficiently concentrated to rank among the first four nationalities in importance. It should be remembered, however, that about 30 per cent of our Canadian immigrants are of French descent.

These maps (3 to 14), besides showing the sources of the foreign stock in different states, bring out several important points. Most important is the fact that our immigrants are not distributed at random throughout our country but that the peoples of a given nationality show usually one region of maximum concentration surrounded by areas of decreasing concentration. With the exception of the people of German, Irish, or English origin, these areas of concentration are fairly restricted. Even among the more cosmopolitan peoples the distribution is by no means random.

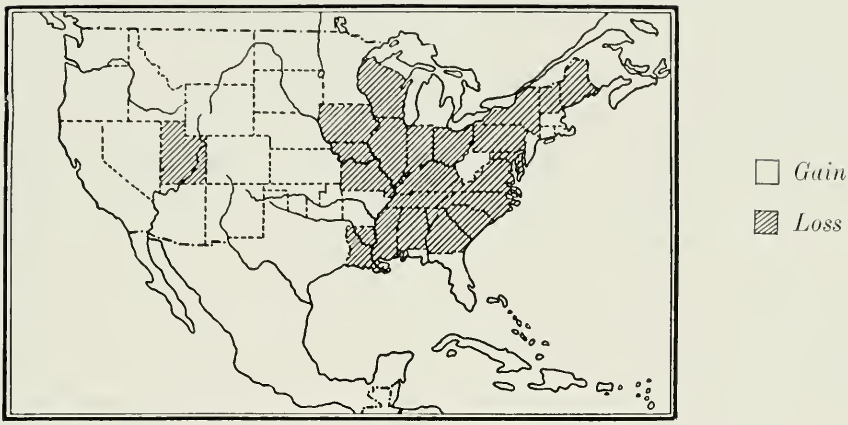
How far can we go in judging the past from the present? Such a regular distribution and localization of nationalities would seem to indicate that this is a very important factor in determining the distribution of our immigrants. Like attracts like. It is not assuming too much to say that this has always been one controlling factor and that the present distribution of our foreign stock will serve in a measure as an indication of the relative importance of the various nationalities in the various states.

Another important factor in the localization of national groups is interstate migration. Maps 15 and 16, based on our last census, show that the general trend of interstate migration is from east to west. Nearly all the eastern states have lost by this migration. It is also interesting to note that the lines of migration are generally from one state into another in the same latitude. Only in instances where there is some unusual drawing factor does migration depart from this rule.

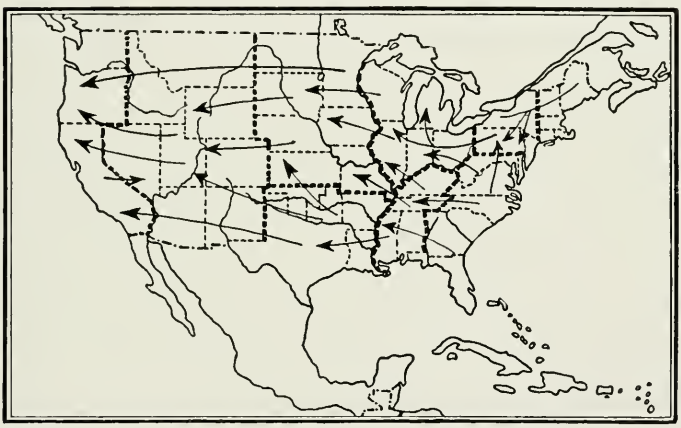
Biological Races and Some Inheritable Characters Distinguishing Them

So far we have been dealing with nationality which is quite a different thing from race. It seems to be a common fallacy for a nationality to look upon itself as a biological race. We hear so often of the Irish race, the Jewish race, the Italian race, or the French race, and numerous organizations exist in this country for the purpose of perpetuating and fostering pride in and loyalty to these and other races. Even in America those of us who can trace back our American-born ancestry five or ten generations begin to look upon ourselves as something quite distinct and different from our newly arrived immigrants whom we are satisfied to lump together as foreigners. Yet the difference is largely a temporal difference. Anthropological research has proved that these fancied races do not exist as such. There is no such thing as an Irish race, an English race, a Scotch race, or numerous others that have been advocated. Differences, when they exist, usually consist in a difference in the proportions of the various racial elements represented in a nationality. The United States alone cannot lay claim to the distinction of presenting a heterogeneity of biological types. France, Switzerland, Germany, Austria-Hungary, Russia, and numerous other nations are close seconds.

What then is race? The average ob-



MAP 15.—STATES SHOWING A LOSS OR GAIN BY INTERSTATE MIGRATION



MAP 16.—THE GENERAL TREND OF INTERSTATE MIGRATION

The above two maps show that the general trend of migration within the United States is from east to west and generally in about the same latitude. Naturally on the Pacific Coast there is a slight counter migration inland. On the whole nearly all of the eastern states show a loss and the western states a gain by interstate migration serving person feels certain that he can easily pick from a heterogeneous crowd the Jew, the Scotchman, the Irishman, the Englishman, the German, the Frenchman, the Greek, or the Italian. But when questioned as to the criterion for the selection, more often the basis will be peculiarities of the clothing, dress of the hair, beard or mustache, or even facial expression and slight mannerisms. But these are not permanent and stable characters by means of which we may always distinguish individuals of one nationality from those of another. The farther back an individual can trace his American ancestry the more difficult it is to guess the nation of his origin. This difficulty is due not to any marked change in biological make-up but to very great changes in language and culture.

For the purpose of determining the racial origin of an individual or group of individuals we must resort to the more staple biological characters. A character to be of any permanent value in distinguishing one race of mankind from another must be an inheritable anatomical character transmitted from parent to offspring. One has only to consider the complexity of the human body to gain a conception of the number and variety of these characters. It is probably safe to say that there are racial differences of varying degrees in every organ and part of the body. Thousands of these differences have been discovered and described and with our newer methods of research others are coming to light daily. Many of these differences are complex and minute and require special training and refined technique for their detection. But there are numerous very important racial characters with which we are all more or less familiar.

Of prime importance in anthropological analysis are the form and color of the hair. Human hair ranges in form from the coarse straight hair of the American Indians, Chinese, Japanese, and Malayans to the closely coiled and frizzly hair of the Negro. In color it grades from the pale blond hair of the Norwegians and Swedes to the very black hair of South European peoples, the Negroes, and the various Mongoloid types. The distribution of the hair on the body differs also. The Mongolian and many of the Negro types are characterized by very sparse beards and mustaches and the body hair is very poorly developed. Our European peoples, some of the inhabitants of southern Asia, the Australians, and the Ainu are characterized by profuse beard and mustache and an abundance of body hair.

We are all familiar with the marked differences in skin color ranging from the white skin of the North European peoples through the darker colored southern Italians and Spaniards, the yellowish brown Chinese and Japanese, the darker brown American Indians, and the dark chocolate brown or nearly black Negroes.

Closely correlated with the color of the hair and skin are differences in the color of the eyes. The North European peoples have blue eyes prevailingly as do also some of our Central European peoples. All the rest of the more deeply pigmented types of mankind have light or dark brown eyes. A blue eye differs from a brown eye, not in the nature of the pigment, which is the same in both cases, but in the amount and distribution of the pigment. When the pigment is confined to the deep layer of the iris the eyes appear blue or gray, but when the outer layer of the iris is also pigmented the eye appears brown or even black. Irises having only a small amount of pigment in the outer layer often appear green or greenish gray.

Another inheritable character is stature or height of the body. Perhaps we have occasion to note the extremes and range of differences for stature more often than for any other character. Yet survey after survey of groups of reasonable racial homogeneity have shown that this character is not much more variable than the other characters noted above, and the average stature of regions with a fairly stable population has remained nearly the same for centuries. Among the Negroes we have both extremes of the very tall and very short racial types. The greater number of the continental Asiatics are short. The Europeans of the north are among the very tallest peoples while those of the south are considerably shorter.

Head form, too, is characteristic of racial types. It ranges from very broad round forms to very narrow long forms. The North and South Europeans, the Negroes with the exception of certain Oceanic types, the Semitic and Hamitic types, the Eskimo and certain American Indians are long-headed. The Central Europeans, many Mongoloid types of Asia, many Polynesians, and some American Indians are short-headed. To this list of characters could be added the extreme variations in the form of the nose, the proportions of the face, and indeed, proportions of the entire body. However, the above are sufficient for a general survey of the races of mankind represented in the population of the United States.

On the basis of the above characters it has become possible to classify all mankind into a relatively few groups. There is some difference in opinion as to the exact number and ranking of these groups, but these differences of opinion are, for the most part, differences in nomenclature and when analyzed reveal a very close agreement on relationships. Most anthropologists are satisfied to distinguish between four great groups or primary races of mankind: the lighter-pigmented European race with straight or wavy hair, fairly tall stature, and a rather prominent narrow nose; the yellowish-brown Mongoloid race characterized by straight black hair, poorly developed face and body hair, shorter stature, a broad face, and a nose very low and flat between the eyes; the more heavily pigmented Negro race with black frizzly hair, a broad nose, and most frequently a fairly long head; and fourthly, an Australian race with a dark brown skin, curly or wavy hair, well-developed face and body hair, and a broad nose.

Included in each of these primary races are several racial types that are characterized by certain peculiarities which distinguish them from other types of the same or different races. It should be said also that there are several smaller groups of mankind which seem to present characters intermediate between two races and are therefore difficult to classify.

The Three Primary Biological Racial Types of Europe

Since we have seen, however, that by far the greater part of our population is of European origin, we are concerned chiefly with the racial types represented in Europe. In the main there are three principal racial types in Europe: the North European, variously called the Teutonic, Germanic, or Nordic type, with blond or light brown hair, blue eyes, tall stature, an elongated head and face and a high and narrow nose; the Central European, known as the Alpine, Celtic or Slavic type, characterized by darker hair and eyes, medium stature, a shorter and broader head and face, and a large nose; and the South European, variously called the Mediterranean, Ligurian or Iberian type, characterized by black hair, brown eyes, a darker skin, long head, short stature, and fairly broad nose.

Besides these main types there are other racial types of lesser numerical importance. Although many of the Jews in Europe belong to the Central European type some of them clearly represent a Semitic type or an Armenoid type. It is absolutely impossible to make any reasonable estimate as to just what proportion of each of these racial types is represented in the Jews of various nationalities, and no attempt has been made to do so. In Austria-Hungary, the Balkan Peninsula and Russia are representatives of several Asiatic types, but there, too, it is impossible to estimate the proportions of these elements. On the whole, though, it is safe to say that the inclusion of these types as one of the three European types tends to increase our estimates of the number of individuals belonging to the Central European type rather than to the North and South European types.

In Norway, Sweden, Denmark, Belgium, Netherlands, and the British Isles the North European type predominates. In the British Isles there are also representatives of the Central and South European types. The fact that throughout the Islands the head is rather long seems to indicate that the South European type has been more numerous than the Central European type. In Germany we have the North European type in the north and the Central European type in the south. Considering the country as a whole, the Central European type is perhaps more numerous. In France we have all three types: the North European type in the north, the Central European type in the central part, and the South European type in the south. Here too, in Dordogne, we have what is supposed to be a remnant of the paleolithic Crô-Magnon type.

In Switzerland and Austria the Central European type is predominant. The North European type, however, is of sufficient importance to be mentioned. In Austria the Armenoid type, supposedly related to the Central European type, also occurs. In Hungary we have several racial types which have been little studied and poorly described. The same is true of the Balkan States. The words Slav, Asiatic, Mongol, and Turki have been used so carelessly in describing them that it is difficult to make a very definite statement. On the whole it seems that the greater number of these people exhibit characters which would identify them as belonging to the Central European type.

Russia also presents several types. The Letts and Lithuanians are of North European type, the Great Russians and White Russians are mixed, and the Little Russians and Poles are Central European types.

In Greece the Central European type predominates but is mixed with the South European type. In Italy the South European type predominates in the south, the source of the larger part of our Italian immigrants, and the Central European type predominates in the north. Traces of the North European race are also said to occur. Finally, in Spain the South European type makes up nearly the entire population.

Population of the United States derived mainly from these Three European Types, from Negroes and American Indians. — Distribution among the Different States

Having then determined the principal sources of our population with some idea of the racial composition of these various nations, we are in a position to estimate approximately the racial types in the various states of our country (see maps 17 to 19).[1]

It is of particular interest to note

[1] The method in estimating the racial composition of each state was to assign each race a given value for a certain nationality and to weigh that value by the relative numerical importance of that nationality in a given state. The average for the first twelve nationalities in numerical importance in each state was taken. The same values were used throughout and if the results cannot boast of accuracy they certainly are consistent. On the whole I believe that the results can be relied upon to give us an idea of the true status of affairs. If I have slightly overestimated a racial element in one nationality I probably have underestimated it in another, so that in an average for twelve nationalities these errors should counterbalance and not appreciably affect the general results. All of the estimations and calculations were made before a single map was plotted.

that we do get a somewhat similar distribution to that we found in Europe. Although all of these three types are found in every state, nevertheless the areas of greatest concentration of a given type show some respect for latitude. The North European type is most important in the New England and northwestern states, the Central European type is most important in the Atlantic and east-north central states, while the South European type is most important in the south central states. What was true for the national groups is more or less true for the racial groups. Usually one racial type is considerably more numerous in a given state than the racial type second in importance. Notable exceptions to the rule are New York, New Jersey, Pennsylvania, Illinois, Wisconsin and a few other states where, as near as we can estimate, the North and Central European elements are about of the same frequency.

Some concern has recently been expressed on the general decrease of individuals belonging to the North European racial type. Although it is inevitable that the Central European type will become of first importance numerically unless there is some marked change in the general trend of immigration, at the present time the North European type is considerably in the lead, especially if we consider the population by states. The North European racial type is most numerous in about half the states, the Central European type in twelve and the South European type in only three. There also promises to be an increase in the number of representatives of the South European type in the future.

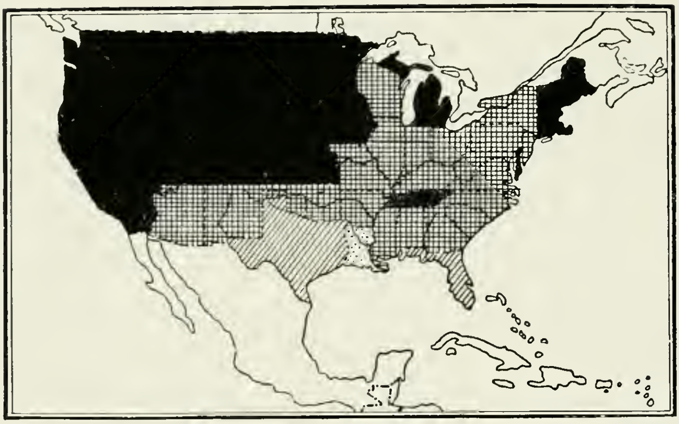
As mentioned before, these three European types also contain representatives of other racial types the importance of which it is impossible to estimate.

Besides these European racial types we have also representatives of two of the other primary races of mankind. The Negroes form nearly 11 per cent of our total population and are more important numerically than representatives of our South European type. The Negro race stands third in rank of frequency. Although the Negroes of the United States undoubtedly represent more than one type the greater number belong to the Nigritian or Sudanese type. They are rather tall in stature, have a long head, broad nose, thick lips, frizzly black hair, and dark brown skin. They still remain concentrated chiefly in the southern states, where they are the most numerous single racial element in eight of our states.

The American Indians, the original inhabitants of our country, are of rather minor importance numerically at the present time. They form only $\frac{3}{10}$ of 1 per cent of our total population. Only in a few of the western and southwestern states do they form any considerable percentage of the total population. They are relatively most numerous in Arizona where they form about 14 per cent of the total population of the state. Physically they are allied to the Mongolian race in hair form and color, eye color, character of the teeth, width of the face and, in some cases, the form of the eye and nose. The skin is slightly darker and in many instances the nose much more highly developed than in many Mongoloid types. The Japanese and Chinese also make up $\frac{3}{10}$ of 1 per cent of our total population. They, too, represent Mongoloid types.

Opinions as to the Valor of Different Races in the World War

From the maps showing the distribution of these racial types (maps 17 to 22) it will be seen that our population differs considerably in racial composition in different states. Each of these racial types has its champions who claim for it all that is high and noble.



Map 17

NORTH EUROPEAN TYPE

Rank:

First

Second

Third

Fourth

Map 18

CENTRAL EUROPEAN TYPE

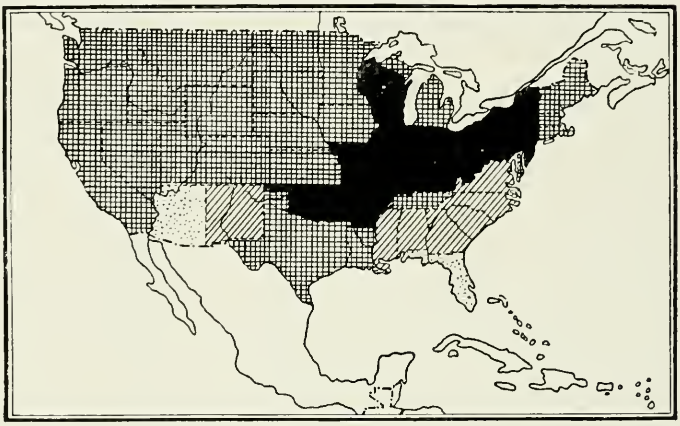
Rank:

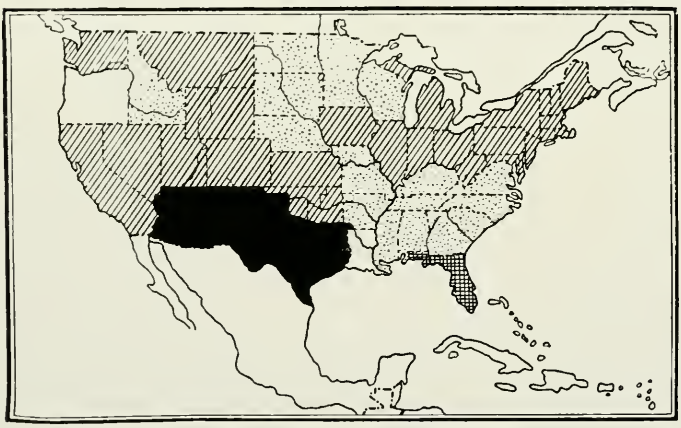
First

Second

Third

Fourth





Map 19

SOUTH EUROPEAN TYPE

Rank:

First

Second

Third

Fourth

The North European type is still the most important element in our population. It will be noted that it is concentrated in the northeast and northwest. Second in importance is the Central European type, ranking first in the north central and Atlantic states. The South European type is fourth in importance at the present time. In a very general way there is some correspondence with the distribution of these racial types in Europe

Map 20

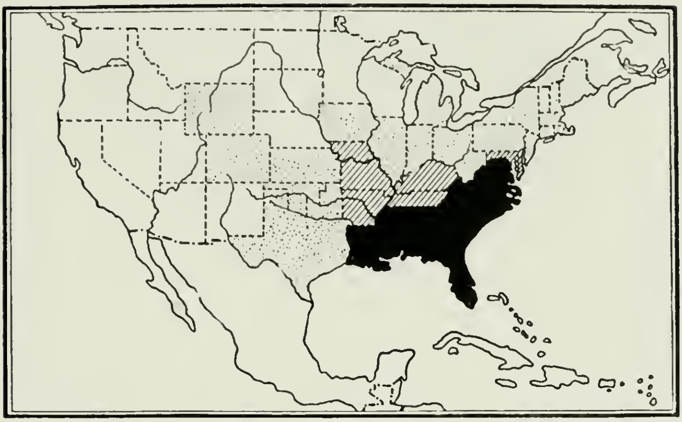
NEGRO TYPES

Rank:

First

Third

Fourth



Map 21

INDIAN TYPES

Per Cent of Total Population:

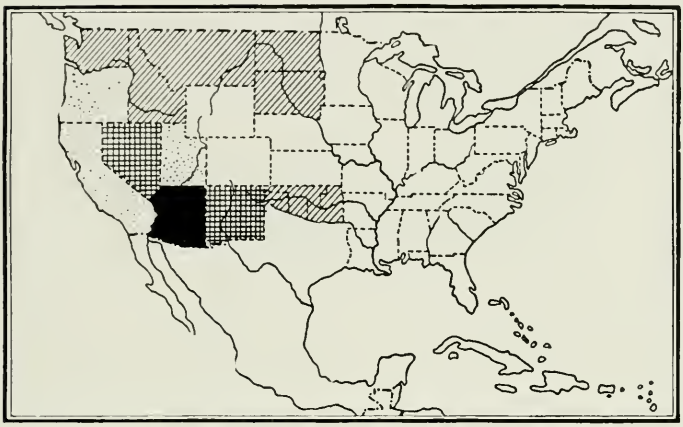
10 +

5 – 10

1 – 5

½ – 1

– ½



Map 22

MONGOLOID TYPES

Per Cent of Total Population:

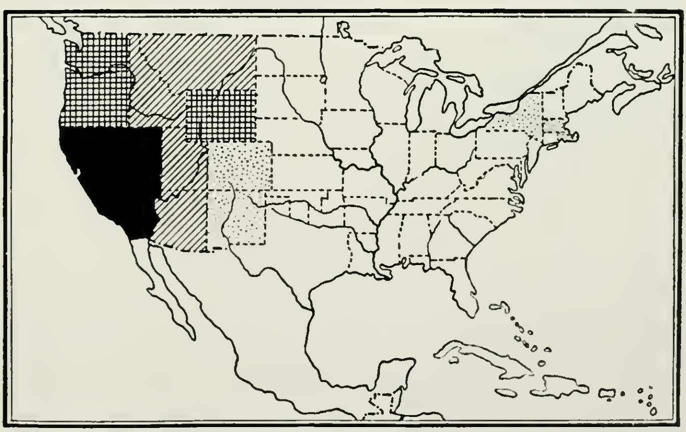
2 +

1 – 2

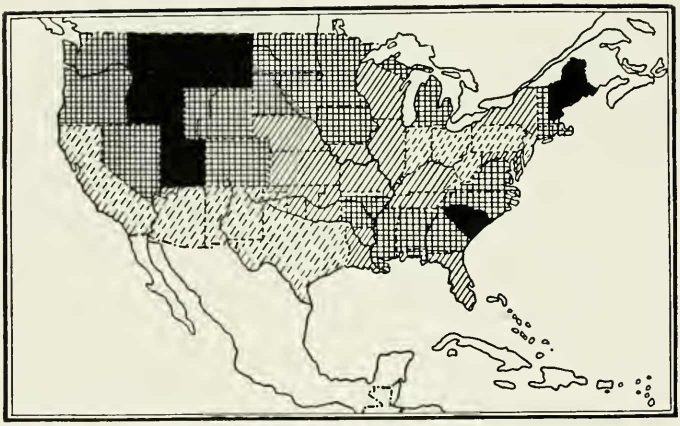
½ – 1

⅒ – ½

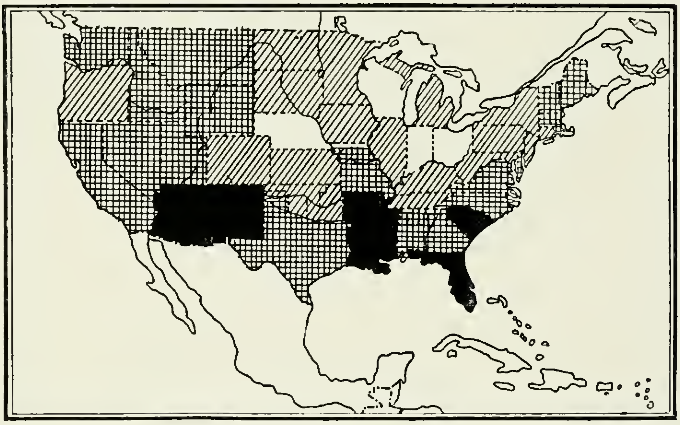
– ⅒



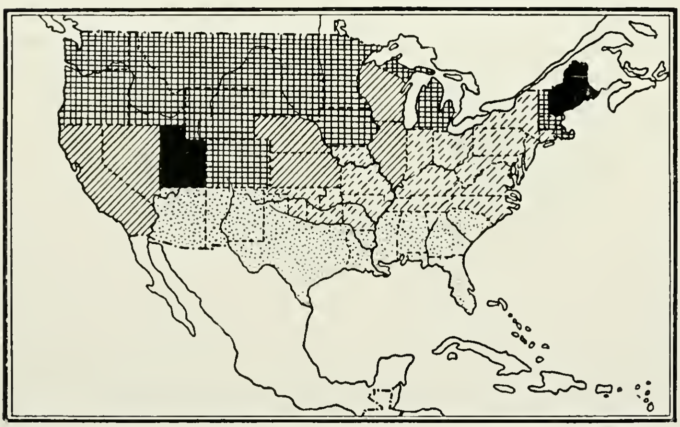
The Negro types are third in rank in the United States forming 11 per cent of our total population. The American Indians form only 3/10 of 1 per cent of our population. The Mongoloid types including Japanese, Chinese, Koreans, and Filipinos also constitute 3/10 of 1 per cent of the population of the United States



Map 23
STATURE
Estimated Averages:
- 67½ inches
- 67 "
- 66½ "
- 66 "



Map 24
CEPHALIC INDEX
Estimated Averages:
- 76 – 77
- 78 – 79
- 80 – 81
- 82 – 83



Map 25
BLONDNESS
Estimated Percentage:
- 50 +
- 40 – 50
- 30 – 40
- 20 – 30
- 10 – 20

Estimated approximate distribution of the three most studied characteristics of race: stature, head form and pigmentation. While the figures given are not based on actual observations and are not intended to imply absolute accuracy, nevertheless they are undoubtedly correct so far as they show the general trend and distribution of these characters (see footnote opposite page)

Especially since this country entered the great world conflict, statements have appeared from time to time claiming a greater amount of valor and courage or number of enlistments for this or that racial type. While such a condition is entirely conceivable it is an absolute certainty that no concrete data have as yet been brought forward to uphold these contentions. Before making any such statement we must take into consideration just such facts as I have tried to bring out in this survey.

Were we to go into a military training camp in the northwestern states or in New England and be impressed with the high frequency of individuals of North European origin, we should not infer from this that the North European type is the more courageous. It is just what we should expect from the composition of the population. Nor would it be fair to the other racial types to estimate the courage of the Negro race by the proportion of Negroes enrolled in South Carolina, the South European type by the proportion of individuals of this type enrolled in Texas, or the Central European type by the proportion of its representatives enrolled in Indiana. Further than this, the social and economic status of the various types must be weighed before any generalization on relative courage or valor can be scientifically made.

Variation in Height, Cephalic Index, and Frequency of Blond and Brunette Types in Different Parts of the United States

It may also be of interest to trace the distribution in the United States of some of the racial characters we have mentioned. This can be approximated more accurately than the proportion of racial types. Here as before we cannot take into account the selection exercised by migration.

Considering first stature, we shall proceed as before and weigh the average stature of a national group by the relative importance of that nationality in each state. By taking the average for the first twelve nationalities in each state we can get some idea of the average stature in each state. Here too we must include the Indian, Negro, and Mongoloid types. As nearly as it can be estimated it seems that the average stature of the different states does not vary more than about two inches. The northwestern, New England, and southeastern states have the higher averages and the southwestern and north central states rather lower. The Negroes help raise the average in the southeastern states.

There are also considerable data on head form in the different European and other nationalities. Head form is

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Footnote (see maps on opposite page).—

Map 23 was compiled by giving the average stature of the various European nationalities a weight in accord with the relative numerical importance of each nationality in each state. There is a range of only about 2 inches in the averages of the various states. When we consider the range of stature for mankind as a whole it will be recognized that the inhabitants of the United States are a rather tall people. There seem to be three centers of very high stature which gradually merge into a region of shorter stature that extends obliquely across the country from southwest to northeast

In map 24, also, the average cephalic indices of the various nationalities are weighted by their numerical importance in each state. Although we must expect to find the entire range of head form well represented in the United States, the averages are not very different. The longer-headed peoples (with the smaller indices) seem to be concentrated along the east and west coasts and along the southern border. The longer heads in the south are in part due to the relatively high frequency of Negro and southern European types. The large central area presents a greater number of short-headed individuals and a higher average cephalic index

Degree of pigmentation is a racial character. Map 25 aims to show the approximate percentage and distribution of blondness, or a slight degree of pigmentation, in the United States. In this map "blondness" includes not only those individuals popularly known as blonds but also those that are scientifically known as dark and mixed blonds. The criteria are the color of hair and eyes. Since there seems to be a correlation between pigmentation in all parts of the body these criteria are consistent. Individuals having blond hair more frequently have blue or gray eyes. Again the large number of Negroes and southern Europeans in the south accounts for the darker pigmentation in that region expressed by the cephalic index. The cephalic index expresses the proportion of the width of the head to the length of the head in terms of percentage. A small index denotes a relatively long head and a large index denotes one in which the width and length are more nearly equal and hence relatively short. This index ranges from 60 to 95. In the United States we have a great variety of head forms but the averages for the various states are probably not very different. The range of these averages is approximately from 76 to 83. The longer heads are more numerous in the south, northwest and New England states while shorter heads predominate in the north central states.

The only other character on which we have sufficient data to base an estimate is the relative frequency of blond and brunette types. A high percentage of blond types indicates a higher percentage of individuals belonging to the North European racial type. While the various percentages plotted on map 25 are not intended to denote accuracy they must show the relative frequency of blondness in the different states. By blondness we include those individuals popularly called blonds and others having blue or mixed eyes and light brown hair. From the map it is apparent that blond types are much more numerous in the northwest and New England than elsewhere. The high percentage of Negroes in the south accounts in part for the relative scarcity of blond types in that region.

Action of the "Melting Pot" Slow

We have seen, then, that a consideration of our population both as national groups and as racial types exhibiting certain peculiarities of physical make-up shows them to be distributed in a more or less orderly fashion. While we do have the most diverse physical types living side by side, one or the other of these types is usually far more numerous. The greatest amount of intermarriage is between individuals of the same national or racial type. This statement is fully substantiated by our census reports. The more diverse two types are nationally and physically the less frequent are intermarriages between these groups. It is probably only after several generations of a type have lived in this country that many of the national barriers are broken down and free intermixture takes place. In the case of some groups of very diverse physical type it is probable that these barriers never will be wholly removed. So then we should not expect too much of the "Melting Pot."

We are having repeated in this country in a somewhat more intense form the same processes that have been going on in Europe and other parts of the world for centuries. Many of nature's own biological experiments of the past are lost to us. We in this country have the unusual opportunity of seeing some of these experiments repeated before our own eyes. It is our duty to observe carefully and record the results of these experiments. It is only in this way that we can hope to throw any light on the past and future history of the various racial types of mankind. This survey aims only to indicate a very few of the many interesting results a careful anthropometric survey of our country might reveal.

This photograph, taken on August 11, 1889, is believed to be the first ever taken of a living Florida crocodile, *Crocodylus acutus* Cuvier. A few days later I shot what I thought the record specimen, 14 feet 2 inches long (it was sent to Yale University), but discovered many years afterward that in 1875, fourteen years previous, Dr. William T. Hornaday, director of the New York Zoölogical Park, had shot a specimen of just the same size. In later years I often visited the Florida crocodiles and found great sport in photographing them. It was a matter of ethics that a crocodile should be free at the time his picture was taken. This species of crocodile is found not only in southern Florida, but also through the Greater Antilles (except Porto Rico), Mexico, and along both coasts of Central America to Ecuador and Colombia

The Florida Crocodile

By A. W. DIMOCK[1]

With illustrations from photographs by the Author and his son, Julian A. Dimock

THAT the authors of dictionaries were supermen I always believed until I began to make the acquaintance of lexicographers and learned that scissors and paste did most of the authoring.

So in other lines, it is usually impossible really to tree an originator, or even a discoverer, of anything. Leverrier's discovery of Neptune was accounted the crowning triumph of human reasoning, but Adams antedated him by months, and many workers had lifted the science of astronomy to a plane which made the discovery inevitable. Amerigo Vespucci gave his name to the new world which Columbus discovered. I have even originated patentable ideas myself, only to find in the Patent Office the evidence that from one to a dozen or a hundred people had originated the same thing.

In exploiting some of the creatures of the wild, I have never been a pioneer; always the trail had been blazed, usually by some one who was pursuing his avocation with a singleness of purpose that left no room for thought of the distinction of discovery.

Uncle Remus' naming of the toad dis-

Mr. A. W. Dimock, member of the Authors Club, New York, and of the Camp Fire Club of America, is the author of *Florida Enchantments*, *Wall Street and the Wilds*, and other books and articles setting forth the natural beauties of Florida and other parts of the southeastern United States and the fascination of the region for the sportsman. His writings are illustrated by large series of photographs taken by Mr. Dimock and his son, Julian A. Dimock.

[1] September 11 brought the announcement of the sudden death of Mr. Dimock at his home at Peekamose, New York.

closed a typical method of discovery. The creature looked like a toad and jumped like a toad, so he called him a toad. But my preamble threatens to be longer than my little story.

During twenty-two annual cruises on the Gulf coast of Florida, I have exploded a few local myths regarding monsters of fabulous ferocity and unknown creatures which proved to be well known to scientists. My pursuit of the manatee was vain for so long that my attitude became that of the countryman toward the giraffe, "There ain't no sich animile," but I finally found the sea cow, some scores of him, or her, and made the acquaintance of their families, capturing specimens ranging from two hundred to two thousand pounds in weight and finally landing a couple of them alive in the New York Aquarium.

It was the ninth year of my hunting and cruising in Florida when I discovered a guide who could have qualified as of that western type known as "half horse and half alligator." We were in the Big Cypress, traveling light, relying upon the ground for our bed and a tropical thicket for our tent. We carried corn meal, coffee, and salt and my rifle added venison, wild turkey, and alligator to our bill of fare.

Our first camp was a dry one and I was dying of thirst, but my guide was cheerful, saying, "Plenty of water, just find an alligator hole," which we soon did, but the owner was at home and his hole a close fit for him. We worried him with sticks until he came outside, when I shot him, but as we drank our coffee I tried to think of pleasanter subjects.

I was a crank on the subject of wild life photography, an industry in which I have reason to think I was a pioneer, and my guide had promised to show me more alligators than I could "shake a stick at." He fulfilled his promise the next day when, through an opening in the jungle, I looked upon a pond a hundred yards in diameter, the surface of which was almost literally covered with the reptiles whose eyes were all turned upon me. After fixing and focusing I drew the slide of the camera and, taking the bulb between my teeth, sent a bullet through the brain of the nearest alligator, pressing the bulb as he threw himself half out of water. The prints from this plate show the wounded reptile partly in the air and seventy-three live alligators on the surface of the water.

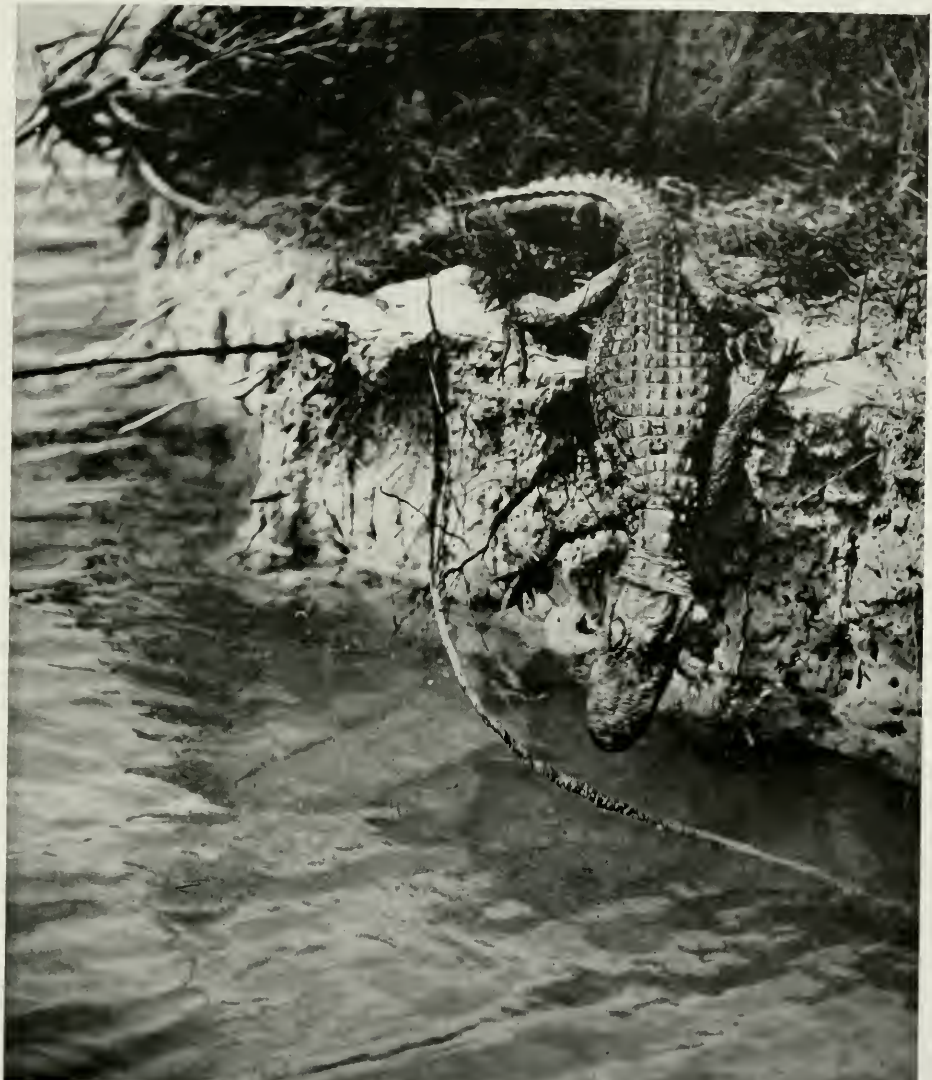
That night as we lay on the ground where the smoke from the camp fire, drifting over us, made a barrage against the mosquitoes, Hall told me of strange monsters he had seen, which were *like* alligators but were *not* alligators. They had pointed jaws, long tusks, were larger and livelier, and were not black like 'gators. He had seen them farther from shore than alligators were ever met and he was sure he could find them again.

We planned to go in search of the creatures the following year, but it was two years before we met and then he had just taken Dr. Veile on the cruise which we had planned. But that was as near being a discoverer as I ever expected to get, so I went on the hunt with Hall just as we had proposed two years before.

One night we anchored a mile or two off Madeira Hammock in Barnes Sound, and in the early morning one of the creatures we were seeking was seen swimming near the "Sunrise," my schooner. Hall and I chased it in a skiff until he was worn out while the quarry was still fresh. I got one shot with the harpoon, but it was a case of projectile *versus* armor and the latter won.

In the days that followed, my son Julian and I, with guide and boatman, pursued the reptiles in skiffs, through narrow bayous, over wide waters and up creeks so overhung with rank vegetation and tangled vines that we could not sit upright in our boats. We caught a number of crocodiles from seven to ten feet in length which we round-skinned for mounting by the institutions to which I gave them. On April 11, 1889, I struck four, of which two escaped, and of one of the others I took what is believed to be the first photograph ever taken of a living Florida crocodile. My journal records that on the following day we had crocodile eggs and steak for breakfast.

The chief excitement of the cruise came a few days later when we encountered the largest crocodile I have ever seen. The story of this adventure has



The alligator, *Alligator mississippiensis* (Daudin), has a broad rounded muzzle which at once distinguishes it from the crocodile with its narrow pointed head. The alligator of the Western Hemisphere (there is a single species in China also) inhabits the rivers and swamps of northern South Carolina, of Georgia and Florida, and westward through Mississippi and Louisiana to the Rio Grande in Texas. The teeth in the upper jaw overlap more or less those below; the large tooth fourth from the front on the lower jaw fits into a deep pit in the jaw above

Early one morning, when we were anchored about one mile off Madeira Hammock in Barnes Sound, we saw a crocodile swimming near the schooner. We chased the creature with a skiff and got one shot with the harpoon, but it was a case of projectile *versus* armor and the armor won

A Florida crocodile on the schooner bound for New York.—This is one of the pair of specimens caught in the Madeira Hammock and sent alive to the New York Zoölogical Park, March 1, 1906 been told elsewhere, so I will merely summarize it here. We had corralled the creature in a deep but narrow channel the ends of which were guarded by our two skiffs, Julian's and mine. He got the first shot with his harpoon, which soon pulled out, having failed to penetrate the hide beyond the barb. The second shot was mine and the harpoon held, but the iron was so small and its barb so short that I dared put little strain upon it, yet it enabled us to follow and find the big saurian however muddy and deep were the holes where she tried to hide.

The hope came to me then of taking her alive but I lacked the experience which I accumulated in later years and was worsted in a contest of some hours which left, on our side, one boat out of commission and the other damaged, and a fighting mad crocodile on the other. That I resorted to my rifle was my admission of defeat. But at least I had killed the record Florida crocodile, of that I could be sure.

The Florida crocodile is a more vigorous fighter than the alligator, but after several vain attempts to escape from a lasso he may become discouraged and tamely allow his jaws to be held open while his photograph is taken. The teeth of the crocodile are somewhat longer than those of the alligator, and more or less interlock, some of those in the lower jaw fitting into pits in the upper jaw, but the long tooth fourth from the front on each side of the lower jaw fits into a notch on the outside of the upper jaw and is thus never hidden from view

I sent the skin to Professor Marsh of Yale College, who wrote me that it was a noble specimen and, making due allowance for the end of her tail which had been bitten off, was fourteen feet two inches long. It was many years later that I learned that my friend, Dr. Hornaday, had not only killed one of the creatures in 1875, thus beating me by fourteen years, but that his was fourteen feet two inches long without making any allowance for an amputated tail. Anyhow mine was a female which ought to count for something.

In the years that followed I frequently visited the little colony of Florida crocodiles which seemed definitely limited to a region at the extreme southern end of the peninsula of Florida, a strip about ten miles long by three wide. Saurians were plentiful in this part of the world but, outside of the limits named, all were alligators, none of which did I ever discover within them. I had specimens enough of the creatures and I never did kill them for sport, but my son and I found ways of making them contribute to our amusement. It was really exciting, after locating the mouth of a crocodile's cave in the bank of a river, to hang the noosed end of a rope before it, while standing on the bank above. As I waited for a bite, my boatman busied himself thrusting a harpoon pole into the earth from ten to twenty feet behind me. This was followed by the outrushing crocodile and some excitement at my end of the line. The big reptile struggled and fought, he clutched at the line and rolled over and over, he swam out in the stream and he sulked in its depths, but the noose was tightly drawn and never allowed to slip, and the end found the creature facing the camera on the bank. It was a matter of ethics that the crocodile should be free when his photograph was taken, and removing the lasso called for much agility on the part of the volunteer. After a few vain attempts to escape, a crocodile would become discouraged, and our hunter boy would hold open the jaws of a very much alive reptile while the camera-man photographed them.

As compared with their alligator congeners, the Florida crocodile is the more combative as evidenced by the larger proportion of mutilated members of that family. Of the thousand alligators which in my unregenerate days I killed, a very small percentage were battle-marked, while among the comparatively few crocodiles which were my victims the number of mutilated ones was surprisingly large.

It was not until 1906, just seventeen years after my introduction to the Florida crocodile, that I carried out my project of sending some living specimens to New York, and on March 1 of that year I sent from Key West to the New York "Zoo" a pair of the creatures which I had captured in the Madeira Hammock.

From the fact that I often found the Florida crocodile far out from land where the alligator was never seen, I inferred that he was of an exploring species, which, coming from the West Indies, had established a colony at Cape Sable with a view to the conquest of the country. It was therefore with much interest that last year, while cruising with Commodore Benedict in his "Oneida," I heard at Trinidad that a river near by abounded in "alligators." Happily there was in the party a man younger than I by enough scores of years to permit of carrying a rifle under a tropical sun while wallowing through waist-deep mud, and he brought home as the result of an arduous day four specimens of the Trinidad "alligator" which were identical in species with my Florida crocodiles of twenty-eight years before.

Islands[1]

By WILLIAM BEEBE

Curator of Birds, New York Zoölogical Society, and Director of the Tropical Research Station

With thrice seven-league boots one could stride from the coast of the United States and with a dozen steps reach British Guiana dry-shod. From an aviator's seat, the chain of West Indies, Windward, and Leeward islands curves gracefully southward, like stepping-stones across a Japanese stream. If, corresponding to this annihilation of space, we could abbreviate minutes, hours, and days as in a moving picture film, we might have the edifying spectacle of our steamer's trip reduced to a succession of loops, ricocheting from island after island, as a stone skips along the surface of the water, sliding along those dotted lines which are so characteristic a feature of coasts in our school geographies, and coming to rest at last with a splash in the muddy current off the Georgetown stelling.

Our steamer is preferable to the seven-league trip, for we thereby omit the big, cumbersome West Indies. It is a curious fact that any land projecting above the surface of the water is interesting and exciting in inverse ratio to its size. The endless New Jersey shore moves one not at all, while the single volcanic cone of Nevis brings thrills and emotions; Cuba is wearisome as one steams slowly past headland after headland, while Sombrero—a veritable oceanic speck of dust—stimulates the imagination to the highest pitch. It seems as if our ego enlarges as our immediate terrestrial cosmos diminishes. In studying the birds of the endless jungles of the South American continent my interest never flags, yet it never quite attains the *n*th power of enthusiasm which accompanies the thought of the possibility of locating every nest on St. Thomas. This love of small islands must savor of the joy of possible completeness in achievement, plus a king's sensations, plus some of those of Adam!

Any guidebook will give the area, population, amusements, best hotels (or the least objectionable ones), summary of history, and the more important exports. But no one has ever attempted to tell of the soul of these islands—or even of the individuality of each, which is very real and very distinct. Some day this will be done, and the telling will be very wonderful, and will use up most of the superlatives in our language. For my part I may only search my memory for some little unimportant scenes which live again when the name of the island is spoken—and string these at random on pages, like the chains of little scarlet and black sea beans which glisten in the fingers of the negresses, held up in hope of sale from their leaky boats, rocking on the liquid emerald around the steamer.

St. Thomas, or How I Was Taught to Catch Lizards by a Danish "Flapper"

Nearly a week had passed since we began to exchange a sleety winter for the velvety tropics, to traverse the latitude spectrum of ocean from drab-gray to living turquoise. As on every trip, it was early morning when the long undulating profile of St. Thomas reared itself lazily from the sea, and almost at once flocks of great-winged booby gannets began to wheel and veer around the ship, banking in a way to make an aviator's blood leap.

From a dusky monochrome the land

[1] This preliminary publication of the third chapter of *Jungle Peace*, soon to appear from the press of Henry Holt & Co., is granted through the courtesy of the Author and publishers.

resolved into shades, and slowly into colors—gray volcanic rocks, dry yellow turf, and green patches of trees. Then contours became traceable, smooth rounded shoulders of hills frayed out into jagged strata, with the close-shaven fur of bushes and shrubs, and occasional tall slender palms reminding one of single hydroids on the sargasso fronds. A thread of smoke drifting free from a palm grove was the first sign of life, and after a few minutes of twisting and turning, the steamer nosed out her circuitous channel, and from the very heart of the island the great crater harbor opened before us.

The beautiful hills rolled up and upward, and to their feet Charlotte Amalie, crowned with Bluebeard's castle, clung obliquely, her streets climbing with astonishing steepness. The little town was newly roofed, all the picturesque old red ones having been ripped off in the last hurricane. The houses were as flat, quite as like cardboard theatrical scenery, as ever.

At the sight of a distant flag I endeavored to thrill patriotically at the thought that this island was now a part of the United States. I would have been more successful, however, if I could have recalled the vision of some fellow countryman in far distant time, landing on these slopes and taking possession by right of discovery. Even if some burly, semipiratical American adventurer had annexed it for his president by feat of arms, my blood would have flowed less calmly than it did at the thought of so many millions of dollars paid as *droit de possession*. However, a tropic bird flew past and put the matter out of mind.

As always, near the wharf thrived the same little open barroom, with its floral-bedecked mirrors, selling good beer and vile soda. Aside from a flag here and there, the only sign of the change of nationality was several motorcycles with side cars which American soldiers drove like Jehu through the narrow streets, hustling natives and their tiny carts and ponies to one side, and leaving enduring trains of gasoline-scented dust. A few minutes' walk up one of the steep streets and all was quiet and unhurried, and the sense of a yet undigested possession, of embarrassing novelty of purchase, slipped aside and we knew that St. Thomas was still the unspoiled little island which the slow mellowing growth of West Indian evolution had made it. We climbed slowly up the steep road toward Mafolie, and behind us the glory of this wonderful island unfolded and spread, the roofs of the town shifting into strange geometric figures, and the harbor circle widening. We passed negroes and pleasant sunburned Danes driving tiny burros laden with small fagots and with grass. At one turn a tamarind tree was in full blossom, and here were gathered all the humming birds and butterflies of the island—or so it seemed. At last we reached a ravine, dry as everything else at this season on the island, and walked slowly up it, catching butterflies. They were in great numbers and gayly colored. The strangest sight was hundreds of large, brown millipedes clinging to the stems of bushes and small trees, apparently finding more moisture in the steady trade winds than in the soil, which even under large stones, was parched and dry; dragon flies were abundant, but the dominant forms were butterflies and spiders.

The road wound over the top of the ridge, and from its summit we looked down on the other half of the island. No house or trace of cultivation was visible and the beauty of the view was beyond adequate description. Rolling, comfortably undulating hills were below us, and in front a taller, rounded one like the head of some wearied tropical giant. Beyond this, a long curved arm of richest green had been stretched carelessly out into the sea, inclosing a bay which, from our height, looked like a small pool, but such a pool as would grace a Dunsany tale. It was limpid, its surface like glass and of the most exquisite turquoise. Its inner rim was of pure white sand, a winding line bounding turquoise water and the rich, dark green of the sloping land in a flattened figure three. I never knew before that turquoise had a hundred tints and shades, but here the film nearest the sand was unbelievably pale and translucent, then a deeper sheen overlaid the surface, while the center of the pool was shaded with the indescribable pigment of sheer depth. In a great frame of shifting emerald and cobalt, set a shining blue wing of a *Morpho* butterfly, and you can visualize this wonder scene.

Outside the encircling green arm, the water of ocean glowed ultramarine in the slanting sunlight, and stretched on and on to the curving horizon of Atlantis. The scene seemed the essence of peace, and to the casual glance hardly a cloud moved. I sat for a long time and let every part of my retina absorb the glory of colors. Soon motion and life became apparent. Shadows shifted softly across the surface, bringing hues of delicate purplish blue, memory tints of open ocean, and against these darkened tones a thousand specks of white glowed and interweaved like a maze of motes in a shaft of sunlight. In imagination we could enlarge them to a swarm of silvery bees, and then my glasses resolved them into gannets—great sea birds with wings six feet from tip to tip—an astounding hint of the actual distance and depth below me of this pool-like bay. An hour later the sunlight left the turquoise surface, and its blueness darkened and strengthened and became opaque, although it was a long time before sunset, and the ocean beyond kept all its brilliance.

My eye was drawn to two tiny dots on the sandy rim. I could just make out that they were moving and guessed them to be dogs or chickens. The glasses made magic again and split up each group into a triumvirate of little burros which trotted along, and presently turned into an invisible side trail.

Perhaps the most fascinating discovery of motion was that of the water's edge. To the eye there were neither waves nor ripples, but careful scrutiny through the strong prisms showed a rhythmical approach and receding, a gentle breathlike pulsation which regularly darkened and uncovered a thread of sand. I forgot the busy little town on the other side of the island, the commerce and coaling and the distant echo of war, and giving a last look at the tarnished turquoise pool, the resentment of financial acquisition of such beauty softened, and I felt glad that I had indirectly some small tithe of ownership, as well as the complete memory monopoly of the glories of this passing day.

As I made my way down the ravine, the fascinating island lizards scrambled about or watched me knowingly from rock or tree trunk. As usual I wrecked my net in striving to sweep them into it, and bruised my fingers in vain efforts to seize their slender forms. Rarely I succeeded; usually I found but a bit of tail in my fingers, or a handful of loose bark, while, just out of reach, the lizards would halt and look me over derisively with their bright intelligent eyes.

At the roadside I came suddenly upon a little Danish girl of about twelve years, dancing excitedly with a lizard dangling from the end of a slender grass stem. Her blue eyes flashed with excitement, her yellow pigtail flew wildly about as she danced and backed away, fearful of touching the little lizard, and yet too fascinated to drop it and allow it to escape. I took it up and found it had been captured with a neat slip noose. She said it was easy to catch them and showed me how, and before I reached the wharf I had a dozen of the interesting little chaps stored in various pockets. Thus after my years of effort a little Danish school girl solved the problem for me. Acting on this hint I tried fine hair wire, but nothing proved as effective as the thin, pliant but strong stems of grass.

It is surprising how difficult it is to touch these little reptiles and yet how easy to noose them. At the approach of hand or net they are off faster than the eye can follow, but the waving grass merely interests them. Even when by an awkward motion one flicks their nose, they merely shake the head or shift a step or two. They detect no connection between the moving grass and the more distant hand that wields it.

Bound to the ground by their short scales and four limbs, these small lizards are yet remarkably birdlike in their vivacity and their enthusiastic playing of their little game of life. Every motion is registered by quick wrenlike movements and by the changing play of colors over their scales, while when particularly excited, they puff out a comical dewlap of yellow and orange skin beneath the throat. Thanks to my "flapper" acquaintance I am now on more equal terms with the little scaly people of the islands, and can study their puzzling color problems at close range.

Looking back at Bluebeard's and Blackbeard's castles from the deck of our vessel as we slowly steamed from the harbor, some one asked when the last pirate plied his trade. I looked ashore at the fort and guns, I listened to the warning bugle, I watched the scattered lights vanish, leaving all of the town in darkness, I saw our own darkened portholes and shaded lights. As my mind went to the submarines which inspired all these precautions, as I recalled the sinister swirl in the Atlantic which had threatened us more than once on my return from the battle front, I could answer truly that Bluebeard and his ilk were worthily represented at the present day. Indeed, of the two enemies, I found much more to condone in the ignorance and the frank, primitive brutality of the pirate of past centuries, than in the prostituted science and camouflaged *Kultur* of the Teutonic Ishmaelite of today.

St. Kitts, a Plunge, Exploration, and Monkeys

I came on deck at daybreak and found the sea like a mirror. Even the clouds were undisturbed, resting quietly in the mountain valleys of St. Eustatius, and on the upper slopes of St. Kitts in the distance. The tropical morning was a lazy one, and the engines seemed to throb in a half-somnolent manner. I folded up into a deck chair and idly watched the beautiful profile of the island astern.

Suddenly the sea became alive with virile beings—curving steel-gray bodies which shot forth like torpedoes from some mighty battery. I thrilled in every fiber and the sloth of the tropics fell from me as if by a galvanic shock: the dolphins had come! Usually they appear in their haunts between Dominica and Martinique or off the latter island, but here they were in dozens, leaping for breath with the regularity of machinery. Now and then the spirit of play would possess one and he vaulted high in air, ten feet above the surface, twisted and fell broadside with a slap which could be heard a half mile away. Then several simultaneously did the same thing. A school would come close alongside, slacken speed to that of the vessel, and now and then dive beneath and appear off the opposite quarter. Another trick was for one or two to station themselves just ahead of the bow and remain motionless, urged on by the pressure of the water from behind. It was very unexpected and very splendid to have this battalion of magnificent cetaceans, bursting with vital energy and fullness of life, injected without warning into the calm quiet of this tropical sea.

We anchored off Basseterre and waited in vain for the doctor. There seemed no chance of landing for some time, so several of us dived off and swam about the ship for an hour. The joy of this tropical water is something which can be communicated only by experience. It was so transparent that in diving one hardly knew the moment he would enter it. Paddling along just beneath the surface, there was a constant temptation to reach down and grasp the waving sea ferns and bits of coral which seemed only just out of reach, whereas they were a good thirty feet beneath. Whether floating idly or barging clumsily along in the only fashion possible to us terrestrial humans, we longed for the sinuous power of the dolphins, whose easy sculling imparts such astounding impetus. Now and then we saw a deep-swimming fish, but the line of envious fellow voyagers along the ship's rail were denied all this joy by reason of their fear of sharks. They had read in many books and they had listened to many tales, and they did not know what we shared with the little nigger boys who dive for pennies—the knowledge that the chance of an attack from a shark is about equal to that of having your ears sewed up by devil's darning needles. Over all the world I have swum among sharks; from Ceylon to the Spanish Main I have talked intimately with scores of native captains and sailors and learned the difference between what they tell to the credulous tourist and what they believe in their hearts.

In time the St. Kitts doctor arrived, and, as he rowed past, looked at us critically as if he suspected us of infecting the waters of the sea with some of those mysteriously terrible diseases which he is always hoping for on the ship's papers, but never seems to find.

Walking hastily through the town, we reached the first of the great sugar cane fields, and skirting these diagonally came ever nearer the sloping base of the high land. Ravines are always interesting for they cannot be cultivated, and it was up one of these lava and water-worn gullies that we began to climb Monkey Hill. We went slowly, for there were many absorbing things on the way. Palm swifts swooped about, while noisy kingbirds gleaned as industriously but with shorter flights. Heavy-billed anis *whaleeped* and fluttered clumsily ahead of us; honey creepers squeaked and small black finches watched us anxiously. From a marshy pool half a dozen migrating sandpipers flew up and circled down to the shore. Every shrubby field was alive with butterflies of many kinds and the vigorous shaking of each bush yielded excellent harvests of strange insects which fell into the open umbrella held beneath. In a grove of wild mango and acacias were hosts of green filigree butterflies, dropping and swirling from the foliage like falling leaves, the comparison being heightened by the brown spots, like fungus blotches, which were etched upon their wings.

Leaving the ravine we climbed over great lateral shoulders of the mountain, grassy slopes with bold outjutting rocks, and rarely a clump of small shrubs, bringing to mind the lower foothills of Garhwal and Kashmir. Higher still came a dense shrubby growth, much of it thorny, seamed by our narrow trail, and threaded here and there by glowing fronds of golden shower orchids. Ground doves perched on low branches and an occasional pigeon whistled past. From the summit a wonderful view stretched out—the long, sloping, green cane fields, the clustered roofs, and beyond the curving beaches the blue water with our vessel resting at anchor. Now came a search for monkeys, regardless of thorns and rough stones, for, strange though it sounds, St. Kitts possesses many of these animals. Whatever the accident of their arrival, they are firmly established, and work much havoc in the small hours among gardens and sugar cane. Our efforts were in vain. We heard the scolding chatter of one of the small simians, and were preparing to surround him, when a warning blast from the ship summoned us and we packed up our collection of insects and flowers, munched our last piece of chocolate, and began to clamber down the great sun-drenched slopes.

Martinique, or a New Use for an Eight of Hearts

Columbus thought that this island was inhabited only by women, and to this day the market place bears out the idea. It is a place apart from all the rest of the city. In early morning, before the gaudy shutters were taken down, the streets were quiet—the callous soles of the passersby made the merest velvet shuffling and only an occasional cry of the vendor of some strange fruit or cakes broke the stillness. When the market was yet half a block away, one became aurally aware of it. The air was filled with a subdued hum, an indefinite murmur which might as well be the sound of tumbling waters as of human voices. It was a communal tongue, lacking individual words, accent, and grammar, and yet containing the essence of a hundred little arguments, soliloquies, pleadings, offers, and refusals. After the aural came the olfactory zone, and none may describe this, so intermingled that fish and vegetables, spice and onions were to be detected only when one approached their respective booths.

The details of market life hold the possibilities of epic description: the transactions of a stock exchange pale into mediocrity compared with the noise and excitement when a sixpence changes hands between Martinique negresses.

All the sales in the market were of the smallest quantities: little silver was seen, pennies, ha'pennies, and sous composing all the piles of coppers. The colors of the fruits were like flowers: melons white with a delicate fretwork of green; brilliant touches of red peppers like scarlet passion flowers; tiny bits of garlic, lilac-tinted. The fish had the hues of sunsets on their scales, and the most beautiful, the angel fishes, were three for a penny, while the uglier, more edible ones, were sixpence each. Beauty was rated at inverse value here.

Around and around the iron fence which bounded the market place, paced a pitiful pair—a tiny black mite who could not have passed three summers, leading an old blind woman by the hem of an ample black skirt. After several halting steps they would hesitate and the gaunt hand would be thrust through the bars begging for market refuse. Once the gods were kind and a bit of melon and a spotted mango were given, but more often alms was asked of an empty stall, or within sight only of a tethered duck or chicken. Some of the gifts were no better than the garbage over which the pair stepped.

We sat in chairs in a tiny pharmacist shop—the artist and I—and were at once the center of a chattering, staring throng, a kaleidoscope of shifting colors. We shoved and dismissed to no avail, then the owner of the shop with a gentle *"Permettez-moi"* threw a pailful of not-too-clean water over the crowd, including the artist and myself. The mob scattered shrieking and for a short time the surrounding space was open. Soon a larger crowd gathered, with the still dripping units of the first assemblage smiling expectantly in the offing, hovering at a safe distance. The second dispersal had a legal origin; the market policeman stole quietly along the wall of the shop and hurled himself like a catapult, butting goatlike into the heart of the crowd. A half dozen fat negresses toppled over.

and cassava, tin cups, and stray fishes flew about. Even those who lost all their purchases showed no resentment but only a roaring appreciation of the joke. In this rush we were almost upset with the crowd, and we began to look forward with dread to any more strenuous defense of our comfort.

The little French mulatto pharmacist who was responsible for the occasional joyful outbursts of *eau*, seemed to profit by our presence, for a number of interested onlookers who had pushed into the shop to watch us from behind, when cornered and hailed by the irate owner, stammeringly asked for some small thing, by the purchase of which they bought their liberty. The regular business of this little shop alone was worthy one's whole attention. A prescription was being pounded up in a mortar and when the clerk reached out for a scoop and for something to scrape the sides clean, an eight of hearts was the nearest and with this the chemicals were mixed. Within the next fifteen minutes eight or ten different prescriptions, powders and crystals, were measured, shaken, mixed and scraped by the same eight of hearts, and the combination of ingredients which the last purchaser obtained must surely have had some radical effect on his system—salubrious or otherwise.

Then came the unusual one—the super person who is always to be discovered sooner or later. Externally she was indistinguishable from the host of her sisters. She was garbed in a wrapper, flowing and reaching the ground, purple and pocked with large white spots. A diminutive turban of yellow and red madras was surmounted by an ancient and crownless straw hat, but at the first word she was revealed. A British subject, she had been here at the eruption of Mt. Pelée fifteen years before. That day she and one of her daughters happened to be far away from St. Pierre. When the explosion came, they were outside the danger zone, but her husband, son, and other daughter were burned to death. She regretted the impoliteness of the French here and apologized for them for crowding us. Later she brought a gift of rose bananas to the artist, saying that Americans had given her food and clothes when she lost everything.

The crowd was curious, thoughtless, selfish, with its dominant hope a laugh at some one's expense. Here was one who sought us out, who left unguarded her little tray of bananas and garlic to speak a word of thanks, to present a handful of fruit which in her station was a munificent gift, and who was satisfied with and grateful for our sincere appreciation. She has sisters in graciousness over all the world, but they are rare and widely scattered,—like the Akawai Indian squaw who gave me her last cassava, like the wrinkled Japanese crone who persuaded her son to become one of my best servants, like the wife of the headman of an isolated village in Yunnan, who from among her sodden, beastlike neighbors came forth and offered fowls and vegetables with a courteous spirit worthy of any station in life.

St. Lucia, a Study in Contrasts

Each time I have visited Castries it has seemed more somber and less pleasant. It is colorless because it is full of coal and no change of weather brings amelioration. When the sun fills the air with a blinding glare and palpitating heat waves (as it occasionally does), each step raises a cloud of coal dust, and when the tropical rain falls in a steady downpour (as it usually does), the whole world seems covered with coal mud, as if about to dissolve into some carboniferous slime.

Castries is an important military and coaling station, which perhaps explains much. Military exigency compelled me to procure a special pass from the Chief of Police to paddle about its dreary streets, but it strictly forbade my climbing the comparatively clean and attractive mountains beyond these streets. As a coaling station I am sure of its success and popularity, for the coal carriers who comprise most of the natives, have apparently no time to wash between steamers. So intensive was the grime that the original dark hue of their skins offered no camouflage to the anthracite palimpsest which overlaid it. Such huge negro women, such muscles, such sense of power, I had never before realized. I should dislike, were I an official of St. Lucia, to take any decided stand on an antifeminine platform.

So saturated are the people in coal, such is their lack of proper perspective of this material, they seem actually to be unconscious of its presence. Returning on board, one passes the Seaview Hotel, about which coal is piled to a much greater height than the roof. Such abstraction is worthy of mention at least.

Amid the memory of all the dirt and damp, dull sadness, two things were unforgetable, as untouched diamonds glisten in their matrix of wet blue clay. Amid sodden clothes, unwashed hands, and bestial faces, a trayful of rainbow fishes gleamed opal-like —coral, parrot, and angel fish, all awaiting some unsavory purchaser. Then, out of the ruck of sexless bearers of coal, came the little French negress, selling fans. When we answered her appeal with a "*Non, merci*," her face lighted up at the courtesy of the words: "*Voilà*," said she, "*c'est bien refusé gracieusement*." No mortal could have resisted buying her wares after such delicate sentiment.

About five in the afternoon we parted from the gritty wharf and steamed for hour after hour along the shore. We forgot the coal carriers, and the thought of the misery and squalor of the town passed with its vanishing, still clad in its cloak of rain. As the natives appeared to us so inferior to those of the other islands, so by some law of compensation the coast was revealed correspondingly beautiful. At four bells the sun sank on the side away from the island, in a blaze of yellow and orange with one particular cloud touching the water line with flame color, as if a mighty distant volcano had just reared its head above the sea, still in the throes of molten erection. On the opposite side were passing the dark green headlands and fjords of the land, while upward, high into the sky, there arose now and then some tremendous cloud, on fire with rich rose or salmon afterglow, or a maze of other tints defying human name or pigment. In front was the living blue water dulled by the dimming light and above all the transparent blue of the tropic sky.

Without warning, from out of the soft folded edges of one of the filmy clouds, crept a curved edge of cold steel, like some strange kind of floating shell coming forth from its cloud of smoke, and a moment later the full moon was revealed, unlike any other color note in this marvelous scene. The icy, unchanging moon craters, the more plastic island mountains fringed by the wind-shapen trees, the still more shifting waters, and the evanescent cloud mist, all were played upon and saturated and stained by colors which were beyond words, almost beyond our appreciation.

Tiny villages, fronted by canoes and swathed in feathery cocoanut fronds, snuggled at the foot of great volcanic and coral cliffs. But the crowning glory was reserved for the last, when we surged past the *trois pitons*, rearing their majestic heads above all the island, hundreds and hundreds of feet into the sky. Even the moon could not top one, and after cutting into sharp, silver silhouette every leaf and branch of a moon-wide swath of trees, it buried itself behind the peak and framed the whole mountain.

A small wandering rain storm drifted against the tallest *piton* and split in two, one half going away down the coast and the rest passing close enough to us to shower the decks with drops. As it fell astern, it spread out fanwise and in its heart developed a ghostly lunar rainbow—the spectrum cleansed and denuded of all the garish colors of day. . . .

Once a faint light appeared upon the distant shore. Our steamer spoke in a short, sharp blast which thrilled us with its unexpectedness, and the signal among the palms was quenched. From the great things of the cosmos, from brilliant Venus, and from the North Star low in the sky, from the new splendor of Fomalhaut, rising ever higher in the south, our thoughts were forced back to the littlenesses of the World War, whose faint influence reached even thus far to break the thread of our abstraction.

Barbados, in Eclipse and in Sun

The vagaries of a naturalist are the delight of the uninitiated, and impress simple natives more than immoderate tips or the routine excesses of tourist folk. One's scientific eccentricities may even establish a small measure of fame, or rather notoriety. So it was that as I walked up the landing stage at Bridgetown, a small ebon personage pointed finger at me and confided to his neighbor, "See de mon—de tall mon da—he de mon who chase tree lizards in de cemetry!"

"Yes, George," I said, "I'm de mon who chased them with you two years ago, but this time we shall catch them as well."

"Anyting you say true, Boss, I'se yo boy."

But as is always true in sport, certainty robs it of the finest element of excitement, and our successful stalks that afternoon with grass stem nooses were less memorable than the frantic tree circlings and grave hurdlings of two years before.

On our return from the cemetery a breeze swept up from the sea, the palm fronds slithered against one another, and I suddenly caught myself shivering. The moment I became conscious of this I thought of fever and wondered if my lifelong immunity had come to an end. Then I observed old hags wrapping themselves up; my eyes suddenly readjusted, I perceived that the glaring sunlight was tempered; again the strange midday breeze arose, and finally I realized that I was witnessing an eclipse of the sun on the island of Barbados. The natives and the birds and even the patient little donkeys grew restless, the light became weaker and strange, and until the end of the eclipse we could think of nothing else. The most remarkable part to me was the reflections. Looking, however hastily and obliquely at the sun, I perceived nothing but a blinding glare, but walking beneath the shade of dense tropical foliage, the hosts of specks of sunlight sifting through, reflected on the white limestone, were in reality thousands of tiny representations of the sun's disk incised with the segment of the silhouetted moon, but reversed, just like the image through the aperture of a pinhole camera. I suppose it is a very common physical phenomenon, but to me it was a surprising thing to trace the curve of the eclipse clearly and with ease in the sunbeams on the pavement beneath my feet, while my retinas refused to face or register the original.

Barbados is very flat, thoroughly cultivated, and said to be the most densely populated bit of land in the world; all of which guidebook gossip was discouraging to a naturalist. But besides the cemetery which was sanctuary for the jolly little lizards, I found a bit of unspoilt beach, with sand as white and fine as talcum powder, where dwelt undisturbed many assemblages of small folk. There were land crabs which had come to have at heart more affection for the vegetable gardens at the beach top than for the waters of their forefathers. They had degenerated into mere commuters from their holes to the nearest melon patch. The lower part of the beach was that ever-changing zone—that altar upon which each tide deposited some offering from the depths of the sea. This will some day have a worthy interpreter, a sympathetic recorder and commentator who will make a marvelous volume of this intermittent thread of the earth's surface, pulsing, changing—now showing as water, now as land—but always vital with exciting happenings.

I sat for an hour on the upper beach and watched the little native folk, autochthons which for innumerable generations had been so loyal to their arenaceous home that the sheltering mantle of its pale hue had fallen upon their wings and bodies. Here were tiny, grayish-white crabs, here were spiders, which, until they moved, were not spiders but sand. And when they did move, recognition usually came too late to some fly, which had trespassed on this littoral hunting ground. Tiger beetles drifted about like sand-grain wraiths, whose life wanderings lay between low tide and the highest dune, veriest ghosts of their brilliant green brethren farther inland. Ashen wasps buzzed past, with compass and maps in their heads, enabling them to circle about once or twice, alight, take a step or two and, kicking down their diminutive front door, enter the slanting sandy tube which for them fulfilled all the requirements of home.

From an aëroplane, Barbados would appear like a circular expanse of patchwork, or a wild futurist painting set in deepest ultramarine—a maze of rectangles or squares of sugar cane, with a scattering of sweet potatoes and sea island cotton. I got a hint of this when I motored to the highest point of land, and then climbed the steeple of the loftiest church. At my feet was the Atlantic with great breakers, reduced by distance to tiny wavelets twinkling among the black boulders and feathery palms scattered along shore. For more than two hundred and seventy-five years the church had stood here, and the graveyard, not to be outdone by the strangeness of the little beach people, boasted the remains of a descendant of a Greek emperor, who long ago had been warden.

But again our steamer summoned us and we left the dusky natives with their weird legends and the tiny island which they love, and were rowed steadily out beyond the two miles of shallow coast.

When we steamed away from shore that night, no lights except those of the dining saloon were allowed. Yet the path of the vessel made a mockery of this concealment. The world did not exist a hundred feet away from the ship and yet there was no mist or fog. The outward curve of the water from the bow was a long slender scimitar of phosphorescence, and from its cutting edge and tip flashed bits of flame and brilliant steely sparks, apparently suspended above the jet-black water. Alongside was a steady ribbon of dull green luminescence, while, rolling and drifting along through this path of light, came now and then great balls of clear, pure fire touched with emerald flames, some huge jellyfish, or fish perchance, or sargasso weed incrusted with *Noctiluca*. Everywhere within the narrow zone of visibility were flickering constellations, suns and planets of momentary life, dying within the second in which they flashed into sight. Once Orion left a distinct memory on the retina—instantly to die forever. Perhaps to some unimaginably distant and unknown god, our world system may appear as fleeting. To my eyes it seemed as if I looked at the reflections of constellations which no longer swung across the heavens—shadows of shadows.

Then four bells struck—silveryly—and I knew that time still existed.

BIRD LIFE OF SOUTH GEORGIA

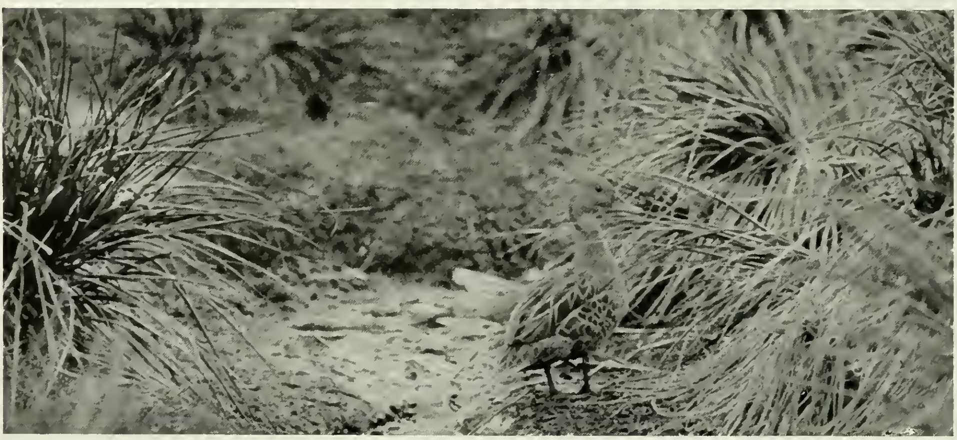
Nine native species of birds of a subantarctic island twelve hundred miles east of Cape Horn—Portraits made during the South Georgia Expedition of the American Museum of Natural History and the Brooklyn Museum, 1912 and 1913

PHOTOGRAPHS AND ORIGINAL DATA BY ROBERT CUSHMAN MURPHY

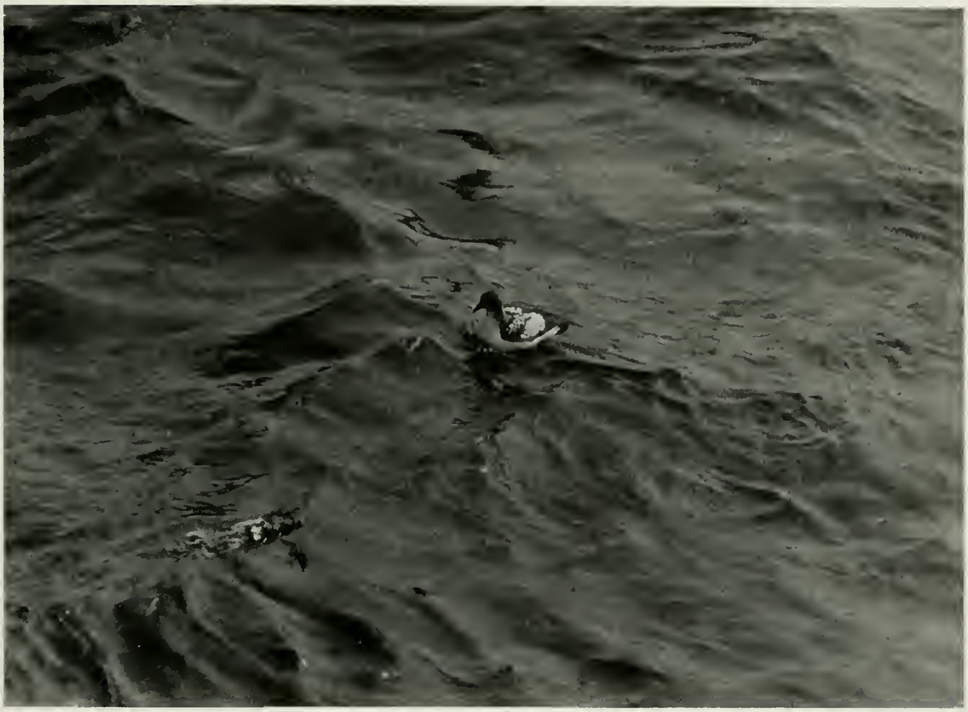
A SOUTH GEORGIAN TERN AND ITS EGG

This small tern (*Sterna vittata georgiæ*) is unlike our northern representatives in that it lays but a single egg, often among the bare pebbles of the terminal moraines of glaciers. The egg or the chick is constantly covered by one of the parents, not only because of the prevailingly inclement weather, but also for fear of enemies which include cannibalistic members of its own species. During the almost daily summer snowstorms, the mother tern sometimes broods the egg or young so persistently that a visitor may touch her before she will abandon it. Photographed at Grace Glacier, Bay of Isles, January 24, 1913

The upland goose (*Chloëphaga magellanica*) was introduced into South Georgia from the Falkland Islands, where the species has been outlawed because it feeds upon grass and hence is supposed to compete with sheep. If it can gain a foothold in its new home, it will be assured of a sheepless future, for these animals cannot endure the South Georgian climate. The position of this pair of geese is characteristic, the white gander standing on the safe side of his barred mate with respect to the observer. Cumberland Bay, November 30, 1912



A female South Georgian teal (*Nettion georgicum*), an endemic duck which is closely related to the widely distributed South American pintail. This charming little teal is almost devoid of fear of human beings, except when it has young. It builds its embowered nest in the heart of a grassy hummock, and lays five cream-colored eggs. The ducklings are very difficult to observe, for, at the alarm note of either parent, they disappear like magic in the tussock grass. Bay of Isles, December 30, 1912



CAPE PIGEONS

The so-called Cape pigeon (*Petrella capensis*) is a familiar, Antarctic petrel, famous in the literature of the sea. It finds its northernmost breeding grounds at South Georgia, but it migrates as far as the tropics. It is a strong, rather stiff flyer, a very buoyant swimmer, highly gregarious in its feeding habits, and one of the most voracious, noisy, and quarrelsome of sea birds. It is known also by the names "speckled haglet" and "pintado petrel," but Cape pigeon is the best vernacular name, for, when it settles on the water and preens its black-and-white plumage, it looks for all the world like a true pigeon out of its element.

The species is exceedingly variable in its color pattern, the white area on the backs of some birds being extensive and almost immaculate, while others are heavily speckled with black. This is partly owing to individual differences but still more to the effects of abrasion, for the black tips of the new feathers, acquired during the Antarctic winter, gradually wear away and leave the upper surface prevailingly white before the new moult.

The flying Cape pigeon was photographed hundreds of miles from land on November 18, 1912; the swimming bird on the coast of South Georgia, November 26

GIANT FULMARS ON THEIR NESTS

This Antarctic and subantarctic, vulture-like cousin of the little Cape pigeon bears the scientific name *Macronectes giganteus;* most of the epithets by which it is known to sailors the world over are hardly fit to print. These three sitting birds were photographed at the Bay of Isles in December, 1912. The one in the center had been snowed under by a blizzard during the night before the picture was taken.

The giant fulmar is of great zoölogical interest because of its many color phases. The newly-hatched young are clad in white down, which is soon replaced by curly, light gray down. This in turn is molted as the chick approaches full growth, and is succeeded by a contour plumage of uniform shiny black. Through the effects of months of wear and fading at sea, the black feathers usually change to a dirty brown color before the recurring molt. It is not yet known how many annual molts must take place before the bird finally attains its mature plumage, but apparently this plumage may be entirely of a mixed, brownish gray color, or gray with a whitish head, or nearly pure white over the whole body. White birds are much less common than dark birds, but it is said that they are increasingly numerous southward toward the coast of the Antarctic Continent.

The color of the giant fulmar's eye is also variable. Most of the gray adults at South Georgia had a pale blue iris, although some were brown-eyed like the young birds. All of the white adults observed on their nests had brown eyes. The white bird shown above was mated with a gray bird, and their offspring, which was collected, is indistinguishable from other young giant fulmars

A GIANT FULMAR GUARDING ITS CHICK

The cold blue eye and terrible beak of this parent are ominous, but even more to be dreaded is the discharge of evil-smelling, half-digested, oily food, and alimentary juices, which the bird is both able and willing to squirt from its crop. Even young giant fulmars just out of the egg employ this effective method of defense against human intruders.

The giant fulmar is the only tubinarine bird that obtains a considerable proportion of its food on land, where it feeds upon carrion of any sort, such as the carcasses of seals, although it is not averse to gobbling up a young penguin or other helpless living creature. At sea it catches squids, besides devouring all sorts of floating refuse. It is an unbelievable glutton, banqueting, when opportunity offers, until it can no longer rise into flight. At such times I have surprised feasting birds, and have seen them hobble off with a curious sidewise canter, throwing up ballast as they went, until they had lightened themselves enough so that their stiffly spread wings could raise them into the air. Bay of Isles, December 23, 1912

A giant fulmar leaving its nest on a promontory over Cumberland Bay. From such a site as this, these heavy-bodied birds can easily launch into flight, while on a level surface they must run for a considerable distance, even when they are "in light ballast"

A large, black petrel (*Procellaria æquinoctialis*), which lacks an English name.—The Norwegian whalers at South Georgia call it the shoemaker "because it sits in its shop and sings." During most of the year it is a conspicuous and abundant species in the southern oceans, but in November, the Antarctic spring, it returns to land, and digs a burrow into the partly frozen soil of some tussocky hillside. Colonies of these petrels in their burrows make a chorus of sweet, bell-like pipings which can be heard a long distance, particularly on calm evenings. This "shoemaker" is flying up the fjord to its nest. Cumberland Bay, November 30, 1912

"MOLLYMOKES"

Many of the smaller albatrosses are known to seafarers as "mollymokes." These pictures are of the black-browed or spectacled albatross (*Diomedea melanophrys*), a species fairly common at South Georgia. During the long voyage to and from that island, the mollymokes were for weeks together the constant followers of our whaling brig. As they poised above the quarter-deck, or swept across the stern so closely that one could see the color of their eyes, they presented opportunities for studies in aëronautics as well as in ornithology. The lower photograph shows a bird with wings fully expanded to the light air, but the pair above, illumined by the early morning sun, are flexing their wings, or "shortening sail," in a manner which tells the initiated that a brisk breeze is blowing

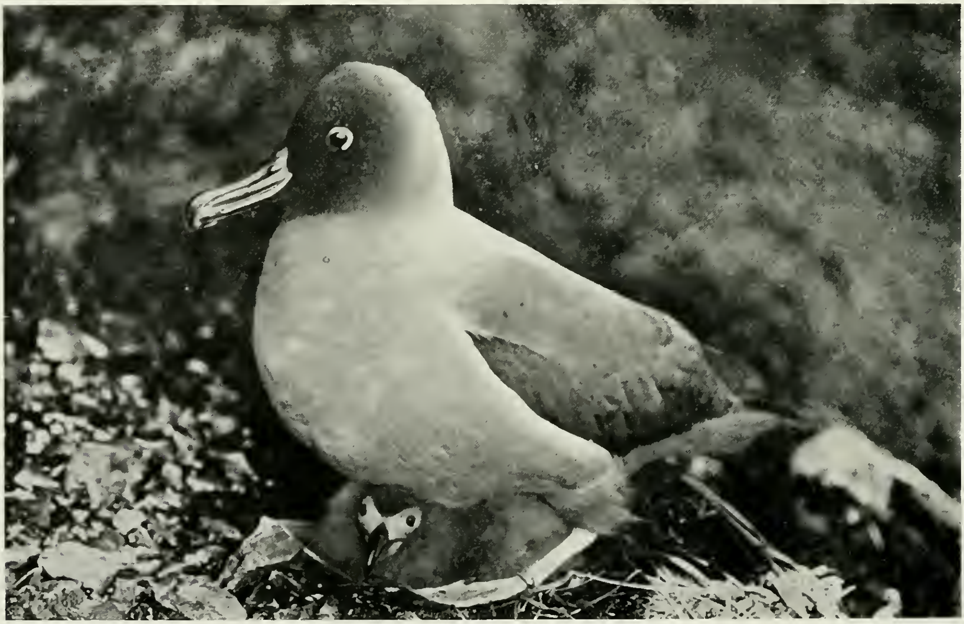
THE "ANCIENT MARINER'S" BIRD AT HOME

Wandering albatrosses (*Diomedea exulans*) at their nest at the Bay of Isles, December 22, 1912. These magnificent birds, the largest flying creatures of the modern world, return to South Georgia, and begin their elaborate courtship in November. As soon as two birds have mated, they scrape together the peaty soil to form the high, truncated cone which serves as a nest, and, after the single egg is laid, they take turns in incubating. The splendid male in this home scene is as white as the fluffy, new-fallen snow in the tussock grass, save for his wings and the fine vermiculations on his back. The pair are illustrating both monocular and bifocal vision, for each bird is looking at the photographer. The male has thrown out the erectile feathers of his "eyebrows," an action which quite changes the apparent shape of the head, and which usually accompanies intense interest. The prominent "elbows" of these birds reveal the great length of the wings as compared with the stumpy tail

A MALE WANDERING ALBATROSS INCUBATING

Either the male or the female parent may begin to sit upon the new-laid egg, while the other flies off to sea to feed upon squids, remaining away, according to my records, for a period of from six to ten days. The patient sitter never stirs from its task—sleeping much of the time with head under wing, basking contentedly in the sunshine, or huddling low beneath the williwaws and blizzards. If an enemy, such as a skua gull, approaches, the albatross will chatter its bill angrily and swear. Toward men it shows neither fear nor dislike, for it looks up calmly with its large, lustrous, expressive, brown eyes, and never moves more than to rotate on the nest so as to meet its visitor face to face. When its mate returns, it slowly, seemingly reluctantly, resigns its place on the egg, and, after a few hours of "conversation" and caressing, flies off to take its turn upon the wide sea

This young wandering albatross is learning to fly. Among the smaller petrels the flight ability is thoroughly coördinated with their general development; they have no "practice," but burst from their burrowed nests when the proper time arrives, and fly away as though they had always flown. But the heavy albatross fledgling must *learn* its art. Standing on a hillside, it spreads its great, weak wings, which even at this early age have an expanse of ten feet; then it leaps into the air, and, poising for a few seconds on the wind, glides downhill, perhaps to tumble head over heels when it alights



A male sooty albatross (*Phœbetria palpebrata antarctica*) guarding its downy nestling. This dark-colored albatross is the finest flyer of all, reaching the very pinnacle of perfection in aërial grace. Unlike the other albatrosses, it nests only on the perilous ledges of mountain headlands that rise abruptly from the sea, and while one parent broods over the chick, the other may often be seen sailing with inspiring, effortless motion, back and forth in front of the cliff, always passing close to the nest and gazing with a white-ringed eye at its quiet mate. Bay of Isles, January 30, 1913

The American Ornithologists' Union[1]

By T. S. PALMER

Secretary of the A. O. U.

THIRTY-FIVE years ago, on September 26, 1883, a little group of scientific men met in the library of the American Museum of Natural History to effect a permanent organization for the advancement of ornithology. They were all deeply interested in the study of birds and believed that greater progress could be made by coöperation than by individual effort. It was essentially a group of young men, for of the twenty-one present, seven had not reached thirty and only three had passed the age of fifty. This little company together with Dr. J. A. Allen, of the American Museum, and Professor Spencer F. Baird, secretary of the Smithsonian Institution, constituted the twenty-three Founders of the American Ornithologists' Union. They builded better than they knew, for when they adjourned three days later they had laid the foundation of work which has since profoundly affected the development of ornithology in America. They had also outlined work which has since resulted in the establishment of an important bureau of the government service, the endowment of a unique association for the study and protection of birds, and has extended its influence even into the fields of legislation and international diplomacy.

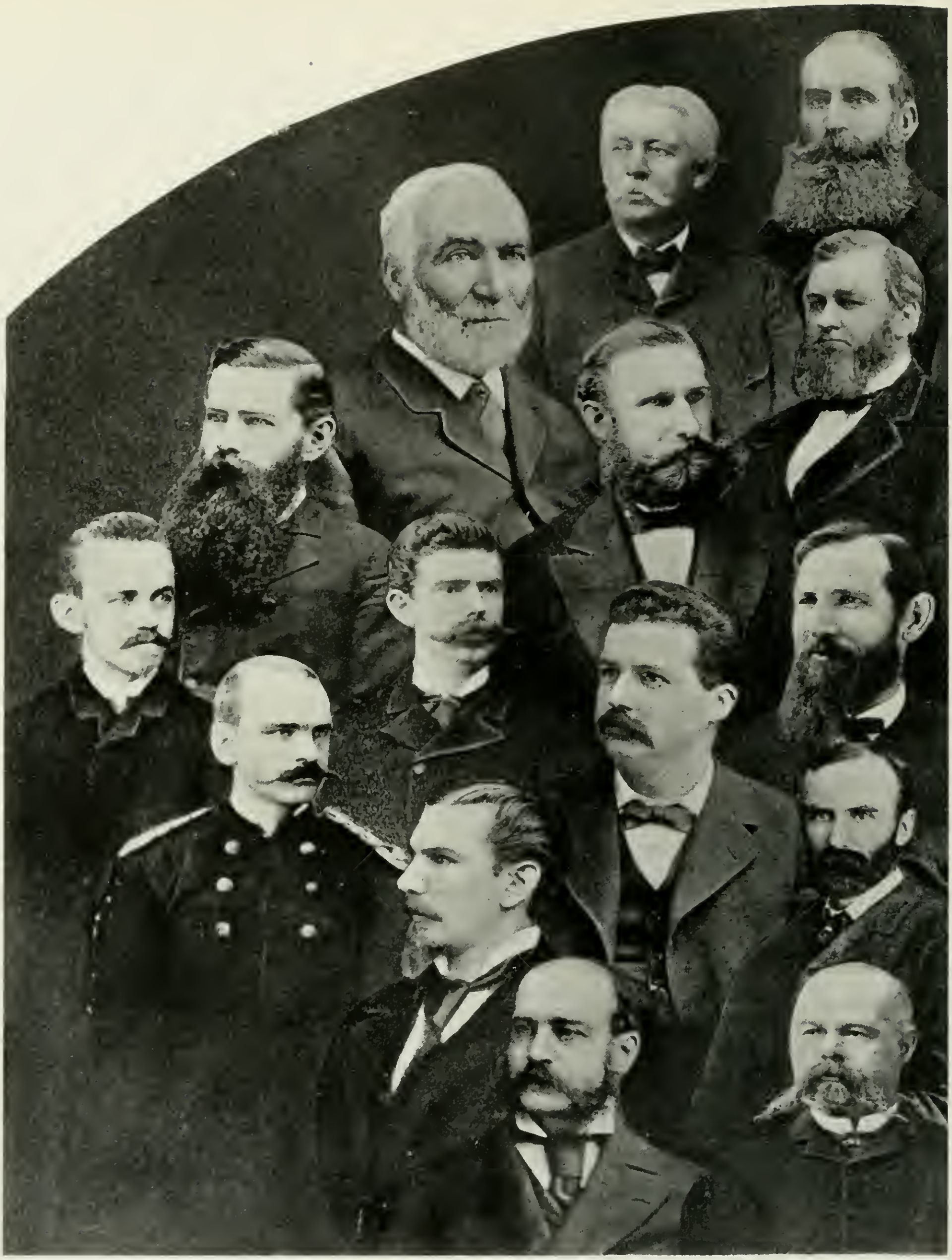
In November of this year, 1918, the Union, now the largest association of its kind in the world, with nearly a thousand members, will return for the twelfth time to revisit its "*Alma Mater,*" to review the work of the year, and to outline plans for the immediate future. It is not granted to many men to live to see the development of their early plans, but more than half of the Founders of the American Ornithologists' Union are still living and most of these are members of its council.

The chief objects of the Union according to the articles of incorporation, for the Union was duly incorporated as a national organization in 1888, are "the advancement of its members in ornithological science and the publication of a journal of ornithology and other works relating to that science." The first object is attained through personal intercourse, meetings, correspondence, and the promotion of projects of common interest, and the second through publications which have now become widely known.

Membership in the American Ornithologists' Union

Membership in the Union is open to any reputable person who has an interest in birds or bird study. The qualifications of the different classes of members are so graded that any one, whether a professional ornithologist, or a bird lover familiar with only a few common species, can find congenial spirits who have interests in common. To meet the needs of the various groups between these extremes, the By-Laws provide seven classes of membership, but virtually these groups are reduced to four: (1) Fellows, limited to 50 in number and eligible to office; (2) Members, limited to 100, who share with Fellows the right to participate in the business of the Union; (3) Associates, unlimited in number; and (4) Foreign Members, divided into two groups of (a) Honorary

[1] The next meeting will be held at the American Museum of Natural History, New York, November 11–14, 1918. Information concerning the Union may be had on application to the Secretary, 1939 Biltmore Street, N. W., Washington, D. C.



Founders and Officers of the American

DR. E. A. MEARNS, U. S. A.	THOMAS MCILWRAITH.	DR. J. B. HOLDER.	DANIEL G. ELLIOT.
NATHAN C. BROWN.	ROBERT RIDGWAY, VICE-PRESIDENT.	H. W. HENSHAW, COUNCILOR.	PROF. SPENCER F. BAIRD, COUNCILOR.
DR. R. W. SHUFELDT, U. S. A.	C. B. CORY.	DR. C. HART MERRIAM, SECRETARY.	J. A. ALLEN, PRESIDENT.
		H. A. PURDIE.	MONTAGUE CHAMBERLAIN, COUNCILOR.
			CAPT. CHARLES E. BENDIRE, U. S. A.

Ornithologists' Union. 1883.

HON. CHARLES ALDRICH.	DR. J. M. WHEATON.	DR. A. K. FISHER.
GEORGE N. LAWRENCE, COUNCILOR.	PROF. ELLIOTT COUES, VICE-PRESIDENT.	CHARLES F. BATCHELDER.
WILLIAM BREWSTER, COUNCILOR.	DR. D. W. PRENTISS.	H. B. BAILEY.
EUGENE P. BICKNELL.		

THE HISTORICAL GROUP OF THIRTY-FIVE YEARS AGO

The group includes the twenty-three Founders and Messrs. H. W. Henshaw and G. N. Lawrence who were members of the first Council. The call for the original meeting was signed by J. A. Allen, Elliott Coues, and William Brewster. Thirteen of these members are still living, and nine, including Dr. Allen who served for seven years, have filled the office of president. Five, including Captain Charles E. Bendire, Dr. Elliott Coues, Dr. E. A. Mearns, Dr. D. W. Prentiss, and Dr. R. W. Shufeldt, served in the Army; of these, Dr. Shufeldt, now a major in the Medical Corps, is the only survivor. Among the other more prominent members were Professor Baird, secretary of the Smithsonian Institution and "Nestor of American Ornithologists"; Mr. George N. Lawrence who assisted in the preparation of several early government reports on birds; and the following ex-presidents: Charles F. Batchelder, for many years associate editor of *The Auk;* C. B. Cory, who has published extensively on the birds of the West Indies; Dr. D. G. Elliot, author of numerous illustrated monographs on birds; Dr. A. K. Fisher, who has given special attention to hawks and owls; Dr. C. Hart Merriam, founder of the Biological Survey in the United States Department of Agriculture; and Robert Ridgway, curator of birds in the United States National Museum, whose great work on the *Birds of North and Middle America* is now in course of publication. When these photographs were taken, comparatively few of the members had accomplished the work which has since made them well known

Fellows, limited to 25, and elected on account of their eminence as ornithologists; and (b) Corresponding Fellows, limited to 100. Fellows and Members are residents of the United States and Canada; Associates, of any part of America; and Honorary or Corresponding Fellows, of any country. The other two groups comprise Fellows who, no longer active, have been transferred to the class of Retired Fellows, and Patrons, including persons who, desirous of furthering the aims of the Union, contribute the sum of $1000 for such purpose. This group as its name indicates is intended to distinguish those members who by their breadth of view and interest in the subject make possible the advancement of ornithology either in the fields of research or in applied science.[1]

Spencer Fullerton Baird,[2] after a crayon portrait by Henry Ulke, in 1883, the year of the organization of the A. O. U. Baird was a man of wonderful ability. He was a friend of Audubon, and his collection of birds afterward formed the nucleus of the National Museum collection. He acted as secretary of the Smithsonian Institution from 1878 to 1887 and was the organizer of the United States National Museum and of the United States Commission of Fish and Fisheries. He was the author of *Birds of North America*, *Review of American Birds*, and (with Brewer and Ridgway) of five volumes on the land and water birds of North America

The list of members includes many of the most eminent ornithologists in this country and abroad, while among the names of members now deceased may be found those of many well-known men whose works live after them. Among the latter are George N. Lawrence and Spencer F. Baird, the leading American ornithologists of their day, whose best work was done about the middle of the nineteenth century; and Coues, Bendire, Merrill, and Mearns whose names recall the valuable contributions to ornithology made by officers of the Army. Among the Honorary Fellows may be found the names of Huxley, Sclater, Sharpe, and Wallace, known the world over wherever the study of birds has received attention.

The business of the Union is conducted by the president, two vice-presidents, a secretary, treasurer, and a council of seven members. Officers and ex-presidents are *ex officio* members of the council, and the editor of the jour-

[1] No initiation fee is required and the annual dues are $5 for Fellows, $4 for Members, and $3 for Associates. Life membership securing exemption from further assessment may be obtained upon payment of $100 by a Fellow, $75 by a Member, or $50 by an Associate. Patrons and Retired, Honorary, or Corresponding Fellows are exempt from dues and all classes of members except Corresponding Fellows receive the journal free.

[2] This portrait of Professor Baird, made in 1883, is apparently an unpublished one and historically correct for the date. At this time he was sixty, and evidently showed his age, for this was only two years before his health broke down and only four years before his death. Compare with the picture in the large group (page 474) which is the standard and undoubtedly the best picture of Baird and is from a photograph taken about 1875 by Mr. T. W. Smillie, photographer of the U. S. National Museum. Baird, then fifty-two years old, was in the height of his vigor, planning for the exhibit in the Centennial Exposition, which was made the stepping stone to the foundation of the National Museum, the ambition of his life. An interesting point is that the Smillie photograph faces to the left while the Ulke pictures (of which the writer has seen two) face to the right.

nal is elected by the council. Although all the officers are elected annually some of them have been reëlected a number of times. Dr. J. A. Allen, the first president, served for seven years and filled the position of editor for twenty-eight years. Mr. John H. Sage, the present president, was elected in 1917, after having served as secretary for twenty-eight years. Two of the treasurers, Mr. William Dutcher and Dr. Jonathan Dwight, have served sixteen and fifteen years respectively. Thus the general policy of the Union has been maintained on a singularly uniform and conservative basis.

Dr. Joel Asaph Allen, who has just celebrated his eightieth birthday, served seven years as the first president of the American Ornithologists' Union, and twenty-eight years as editor of its publications. He is author of nearly one thousand papers and reviews on ornithology, many biographical sketches of ornithologists, and a series of papers on nomenclature, besides many publications on mammals and other subjects. This photograph was taken in 1885 when he became curator of ornithology and mammalogy in the American Museum of Natural History, with which institution the A. O. U. has always been very closely associated

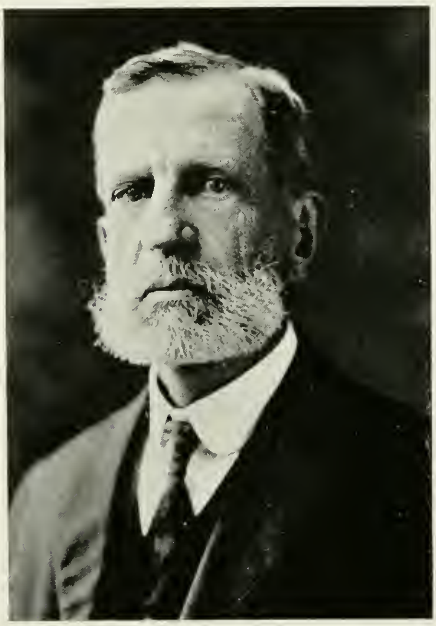
WOMEN AS WORKERS IN ORNITHOLOGY

Membership in the Union is open to women on the same terms as men. Sex has been no bar to election, and meritorious work by women has always received prompt recognition. More than 140 women are now on the rolls, four of whom have been elected Members, and one a Corresponding Fellow. They take part in the annual meetings and frequently present papers containing important original observations. It is hardly to be expected that women will have the same active interest as men in collecting birds in the field, but several of the members do not hesitate to venture into the wilds in quest of specimens and data when opportunity offers. Dr. Emilia Snethlage, a Corresponding Fellow who is director of the Pará Museum in Brazil, has made several expeditions into the tropical forests of the Amazon region, and published the scientific results of her trips. Miss Annie M. Alexander, founder of the Museum of Vertebrate Zoölogy at Berkeley, California, has organized and personally conducted several expeditions to Alaska and to remote sections of California. Mrs. Florence Merriam Bailey has accompanied her husband on many field trips in the West and has thus collected material for her well-known *Handbook of the Birds of the Western United States*, her recent papers on the birds of the Glacier National Park, and other publications on the birds of the West. Mrs. Bailey was the first woman elected to the Union and for two years was the only feminine member.

In several lines of work women are especially fitted not only to make substantial contributions to knowledge but to advance the cause of ornithology. In making observations on habits and migration, in presenting the subject in popular form, in teaching, and in arousing an interest in birds among the younger generation, they have already accomplished invaluable work. The observations of Miss A. R. Sherman and Mrs. Irene G. Wheelock, the works of Mrs. Olive Thorne Miller and Mrs. Mabel Osgood Wright need only be mentioned as illustrations, while the interest which Mrs. Russell Sage has shown in the cause of popular education and bird protection has made possible results accomplished by few other persons either in this country or abroad.

Meetings and Field Journeys of the American Ornithologists' Union

Regular meetings are held annually, usually in November, and continue four or five days. The first day is devoted to the transaction of business and the next three days to public sessions for the presentation of scientific papers. An informal dinner is usually arranged for one of the evenings, and the fifth day is devoted to an excursion or a visit to some zoölogical garden, museum, or other point of ornithological interest. The excursions have included, besides zoölogical gardens, several points of historic or scientific interest such as Audubon's home, Bartram's garden, and the New Jersey pine barrens near Philadelphia; the New York Aquarium and the Brooklyn Museum; trips to Concord, the Thayer Museum at Lancaster, and the Ipswich sand dunes from Cambridge; and the headquarters of the Biologists' Field Club at Plummer Island in the Potomac near Washington. As a matter of convenience, meetings are usually held in the four cities which have large public museums and near which most of the members are located, namely, Cambridge, New York, Philadelphia, and Washington. Local scientific societies such as the Nuttall Ornithological Club of Cambridge, the Linnæan Society of New York, the Delaware Valley Ornithological Club, and the Biological Society of Washington usually take part in entertaining the members.



John Hall Sage, president of the American Ornithologists' Union, today.—Prior to becoming president of the Ornithologists' Union he served as secretary of the organization for twenty-eight years. He is a Fellow of the American Association for the Advancement of Science and a member of the New York Academy of Sciences and of the Biological Society of Washington. In collaboration with Dr. L. B. Bishop he published *The Birds of Connecticut*, in 1913. (Half tone from a photograph taken in 1918)

On two occasions, in May, 1903, and May, 1915, the Union crossed the continent to meet in San Francisco with the Cooper Ornithological Club. On the former occasion a week was spent *en route* and stops were made at Santa Fé, New Mexico; in the Painted Desert, and at the Grand Cañon in Arizona; and in the Mohave Desert, and at Los Angeles in southern California. Side trips were also made to Monterey, the Farallon Islands, Los Banos, and the Yosemite Valley, thus affording most favorable opportunities for comparing the fauna and flora of several widely different regions. On the latter occasion stops were made at the Grand

Cañon and Los Angeles, a week was spent at the Panama-Pacific Exposition, and side trips to the redwoods and the Yosemite Valley were arranged for those who could take them. A permanent and instructive exhibit of one of these trips may be seen in the American Museum in two of the habitat bird groups—"Brandt's Cormorant at Monterey" and "Summer Bird Life of the San Joaquin Valley"—the material for which was collected in 1903.

Scientific Work of the A. O. U.

The decade immediately preceding the organization of the Union was a period of great activity in the study of North American birds. Many books and papers had been published, but the classification and nomenclature which they followed were not always uniform and it was not uncommon for a bird to appear under several scientific names. In fact two check lists of birds, differing widely in classification and names of some of the species, were in common use. To remedy this confusing condition a committee on classification and nomenclature was appointed at the first meeting and at once began a thorough review of the whole subject. Rules of nomenclature known as the A. O. U. Code were adopted and later were accepted by virtually all American ornithologists and many workers in other branches of zoölogy. They have since been incorporated in large part in the International Code of Nomenclature. A new check list was prepared in which well-marked species were indicated as usual by binomial scientific names, while birds which are slightly marked and grade into geographic forms or subspecies were designated by trinomials. Thus the name of the common red-headed woodpecker is *Melanerpes erythrocephalus*, but that of the California woodpecker which grades into several forms is *Melanerpes formicivorus bairdi*. Instead of beginning with the highest birds and running down the scale, the new list followed the more logical plan of beginning with the lowest or most generalized and working gradually up to the highest or most specialized forms. The year 1758 was recognized as the beginning of binomial nomenclature and the earliest available scientific name after this date was adopted for each bird. The report of the committee, published after three years of laborious investigation, formed a volume of nearly four hundred pages and was at once accepted as the standard authority on the names of North American birds. In this respect the committee succeeded beyond expectation in its difficult task. As new birds were discovered or changes in names were made necessary by progress in knowledge, supplements were issued

William Dutcher, president of the National Association of Audubon Societies, was treasurer of the Ornithologists' Union from 1887 to 1903. His name stands for bird conservation, that most popular branch of applied ornithology, and it is largely due to his enthusiastic efforts that such rapid strides were made in bird protection between the years 1896 and 1905, resulting finally in the establishment of the National Association of Audubon Societies and its incorporation in the latter year. (From a photograph of 1910) from time to time and later incorporated in new editions of the check list of which the second was published in 1895 and the third in 1910.

Three other committees, also appointed at the first meeting, those on migration, geographic distribution of birds, and on the status of the English sparrow, began the collection of data on such a comprehensive scale that the work soon outgrew the resources of the Union to handle it. In 1885 Congress was induced to provide a special appropriation for carrying it on in connection with the investigations of the United States Department of Agriculture, and thus was founded the Division of Ornithology which later developed into the present Bureau of Biological Survey. The first bulletin issued by the Division was a *Report on Bird Migration in the Mississippi Valley*, the forerunner of many other publications on migration and geographic distribution; and the second was a comprehensive bulletin on *The English Sparrow in America*, the initial number of a long series of reports on the food and the economic relations of birds.

Some Publications of the A. O. U.

As a publisher the American Ornithologists' Union occupies a field peculiarly its own and concentrates its energies on the two main objects of keeping its members informed concerning (1) current literature on birds and all that relates to their food, migration, and life histories; and (2) the latest facts concerning the nomenclature and distribution of the species found in North America. To attain these objects it issues a quarterly journal and occasional check lists. It has never undertaken the publication of memoirs, monographs, or similar extended papers usually issued by academies of science and other scientific institutions, or manuals, handbooks, or works containing popular descriptions of birds which are brought out frequently by private publishers. Its journal, known as *The Auk*, in accordance with the custom of naming ornithological journals after some characteristic bird, serves as a medium of publication for papers or short notes on any phase of ornithology. A bound set of this journal, now in its thirty-fifth volume, fills a five-foot shelf and contains an epitome of the principal ornithological work in America since 1883. *The Auk* is practically a continuation or second series of the *Bulletin of the Nuttall Ornithological Club* which was published from 1876 to 1883. It is especially rich in short notes, faunal papers or local lists of birds of special regions, and reviews of publications on birds which have appeared elsewhere. A general index has been published containing references to all the articles in the *Bulletin* and in *The Auk* from 1883 to 1900, while a decennial index covers the volumes from 1901 to 1910. Thus by means of these two indexes and the annual indexes the great mass of records and notes contained in about eighteen thousand printed pages are rendered accessible to the general reader.

The other publication, an authoritative list of the genera, species, and subspecies of birds found in North America north of Mexico, with a statement of the geographic distribution of each form, is known as the *A. O. U. Check-List*. An abridged check list, containing only the names, was published in 1889, and a pocket edition for field use in 1911. These publications, technical as they may seem at first sight, contain much of interest and are highly valuable as works of reference. Even the *Check-List* contains many facts which only require elaboration to make them interesting. Any one who will glance over the charming chapter on "Reading a Check-List" in Bradford Torrey's *Field-Days in California* will be inclined to agree with the author that "for the right man there's a world of good reading in a check-list."

Mrs. Florence Merriam Bailey was the first and for two years the only woman member of the American Ornithologists' Union, which now numbers 140 women on its rolls. Among her publications on ornithology are: *Birds Through an Opera Glass*, *Handbook of the Birds of the Western United States*, and many papers on western bird life

THE INFLUENCE OF THE A. O. U. ON BIRD PROTECTION

Not less important than the scientific and economic work which was taken over by the Department of Agriculture is that relating to the protection of birds. At the Second Congress in 1884, a committee on bird protection was appointed and at once entered upon an active campaign. Wholesale bird slaughter was then at its height due to the enormous demand for plumage by the millinery trade and the traffic in birds' eggs and skins which was fostered by dealers and taxidermists. A comprehensive law for the protection of birds, now known as the "Model Law," was prepared by the committee and was adopted by New York in 1886, and later in modified form by nearly three fourths of the states. This law differed from similar statutes then in force by dividing all birds into three groups, protecting at all seasons nongame birds, for example, thrushes; allowing a season for hunting game birds, such as the quail; and withdrawing protection from such injurious species as the English sparrow. Ample provision was made for scientific work under a system of permits. Simultaneously with the new law, the first Audubon movement was launched in 1886, but after a few years began to languish. Ten years later it was again started on a different and more permanent basis and soon developed to large proportions.

In the decade from 1896 to 1905 rapid progress in bird protection was made under the enthusiastic leadership of Mr. William Dutcher. In 1896 commercial destruction of sea birds' eggs on the Farallon Islands in California was stopped. In 1900 the first practical work of guarding breeding colonies of sea birds along the Atlantic Coast was made possible by means of the Thayer Fund, the first steps were taken in the organization of the National Committee of Audubon Societies, and the first Federal game law, the Lacey Act, was passed by Congress. The year 1903 was marked by the establishment of the first Federal bird refuge on Pelican Island, Florida, and an agreement with the millinery trade to check the traffic in plumage of native birds. In 1905 the National Association of Audubon Societies was incorporated, and the narration of subsequent events belongs more properly to the history of that organization.

Reference, however, may be made to several matters in order to complete this sketch of American bird protection. In 1906 the National Association of Audubon Societies received an endowment and this fund, gradually increasing, provides a permanent and assured income for carrying on its work of practical bird study and protection. It may be noted incidentally that the officers of the National Association are all members of the Union. In 1913

Congress enacted the Federal Migratory Bird Law, and it is interesting to recall that the members of the committee which prepared the regulations for carrying it into effect were Fellows of the American Ornithologists' Union. Finally in 1916 a treaty for the protection of migratory birds in the United States and Canada was concluded by the United States and Great Britain, followed in 1918 by an act of Congress and the regulations necessary for carrying it into effect. In these negotiations members of the Union again took an important part. Thus in thirty-four years the work of applied ornithology originated by the committee on bird protection has developed in one direction into that of the National Association of Audubon Societies, a permanently endowed corporation, and in the other has found expression in the form of state and Federal laws and also in an international treaty covering migratory birds from the Gulf of Mexico to the Polar Sea.

The American Ornithologists' Union and the World War

Like other national organizations the American Ornithologists' Union is taking its part in carrying on the great World War. It has invested in Liberty Bonds, it has members in several branches of the military and naval service, and its members at home are assisting in war work with the Red Cross and in various other ways. Those members who have joined the colors are exempt from dues during the war, and to provide for these dues a fund is being raised by special contributions. After the war, this fund will become part of the permanent endowment fund and the income will be available for publications.

Nearly 10 per cent of the membership, exclusive of the Foreign Members, is already in military service, and the proportion is likely to be greatly increased in the near future. The men are in all ranks from private to colonel in the Army and from seaman to lieutenant in the Navy. Many are now in France, some in the American Expeditionary Forces, and some in the Canadian Expeditionary Forces, while others are in training camps and cantonments in this country, eagerly awaiting an opportunity to go to the western front. Most of them are in the infantry, artillery, or medical corps but others have been detailed to special duty for which they are peculiarly fitted by previous training. Destroying rats in the trenches and in quartermasters' stores, examining recruits for hookworm, caring for birds in the pigeon service, acting as gun pointer in a naval crew on a merchant vessel, sighting rifles in an arms factory, and assisting in *camouflage* experiments are only a few of the actual duties performed by ornithologists in connection with the war. Letters from some of the men indicate that their interest in birds remains unabated, notwithstanding the serious work in which they are engaged, and requests have been received even from the trenches for pocket handbooks in English containing descriptions of birds likely to be met with in France. But whether at home or over there, whether detailed to the aviation corps, on the seas, or in the trenches, A. O. U. men are finding their field experience and their habits of observation acquired in pursuit of science of the highest service in the grim work of war.

What of the Future?

While reviewing its past record with pardonable pride, the Union may well feel confident that the future offers opportunities for even greater accomplishments. With an adequate endowment, an enlarged field of publication, and a membership of several thousand, including workers in every branch of technical and applied ornithology, the American Ornithologists' Union will be in a position to advance the study of ornithology on a broader scale than has hitherto been possible.

On every side technical, theoretical, and practical problems await solution. The problem of the subspecies only begins with the naming of an obscurely marked form, and the more difficult questions of the bird's distribution, life history, and relation to other forms still remain to be worked out. In spite of the progress made in recent years certain mysteries of bird migration still confront us. Where is the winter home of the chimney swift or the breeding ground of the blue goose? These familiar questions cannot remain unanswered much longer. As for other questions of migration, bird banding promises to throw much light on the routes traversed by migrants, and aviation on the height and speed at which birds travel. How shall we learn more of the extinct birds of America now known only by a few fragmentary bones, and how shall we prevent from becoming extinct other valuable species now threatened with extermination? These and other problems ranging from the purely theoretical to the severely practical await solution by competent investigators.

Even amid the distractions of war, plans are being made for broadening the scope of the American Ornithologists' Union so as to make the organization international in fact and enable it to assume its share of the larger undertakings in the world's work. To each and all who are interested in birds the Union extends a cordial invitation to join in the advancement of ornithology and the advancement of members in ornithological science.

Figure from a recent number of *The Auk*, official organ of the American Ornithologists' Union, illustrating the study of life histories of birds in the field. This nest of the bay-breasted warbler (*Dendroica castanea*) was photographed by Messrs. P. B. Philipp and B. S. Bowdish in June in northern New Brunswick. Collectors of the American Museum of Natural History have found this warbler in the mountains of Colombia between the middle of December and March 10. The route by which the bird reaches the tropics and returns again the next spring is one of the problems of migration as yet unsolved. Since the bay-breast occurs neither in Mexico nor Florida, it is supposed to fly across the broad expanse of the Gulf of Mexico in the course of its long journeys from its breeding grounds to its winter home and back again

RIO NEGRO CAÑON IN THE EASTERN ANDES

Eastern ridge, near Monteredondo, altitude 4500 ft. (Junction of Orinocan Tropical and East Andean Subtropical Faunas)

The Chapman expedition stopped at Monteredondo and Quetame (five miles west) while following the ninety-mile trail from Bogota to Villavicencio and the llanos of eastern Colombia. There was scarcity of forest growth, therefore few tree-loving birds. Mingled with the Subtropical birds were representatives of the Temperate Zone above and of the Tropical Zone below. This very evident mingling of zonal species was not often found; zones were usually sharply marked off.

It is chiefly from the Bogota region that millions of skins of small birds, collected by natives with blowguns, have been sent to Paris and London for millinery purposes. The trade began about 1840 and was at its height in 1885. Many of these specimens reached scientific institutions but all were without scientific data of any kind. In the latitude of Bogota the Eastern Andes have a width of about 100 miles. There is very great need for further exploration work in this eastern mountain range

"The Distribution of Bird-Life in Colombia" A Review*

By ARTHUR A. ALLEN

Assistant Professor of Ornithology, Cornell University

OF the nineteen or twenty thousand species and subspecies of birds known to inhabit the world, from four to five thousand, or about one fourth, are found in South America. South America, therefore, is the richest part of the globe in variety of bird life. The vast stretches of forest and llanos, the high mountains, the isolated ridges, the great altitudes and extensive latitudes, with their resulting diverse climatic conditions, all combine to create the innumerable isolated environments that are necessary for the development of a great variety of species.

In South America there are found not only a larger number of species but also a far larger number of families than in other regions of the world, showing either that the birds have diverged more widely from their ancestral types or that more of the connecting links have been preserved. The latter is more likely to be the case because most of the families are still those which are considered low in the scale of evolution. Some of these families have many representatives in Africa; others seem related to Australian forms, and still others, like the humming birds, tanagers, orioles, and warblers, undoubtedly represent the stock from which many of our North American birds were derived. Indeed, the origin of North American birds and the perplexing problems of their distribution and migration are so closely linked with the origin and distribution of South American birds that it seems necessary to understand the problems of South American bird life before we can go very far with our own. When we know where the ancestors of our birds lived and where they probably came from, we can deal more intelligently with the mysteries that still enshroud the lives and movements of our own birds.

It was with this ultimate aim that, in December, 1910, the American Museum of Natural History inaugurated its extensive zoölogical survey of South America. As the first great step in its accomplishment, Dr. Chapman has now published the result of seven years' study, "The Distribution of Bird-Life in Colombia."

When the work was conceived, it was thought that most of the exploration had already been accomplished and that the list of South American birds was reasonably complete. The first contribution was to be in the nature of a survey of the distribution of the birds already described. As material came in from the various collectors, however, and also through expeditions which Dr. Chapman himself led into Colombia, it was discovered that there was still a good deal of preliminary work to be done. In fact, before the paper on the distribution of bird life could be prepared, Dr. Chapman found it necessary to describe from Colombia alone, 22 species and 115 subspecies of birds new to science.[1]

But it was not only in the descriptions of new species that pioneer work had to be done. Some of the expeditions extended their explorations into little-known parts of Colombia that had never been accurately mapped.

[1] *Bulletin American Museum Natural History*, XXXI, 1912, pp. 139–166; XXXIII, 1914, pp. 167–192, pp. 606–637; XXXIV, 1915, pp. 363–388, pp. 635–662.

* *Bulletin of the American Museum of Natural History*; Vol. XXXVI, 1917, The Distribution of Bird-Life in Colombia; A Contribution to a Biological Survey of South America, by Frank M. Chapman.

Always detailed accounts of the country traversed were preserved, altitudes taken, and the nature of the water courses and forests recorded—information of utmost importance for Dr. Chapman's study of the distribution of bird life and of almost equal importance to a knowledge of the commercial or economic development of the country. The descriptions of transportation facilities, roads, and trails found in Dr. Chapman's volume are valuable not only to the zoölogist but to travelers or explorers, particularly at this time when Colombia seems to be on the verge of an economic awakening.

The large number of photographic illustrations of the country add greatly to the value and interest of the written descriptions. The maps of the life zones, which are likewise crop zones, and the map of the distribution of the forests will be welcomed equally by zoölogical, botanical, and commercial investigators. What is important to the zoölogist in planning an expedition to collect as many forms of life as possible is equally important to the promoter of a railroad or to anyone seeking the development of the agricultural resources of the country. The climatic factors which control the distribution of animal life likewise influence the growth of crops and the development of forests or grazing country, and upon these depend the building of railroads and the growth of cities. The life zones of Colombia found in Dr. Chapman's report are based upon the distribution of bird life. Each zone, however, has its characteristic plants and trees and its characteristic cultivated crops. A glance at the map will show equally well where one can expect to find black merulas or where one can grow wheat. Where red-rumped tanagers occur, there coffee grows well.

The topography of Colombia and the resulting life zones are as varied and interesting as can be found anywhere in the world. This region, lying, as it does, just north of the equator, between the first and twelfth parallels of latitude, might be expected to possess a uniformity of life and climatic conditions, but because of the mountains there is a greater diversity than occurs between Florida and Greenland. Palms and glaciers, dripping forests and sandy deserts, tropical heat and blinding snowstorms greet the traveler in rapid succession.

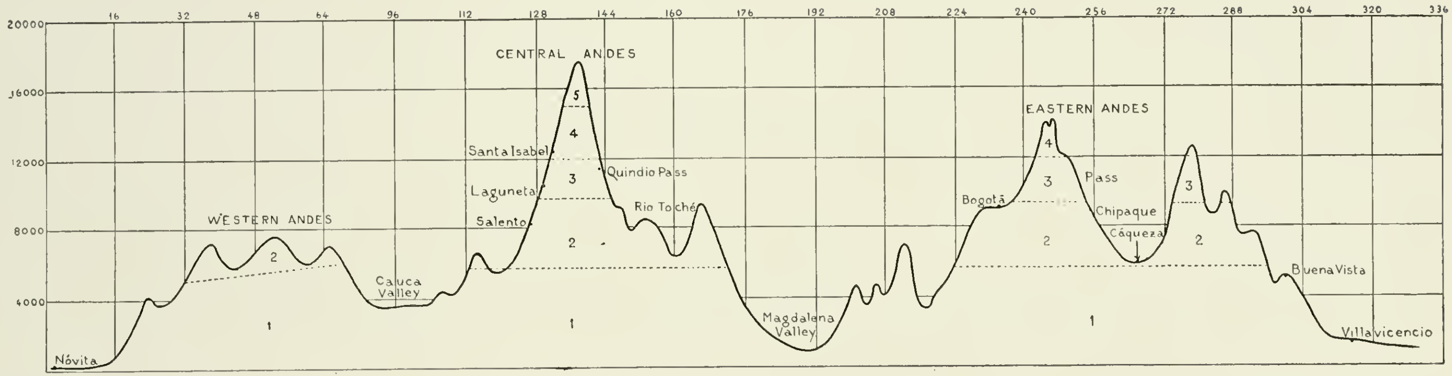
The great chain of the Andes breaks up into three ranges in southern Colombia, being separated by the Cauca and Magdalena valleys. The highest peak is Nevada del Tolima of the central range, 18,500 feet, a symmetrical cone of gleaming snow, extending 6000 feet above the forest-covered ridges about it. The eastern range continues northward nearly to the Caribbean Sea but is separated by the valley of the Cesar from the isolated ridge of the Santa Marta Mountains. The central range extends not quite so far, being interrupted by the Cauca River as it swings eastward to join the Magdalena. The western range was, at one time, Dr. Chapman points out, continuous with the mountains of Central America, but a great subsidence has taken place in northwestern Colombia and in Panama rather recently geologically, leaving the high peaks of western Panama and Costa Rica with no direct faunal connection with the Colombian mountains but with every evidence of once having been continuous with them.

Between the western and central ranges extends the Cauca Valley, a flat plain about thirty miles wide. Through it winds the Cauca River, a fair-sized stream, navigable to river steamers in its lower and upper courses but interrupted in the middle by a series of rapids. The upper valley is apparently the bed of an ancient lake which broke through its northern barrier, forming the cañon of the Cauca and the rapids in that region. The land is fertile, therefore, and although at present much of it is given over to grazing instead of agriculture (doubtless owing to transportation difficulties), sugar, coffee, cacao, rice, and tropical fruits grow luxuriantly. The Magdalena Valley, between the central and eastern ranges, is somewhat broader and much more arid except in its lower (northern) reaches where it is quite the reverse. The extensive level region east of the eastern range is similar to adjacent parts of Venezuela and Brazil, there being llanos north of the Guaviare River, and south of it the great Amazonian forest.

Dr. Chapman points out that all the life of tropical South America was probably alike prior to the rise of the Andes Mountains and as late as the latter half of the Tertiary period. If, at that time, there were no mountains to act as barriers to the moisture-laden winds and no differences in altitude, the sea of life that flowed through the continuous forest must have been quite uniform from the Atlantic to the Pacific. Indeed, today, the faunas of the tropical Pacific area and the great Amazonian forest are very similar in spite of the barrier separating them. But with the rise of the mountains, there came great differences in climatic conditions and eventually five distinct areas could be recognized. West of the mountains was an area of great condensation, the moisture-laden winds from the sea giving up most of their vapor and causing vegetation of great luxuriance to grow. Northward, along the Caribbean Sea, was an area which, entirely cut off by the mountains from those breezes, then became arid. East of the mountains, the northern Orinocan part became arid while the southern part received its moisture-laden winds from the southeast and remained extremely humid. The valleys of the Cauca and Magdalena became more or less cut off from the other regions by the mountain barriers and formed a fifth area, part arid and part humid.

Altitudinally the change was even more striking. Beginning at sea level and continuing up to an altitude of from 4500 to 6000 feet, the tropical forests and all their life continued to luxuriate. From the upper reaches of the tropical belt to about 9000 or 9500 feet, conditions changed. The temperature decreased and the growing season became shorter. Tropical forms either had to adapt themselves to the shorter, cooler season or perish, and so, as they were carried upward by the rise of the mountains, many new forms or adaptations arose and a new fauna was established which Dr. Chapman has called the Subtropical Zone fauna. As the mountains rose higher and higher, a third belt was correspondingly formed so that today between 9000 to 9500 and 11,000 to 13,000 feet, we have the Temperate Zone. Conditions here are not unlike those of temperate North America, or South America in Chile and Argentina. In fact, so like were the conditions of southern Chile to those of the mountains of Colombia, Ecuador, and Peru above 9500 feet, that many southern forms of this region extended their ranges northward to occupy the territory newly formed. Thus while the birds of the Subtropical Zone, between 4500 and 9000 feet, are today most closely related to the tropical forms below them, the birds of the Temperate Zone are most closely related to the seacoast forms of southern Chile.

At an altitude of from 11,000 to 13,000 feet, tree growth stops. The season is too short for any tree to thrive and there is an area of sedges, herbaceous plants, and curious woolly perennials. This is the region called Paramo and extends up to snow line at about 15,000 feet. It is a land of fog and sleet during the bleak months of its winter, and even during its short summer clouds roll up from the forests below to obscure the landscape part of the day.

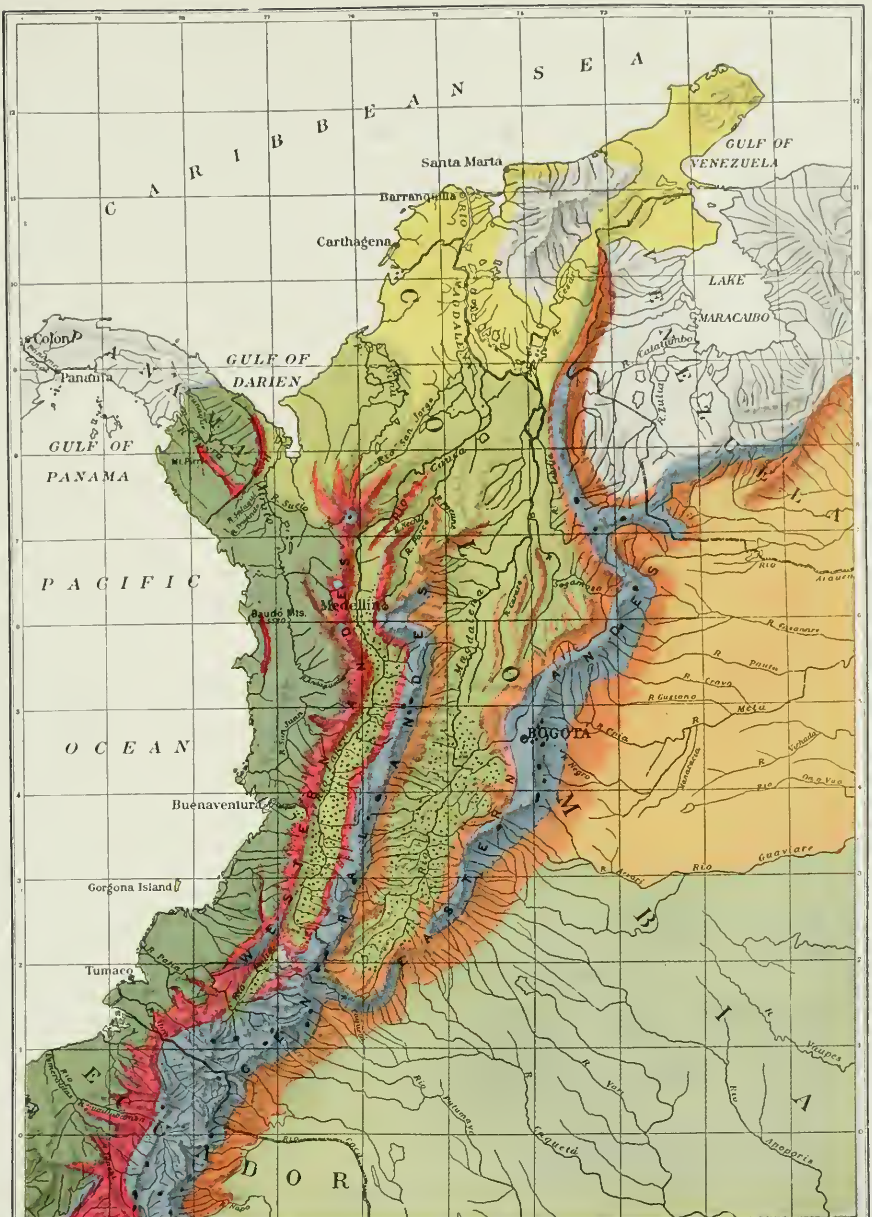


LIFE ZONES OF THE COLOMBIAN ANDES

Temperature as influenced by altitude brings about a division of Colombia vertically from sea level up to the highest point of the Andes into life zones as follows: 1—Tropical (sea level to 4500–6000 ft.), 2—Subtropical (4500–6000 to 9000–9500 ft.), 3—Temperate (9000–9500 to 11,000–13,000 ft.), 4—Paramo (11,000–13,000 to snow line about 15,000 ft.), 5—Perpetual Snow (above 15,000 ft.).

Comparison of this semi-diagrammatic profile with the map in color opposite will make clear the topography of Colombia and division into these life zones and into faunal areas. The Andes break up here into three ranges alternating through a distance of about 300 miles from west to east with first, the low Pacific Coast, second, the Cauca River Valley, third, the Magdalena River Valley, and fourth, on the east, the Orinoco River drainage. The central range is the most lofty, its highest peak, Tolima, reaching 18,500 ft.; the western range is low, not reaching to snow line; the eastern range is the most extensive; the isolated Cauca Valley is from twenty to thirty miles wide and the Magdalena somewhat wider, both arid in their upper (southern) portions. East of the eastern range, the Orinocan drainage toward the north consists of llanos, and the Amazonian drainage at the south of tropical forest.

Comparison of profile and map with the series of photographs following (also with the map on pages 496 and 497) will give an understanding of the types of country in which the bird life was investigated by the Chapman expeditions of the American Museum. The work done by Dr. Chapman in mapping Colombia's life zones and faunal areas is of interest not only to zoölogists but also to travelers and explorers generally, and is of value for the economic development of the country itself. The zones of the distribution of bird life are also Colombia's crop zones



Colombian Life Zones (vertical distribution) and Faunas (horizontal distribution in the Zones)

Colombia is a country just north of the equator, yet because of its mountains, it has as great diversity in climate and plant and animal life as can be found anywhere on the earth. Palms and glaciers, dripping forests and sandy deserts, tropical heat and blinding snowstorms, greet the traveler in rapid succession. In the development of faunas in Colombia, humidity, character of soil, and ease of access have been the active agents.

Tropical Zone	Colombian-Pacific Fauna
	Cauca-Magdalena Fauna[1]
	Caribbean Fauna
	Orinocan Fauna
	Amazonian Fauna
Subtropical Zone	West Andean Fauna
	East Andean Fauna
Temperate Zone	Temperate Fauna
Paramo Zone	Paramo Fauna

[1] The dotted area is the arid portion of this fauna.

Tropical Zone, Colombian-Pacific Fauna.—(The lower Dagua.) Winds from the sea bring moisture; the annual rainfall here reaches 400 inches. Humidity and isolation have made this faunal area the main local center of adaptive radiation in Colombia

Tropical Zone, Colombian-Pacific Fauna.—(Rio Sucio, altitude 1500 ft.) Primeval forest, and the many bromelias, ferns, and parasitic plants prove abundant rainfall. There is no marked dry season

Tropical Zone, arid part of the Cauca-Magdalena Fauna.—(Western Andes near Antioquia, altitude 2600 ft.) With little vegetation except mimosas and cacti, which add to the desert-like appearance; hemmed in by the Western and Central Andes as with huge walls of pink clay and sandstone

Tropical Zone, Cauca-Magdalena Fauna.—(Puerto Valdivia, on the Rio Cauca.) Forests of the Central Andes rise from the right bank, of the Western Andes from the left. The Cauca and Magdalena valleys are isolated from contiguous faunas by mountain barriers with few passes

Tropical Zone, Caribbean Fauna.—(Coast near Carthagena.) This arid faunal area extends also along the coast of Venezuela. Rainfall is slight and irregular; there are no forests

Tropical Zone, Orinocan Fauna.—(Near Villavicencio.) Open fields, largely under cultivation, and no large forests, but the banks of streams are wooded

Tropical Zone, Orinocan Fauna.—(Near Villavicencio.) The most easterly ridges of the Eastern Andes are covered with primeval woods from base to crest; at their feet stretch the grass-covered level plains—the llanos

Tropical Zone, Orinocan Fauna.—(At Buena Vista, 3000 ft. above Villavicencio.) Richly developed tropical forests, with trees more than 100 feet high, here cover the eastern slope of the Eastern Andes, similar to the Amazonian forests farther south

Subtropical Zone, West Andean Fauna.—(Boquilla Valley from Salento.)—The mountains on the left (west) are the eastern slope of the low Western Andes. On the right (not shown) of the valley towers the lofty western slope of the Central Andes. The Chapman expedition ascended through this Boquilla Valley to headwaters, then up the Central Andes mountain-side, through the forests of the Temperate Zone, to the Paramo Zone of Santa Isabel (12,500 ft. See page 494)

THE TREE FERN OF HIGH ANDEAN FORESTS

Subtropical Zone, West Andean Fauna.—(View from La Gallera, a camp of government road laborers in the heart of the forest, altitude 7000 ft.)

At the high altitude of the Subtropical Zone (from 4500–6000 to 9000–9500 ft.) there prevail heavy rainfall and high humidity. It is preëminently a zone of forests, with luxuriance in undergrowth. Tree ferns attain a height of fifty feet; there are great tangles of climbing bamboo where orchids and bromelias flourish; everywhere are cushions of green moss; and everything is saturated and dripping with moisture. The life in these forests shows exceptional uniformity, and as a whole has been derived from the Tropical Zone. We found 230 distinctively Subtropical species of birds, and of these 121 are found in the Subtropical Zone of each of the three ranges of the Andes; but the remaining number is so divided as to suggest two centers of adaptive radiation, a West Andean Subtropical Fauna (Western Andes and western slope of Central Andes) and an East Andean Subtropical Fauna (Eastern Andes and eastern slope of Central Andes)

WAX PALMS ALONG THE QUINDIO TRAIL

Eastern slope of the Central Andes (East Andean Subtropical Fauna)

The trail across the Central Andes from the Cauca Valley to the Magdalena Valley over the Quindio Pass has been traveled for centuries. The country along the trail on the foothills of the western slope up to 9000 ft. (beginning of Temperate Zone) is more or less under cultivation. Before reaching this elevation one begins to catch occasional glimpses ahead of the brown paramo and white snowfields of Santa Isabel and Tolima, the latter the highest Andean peak. The divide is passed at 11,500 feet and the descent begun over the eastern slope down to the Magdalena. Wax palms appear on this eastern slope a thousand feet below the divide in the Temperate Zone and are the most abundant tree along the trail down through the Subtropical Zone.

These stately trees, discovered here by Humboldt and Bonpland in 1801, attain a height of from 180 to 200 feet. They are of especial interest to the ornithologist as the home of the yellow-eared parrot (*Ognorhynchus icterotis*). In places along the trail, every palm was occupied by a pair of parrots

CHAPMAN EXPEDITION IN THE HEART OF THE CENTRAL ANDES

Subtropical Zone, East Andean Fauna.—(View of the Rio Toché from above El Pié de San Juan)

This locality was visited by the Chapman expedition on one of its journeys eastward over the Quindio Trail from the Cauca Valley to the Magdalena Valley. The Rio Toché is here a dashing mountain stream, the home of torrent ducks and dippers. The new yellow-headed finch was found along the trail at this point (see color plate)

Junction of Temperate Zone and Paramo Zone.—(Slopes above Bogotá.) The line of junction between zones is most often sharply indicated, especially on the eastern slopes of the ranges where humidity combines with temperature to mark the boundaries. Occasionally the line of union is very uneven, long finger-like extensions of one zone reaching upward or downward, as the case may be, into another.

Great lack of intercommunication between the various regions of Colombia, even when contiguous, made it necessary for the Chapman expeditions to do most of their work with pack mules and porters

Temperate Zone, showing characteristic trees.—This zone lies approximately between 9000 and 12,000 ft.; the upper limit is likely to correspond with timber line. It is represented in only a few isolated localities on the low Western Andes; it is probably continuous through the Central range; it occupies most of the summits of the Eastern Andes. Conditions in the Temperate Zone are not unlike those of temperate North America, or of South America in Chile and Argentina,—in fact the bird fauna shows close relationship with that of the coast area of southern Chile, as well as with the Subtropical Zone just below it

Paramo Zone, between upper tree line and lower snow line.—(Paramo of Santa Isabel, 12,500 to 15 200 feet, Central Andes.) The Paramo Zone, a land of fog and sleet for many months of the year, has too low a temperature for tree growth. Curious woolly perennials are conspicuous among its flora. The life of the Temperate and Paramo zones shows a uniformity not manifest in lower altitudes; it is not possible to divide these zones into various faunas. The Paramo Zone occurs on very many mountains in the Central Andes; it is lacking in the low Western Andes; it is present on at least twenty summits in the Eastern range

The line separating the different zones is in some places very sharp, particularly on the eastern slopes of the ranges where humidity combines with altitude to make the line between the Tropical and Subtropical zones very distinct. But often long fingers of one zone, for one reason or another, extend into the one above or below so that the line is very uneven. To determine the limits of each zone, as given above, from the nature of its bird life was, therefore, no small task and required innumerable data and specimens before any sort of a map could be charted. The work of previous ornithological explorers was largely unsatisfactory from the standpoint of the present distributional study, because the insufficient or inaccurate data as to the locality where specimens were collected confused rather than assisted. Dr. Chapman had before him, therefore, a work of great magnitude when he began his field operations in 1910, and he is to be congratulated upon the wealth of material which he has brought together and interpreted.

Between 1910 and 1915 Dr. Chapman organized eight expeditions into Colombia, as follows, two of which he himself led:

The first was in the nature of a reconnaissance. Dr. Chapman, accompanied by L. A. Fuertes, W. B. Richardson and Leo E. Miller, entered Colombia at the western port of Buenaventura and crossed the western range to Cali, working at San Antonio at the crest of the western range and then in the Cauca Valley about Cali and La Manuelita, and on the western slope of the central range at Miraflores. Leaving Richardson and Miller in Cali, Chapman and Fuertes continued their survey across the central range over the Quindio Pass to Ibagué and Girardot and then down the Magdalena River.

On the second expedition Richardson and Miller started for Popayán at the headwaters of the Cauca River, whence they worked westward to the top of the western range at an altitude of 10,340 feet and down the western slope of the first ridge, through unexplored country, to Cocal, at an altitude of 4000 feet. Thence they returned to Cali, Richardson to return for a time to Nicaragua.

Third, the writer joined Miller in Cali and we proceeded over the route followed by Chapman and Fuertes in their reconnaissance down the Cauca and over the Quindio Pass, stopping to collect in each faunal zone. This is the main route of travel from the Cauca to the Magdalena Valley, and it might be supposed that the birds along the trail would be very well known. On the contrary, even along this much traveled trail, several birds new to science were found. In ten days' collecting at Laguneta, near the Quindio Pass, thirteen specimens represented two species new to science and others represented subspecies not previously described. Fuertes' parrakeet and Miller's antpitta were both found here. At Rio Toché, just over the ridge, four days' collecting yielded two specimens of the new yellow-headed finch, and at Salento on the western slope, was found Allen's antpitta. All four of these birds are quite distinct species and yet were found at no great distance from the trail.

Returning to Salento on the western side of the central range, we made a side trip to the paramo of Santa Isabel, climbing to snow line at about 15,000 feet and camping for ten days at the edge of timber. Here were found a new goldfinch and a new flycatcher. Again returning to Salento, we retraced our steps to an extensive forest along the Cauca River at Rio Frio and then prepared to cross the Western Andes from Cartago. This was a rather difficult trip as pack animals could not be used, the trail being barely passable for Indian packers. Because of the scarcity of food, the trip over the mountains was made as rapidly as possible, in five days, and some very interesting country unfortunately was left unexplored. Arriving at Juntas de Tamaná, on the Pacific side of the range, we collected here and later at Nóvita and Noanamá, all in the lowlands of the tropical Pacific fauna. The return was then made to Cali.

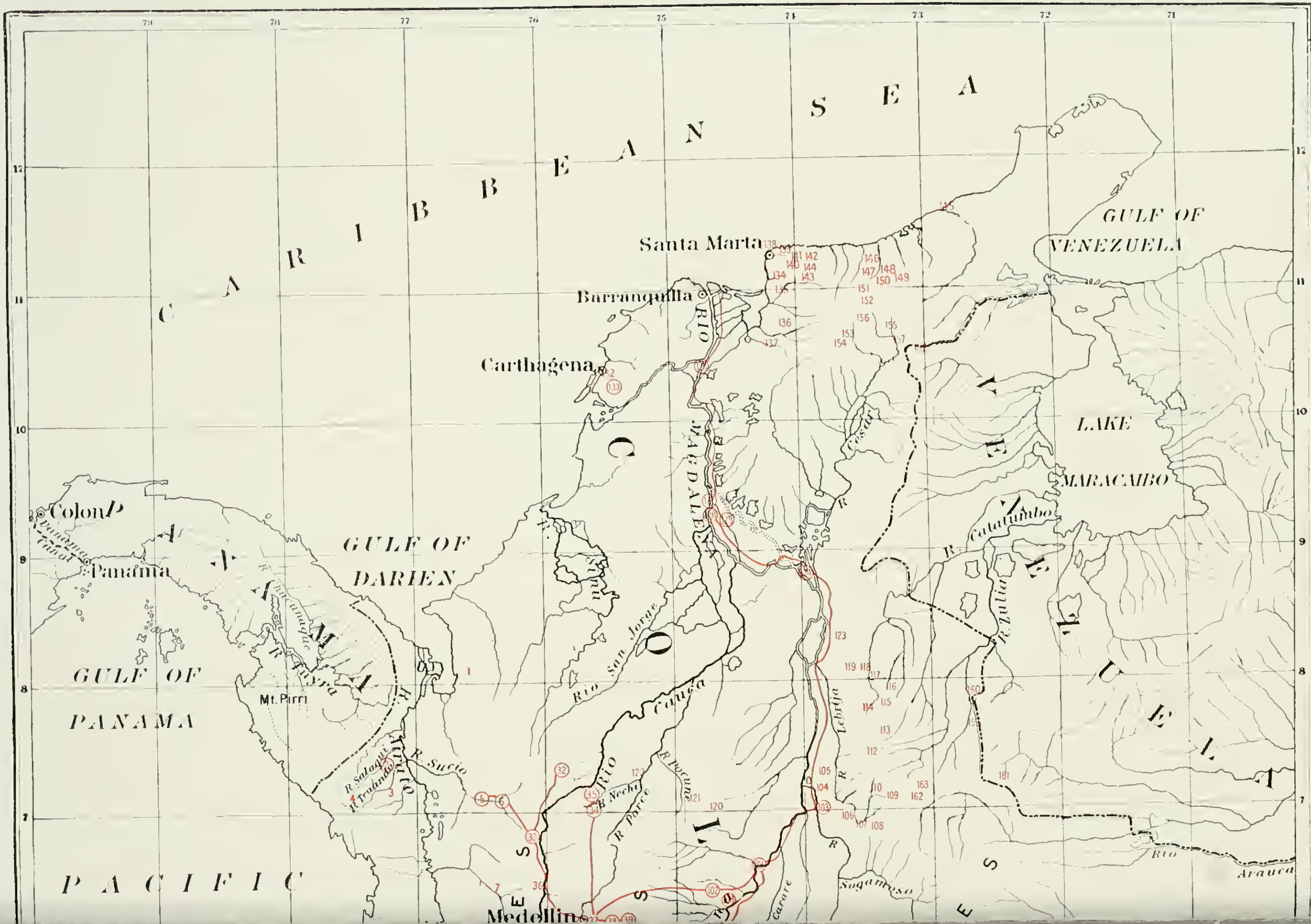
On the fourth expedition Miller and the writer were joined by J. T. Lloyd. The party proceeded from Cali up the Cauca Valley to Popayán and then crossed the central range by way of Almaguer and the pass over the paramo of the Valle de las Pappas to San Augustin. Here fever contracted in the Choco region so weakened the writer that he was compelled to set out for Bogota with Lloyd for medical treatment and thence to return to the United States.

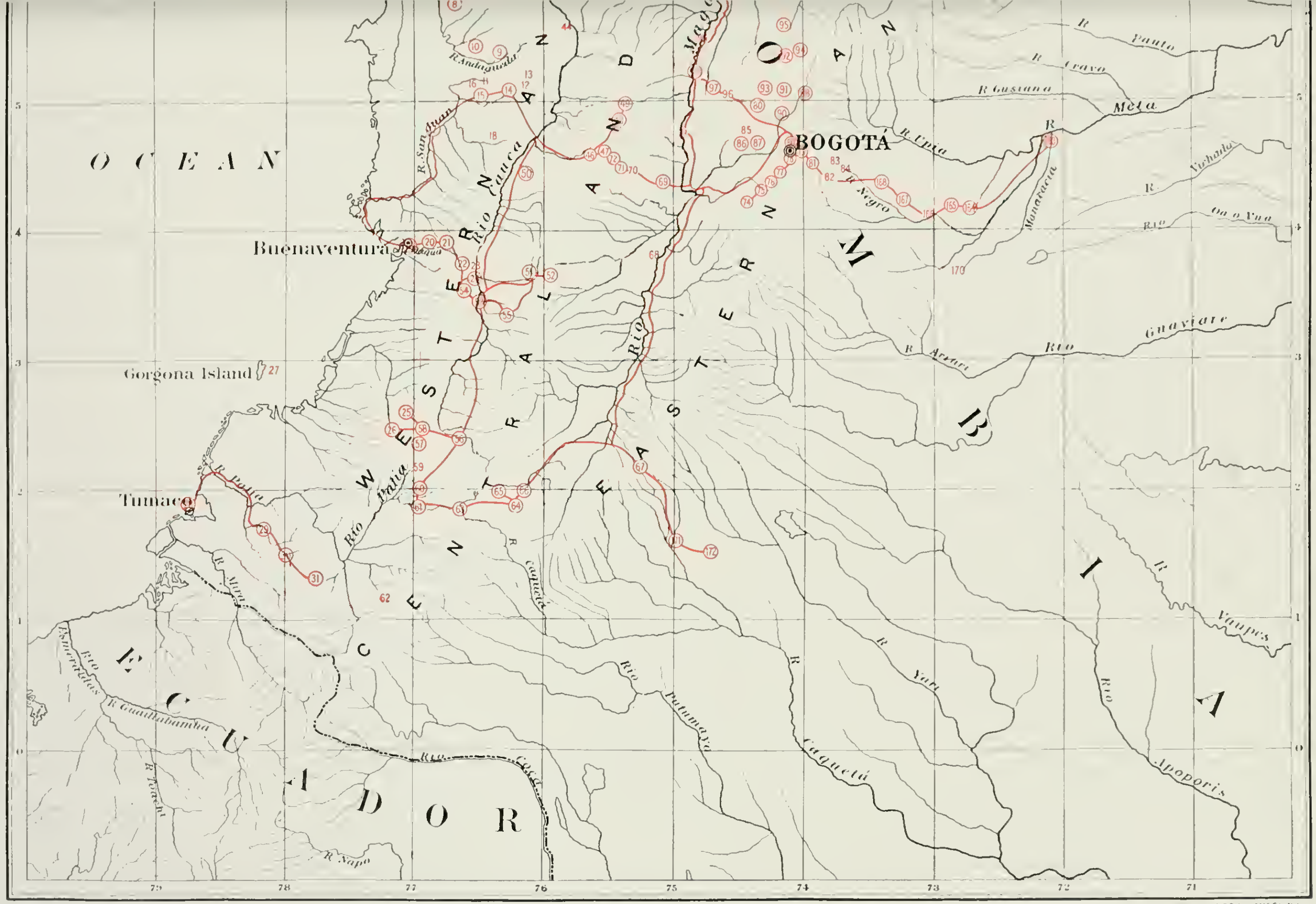
On the fifth expedition Miller proceeded from San Augustin with a native hunter into the Caquetá region, after first collecting near San Augustin where he found the black-headed finch and a nesting colony of the famous "cock-of-the-rock." Miller was the first ornithologist to enter Amazonian Colombia and he did so by crossing the eastern range on the new government road by way of Guadaloupe and Andalucia to Florencia and Morelia.

The sixth expedition was that of W. B. Richardson who explored the tropical Pa-

KEY TO COLOMBIAN COLLECTING STATIONS

Numbers enclosed in circles indicate collecting stations of the American Museum's expeditions; the lines connecting these stations show the routes followed. Lack of space prevents publication of the most interesting 15-page gazetteer which accompanies this map in the *Distribution of Bird-Life in Colombia*, describing briefly the locality at each of the more than 200 stations





ROUTES OF A ZOÖGEOGRAPHICAL INVESTIGATION OF COLOMBIA

The first aim of the Chapman expedition of the American Museum was to discover the boundaries of the zones and faunas in Colombia determined by temperature and other conditions and manifested by the distribution of birds. And Colombia was chosen for this zoögeographical investigation, first, because of its close connection with North America through the Isthmus of Panama, and, second, because of the great diversity in its climate and bird life cific fauna. He entered Colombia at the southern port of Tumaco and continued up the Patia River by steamer and canoe as far as Barbacoas and by trail to Ricaurte, seventy-five miles farther inland on the western slope of the western range.

The seventh expedition, led by Dr. Chapman, explored the Bogota plateau and crossed the eastern range, descending to Villavicencio on the llanos. With Dr. Chapman were L. A. Fuertes, G. K. Cherrie, P. G. Howes, G. O'Connell, and T. M. Ring. This was perhaps the most important expedition of all because it gave first hand information of the country whence have been shipped the thousands of bird skins without data, from which so many species have been described. The vast amount of skins shipped by dealers from Bogota, labeled only "Bogota," may have come from any one of four zones and three faunal areas. By means of the fresh specimens collected, Dr. Chapman was able, however, to locate the probable type localities of many species and to escape many pitfalls into which other ornithologists have fallen because of the faded condition of most "Bogota skins." One would not suppose that any species would escape the native hunters after so many years of intensive collecting and yet within six miles of the city in the Suba marshes Dr. Chapman himself discovered a new least bittern and a new yellow-headed blackbird and described a new marsh wren and a new flycatcher from specimens taken by Brother Apolinar, director of the museum of the Instituto de la Salle at Bogota.

The eighth and concluding expedition, composed of Leo Miller and Howarth Boyle, explored the northern end of the central range in the Antioquia region. They crossed the lower Cauca at Puerto Valdivia and worked in the headwaters of the Atrato River at Dabeiba and Alto Bonito. On this expedition, Miller and Boyle likewise explored the little-known Paramillo at the extreme northern end of the western range. Altogether 15,775 skins and valuable detailed data were collected by these various expeditions.[1]

In publishing this work on "The Distribution of Bird-Life in Colombia," Dr. Chapman lays the foundation upon which Colombian ornithology will be built. We cannot praise too highly the ability with which he laid his plans and the care with which he executed them. Those using the volume, whether scientists or laymen, will be delighted with the logical, convenient, and attractive treatment of this difficult subject.

In mentioning those who assisted in this monumental work, the writer believes that Dr. Chapman would feel that a serious omission had been made in this review if a conspicuous place were not given to his acknowledgments. We can, therefore, do no better than to quote some of his own generous words:

> We should indeed be lacking a sense of appreciation if we did not express our gratitude to the people of Colombia with whom at one time or another and in a thousand nameless ways, we have come in contact. From the peon by the wayside to the owners of haciendas one and all have shown us the most courteous attention.
>
> When traveling through remote, unsettled regions with a valuable outfit and often considerable sums of money, we have felt as safe (possibly safer!) as when in our own homes. When in camp or at hotels, country inns or *posadas*, we made no special provision for guarding our equipment and supplies; nevertheless, during the five years of our work we did not suffer the loss of a single item by theft. Indeed, on passing through a certain village where one of our party had previously worked, we were stopped by a native bringing a needle and thread which had been left behind!
>
> But especially do I desire, so far as mere words will permit, to pay a tribute to the men with whom it has been my privilege to be associated on our zoölogical explorations in Colombia: To William B. Richardson, Louis A. Fuertes, Leo E. Miller, Arthur A. Allen, George K. Cherrie, Paul G. Howes, Geoffroy O'Connell, Thomas M. Ring, and Howarth Boyle. To their untiring enthusiasm and whole-souled devotion to the American Museum's interests may be credited the most valuable collections of birds and mammals which have been brought from any part of South America.

The success of any great undertaking depends not only upon the strength of the leader but upon his ability to draw from his assistants the best that they have to give. In this particular Dr. Chapman has no peer, and what help he received from others is in large measure but a further tribute to himself.

[1] Dr. Chapman had access also to collections made by Mrs. Kerr in the Atrato drainage and Smith's collections in the Santa Marta region. From the standpoint of distribution, however, as before stated, the reports of previous ornithological expeditions, with few exceptions, are of little value. Salmon's collections in Antioquia about Medellin, reported on by Sclater and Salvin, are an exception as is also the collection of the Michler expedition in the Atrato, reported on by Cassin. Palmer's collections about Cali and in the Choco and Carriker's work in the Santa Marta region should also be mentioned.

A NEW MOUNTAIN PARRAKEET

About one half natural size

Fuertes' Parrakeet, *Hapalopsittaca fuertesi* (Chapman), a new species collected by one of the Chapman Expeditions at 10,340 feet elevation, near Quindio Pass, Cauca, Colombia.

Of the 1285 species, 61 families, described in Chapman's *Distribution of Bird-Life in Colombia*, all were collected by the Chapman Expeditions. These 1285 species of birds, with the exception of 45 North American migrants, are permanent residents of Colombia. Of this family of macaws, parrots, and parrakeets (Psittacidæ), there were 31 species collected, most of them living in low altitudes; 22 species in the Tropical Zone, 6 in the Subtropical, 2 including the new species in the Temperate, and none on the Paramo.

The new parrakeet (there were 7 specimens taken) was named in honor of the artist, Mr. Louis Agassiz Fuertes. The lower figure shows the plumage of the immature bird

NEW FINCHES OF COLOMBIA

One half natural size

Yellow-headed and black-headed finches (*Atlapetes flaviceps* Chapman and *Atlapetes fusco-olivaceus* Chapman) are two of the 22 species and 115 subspecies described as new to science in Chapman's *Distribution of Bird-Life in Colombia.* That so large a piece of systematic work on new forms was possible is owing in part to the very large collection brought together which allowed comparative study. The yellow-headed finch was found along the Rio Toché at an altitude of 6800 feet on the Quindio Trail of the Central Andes, and the black-headed species came from San Augustin, altitude 5000 feet, Huila, Colombia.

Of the family of finches(Fringillidæ), more than 60 species were collected in Colombia. The birds are distributed throughout the four life zones, but with a diminishing number of species as the altitude increases; namely, 35 species in the Tropical Zone, 17 Subtropical, 11 Temperate, and 2 Paramo

PORTRAITS OF FRUIT-EATING BIRDS OF COLOMBIA

About one quarter natural size

These toucans of Colombia were drawn in color by the artist of the expeditions, Mr. Louis Agassiz Fuertes, directly from the freshly collected specimens. The bird at the upper left corner is described by Dr Chapman as new. Twenty-three species of this family (Ramphastidæ) were collected by the Chapman Expeditions; 17 species among the 23 are characteristic of tropical Colombia, while 7 species belong in the Subtropical Zone, and one is found in the Temperate Zone. The birds whose portraits are shown live in the Tropical Zone except the upper two which are Subtropical.

The species above are as follows:

Andigena nigrirostris occidentalis Chapman
Ramphastos swainsoni Gould
Ramphastos citreolæmus Gould
Ramphastos culminatus Gould
Aulacorhynchus albivitta albivitta (Boiss)
Pteroglossus torquatus nuchalis Cabanis
Pteroglossus castanotis castanotis Gould
Pteroglossus pluricinctus Gould

TWO NEW ANT THRUSHES

One half natural size

The more evenly colored bird is Miller's antpitta (*Grallaria milleri* Chapman), named in honor of Mr. Leo E. Miller of the American Museum, and was found in the Temperate Zone at 10,300 feet, near Quindio Pass, Cauca, Colombia.

The lower bird is the second new species, Allen's antpitta (*Grallaria alleni* Chapman), a discovery made while the Chapman Expeditions were working in the Subtropical Zone at Salento, altitude 7000 feet, in the Central Andes. This species was named after Mr. Arthur A. Allen, of Cornell University.

Of the family of ant thrushes (Formicariidæ), the expeditions collected 83 per cent of the 124 species known in Colombia. These small active birds living in dense undergrowth are more difficult to study and collect than even the humming birds. The various members of the family are distributed throughout the four life zones, but with far the greatest number in the Tropical Zone; namely, 82 species, Tropical Zone, 17 Subtropical, 7 Temperate, and 1 Paramo

Hidden Wealth in British Guiana

By WILLIAM J. LAVARRE, JR.

ON the northern coast of South America lies British Guiana, topographically varied by rivers, jungles, mountains, and savannahs, each of which may some day furnish the world with products of much value. The rivers are capable of turning great electrical dynamos; the jungles contain vast quantities of lumber, and both jungles and mountains contain aluminum, to say nothing of other mineral probabilities; the savannahs can be converted into grazing lands for cattle, while the opening up of the railroad from Brazil to Georgetown and the dredging of the harbor of Georgetown, puts the colony into commercial relations with the outside world. Gold and diamonds are now being found in secluded places in British Guiana. Much gold has already been taken, and in the days to come valuable diamond deposits may be discovered.

The Mazaruni River rises in the central part of the colony, flows northwest around the Merume Mountains and then back northeast, emptying into the Essequibo at Bartica—where Kalacoon, the biological station of the New York Zoölogical Society, is located. This river affords the principal field for diamond exploitation. The region, which lies fifty miles from Bartica and extends one hundred miles farther into the interior, has been scantily prospected by a group of harum-scarum men locally termed "pork-knockers." They know no system in their prospecting, but move about here and there in the wake of such of their group as chance to make a discovery of any value.

As yet few deposits of any size have been located; the diamond-bearing gravel does not seem to run in mother lodes, but is scattered over the country in potholes. Only one mine has been established, and this, both because of the nature of the place and the primitive methods employed, has not proved a success.

Nevertheless, there is shipped to England each year a quantity of diamonds which are the direct result of the labors of these pork-knockers. The men go into the bush in small groups or alone, and scrape the gravel from the shallow creek beds, or perhaps dig one or two feet into the gravel banks of the forests if it seems profitable. They are a happy-go-lucky lot of men, of either Dutch and Indian or Negro lineage. They gather together at Bartica, the outermost point of

Not only is traveling up the rapids of the Mazaruni River very difficult, but the climate is humid, and malaria and black water fevers tax the endurance of prospectors and laborers. Provision boats (these are made of heavy greenheart wood) must be unloaded before they can be drawn through the rapids, while the provisions are carried around the rapids on land. Such scenes as this are typical of the jungle interiors almost anywhere in the Mazaruni District of British Guiana during the dry season civilization, and await the departure of some prospecting party that requires extra paddlers, or of the supply boat going to the numerous trading posts in the mining districts. These trading posts carry a supply of foodstuffs and gin (sad to say, mostly gin), which is sold in exchange for the diamonds of the pork-knockers. By these boats the men work their way into the diamond fields; serving as paddlers, and toiling all day long for several weeks, they reach their destination, having earned in addition one week's supply of rice, salt fish, salt pork, sugar, tea, and flour. They do not carry provisions with them from Bartica, but depend upon this supply to last them until they can unearth enough stones to pay for the next week's rations—and so on each week.

The one diamond mine established in British Guiana was equipped very little better than are the individual prospectors, or "pork-knockers." Enough gravel for two or three days' sorting was brought from the mine to the washing beds. A trough having strainers of different-sized mesh was used for the first rough sorting out of the coarser stones from the gravel, after which it was turned over to the jiggers. This mine has since been deserted, as working it without proper equipment proved a failure

Two steps in the process of separating the diamonds from the gravel.—The man at the right is swirling some gravel in his sieve to send the diamonds to the bottom. The other man is scooping out of his sieve the top layer of residue gravel from which the diamonds have been jigged to the lower layer. A careful jigger rarely loses a diamond from the mass of gravel

Their prospecting is begun most often in some shallow creek bed. Those who are more fortunate in the possession of implements may be able to make enough each week to pay for their provisions and leave a profit, but most of them make barely enough to buy their provisions, and often have to go into debt during many weeks before they make a find of any important size. Implements usually consist of an ax, shovel, pick, bucket, and a round sieve used for separating the diamonds from the gravel.

A party I once chanced upon was illustrative of the average group that one might meet in the bush. A negro (giant in size and clad only in a loin cloth) stood knee-deep in the creek and with a long-handled shovel filled the bucket with small gravel. The boy who held the bucket carried it to an old man (picturesquely gray-haired and with exceedingly large and knotted forearms) who did all of the "scientific part" of the work—that is, the jigging of the gravel in the round sieve. Diamond production depends largely upon the abilities of the jigger; if he be careful and know his work there will be no loss. This man was very careful and experienced; in fact, as I learned later, his ability was so marvelous that instead of making the diamonds go to the bottom center as he should have done, he often brought them to the top and picked them off for himself.

When I first saw him he was at work, stooping astride a pool about three feet across and two feet deep. By a series of calculated motions he attempted to form a centrifugal force which would serve to center the heaviest material in the bottom of the sieve, and as diamonds are the heaviest of the pebbles, they naturally are the first to respond to the movements. Where diamonds are found, there are likely to be also tin, carbon, and pulsite, mixed with quartz. These minerals are heaviest next to diamonds, and are therefore also sent to the bottom.

The sieve filled with gravel was lowered into the water and turned from left to right while kept in a level position. Then it was quickly lowered and raised in the water and shaken from side to side while being turned around. Finally, it was swung around while tilted. After a few minutes of such work, the man scooped up the top gravel and threw it away; then he added new gravel to that left in the sieve, and repeated the operation again and still again for an hour. By this time, there was left in the sieve only black carbon, brown pulsite, and a small center of tin, in which the diamonds, if any, were to be found. The sieve was now turned upside down on a piece of level canvas stretched out on the ground by means of pegs. From the middle of the overturned residue, he picked out a small but perfectly shaped diamond of one half carat. That stone I have with me today as a reminder of the first time I ever saw a diamond taken from the soil.

Diamonds are easily identified in the raw state by their peculiar sheen and shape, but if there is any doubt about the stones, the matter can be decided by subjecting them to pressure between two knives. Anything except a diamond can be crushed. In color they vary from white to pink, blue, yellow, green, and black. Their shapes range from spherical to flat, and include some nearly perfect diamond-shaped gems. A few stones which I saw were so perfect, both in shape and color, that it was difficult to believe they had not been cut and polished by machinery. The largest stone on record for this region weighed fourteen carats; it was found by a pork-knocker named London, who, because of his great size and strength and previous lawless acts, was feared by the other bushmen. At that time he was working for another man, and strange to say, contrary to the precedent set by his previous life, he turned the stone over to his employer. I chanced to meet him afterward in the interior and asked him how it came about that he did not keep the stone for himself. With an unlooked-for show of eloquence he said, "Give unto Cæsar what is Cæsar's, and unto God what is God's—anyway he be too beeg a stone for one feller-man to steal." His employer probably never would have seen the stone if it had been a mere five carats, but for once London had been scared into honesty.

The one mine that the colony had, the "Le Desire," was located in the alluvial deposits in an old bed of the Mazaruni, about two hundred miles within the forest. The river had changed its course since depositing this sixty-foot pile of diamond-bearing gravel, which with age had conglomerated, and on

After the gravel has been worked down to a very thin layer made up of a brown stone called pulsite, small particles of tin, pebbles of carbon, and any possible diamonds, the sieve and its contents are turned upside down on the sorting table. The biggest diamonds are usually found right on top in the middle of the heap. With the point of a knife, the sorters flip each pulsite, tin, and carbon pebble, one by one, from the mass, leaving the diamonds on the mat top of which giant trees had grown. For the working of the mine, the land was cleared of trees which later furnished the beams for the shafts. Water was encountered when the work had progressed twenty feet below ground and a diaphragm pump was used. In time, however, the water increased and made conditions so bad that the work had to be continued at another side.

The only difference between the process

British Guiana has already yielded gold-bearing material. The gold miners have a simple way of washing earth supposed to contain gold. The dirt is put into a shallow conical-shaped wooden bowl called a *batea*, which is then slewed about in the water with a circular sidewise motion. A bit of quicksilver in the apex of the cone mingles with the dirt and attaches to itself whatever small particles of gold are present; then, being heavier than the dirt, it sinks back to the bottom again. The earth is gradually washed away by the action of the water and the gold and quicksilver are left in the *batea*

of getting the diamonds from the gravel in the mine and the way in which the work is usually done by pork-knockers, was in the washing of the gravel in "long toms," and the employment of several jiggers instead of one. Of course there was also the advantage that came from good tools for the work.

The "long toms" were long troughs placed at the outlets of a dam in the creek. In each trough were inserted three sieves of different-sized mesh. The gravel was dumped into the upper end of the trough and washed down by the pressure of the water coming through from the dam above. The larger stones and gravel were kept back and thrown away. After passing through the "long tom," the gravel of uniform size fell into a rectangular flat sieve that was suspended by four chains from a scaffolding in such a way that the water in the pool below just covered the bottom of the sieve. A man stood in this water and shook the sieve (locally called a "baby") back and forth. This gave the finishing touches to the washing. Then the gravel was brought to jiggers, and they jigged it in large square boxes which had been filled with water after the seams had been stopped with rags and rubber.

This mine undoubtedly has some valuable material in it, but on account of the looseness of the gravel which causes cave-ins, and the presence of an excess of water, it has proved a failure as worked. Supplies had to be brought up the river from Georgetown, and as the river has many rapids and falls, much hauling and portage was necessary. The only pump that could be had in Georgetown was too small to serve the emergency at the mine, as it could draw up water only twenty feet, and the place has finally been deserted. The buildings by this time have probably disappeared, each board being carried away separately by passing pork-knockers, or by those who came especially to get them. Boards are scarce there, and it could not be hoped that such an unguarded supply would remain long.

These diamond gravels, however, are a valuable asset of British Guiana. Even by their primitive methods, the pork-knockers have enriched the colony by hundreds of dollars collected as royalties, and have put upon the market many fine gems, besides much bort or chips and small stones, used in British manufacturing plants where highly polished surfaces of steel are required. Labor is cheap in British Guiana, from forty-eight to seventy-two cents a day. The men are registered by the government for a period of one hundred and twenty working days and are forced by law to serve the full time.

Both diamond and gold-bearing material is here, to be profitably, if scientifically, explored and prospected, for this interior of jungle, savannah, and mountain represents one of the least known places of the world.

A New Edible Shad

By EMERSON STRINGHAM

Scientific Assistant, United States Bureau of Fisheries

POSSIBLY the cynics may find grist for their mill in this situation. The shad, which on the Atlantic coast is almost as much sought after as Kipling's "Old Man Kangaroo," is despised on the Mississippi River. It adds to the humor of the situation that an effort was made forty-five years ago to introduce the Atlantic coast shad to the great river. The inland fish is not identical with the coast species but it is so much like it that the two were confounded by scientists, and there are now specimens in the National Museum which were wrongly identified as the coast species. Because it was first scientifically described from Ohio River specimens, the fish is called Ohio shad (*Alosa ohiensis*). But it was taken in numbers from the Mississippi River at Keokuk, Iowa, in 1914 and 1915.

There are three forms living with the Ohio shad which may be confused with it. There is no occasion for confusing it with the gizzard shad or mud shad (*Dorosoma cepedianum*) which is found principally in quiet waters and has a very small mouth. The mooneyes are easily distinguished by the absence of sawlike scutes along the ventral edge. To distinguish the Ohio shad from the river herring (*Pomolobus chrysochloris*) requires more care. In general appearance the two fish are similar, but the herring has a protruding lower jaw, as shown in the illustration. By opening the mouth the gill arches may be seen and these are entirely different. The herring has from 30 to 54 rakers in the outer arch, and the raker at the angle of the arch is between one fifth and one twelfth as long as the head; the larger number and greater relative length are found only in young fish. The shad, of which only adults have been examined, has from 60 to 75 rakers in the outer arch, the one at the angle being about one quarter as long as the head. A third distinguishing feature is the color of the tip of the lower jaw, which in the herring is olive in life (blackish in preservative), while in the Ohio shad it is pink (straw color in preservative).

The describer of the fish, Dr. B. W. Evermann, stated that those who are familiar with the Atlantic shad find this one not at all inferior, and the present writer is able, from repeated trials, to concur in this opinion. Although eaten to some extent along the Ohio River, this fish seems never to be used on the Mississippi. Several people living in Keokuk were persuaded to try it and one restaurant served it for part of a day. But it was uniformly condemned because of its bones, although it is certainly no worse

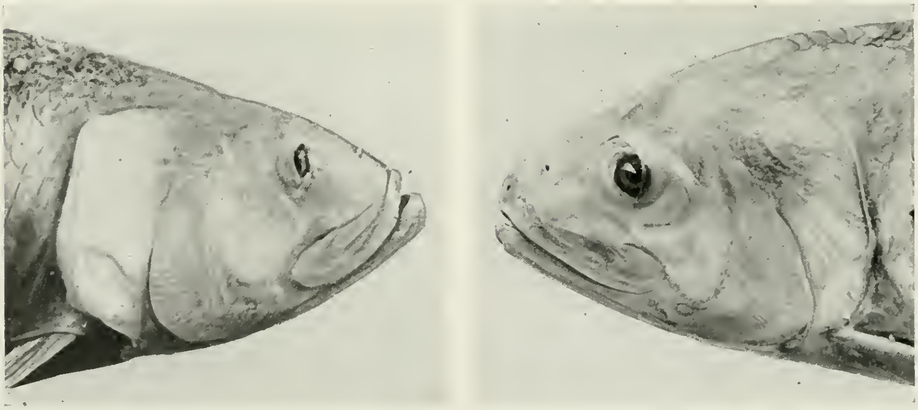
Catching the "Ohio shad" in a trammel net near the Keokuk dam on the Mississippi River. This shad, which reaches a length of nearly two feet and weighs from one to three pounds, is quite as palatable, either fresh or smoked, as the much prized Atlantic variety in that respect than any other shad. The smoked fish, however, was generally acknowledged to be delicious; bones are less troublesome in smoked fish. Another reason why the fish is neglected is that the fishermen confuse it with the river herring, which is an excessively thin and tasteless fish, so that anyone trying it would be likely to denounce the whole tribe.

During the course of an investigation of the relation to the fisheries of the huge dam and power plant at Keokuk, the opportunity to examine specimens of Ohio shad presented itself. They measured from 16 to almost 20 inches in length and weighed from 1 to 3 pounds. The structure of the mouth parts indicates that the food consists of buoyant organisms strained from the water. Stomachs of more than 150 were examined and most of them were wholly empty, but about 50 contained remains of hard parts of insects, or fragments of vegetation. A further indication that they do not feed regularly at this stage of their life is furnished by the fact that they are rarely, if ever, hooked by anglers. Examples are occasionally found in fyke nets, but the usual implement of capture is the drifted trammel net, which takes these incidentally. It seems that they swim near the surface although there is no quantitative evidence on the point.

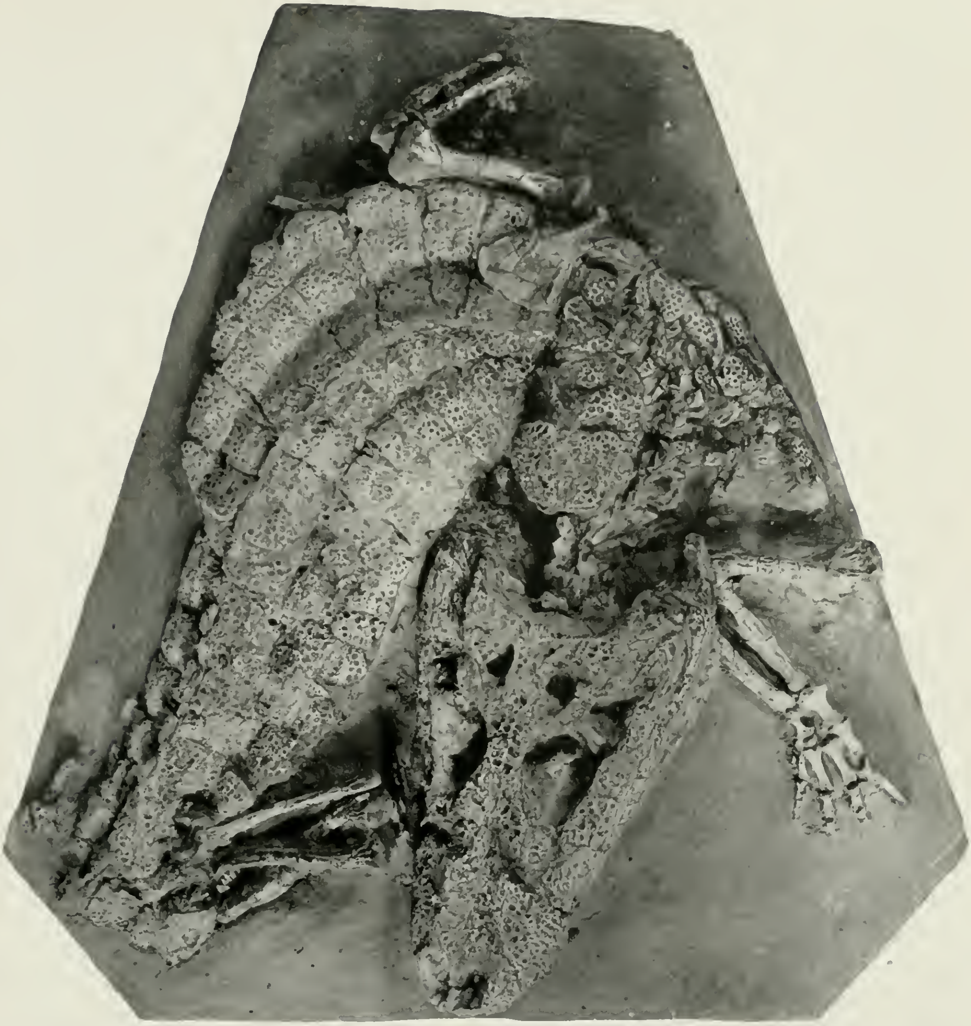
It has been assumed that the fish is anadromous, spending part of its life in salt water and part in fresh—principally because of its close relationship to known anadromous species. The most serious objection to this view is the fact that it is found so far from salt water. Observations made during 1915 and 1916 tend, however, to confirm the assumption that it passes down to the sea. In the former year it was present at Keokuk, about a thousand miles from the Gulf of Mexico, from the first of May to the middle of July, and at no other time. In 1916 it was a much rarer fish and was taken from the middle of May to the end of June. Among all examples dissected no spawned-out fish were found; the absence of spent fish is not surprising as Keokuk is the upper limit of migration since the building of the dam. Somewhat farther down the river it should be possible to get such fish. The spawning period appears to be early summer.

It is by no means certain that the Ohio shad is abundant enough to sustain a considerable fishery, but it is desirable that those which are taken should be utilized. The United States Bureau of Fisheries is planning propagation on the Ohio River where they are now used.

If a market of any extent develops, it is to be expected that other fishes will be sold as Ohio shad. The mooneyes are themselves good eating; the other possible substitutes should not be sold at shad prices. A reasonably safe rule for the inexperienced purchaser is to accept only fish weighing one and a half pounds or more, as the four other kinds rarely attain this weight and the adult shad nearly always exceeds it.



The river herring (left), a thin and tasteless fish, is caught in the nets with the Ohio shad (right) and is confused with it in the market. The shad is quickly distinguished, however, by its short lower jaw, as well as by the greater number of gill rakers. This confusion is probably one explanation of neglect to utilize this excellent food fish of the Ohio and Mississippi rivers



An unusually perfect skeleton of an alligator discovered by Mr. H. F. Wells some years ago in the Tertiary formation of the Big Bad Lands in South Dakota and only recently extracted at the American Museum from the rock in which it had lain imbedded so many thousands of years. Alligators are found at present only in southern United States, Mexico, and China. Very little has hitherto been known as to their geological history. This is a rather small specimen, probably not full grown. The lower jaw measures 9½ inches in length

A Tertiary Alligator

CROCODILES have narrow and triangular skulls with a notch on each side into which fits the large fourth tooth of the lower jaw. In the alligators and caymans the head is broader and flatter and the notch is lacking, the lower tusk fitting into a socket in the upper jaw. Crocodiles are found in nearly all tropical countries, but alligators only in the southern United States, Mexico, and China, and caymans in South and Central America.

Numerous fossil crocodiles have been found in the Tertiary and older formations of various parts of the world, but hitherto nothing has been known about the geological history of the alligator. One of the American Museum expeditions of 1916 found remains of a true alligator in the later Tertiary of Nebraska, and a fine specimen here figured from the middle Tertiary of the Big Bad Lands of South Dakota also proves to belong to this genus; although in some respects it is intermediate between modern crocodiles and alligators. It thus appears that there were true alligators in North America as early as the beginning of the Oligocene epoch. Many skulls of crocodilians from the older Tertiaries of this country have been found, but so far as known there were no alligators among them; most of them were true crocodiles but there were at least two peculiar extinct genera.

It seems probable, therefore, that the alligator invaded this country at the beginning of the Oligocene or middle Tertiary along with the numerous kinds of mammalian quadrupeds that suddenly appeared at that time. Where they came from is not so certain; perhaps from the northern parts of North America, but probably ultimately from some part of central or northern Asia. The earlier ancestry of the alligator is one of the many problems for the solution of which we may look to explorations in China and Central Asia after the war has come to an end.

The specimen here figured was collected by Mr. H. F. Wells in the Big Bad Lands some years ago, but has not until now been extracted from the matrix. It is an unusually perfect skeleton, although lacking the tail, and is probably the same species as the "*Crocodilus*" *prenasalis* described by Dr. Loomis [1] in 1904, from a part of the muzzle and other fragments.—W. D. M.

[1] Two New Reptiles from the Titanothere Beds, by F. B. Loomis, *American Journal of Science*, 4th series, Vol. XVIII, Dec., 1904, pp. 427–432.

Charles Rochester Eastman (1868-1918)

DR. EASTMAN was associated with the American Museum since 1915, and under his learned editorship there appeared from the Museum press two volumes dealing with the literature of fishes which included the collation and revision of about fifty thousand titles,—a labor the patient magnitude of which cannot be measured readily. For the accomplishment of this task Dr. Eastman brought into play an extraordinary range of attainments: he had had the training of Harvard, had studied at Johns Hopkins, and had taken the degree of doctor in philosophy at Munich; he was a gifted linguist (our references deal with about eighteen languages); he was an accomplished ichthyologist, familiar with the literature of the fishes through years of research; and, possibly best of all for our purpose, he was a devoted bibliophile, which enabled him patiently to consider the ways and means of obtaining out-of-the-way references to make our series complete. In fact, in this regard, he had for our particular subject the zest of the amateur who captures a rare specimen, or of a collector of paintings who discovers under concealing varnish the name of an early master. For this labor, then, the thanks of students of fishes will ever be given to Dr. Eastman.

As an ichthyologist, Dr. Eastman had devoted himself since 1893 to the study of the older groups; and to our knowledge of fossil fishes from all horizons, he contributed about one hundred papers. His first publication dealt with certain sharks of chalk times. This led him to trace back the earliest sharks, especially those of the Devonian age, and these in turn introduced to his critical eye a group of contemporary fishes known as "placoderms," whose forms and relationships have ever been puzzles to students. By some they have been recorded as masquerading sharks, by others as highly modified lung fishes, by still others as curious offshoots of a race of fishes older and more primitive even than sharks. Dr. Eastman studied the remains of these early placoderms with the greatest zeal and skill. He examined collections from all parts of the world; he described new forms and he traced their kinships, root and branch. His keen eye associated the tattered bits of these earliest creatures and presented them to us almost as living fishes. His skill in this interpretation was almost uncanny, and students of fossil fishes will ever appreciate his clear descriptions and the light which he cast upon the tangled kinships.

His work also as a reviewer and memorialist should be mentioned. He had a distinctly literary gift and his work appeared in a form and with a finish by no means common in science. As a teacher he was precise, although his main service in this field was less to individual students than to those he helped by his translation of the work of his old preceptor, Professor Karl von Zittel.

During the last decade Dr. Eastman gave his attention largely to the history of the recent fishes. He had been the means of bringing to the Carnegie Museum a remarkable collection of these forms from Monte Bolca, and during his sojourn in Pittsburgh he published a descriptive catalogue of them together with various special memoirs. So too in his last years he gave free rein to his love for Greek and Roman literature. He was a constant reader of the natural history of the ancients and was probably better informed in this field than any living author.

Dr. Eastman's death was a tragic one. Anxious to help in the war, he had relinquished his work in the American Museum and had associated himself with the War Trade Board in Washington. Here he had worked assiduously for several months. He returned to New York for a brief rest, was attacked by the present epidemic of influenza, and had gone to Long Beach hoping for a speedy recovery. On the evening of his arrival, September 27, although suffering with fever, he left the hotel to take the air on the board walk. So far as can be ascertained he wandered away from the lighted part of the walk and fell either from the edge of the walk where the rail was broken, or between loosened boards. The sea was rough and at that hour the tide extended well beyond this dilapidated end of the walk, so that in the fall it appears that he was stunned and carried out in the surf. It had been the hope of Dr. Eastman, as well as of the authorities in the Museum, that at the conclusion of his work for the United States Government, he would return to the Museum and take in charge the editing of the index volume of the *Bibliography* to which he had given the last three years of his life.—BASHFORD DEAN.

Minerals That Are Helping to Win the War

(*An Exhibit in the Hall of Minerals at the American Museum*)

THOSE of us who are constrained to view the amazing spectacle of the World War from this side of the Atlantic are increasingly conscious of the far-reaching effect of this supreme struggle upon every phase of industry and production. New and vital problems along many lines present themselves for solution almost daily.

In few phases of the question of production are the conditions more pressing than in that which concerns the supply of raw materials for the manufacture of munitions of war. The term "war minerals" has recently been applied to the ores which produce the metals used in the making of ammunition, ordnance, armor plate, special forgings for motor parts, as well as those essential to the production of tools and apparatus.

These basic elements of our war machinery are featured in a series of war minerals and their products just put on exhibition in the hall of minerals at the American Museum. So far as possible this series aims to visualize the steps in the development of war munitions, from the ore to the finished product, and to emphasize the need of establishing an adequate domestic source of supply of ores of the rarer metals, such as mercury, nickel, manganese, chromium, tungsten, vanadium, and molybdenum.

Under each group of ores and products in the exhibit the application of the given metal or mineral to its specific war industry is indicated, as in the case of molybdenum steel, used in the inner tubes of large guns, which "resists the erosion of the gases developed by smokeless powder."

Small maps displayed with each mineral in the exhibit show the occurrence of the ores in the United States, and are accompanied by statements of the principal sources of the world's supply prior to the war. Specimens of the foreign ores and of the occurrences which might, under favorable circumstances, be developed in this country, emphasize the vital need as well as the possibilities of domestic production.

It is in the display of the finished products of the war industries, however, that the exhibit makes its distinct appeal to the public. Through the courtesy of a number of prominent manufacturing firms, material has been made available which shows how minerals, and metals extracted from minerals, are being turned into the tools of our fighting Army and Navy. In this way one may see the sectional barrel of that very efficient eliminator of submarines, the three-inch naval gun, with its lining of molybdenum steel, designed to resist the corrosive action of smokeless powder, or can trace the application of mercury from cinnabar, its ore, to the primers charged with fulminate of mercury which explode the hand and rifle grenades now being used to push forward our fighting line in France and Alsace.

One of the most complete series in the exhibit is that which shows the many stages in the manufacture of the nickel-jacketed bullets which are now being dispatched, millions in number, from the rifles, machine guns, and revolvers of our Army and of those of the Allies. These are assembled in a number of mounts which show, step by step, the evolution of a cartridge from a meaningless bit of metal to the smooth, slender-pointed engine of war. A significant detail in the manufacture of the .303 caliber cartridge used in the Lee-Enfield rifles of the British Army, is the little "U. S." which is stamped on the lead insert of the bullet before it is assembled in the shell.

On the whole, the "war minerals exhibit" has already proved its popularity, judging from the numbers of both soldiers and civilians that have been attracted by it, and it is to be hoped that it will have considerable influence in bringing to the front of public interest a phase of our war production which is of primary importance in this period of more than usually important things.—HERBERT P. WHITLOCK.

Notes

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

Life Members, MESDAMES GEORGE E. CHISHOLM, PHOEBE A. HEARST, LINDA V. MALLINSON, AUGUST R. MEYER, MORTON F. PLANT, BENJAMIN STRONG, JR., MISS ALTHEA R. SHERMAN, DR. ALEXANDER HAMILTON RICE, THE HON. ROBERT WORTH BINGHAM, THE HON. A. BARTON HEPBURN, MESSRS. C. F. AHLSTROM, D. NEWTON BARNEY, M. L. BYERS, FULLER E. CALLAWAY, HAMILTON CARHARTT, R. T. CRANE, JR., JOHN T. DAVIS, GEO. W. HOADLEY, R. L. IRELAND, FRANK J. MYERS, HERMAN ARMOUR NICHOLS, HENRY D. SHARPE, E. A. CAPPELEN SMITH, WILLIAM C. SQUIER, 3D, and A. F. TROESCHER.

Sustaining Members, MESDAMES S. S. MERRILL, GEORGINE HOLMES THOMAS, MESSRS. WALTER B. CONGDON, R. D. BENSON, JESSE H. JONES, GEO. A. MCKINLOCK, and C. J. ULMANN.

Annual Members, MESDAMES SAMUEL W. ALLERTON, CAROLINE S. CHOATE, CHARLES M. CLARK, CEASAR CONE, A. P. L. DULL, R. M. GALLAWAY, J. W. GATES, ARTHUR LEE, JOHN MARKLE, GIFFORD PINCHOT, ROBERT W. SAYLES, VICTOR MORRIS TYLER, MISSES VIRGINIA SCOTT HOYT, MARIE C. JERMAIN, ETTA LASKER, GEN. J. FRED PIERSON, THE REV. IRVING C. GAYLORD, THE REV. ARTHUR R. GRAY, DR. SVEN GERTZON, MESSRS. ERASTUS W. BULKLEY, HARRY CHANNON, JOHN S. ELLSWORTH, ANDERSON GRATZ, LEONARD HARRISON, SAMUEL HIRD, FRANK E. HOADLEY, GEO. A. KUHIRT, MAXWELL LESTER, HOUSTON LOWE, RUSSELL W. MOORE, ADELBERT MOOT, W. H. MULLINS, WILLIAM T. NOONAN, JAMES M. PRENDERGAST, AARON B. SALANT, HANS SCHMIDT, JAMES R. STRONG, THEO. F. THIEME, EDWIN J. TREFRY, PHILIP V. R. VAN WYCK, ALBERT B. WIEMANN, and MASTER DEAN HAWLEY HOLDEN.

Associate Members, MESDAMES T. P. BURGESS, WILLIAM C. MCGOWAN, PROFESSORS JOHN M. BURNAM, JAMES HARDY DILLARD, CHARLES H. O'DONOGHUE, THE HON.

D. H. Beyea, Lieut. Col. Frank T. Woodbury, Messrs. Russell M. Bennett, Robert D. Carson, Percival W. A. Fitzsimmons, Lloyd Hemingway, Morton C. Kahn, John T. Pirie, F. A. Purdy, and Ernest Windle.

Dr. James Douglas, a trustee and benefactor of the American Museum of Natural History since its organization in 1869, died at his home in New York City on June 25, 1918, in his eighty-first year. By the terms of his will, dated December 4, 1917, the sum of $100,000 was bequeathed to the American Museum. Dr. Douglas was for many years rated as one of the foremost metal and mining authorities of the world. He was born in Quebec, Canada, and received his education at Queen's University, Kingston, and at the University of Edinburgh. For his work in the field of hydrometallurgy, in which he was associated with Dr. T. Sterry Hunt, famous for his copper research, McGill University, Montreal, awarded him the degree of Doctor of Laws. After some years spent in giving instruction he resigned the professorship in chemistry which he held in Morrin College, Quebec, to become a mining engineer, and in 1875 came to Phœnixville, Pennsylvania, where he took charge of a copper plant. Later he became identified with the copper industry of Arizona, New Mexico, and Sonora, Mexico, as well as with the railroads, and together with his early associates in business, the late William E. Dodge and the late D. Willis James, was largely responsible for the development of that region. He was president of the Copper Queen Consolidated Mining Company, one of the largest copper producing companies of the country, and also of the El Paso and Southern Railroad and allied lines. In addition, Dr. Douglas was a historian and writer of note and a philanthropist. His writings include *Canadian Independence, Imperial Federation and Annexation, Old France in the New World*, and *New England and New France—Contrasts and Parallels in Colonial History*, besides numerous technical articles relating to minerals and mining. He was prominent in many organizations, including the American Institute of Mining Engineers, of which he was president twice, the American Philosophical Society, the American Geographical Society, and the Society of Arts of London.

In honor of Mr. Joseph H. Choate, Professor Henry Fairfield Osborn has prepared a memorial volume, which contains an account of Mr. Choate's connection with the American Museum from 1869 to 1917. An address which he delivered in 1874, giving a *résumé* of the history of the Museum, is included, and the volume closes with his last paper on the same subject, which was published in the American Museum Journal for May, 1917. Copies of the memorial have been distributed to the following persons and institutions: Mrs. Joseph H. Choate; Messrs. J. P. Morgan; Frederick F. Brewster; Thomas De Witt Cuyler; Viscount James Bryce; the Library of Congress; Salem Public Library; the Harvard Club; the Association of the Bar, New York City; the Metropolitan Museum of Art; and the trustees and library of the American Museum.

As all available space in the new National Museum at Washington is occupied at present by the Bureau of War Risk Insurance, the building has been closed to the public by the board of regents. It will be reopened when the new office building of the bureau, at Vermont Avenue and H Street, is ready for occupancy.

President Wilson has authorized a loan of one million dollars from the special defense fund placed by Congress at his disposal to the Forest Service for fire-fighting expenses, in recognition of the fact that protection of the national forests is an important and essential war activity. Early drouth, high winds, electrical storms, and depletion of the regular protective force as a result of the war, have combined to make the present fire season in the Northwest the most serious with which the Government has ever had to cope.

On Bastille Day, July 14, in commemoration of the national holiday of the French Republic, the French flag was raised at the American Museum of Natural History, and a cablegram was sent by President Henry Fairfield Osborn to Paris, carrying the greetings of the staff of the American Museum to their scientific colleagues in the ancient Muséum National d'Histoire Naturelle, an institution which entered a period of great achievement following the first Bastille Day. An immediate response from the director of the Muséum d'Histoire Naturelle brought a return message of cordial greeting with an expressed hope for early victory to the Allied nations.

Major Frank M. Chapman, who has lately been director of publications for the American National Red Cross at Washington, D. C., has been appointed Red Cross commissioner to Latin American republics. He leaves for South America in October.

Not for a hundred years will there again be a solar eclipse like that of the summer of 1918 when the shadow passed across the whole United States from Washington to Florida. The war prevented expeditions from abroad, but from our own country expeditions from Lick, Mount Wilson, Yerkes, Naval, and other observatories, as well as from the Smithsonian Institution and the United States Weather Bureau, were sent to the Northwest where opportunity for observation was greatest. Dr. W. W. Campbell, director of Lick Observatory, whose interesting account has appeared in many publications, made observations and obtained photographs at Goldendale, Washington, exactly on the middle line of the path of the eclipse.

Sergeant Charles A. Connolly met his death while fighting for the cause of the Allies at Château-Thierry. He was twenty-five years old, one of three sons employed at the American Museum and all called into Army service early in the present conflict. As a member of the old 69th regiment of the National Guard of New York, he had been in active service on the Mexican border

The American Museum service roll of the war now numbers sixty-five names. These include the men who are actively engaged in the Army, Navy, and aviation service, and also those in the Red Cross and scientific divisions. Lieutenant H. E. Anthony, after about three months in France with his company of field artillery, was ready to go into action, when he received orders from headquarters to return to the United States to drill troops for the front. The order carried with it a promotion to the rank of captain. He is at Camp Lewis, Washington. Lieutenant Leo E. Miller is now chief observer in aviation and has been transferred to Camp Jackson, South Carolina. Lieutenant James P. Chapin is employed in the south of France as billeting officer, covering the ground on a motor cycle or in a Ford car. Mr. C. H. Rogers is now a sergeant in physical training at Camp Meade, Maryland. Mr. Howarth Boyle was one of twenty to volunteer from Naval Base Hospital No. 1 for first aid work in the trenches. Many of the boys have had their baptism of fire, having been in and out of the trenches many times. Private Chris Schroth was the first to be wounded, losing two fingers in his third trip "over the top." Private Albert J. Kelly was wounded with shrapnel. Both are now ready for action again. Private Benjamin Connolly has received the rank of corporal since he went across a few months ago. Sergeant Charles A. Connolly, of the old 69th regiment of New York, formerly an attendant in the Museum, lost his life in the heavy fighting of the Americans during the last part of July.

The "Museum Letter," issued by the publicity department of the American Museum under the direction of Mr. George N. Pindar, is designed to keep the boys in service in touch with the happenings "at home," and also to give them news concerning one another.

The American Ornithologists' Union will hold its thirty-sixth stated meeting at the American Museum of Natural History, November 12–14, 1918. A business meeting of the Fellows and Members will take place on the evening of the 11th.

The Journal is particularly glad to publish in this October issue the paper on the history of the American Ornithologists' Union. This organization may almost be looked upon as one of the collateral branches of the American Museum, having been born in the Museum in 1883, having drawn one fourth of all its officers from the Museum's staff, and having held one third of all its meetings within the Museum's walls. The thirty-sixth annual meeting of the Union will mark the twelfth to be held in the American Museum.

Dr. Clark Wissler, curator of anthropology at the American Museum, spent July as the guest of Dr. W. T. Mills, state archæologist of Ohio, who is making an archæological survey of the famous Flint Ridge district between Columbus and Zanesville. Flint Ridge is an outcrop of flint-bearing limestone extending east and west for ten or more miles. The entire surface of the ridge is covered with pits dug by prehistoric miners while searching for flint suitable for making implements. This is one of the most remarkable prehistoric flint workings known in America and perhaps in the world. Adjacent to the ridge are large accumulations of flint chips or fragments, struck off from larger pieces in the shaping of arrowheads or other articles. These deposits in some cases reach a depth of fifteen feet and the material is now being utilized for road building in the vicinity. Scattered along the small streams whose sources lie in Flint Ridge, broken stone implements made of flint taken from the pits on the ridge, together with fragments of pottery and bone, mark former Indian village and camp sites.

Dr. Wissler was occupied during the remainder of the summer in a reconnaissance of southeastern Indiana, with a view to determining how far westward the Ohio mound area extends, in order to supplement the very full and accurate map of mounds and earthworks which Dr. Mills has prepared for the state of Ohio. For this purpose all the counties of southeastern Indiana were visited and the situation and character of the earthworks mapped. A number of very important sites were located for future exploration by the Museum.

The present year has been a period of great activity in wooden ship building. In May, according to the report of the United States Shipping Board, an average of one ship a day was launched. During the first seventeen days of that month 60,000 tons were added to the American merchant marine. On a record-breaking day four launchings were reported, totaling 14,500 tons. On the Fourth of July, fifty-two ships were launched throughout the United States. For the most part these wooden ships are built of fir or part fir, and more than one half of the total number launched are produced by the shipyards of Oregon and Washington.

A third edition of *Men of the Old Stone Age*, by Henry Fairfield Osborn, was issued from the press of Charles Scribner's Sons on September 13. This edition, which is in less expensive form than the others, brings the whole issue above the ten thousand mark. The new volume includes additional illustrations and appendixes bearing upon palæolithic implements of northern Africa and Spain. Arrangements have been made by the same publishers to bring out an edition in French of Professor Osborn's work on *The Origin and Evolution of Life*.

Captain Ralph Sanger, of the American aviation service, met his death the latter part of September in a flying accident in France. A cable to Mitchel Field, Mineola, indicates that the accident occurred in a training field many miles behind the lines. Captain Sanger was a son-in-law of President Henry Fairfield Osborn of the American Museum. He was graduated from Harvard University in 1904. After war was declared he went to Plattsburg and received a commission as captain of infantry. Later he was sent to the aviation camp at Dallas, Texas, where he showed peculiar adaptability for air service, so that when he was transferred to Mitchel Field he was recognized as one of the most promising aviation commanders in America. Captain Sanger's wife, who was Miss Virginia Sturges Osborn, is serving as a nurse in France.

Dr. Thorild Wulff, Swedish botanist and geologist, after accomplishing a valuable piece of scientific work along the coast of northwest Greenland in the spring of 1917, died on the homeward trip. It is reported that he continued work to the last, dictating to his companion, Lauge Koch, a survey of the vegetation about Peabody Bay. The party, which was under the leadership of Mr.

Underwood and Underwood

Captain H. E. Anthony last spring accompanied the 309th F. A. regiment to France as First Lieutenant. After three months, there came promotion to a captaincy with the order to return to the United States to drill and take across a new company. Captain Anthony is now at Fort Lewis, Washington, training a company of field artillery for service at the front

Knud Rasmussen, left North Star Bay early in April, 1917, traveled to Peary Land, and returned across the Greenland ice cap. By the time De Long's Fjord was reached, game gave out and the men were obliged to retrace their steps. They suffered incredible hardships on the way back, and at Cape Agassiz, Rasmussen and one of the Eskimos started on ahead on a forced march for aid, while the others followed slowly. After a few days' travel without food, Dr. Wulff weakened and died. In the fall, Peter Freuchen, the Danish factor at North Star Bay, made an unsuccessful attempt to recover the body.

Despite the general policy of the American Museum to suspend field work until the close of the war, it has been deemed expedient to continue certain explorations. Two expeditions have been sent to China: The Second Asiatic Zoölogical Expedition, in charge of Mr. Roy C. Andrews of the department of mammalogy, sailed on June 22, and plans to supplement the work of the Asiatic Zoölogical Expedition of 1916–1917, if possible penetrating farther into the interior; The Third Asiatic Zoölogical Expedition, under the leadership of Mr. Paul J. Rainey, accompanied by Mr. Edmund Heller as naturalist, left San Francisco on July 27, its purpose being to collect large game animals in the Far East. In Aztec, New Mexico, Mr. Earl H. Morris, assisted by Mr. B. T. B. Hyde, has continued the excavation of the Indian ruins, which are yielding important collections and historic data.

The department of vertebrate palæontology of the American Museum has lately added to its study collection, through the gift of Mr. Warren Delano, of New York, the skull and vertebral column of a colt which is a cross between an Arabian steed and a Norwegian horse. Whether the Arabian type, with its five lumbar vertebræ as contrasted with the six lumbar vertebræ of the commoner species, would be perpetuated by such a crossing of species, or whether the reverse would be true, is the question which interests scientists. The present specimen shows both influences. It follows the Arabian type in having but twenty-three dorsal-lumbar vertebræ instead of twenty-four as in the common horse, but to the last of the dorsal vertebræ there are attached, instead of true ribs, the transverse processes of lumbar vertebræ articulated like ribs and having on one side, not directly joined to the process, a little abortive rib. Technically, however, the possession of the correct number of vertebræ seems to place the specimen with the Arabian species.

In June and July Dr. C.-E. A. Winslow, of the American Museum, was in charge of the courses in bacteriology and hygiene at the Vassar College Training Camp for Nurses, where four hundred college graduates received the theoretical part of their training for service in the emergency created by the war. In August he gave an intensive course in industrial hygiene at the Massachusetts Institute of Technology. As chairman of a committee appointed by the Committee on Higher Education and Special Training he was in charge of the work of preparing the official syllabus for instruction in hygiene and sanitation to be offered to the enlisted men in the Students' Army Training Corps at four hundred colleges this fall.

Professor Henry Shaler Williams, dean of Cornell University, died at Havana on August 14. Professor Williams was well known both for his scientific attainments and for his kindliness and nobility of character. He was born in Ithaca, New York, on March 6, 1847. In 1868 he was graduated from Yale University, where later, after specializing in geology, palæontology, and biology, he received the degree of Ph.D. Preferring scientific work to a business career, he began teaching at Kentucky University, but was soon called to Cornell University, of which he became dean after a few years. While in this position he founded the honorary society of Sigma Chi, which is now the highest goal of scientific students in American colleges. By request of James D. Dana, who was retiring from the position, he accepted in 1892 the Silliman professorship of geology at Yale. There he edited the *American Journal of Science* and published numerous books on scientific subjects. For many years he was closely associated with Major Powell, Charles D. Wolcott, and T. W. Vaughan in investigations for the United States Geological Survey. He made special studies of the Devonian and Silurian periods both in this country and in Europe. From 1904 to 1912 he was again at Cornell, in charge of the geological department, but was chiefly engaged in scientific research. His surveys in Cuba from 1913 on have resulted in the starting of oil developments in western Havana and the eastern Pinar del Rio provinces. He was a member of many scientific societies in America and England. Among his many publications his *Geological Biology* has been a great stimulus to geological thought of later years.

Dr. Frank M. Chapman, author of *The Distribution of Bird-Life in Colombia*, has been highly complimented by reviewers on

Major Barrington Moore, associate curator of woods and forestry at the American Museum, is at present in France assisting with the work of the *Comité interallié des Bois de Guerre*, which acquires and delivers to the Allies the timber needed in the conduct of the war. (See p. 415 for further notice of his work) the quick completion and publication of the work. As Dr. Witmer Stone says in *The Auk*, "We realize at once that it is the most important contribution ever made to the subject of which it treats, but we further recognize in it the completion of a definite plan, clearly conceived and carefully carried out—an accomplishment that must be as much of a gratification to the author as it is to those who consult the volume. Too often, especially in America, important explorations have been made and extensive collections obtained which through force of circumstances remain unreported. . . ."

The four species of South American birds reproduced in color in this number and described as new by Dr. Chapman are of particular interest because so distinctly different from species of North America. The toucans are the strangest of all the strange birds of Colombia, their huge bills serving as arms to reach fruits borne on branches not strong enough to bear the weight of the birds. Their bright colors, often in conflicting shades, are carried to the extreme on their enormous bills. That the color patterns of these birds look to us much like today's experiments in ship *camouflage* gives interest to Dr. Arthur A. Allen's statement that the species are difficult to see in the forest despite their conspicuous colors. Antpittas have been called "bobtailed robins," and the lower bird especially, of the two shown in the color plate, will remind the citizen of the United States of a young American robin. Antpittas are not well known to the citizens of South America, however. They are likely to escape the observation of even the native collectors, because so well concealed in their habitat, the moss-grown vegetation of the jungle floor. Fuertes' parrakeet lives in small flocks in the tree tops. Like other parrots, these birds seem to be mated for life, and in flight pairs always keep together. The finches of South America have habits similar to those of our chewinks or towhees.

A hospital for birds is a new departure, but one that seems eminently worth while in view of the results achieved by Dr. W. W. Arnold at Colorado Springs, as described in a summer number of *Bird Lore*. Dr. Arnold first became interested in treating wounded birds when a little girl brought to him a nighthawk and tearfully asked if he could not make it well just as he did the broken arms of little boys and girls. In a commodious aviary he constantly provides for from twenty-five to thirty feathered patients, disabled by contact with telephone wires or by other accidents which befall them in their migrations across country. While ministering to their needs he becomes acquainted with many unsuspected bird traits.

Armand Thevenin, a French palæontologist, died on March 7 from the effects of poisonous gases with which he was experimenting in connection with the war. He was forty-eight years of age and well known for his careful and accurate work in the development of vertebrate palæontology. He was associated at the Muséum National d'Histoire Naturelle, in Paris, with palæontologists of international fame, and produced under such stimulus his interesting studies on fossil vertebrates. Thevenin gave especial attention to the subject of fossil Amphibia and was the discoverer of an interesting primitive reptile, *Sauravus costei*, a form which, as the most ancient reptile of France, is paralleled in America by the *Eosauravus copei*, described by Williston from the coal measures of Linton, Ohio. The publications of Thevenin number probably not more than a dozen papers. Of these the best known is his monograph on "Les Plus Anciens Quadrupèdes de France," in Tome V of the *Annales de Paléontologie*, a well-written, finely illustrated memoir which was awarded a prize by the Academy of Sciences; it epitomizes the ability and ideals of Armand Thevenin. His opinion that the vertebrates of the coal measures, although very ancient, were still a long way from their origin, agrees with the decision reached by students of early vertebrates in America.

The Katmai Expedition of the National Geographic Society to the Valley of Ten Thousand Smokes, Alaska, in the summer of 1918, had for its object a reconnaissance of regions not yet visited, with a view to more intensive study of the volcanic phenomena. Because of war conditions, and particularly the difficulty of obtaining transportation, the party included only two men, Messrs. Jasper Sayre and Paul P. Hagelbarger, both members of last year's expedition.

After a somewhat hazardous voyage, in which their ship, the "Dora," was seriously hampered by ice floes in Bering Sea, they finally arrived at Naknek Lake by June 10, and in August, a wireless message announced the successful termination of the season's work. The topographic survey begun last year was extended to the shore of Bering Sea, adding about fifteen hundred square miles to the map and completing a section across the base of the Alaska Pen-

Lieutenant Leo E. Miller is chief observer in aviation at Camp Jackson, South Carolina. He is the author of a forthcoming book, *In the Wilds of South America*, recounting a story of travel and bird study while engaged in the work of the American Museum expeditions

insula from Katmai Bay to Naknek Lake, thus furnishing data for an accurate topographic map of the region. The first accurate measurement of the temperatures of volcano vents was obtained, through the use of pyrometers supplied by the geophysical laboratory of the Carnegie Institution. The highest temperature measured was 430 degrees Centigrade. The party reached Seattle in September, returning overland.

THE new Whitlock Premier printing press lately installed at the American Museum of Natural History is handling the various publications of the institution in good shape under the direction of Mr. Stephen Klassen. All Museum printing with the exception of the JOURNAL will henceforth be done through the medium of this press, which has four times the capacity of the small press previously in use. The work is further facilitated by a monotype machine, obviating the necessity of setting type by hand.

OBSERVERS have noted that as a rule birds on the battle front in Europe pay little attention to the noise and confusion around them. When a shell burst through the roof of a shed in the rafters of which swallows were nesting, the birds quickly took advantage of the new opening when flying back and forth to feed their young. According to H. Thoburn Clark, British ornithologist and soldier, the masked sites of guns are favorite nesting places. A brood of four young blackbirds was hatched within four feet of the muzzle of a gun; and when a German shell destroyed the stump of an apple tree in which a pair of blackcaps had made their home, they built in the adjoining stump and reared their brood successfully. The nest of a pair of hedge swallows in the hub of a broken wheel was continually under fire, yet the parental instinct of the birds exceeded their fear and they fed their young in disregard of dropping shrapnel and bursting shells. Obliviousness to danger often proves fatal, however, as is shown by the large numbers of dead birds found in the woods that have been exposed to a gas attack, and by the complete destruction of the bird life of the forests near Verdun through the effects of bombardment. It is said that droves of magpies have been driven from France by gunfire and have settled in England. At St. Omer, France, jackdaws have been known to leave their homes in the church steeples and attack passing aëroplanes, to which birds ordinarily seem to pay little attention.

MR. LESLIE SPIER has returned from central Arizona where he examined during the early summer prehistoric ruins in the White Mountains and the Rio Verde Valley. Later he visited the little-known Havasupai Indians, who live on a tributary of the Grand Cañon of the Colorado.

Mr. Louis R. Sullivan, assistant curator in the department of anthropology at the American Museum, has received the commission of Second Lieutenant in the Sanitary Corps of the United States Army, with headquarters at Washington. Mr. Sullivan is attached to a newly organized division of the Sanitary Corps, which includes on its staff Messrs. C. B. Davenport, of Cold Spring Harbor, New York; B. W. Hawkes, of Milwaukee; and W. D. Wallace, of California. The work so far as planned is the oversight of the physical measurements made by the war boards with a view to their standardization. The lieutenants will visit the various army camps and make anthropometric studies of as many of the men in training as possible.

A new game bird law has been enacted by Congress to make effective the treaty recently entered into between the United States and Canada governing the killing of migratory birds. Under the rules based on the new law, uniform bag limits are set for the entire country, and the sale of wild migratory birds is prohibited absolutely. Permission to propagate migratory wild fowl on game farms and preserves may be obtained from the Department of Agriculture, and birds so raised may be sold as an addition to the food supply. Experiments have proved that many species of wild waterfowl may be raised successfully in captivity, and the sanction and protection of the Government will do much toward promoting this industry. There is now no spring open season for hunting wild fowl, and the fall open season is the same throughout the country, extending generally from September 1 to January 31, with certain exceptions, as in the case of the New England shore bird season which is from August 16 to November 30. The open season for individual species must not exceed three and one half months. States may make and enforce their own regulations, but only to afford greater protection to the birds and not to extend the open season or in any way to conflict with the Federal law. Continuous protection is given to all insectivorous birds, band-tailed pigeons, cranes, wood ducks, eider ducks, swans, curlew, and upland plover. No night hunting is permitted, the killing or capturing of migratory birds between sunset and a half hour before sunrise being prohibited. Provision is made for the collection of birds for scientific purposes, and under extraordinary conditions Federal permits may be issued to kill migratory birds which are injurious to agriculture.

The large tusks of an elephant shot by Mrs. Carl E. Akeley on the American Museum expedition to Africa some years ago have lately been added to the collections of the American Museum. They weigh 112 and 115 pounds respectively and are the record tusks for the Mount Kenia region.

War is proving a stimulus to research. Incidentally, opportunity for the study of fossil plants of great scientific interest has been afforded by the opening of abandoned mines to increase the supply of fuel. Botany seems remote from things warlike, yet as a result of the food situation and the educational campaign of the Food Administration and the Department of Agriculture, for instance, American botanists have organized for a vigorous onslaught on plant diseases. A war board of American pathologists has been appointed. Humanity, it has been shown, in the last analysis is directly dependent on green plants for food, and of this food large amounts of wheat, fruits, and vegetables are lost annually through plant diseases. Some of these are known to be preventable—such as the stinking smut of wheat—and botanists realize their responsibility.

Among important war services performed by botanists are the study and cultivation of kelp and other marine algæ to augment the supply of potash needed by the Government, and the exploration of the country for certain species of sphagnum moss (especially *Sphagnum papillosum* and *S. palustre*) which are now recognized as valuable substitutes for absorbent cotton in the making of surgical dressings.

Mr. H. G. Barber spent the month of July at the American Museum in research work on the institution's collection of Hemiptera.

Dr. C.-E. A. Winslow has been appointed consulting expert on industrial hygiene to the United States Public Health Service in charge of a squad of men studying conditions affecting the efficiency of munition workers.

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 1917:

Attendance in Exhibition Halls	786,151
Attendance at Lectures	115,802
Lantern Slides Sent out for Use in Schools	63,111
School Children Reached by Nature Study Collections	1,104,456

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 the JOURNAL. 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.

The various Classes of Membership are as follows:

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

They have the following privileges:

An Annual Pass admitting to the Members' Room
Complimentary tickets admitting to the Members' Room for distribution to their friends
Services of the Instructor for guidance through the Museum
Two course tickets to Spring Lectures
Two course tickets to Autumn Lectures
Current numbers of all Guide Leaflets on request
Current copies of the AMERICAN MUSEUM JOURNAL

Associate Membership

In order that those not living in New York City may associate with the Museum and its work, the class of Associate Members was established in 1916. These Members have the following privileges:

Current issues of the AMERICAN MUSEUM JOURNAL—a popular illustrated magazine of science, travel, exploration, and discovery, published monthly from October to May (eight numbers annually), the volume beginning in January
A complimentary copy of the President's Annual Report, giving a complete list of all Members
An Annual Pass admitting to the Members' Room. This large tower room on the third floor of the building, open every day in the year, is given over exclusively to Members, and is equipped with every comfort for rest, reading, and correspondence
Two complimentary tickets admitting to the Members' Room for distribution by Members to their friends
The services of an Instructor for guidance when visiting the Museum

All classes of Members receive the AMERICAN MUSEUM JOURNAL, which is a magazine issued primarily to keep members in touch with the activities of the Museum as depicted by pen and camera; also to furnish Members with reliable information of the most recent developments in the field of natural science. It takes the reader into every part of the world with great explorers; it contains authoritative and popular articles by men who are actually doing the work of exploration and research, and articles of current interest by men who are distinguished among scientists of the day. It takes the reader behind the scenes in the Museum to see sculptors and preparators modeling some jungle beast or creating a panorama of animal life. It shows how the results of these discoveries and labors are presented to the million public school children through the Museum Extension System. In brief it is a medium for the dissemination of the idea to

which the Museum itself is dedicated—namely, that without deepening appreciation of nature, no people can attain to the highest grades of knowledge and worth.

Publications of the Museum

The Scientific Publications of the Museum comprise the *Memoirs*, *Bulletin* and *Anthropological Papers*, the *Memoirs* and *Bulletin* edited by Frank E. Lutz, the *Anthropological Papers* by Clark Wissler. These publications cover the field and laboratory researches of the institution.

The Popular Scientific Publications of the Museum comprise the *Handbooks*, *Leaflets*, and *General Guide*, edited by Frederic A. Lucas, and the JOURNAL, edited by Mary Cynthia Dickerson.

POPULAR SCIENTIFIC PUBLICATIONS[1]

HANDBOOKS

NORTH AMERICAN INDIANS OF THE PLAINS
By Clark Wissler, Ph.D. — Paper, 25 cents; cloth, 50 cents

INDIANS OF THE SOUTHWEST
By Pliny Earle Goddard, Ph.D. — Paper, 25 cents; cloth, 50 cents

ANIMALS OF THE PAST
By Frederic A. Lucas, Sc.D. — Paper, 35 cents

DINOSAURS
By W. D. Matthew, Ph.D. — Price, 25 cents

TEACHERS' HANDBOOK, PART I, THE NORTH AMERICAN INDIAN COLLECTION
By Ann E. Thomas, Ph.B. — Price, 10 cents

TREES AND FORESTRY
By Mary Cynthia Dickerson
A new edition in course of preparation.

HEALTH IN WAR AND PEACE
By C.-E. A. Winslow, M.S., M.A. — Price, 25 cents

ANCIENT CIVILIZATIONS OF MEXICO AND CENTRAL AMERICA
By Herbert J. Spinden, Ph.D. — Cloth. Price, 75 cents

ILLUSTRATED GUIDE LEAFLETS

THE COLLECTION OF MINERALS
By Louis P. Gratacap, A.M. — Price, 5 cents

NORTH AMERICAN RUMINANTS
By J. A. Allen, Ph.D. — Price, 10 cents

THE ANCIENT BASKET MAKERS OF SOUTHEASTERN UTAH
By George H. Pepper — Price, 10 cents

THE MUSICAL INSTRUMENTS OF THE INCAS
By Charles W. Mead — Price, 10 cents

THE SAGINAW VALLEY COLLECTION
By Harlan I. Smith — Price, 10 cents

PERUVIAN MUMMIES
By Charles W. Mead — Price, 10 cents

[1] Prices net; postage extra

The American Museum of Natural History

Scientific Publications

MEMOIRS

VOLUME I.—Zoölogy and Palæontology.

VOLUMES II–VIII.—Anthropology.

VOLUME IX.—Zoölogy and Palæontology.

VOLUMES X–XIV.—Anthropology.

VOLUMES II, IV, V, VII, VIII, X–XIV, and an ETHNOGRAPHICAL ALBUM form the Memoirs of the Jesup North Pacific Expedition, Volumes I–X.

MEMOIRS—NEW SERIES

VOLUME I.—Zoölogy and Palæontology.
VOLUME II, part 1.—Palæontology.

BULLETIN

VOLUMES I–XXIV; XXV, parts 1 and 2; XXVI–XXXVII; and XXXVIII, parts 1–14.

ANTHROPOLOGICAL PAPERS

VOLUMES I–IX; X, parts 1–6; XI; XII, parts 1–5; XIII; XIV, parts 1 and 2; XV, part 1; XVI, parts 1 and 2; XVII, parts 1–4; XVIII, parts 1–4; XIX, part 1; XX, in preparation; XXI, part 1; XXII, parts 1 and 2.

MONOGRAPHS

A Review of the Primates. By D. G. ELLIOT. 3 volumes.

Hitherto Unpublished Plates of Tertiary Mammals and Permian Vertebrates. By COPE and MATTHEW.

A more detailed list, with prices, of these publications may be had upon application to the Librarian of the Museum.

Photograph by Underwood and Underwood,

AMERICA'S "STONE WALL" WILL HELP TO HOLD THE ENEMY IN CHECK.
BESIDE THE STARS AND STRIPES ARE CARRIED THE BLUE COLORS OF THE UNITED STATES INFANT

THE AMERICAN MUSEUM JOURNAL

The American Museum of Natural History

THE AMERICAN MUSEUM JOURNAL

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

November, 1918

VOLUME XVIII, NUMBER 7

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 members 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 AMERICAN MUSEUM JOURNAL

The American Museum Journal, 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 One Dollar and Fifty Cents a year. The Journal 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

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The American Museum Journal

CONTENTS FOR NOVEMBER

Mary Cynthia Dickerson, *Editor*

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

The Journal 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.

SAMUEL WENDELL WILLISTON, PROFESSOR OF PALÆONTOLOGY IN THE UNIVERSITY OF CHICAGO AT THE TIME OF HIS DEATH, AUGUST 30, 1918

Although Professor Williston preferred scientific investigation, the influence of his work as an educator was even greater than that of his writings; and yet few modern scientific men have left so brilliant a record of achievement in such varied subjects. Palæontology, geology, entomology, and comparative anatomy all have been greatly enriched by his indefatigable zeal and his investigations

—See SAMUEL WENDELL WILLISTON by One of His Students, page 609

The American Museum Journal

Volume XVIII — NOVEMBER, 1918 — Number 7

A League of Free Nations[1]

GEOGRAPHICAL ISOLATION OF COUNTRIES AND CONTINENTS DISAPPEARS IN FACE OF INSTANTANEOUS TRANSOCEANIC COMMUNICATION AND RAPID TRANSPORTATION OF RESOURCES.—LAWS OF INTERNATIONAL TRADE IN RAW MATERIALS.—COÖPERATIVE WORLD ORGANIZATION WILL MEAN ULTIMATE WORLD PEACE

By CHARLES R. VAN HISE

President of the University of Wisconsin

GERMANY, Austria, Bulgaria, and Turkey have all urgently asked for armistices. By the Allies the conditions of ceasing to press their highly successful attacks have been given, and have been accepted by all the powers named. The conditions are so drastic that hostilities cannot possibly be resumed. The accepting powers must submit to the terms of peace imposed upon them by the Allies, however severe they may be. The war is won.

If, when the terms of peace have been concluded, some way has not been worked out so that gigantic wars will not recur, we shall be obliged to conclude that the human being has not traveled sufficiently far along the road of rationalism to have learned even by the most bitter and costly experience.

The proposal which has met general approval for preventing war is a League of Nations; or, to introduce a recent qualification, a League of Free Nations. The President of the United States and the premiers of Great Britain are definitely committed to a League of Nations, and high officials of France, Italy, and Japan have expressed warm sympathy with the principle.

The League must be created as an integral part of the terms of peace. This is the golden opportunity. If it be allowed to slip away and each of the allied nations again devotes itself exclusively to its own interests, it will then be very difficult to form an effective league. Now, when the allied nations are acting together in all that relates to the prosecution of the war and the terms of peace, is the time that they are most likely to agree upon obligations to prevent the recurrence of wars.

In regard to the covenants of the League, proposals have been made ranging from a complete United States of the World to an alliance with vague and general obligations. A number of interesting plans have been worked out for the United States of the World, but so far as I have met men in this and other countries—and my opportunities in England have been exceptionally fortunate—I know of no man who believes that a "United States of the World" is now a practicable proposal. If, in the future, there is such an organization, it will be a growth. Therefore I shall con-

[1] Opening address before the Wisconsin State Convention of the League to Enforce Peace, November 8, 1918.

sider the problem of a League of Nations from the minimum rather than the maximum point of view.

What are the minimum obligations which the nations entering into a free league will be willing to accept, but which will be sufficient to make the league effective for the purpose for which it is primarily created—the prevention of war?

All the proposals that I have seen concerning a League of Nations provide for a separation of cases arising between the members of the League into two classes: justiciable and nonjusticiable. All agree that justiciable cases should go to a regularly constituted court, either the existing Hague court, or a new court formed directly under the League.

For the nonjusticiable cases it is agreed that in the case of a difference between two nations which they themselves are unable to settle, they shall not go to war with each other until the members of the League not parties to the controversy have had the grounds of difference investigated and have made recommendations for settlement.

The method of reaching the recommendations raises the question of the nature of the organization of the League. It is suggested that it will be advisable for the body created by the direct representatives of the nations in the League to confine itself to essentially legislative functions. This body should control policies; it should create instruments and agents to carry out these policies. The actual work should be done by these instruments and agents. A League of Nations composed of a considerable number of members could well consider and control policies. It could not wisely undertake the investigation of a difference between two nations and make recommendations concerning the same. These duties should be performed by a quasi judicial body analogous to a commission.

Presuming, therefore, that the investigation in any case will be made by a commission or council appointed by the members of the League not parties to the controversy, its recommendations, whether unanimous or by majority, must be final, precisely as the determination of a court, whether unanimous or by majority, is final. To require that the recommendations of a tribunal shall be unanimous, or after their consideration by the members of the League the League itself shall be unanimous, as has been seriously proposed, would be a decision at the outset to make the League of Nations futile.

The case of the nobles of Poland, who acted under the principle of unanimity with calamitous consequences to that country for more than a century, is a conclusive illustration. On the other hand, the acceptance by the American people of the decisions of the Supreme Court of the United States, often with a bare majority, upon most momentous questions, some of these between the several states during the early years of the Union when the states were being cemented into a nation, is conclusive evidence of the soundness of the principle advocated.

The next question that arises is what is to happen if a nation of the League goes to war contrary to the recommendations made. It has been proposed, indeed strongly urged, by many who are advocating a League of Nations that all members of the League shall bind themselves in such a case to support the attacked state with their armies and navies and also economically.

It does not seem to me that it will be practicable to obtain the agreement of the nations to such a condition, and I therefore propose as a substitute that they agree that any nation in the League shall be free, if it so desire, to support the attacked state with its army and its navy; and that all the members of the League agree absolutely to boycott the offending nation, to have no trade or communication with it in any way whatever, to treat it as an outlaw among the free peoples of the world.

So dependent are nations upon one another in these days of instantaneous communication, rapid transportation, and international commerce, that it seems to me any nation would be very slow to go to war contrary to recommendations which had been made upon its case, with the certainty that the war would have to be prosecuted entirely upon its own resources, that no help could be derived in any way from any other nation: not only so, but that in relations other than war, it would be treated as a leper.

In regard to differences between states that are members of the League, and states not members of the League, the League of Nations should be free to follow precisely the same procedure as though both nations were members of the League; and whether or not the nation outside the League requested it, the League should take steps for the investigation of differences and the making of recommendations. If the nation outside the League attacked a nation within the League before the case was investigated and recommendations made, or contrary to the recommendations, then, again, the nations of the League should be free to support their ally with their armies and navies and should be bound to support it by complete boycott of the offending state.

In the case of a controversy between two nations altogether outside the League, probably it is not wise to propose that the League should do more than tender its good offices to settle the difference which threatens war, precisely as if the two states were members of the League. This offer might not always be accepted; but if it were accepted by one state and not accepted by the other, it is inevitable that the state that was attacked contrary to the recommendation would have at least the moral support and influence of the nations of the League; and no war has ever illustrated the mighty power of moral support as has this war which is just being finished.

The second fundamental point upon which agreement must be reached by the League of Nations is in regard to armaments. At the end of this war, the great nations involved will have mighty armaments upon land and sea. They have maintained these armaments by borrowing enormous sums of money. After the termination of the war, the current expenses for any country must be reduced to the income derived from taxation: and that income must in addition provide for the interest upon the colossal war debt, and if possible some increment toward liquidation. It is therefore clear that armaments as they exist at the end of the war cannot be maintained. They must be reduced, however jingoistic a nation may be. It is obvious that it cannot be proposed that armaments shall be equal for all nations. It cannot be suggested that Liberia and Great Britain shall have armies and navies of the same size. The reduced armaments should be proportioned to the importance and power of the nations.

As a first approximation toward this, we may suggest that the disarmament be proportioned, and that the disarmament under this principle be carried as far as possible. To illustrate for the navies: Great Britain at the end of the war will have a fleet upon the sea substantially three times that at the beginning of the war. To maintain a fleet in times of peace is almost as expensive as during war. The men must be paid, the ships kept in repair. It should therefore be agreed that the British seagoing fleet shall be reduced to say one third, one fourth, one fifth, one tenth, or any other fraction which may be decided upon, of the power of the fleet at the end of the war; the reduction to apply so far as practicable to each class of ships. In regard to the ships which are put out of commission, the guns would be dismantled, and the ships placed at anchor in the harbors. In case of necessity they would be available rapidly. The proportion agreed upon would apply to the United States and to all other members of the League.

The proportional reduction of armies is not so easy to illustrate in simple terms, but the principle of armaments in proportion to power and influence should be applied so far as practicable.

It is to be noted under the principle of proportional disarmament that each nation would have the same relative power it possessed before such action. I am glad to be able to state that Lloyd George supports the principle of proportional disarmament. In the majority of proposals which have been made, it has been provided that all the free nations that desire to enter a League may do so. A League thus formed would consist of many nations. Recognizing the very great difference in the strength and influence of the members of such a group of nations, various schemes have been suggested for proportional influence; but all the schemes, it seems to me, present insuperable difficulties because of the pride of nations of intermediate power and influence. These would claim as their right the same position as the first-class powers.

It therefore appears to me that to form a League of Nations which shall at the outset include all the free nations that wish to enter is inadvisable. The League of Nations should at first consist of the free nations that have borne to the end the larger part of the burden of this war against autocracy, namely, the United States, England, France, Italy, and Japan. The organization of such a League under the principles above given, even if it included no other nation, would go far toward sustaining the future security of the world. Even covenants to the extent above outlined of the English-speaking peoples would be a mighty influence in that direction. If the League of Free Nations is first limited to the five powers named, the difficulties in regard to representation are overcome. They will have equal representation. The difficulties of disarmament are largely overcome. These nations have acted together; their interests are common; they are in sympathy. They will work out a plan under the general principle of proportioned disarmament, maintaining in the aggregate a power sufficient to secure the peace of the world. The League of the five nations once formed, other nations would be admitted under the constitution of the League, and they would have the rights and powers given them under that constitution.

A question which immediately arises is, Shall Germany, which country is already committed to the principle of a League, be admitted under the terms of its constitution?

My answer is that as soon as the German people have shown that they are a free people, wholly independent of autocracy, have completely abandoned the evil doctrine of "Might," and are ready to support the existence of a moral order in the world, that nation should become a member of the League of Free Nations. This would mean that Germany, once admitted to the League in the matter of armaments as well as others, should be treated upon the same basis as the other five powers. But there should be the strictest guaranties that the agreements will not be surreptitiously disregarded. If Germany is allowed unduly to expand her armies, this will start again in the world the race for enormous armaments.

Another question that arises in connection with the admission of Germany to the League is the economic treatment of the Central Powers after the war. In this matter, to my mind, there are two phases, that of reconstruction and that of a permanent policy following reconstruction. It is possible, indeed probable, that during the period of reconstruction, there will be a shortage of essential materials. I hold that during this period the needs of the Allies must have preference, since the restoration of Belgium, France, and Serbia has been made necessary in large measure because of the ruthless and unlawful acts of the Central Powers.

Following the reconstruction period, when the world has assumed its normal condition, the Central Powers should be placed upon precisely the same economic basis as are other nations. Each nation, with regard to tariff and similar policies, will retain its own autonomy; but the League of Nations must see that no nation within the League which has equal treatment with regard to raw materials, shall pursue unfair practices in international trade. In short, unfair practices in international trade, illustrated by dumping, must be outlawed, precisely as are unfair practices in national trade. In this respect Germany has been an offender in the past; and only when she reforms completely, shall she have the same treatment as other nations with regard to raw materials.

In making the above statement, I wish it clearly understood that if I were in a position of power, I should be implacable in imposing upon Germany, to the utmost limit she is able to bear them, the full penalties for all actions she has taken contrary to international law. When peace has been concluded, the sanctity of international law must be reëstablished. The small nations which have been outraged contrary to international law, so far as possible must be reimbursed for all the wrongs they have suffered. This position is not taken with the idea of revenge, but from the point of view of justice and the necessity of convincing every German that all violations of international law will carry their inexorable penalties.

There is not space and it is not appropriate for me to discuss the further terms of peace. They undoubtedly will be severe. Having been imposed, however, and the penalty having been exacted, the past should be eliminated from further consideration and a course of justice pursued. Only so can there be permanent peace in the world. It cannot be denied that the Germans are a great people, and that, if permanently kept out of a League of Nations, Germany will be the center of another group of nations; and we shall have the old balance of power between the League of Free Nations and another League of Nations led by Germany. There can be no permanent peace which does not include finally all the great nations of the world in the League of Free Nations.

In accordance with the ideas of General Smuts recently expressed at a dinner in England, I hope that the world of the future may be a free world, an organized world (that is, with a League of Nations), and a friendly world.

In order that the League of Free Nations shall have permanence and its influence grow, it is necessary that it have something to do. In the matter of justiciable cases this is provided for. The nonjusticiable cases would be sporadic. They would doubtless be handled as they arose by appropriate agents, appointed for the purpose. The terms of peace, however, are likely to require a number of international obligations. It is clear that the Dardanelles must be made open to the peoples of the world; they must be internationalized. It is generally believed that the German African colonies should not be returned to that country. With the exception of southwestern Africa, the administration of these colonies in the interest of their peoples might well become an international obligation. New states have been created through the disintegration of Russia and will be created by the disintegration of Austria. It will be necessary that these states have a big brother to assist them when needful until they get on their feet, precisely as the United States served as a big brother for Cuba until she was able to act independently. This is international work. It seems to me that this function should be exercised directly through the League of Free Nations. An organization should be created by it to handle international responsibility in the interests of the world. This will involve the setting up of an appropriate government in each case, the apportioning of the necessary protection, and the allocation of the required funds among the members of the League. From time to time, as need arises, a helping hand should be given, but always with the purpose of developing a province exclusively in the interests of its inhabitants, and when the time comes, of establishing self government.

The foregoing discussion assumes that the United States will become one of the great nations of the Free League. Already in this war, the United States has abandoned the policy of isolation and has acted in practical alliance with the great powers fighting Germany. In every respect in the conduct of the war the United States has acted precisely as have the other members of the alliance. Indeed the United States has taken leadership in making the alliance stronger and firmer through a common command of the fighting forces, through coöperation in the feeding of the Allies, and through apportionment of the materials of war.

In the second place, even if we had not already abandoned the policy of isolation, sooner or later it would have been necessary to do so under the conditions of the modern world. The policy may have been wise when the Atlantic Ocean was a great gulf between America and Europe. Transportation and communication were so slow that the United States could pursue policies independent of those followed in Europe. Now, however, that communication is instantaneous and transportation so rapid that goods cross the Atlantic in less than a week, and the trade of each nation depends upon materials derived from other nations, isolation is no longer possible. The world has become one body, and no great member of it can proceed independently of the other members. They must act together; and this is possible only through formal treaty covenants.

It seems clear that if the United States now shirks the responsibility of entering the League of Free Nations, it is inevitable that some time in the future she will again be obliged to intervene in a war for which she is in no way responsible and the initiation of which she has no means to control. Because of the intimate international relations, if a world conflagration again start, it is almost inevitable that we shall be drawn into it precisely as we were into this.

Finally it should be pointed out that the proposal to join a League of Free Nations is fundamentally different from joining an alliance of the kind which was meant when the doctrine of avoiding entangling alliances was developed. The danger of joining an alliance is that this alliance will get into armed conflict with another alliance. The plan of balance of powers between alliances in Europe we know has led to disastrous wars from time to time. If it were proposed that the United States should enter into an alliance with one or two powers of Europe, the objection would hold that it would be entering into an entangling alliance; but the proposal is that the United States shall enter a League of Free Nations which shall, at the outset, include the great dominant free nations, and which shall finally include practically all nations. This is not an alliance, but a step toward coöperative world organization, and therefore World Peace. Not only should the United States enter the League of Free Nations, but she should take the position of leadership in its formation to which she is entitled by the commanding influence she is exercising at the present time in the councils of the world.

The well-kept space encircled by a hundred huts is the "stadium" of Mangbetuland, over which tower the groves of oil palms—an imposing setting for Okondo's great residence. Here, at the king's bidding, the quiet of peace gives way to the turmoil of barter, to shrewd appeals of crafty justice, to riotous gatherings of pleasure, or to turbulent waves of war. Those who are welcome are invited to pass the forbidden gates to the king's harem; but woe to those who are subject to the cruel dictum of his tribunal

Famous Ivory Treasures of a Negro King

By HERBERT LANG

The ethnographical collection, a small part of the 54 tons of natural history material brought home by the Congo Expedition (1909–1915), comprises about 3800 examples representative of the culture of the Mangbetu and neighboring tribes. More than 1000 photographs, including a series of portraits and illustrations of habits and customs, plans of villages and houses, together with water color studies of mural painting, and more than 100 life masks, form a splendid contribution to the better knowledge of these little-known peoples. The jewels of the collection are 380 pieces of carved ivory, beautiful in design and remarkable in execution, all denoting a keen sense for well-balanced composition. These ivories are now on exhibition in the Morgan hall of the American Museum of Natural History, and although made by untutored savages they harmonize surprisingly well with displays of art treasures exhibited near them which have come from many lands. This collection is particularly valuable inasmuch as it cannot be duplicated, for Okondo, king of the Mangbetu, died in 1916, three years after we left him, and for administrative reasons his realm was divided among many smaller chiefs who more easily can be made to abide by the golden rule of civilization. These chiefs, being virtually without authority, possess comparatively few show pieces; nor can they offer inducements to artists in this line, as ivory is now scarce.

These Mangbetu ivories astonish even modern artists of civilization. The unusual amount of care the savages have bestowed upon their work is as surprising as the range and adaptability of the conventionalized subjects chosen. Man occurs as often as purely geometric compositions, but curiously enough, animal forms are seldom admitted. The carved form of the human head in miniature as a terminating figure for an ivory piece is especially common, sometimes in natural proportions but more often lengthened or flattened either to an extreme extent or cleverly suggested by only a few sharp lines.

Those who enjoy the beauty of the Mangbetu ivories are indebted in a large measure to the president of the American Museum of Natural History, Professor Henry Fairfield Osborn, who by his liberal plans and generous encouragement made possible the gathering of so unique a collection, although the chief errand of the expedition was zoölogical.—THE AUTHOR.

THE first decorative use of ivory dates back to the cave men of the Old Stone age. Their artistic inclination was forceful enough to guide the historian's sharp-pointed flints over the smooth surface of tusks. About eighteen thousand years ago primitive artists of France thus recorded stories of animals they hunted and dangers they escaped. One of the earliest masterpieces, preserved from the Magdalenian period, successfully pictures, in realistic sharp-cut lines, a spirited charge of woolly mammoths.[1] Ever since, craftsmen of all races have been encouraged to use ivory as a substance fitted for the expression of the beautiful. Their success is proof conclusive of the fascinating possibilities this rich material has offered to a remarkable variety of tastes, and its continued association with the costliest metals and even precious stones shows the high favor in which it has been held. Neither the relative rarity, nor the naturally small proportions of tusks, succeeded in imposing restrictions—as is proved by the colossal gold and ivory statues of ancient Greece.[2] Monuments of deities and rulers, thrones, chariots, and scepters, and the broad field of religious art accorded it prominence long before ivory was found to be a suitable material for billiard balls and modern trinkets.

America, champion of democracy, long ago gave the alien negro a full-fledged citizenship; but, strange to say, she has evinced small interest in the study of the native African and therefore knows relatively little of the high perfection to which he may attain along certain lines under the sway of powerful chieftains. As a race, it is true, the black man has often failed to profit by the processes of civilization offered in Africa. In the eastern part, which for centuries has been in contact with ancient and modern culture, one might at first be disappointed at the paucity of indigenous art. But who would expect niceties of this kind from tribes that barely succeeded in eking out a meager existence; and that were afflicted at the same time by the currents of slave trade which swept over their country, with their destructive sequels? Other tribes, although more prosperous, were cattle owners, sometimes with seminomadic habits, conditions equally unsuitable for the development of artistic tendencies. Even so well-organized a people as the Waganda can claim no particular achievement in the realm of art.

The two great centers of true negro art were discovered only within the last few decades. They lie in Central Africa, along the fertile fringe of the huge, equatorial rain forests; in the south, the Kasai region; and in the northeast, the Uele district. Here, with a background of more settled conditions and a lavishness of natural resources, art has flourished. In many districts the powerful incentive of fetishism occasions a profusion of elaborate idols and offers a foundation for artistic wood carving, widely practised on account of its utilitarian character and an abundance of suitable timber. The favor in which negroes hold dances, in connection with drinking bouts, fosters the production of musical instruments such as gongs, drums, and clappers. A motley array of stools and a diversity of curious potteries and ornamented gourds are also in common use at such riotous gatherings, and it becomes apparent that the desire to arouse the admiration of friends by the possession of noteworthy pieces insures a healthy stimulus to this industry. The many queer shapes of hats, the pleasing patterns of mats and other wickerwork, a variety of elaborate hairdresses, and the complicated designs of raised tattoos show the wide range of their artistic tastes. Blacksmithing, too, is a craft in which extraordinary results are achieved. Some of the best work proves that the West African Bantu negro has a deep-rooted sense for decorative effect together with a great store of practical intelligence.

Although in many ways the natives of the Kasai show a higher develop-

[1] Their sundry achievements have been admirably dealt with in Professor Henry Fairfield Osborn's *Men of the Old Stone Age.* Charles Scribner's Sons, 1916.

[2] *Ivory and the Elephant*, by Dr. George Frederick Kunz, Doubleday, Page and Company, 1916, a standard work on this subject, representing the harvest of a great authority (p. 22).

ment in their art than the Mangbetu of the Uele, the latter rank foremost among negroes in the carving of ivory, which is so essentially connected with luxury.[1] Their kings alone, by continued encouragement of it, succeeded in building up so difficult an art. Their superiority in many other lines has been enthusiastically commented upon by the few explorers and travelers visiting their country.[2]

Living in the heart of Africa, eighteen hundred miles inland, far removed from trade routes, these people were shielded from foreign influence; and ethnological specimens illustrating their skill seldom reached civilized countries. These Mangbetu were cannibals of the worst repute. Under King Munza's reign (1870) they inhabited the fertile regions about the northeastern edge of the African rain forest and, toward the end of the last century, nearly lost their independence in a stubborn contest with the warlike Azande. Their kings claimed power over life and death and incidentally raised art to an extraordinarily high standard. Of all negro potentates not influenced by higher civilization, they boasted the greatest architects. Their dance halls, compared with ordinary negro huts, were gigantic palaces: one built during our sojourn there measured 35 feet in height, 80 in width, and 200 in length. Artistic features were impressed upon every object, and the barbaric splendor of their court and the rigor of public ceremonies were as much a surprise to us as they had been to Schweinfurth. (We, fortunately, were spared the gruesome sight of piles of human skulls of devoured victims, lying about refuse heaps from the king's kitchen.) The veneration of the people for their autocratic chieftains is as overwhelming as their fear, and any object of beauty or value is offered speedily to them as a gift, for possession might mean ruin to its owner.

That the negro race produces a smaller number of superior men than other peoples becomes particularly evident in these regions. Perhaps it was the fact that these rulers surrounded themselves with the few men of talent and ability they could bring together that raised Mangbetu domination to such heights. No wonder thousands of subjects flocked to the court to see the spectacular exhibitions. Thus we can understand why tyrants, who daily slaughtered a dozen prisoners bound to the stake, to furnish meat for their household of hundreds of queens, would grant generous protection to artists. These, in turn, surrounded by a bewildering chaos of rapidly rising and falling destinies, had grave reasons to please their master, and naturally strove to outdo one another in eager competition. Credited by popular belief with supernatural acquisition of talent, they formed a small caste to which access could be gained only through initiation, and any one attempting to compete with them invited severe misfortune or forfeited his life. They even fashioned their own tools; thus the rude ax, the sharp chisels and blades, the rough saw, the handles and special tools, are their handiwork.

That a real industry never was built up cannot be imputed to these restric-

[1] The famous ivory carvings from the former negro kingdom of Benin, on the Niger delta, show a strong infusion of foreign influence, and can hardly be attributed to pure negro art. Nor can the natives of Loango (north of the mouth of the Congo) make any legitimate claim; for they are encouraged by traders and other white men to make processionally carved tusks, which sometimes are skillfully executed, but which represent a motley of European ideas badly jumbled in a negro's brain. At Stanleyville, in the Belgian Congo, I saw more than a hundred tusks carved in relief with subjects wending their way from the root toward the tip. Human beings, performing various feats, were the favorite subjects. Elephants, leopards, antelopes, crocodiles, lizards, butterflies, flowers, and leaves were rendered in poor, school-boy fashion. Since the exportation of small tusks is forbidden by law, these were transformed into works of art, exported to Antwerp, and from there sent to Khartum where they became Egyptian curios, to the delight of foreign visitors.

[2] Schweinfurth's able description has an added value, for in 1870 he lived at King Munza's court, which Junker, Emin Pasha, and Casati also visited. Boyd Alexander (1906) assisted at a dance, and Schubotz (1910) spent a fortnight there.

A FORMER PATRON OF ARTS IN THE CONGO

Three hundred and eighty pieces of carved ivory were gathered by The American Museum Congo Expedition. Many of these had been the treasure of Okondo, King of the Mangbetu, and others were made by artists of Mangbetu or Azande origin, and are now on exhibition in the American Museum. Okondo looked most spectacular in his dancing costume, which he always discarded immediately after the performance. His unusually dark torso was girded by stiff, Havana-brown bark cloth, held in place by belts especially consecrated. Graceful plumes of dark eagle and red parrot feathers crowned him impressively. A necklace of white beads, bunches of wart-hog bristles, skins of the lemur, and a strap of okapi hide denoted royalty and supposedly endowed him with occult powers. To him a dance meant the heroic effort of a star performer, and his endurance, agility, and display of splendor were famed abroad by hundreds of admiring subjects tions alone or to the proverbial indolence of negroes: the great obstacle to tribal intercourse in a land of cannibalism is the fact that travelers were considered "walking lumps of meat." Conditions had become so dangerous that men walking through the forest carried bows and poisoned arrows ready for emergency, and women would not venture abroad alone.

Thus the black man has received as little credit for attainments in carving ivory as for his ability to smelt and work iron: although lately he has been hailed by modern ethnologists as the inventor of the iron trade. The carvings of the Mangbetu show such technical perfection that the use of a lathe and other modern instruments suggests itself. After much consideration, they work without tracing a plan or indicating divisions, although apparently they have a fair idea of the final form. The tusk, or piece of ivory, is trimmed with a hatchet exactly as if it were hard wood. With an adz they shape the ruder outlines. An indented blade serves as a saw to cut the deeper moldings. The finer, ornamental features are carefully carved by variously shaped tools: and, finally, the whole is smoothed with the sharp edge of a knife. Foliage, from various trees, containing fine crystals of silica, is used like sandpaper: thus with a moistened leaf they produce the polish which so heightens the beauty of these ivories.[1]

Imagine the uncouth figure of an ill-smelling, nearly nude negro bent over the immaculate, white substance, often holding the object with his feet to have his hands free, industriously hewing, carving, scraping, and polishing, while surrounded by a group of enthusiastic friends who spur on his desire for greater accomplishments. His one goal is to arouse the admiration of his fellow men whom he likes to surprise by changing the decorative features for every object. The translucent effect of the subtle, wavy lines and strange concentric rings appearing on the well-balanced forms of the ivories is ample reward for his diligence. The best of his creations he passes from hand to hand, for closer scrutiny brings out more fully their peculiar beauty. In fact, the delicate details stamp it as a labor of love and can be appreciated only by careful examination.

Through their contributions, these artists have unwittingly guided their race to a keener realization of the beautiful: and it is regrettable that the greedy trader[2] whom civilization sends with his machine-made, utilitarian goods, millions of them cast in the same mold, should completely supersede an exquisite art. In these regions, older chiefs often decline to wear the gaudy cotton goods "fit only for slaves"; they still strut about in the stiff, homemade "Malumba," a bark cloth peeled from their own fig trees. The deeply folded, Havana-brown material encircling their waists admirably fits the well-built, bronze torsos.

The day before our arrival at Okondo's court (November 5, 1910), and indeed throughout the following day, an army of runners assured us that "There is no greater king than

[1] The Mangbetu neither soak nor in any other way prepare ivory before or during carving. The straightening of small curved pieces, however, causes no perplexity. In the core of the juicy banana trunk they place the ivory to be bent. This succulent cylinder, nearly a foot in diameter, discharges steam from the center as it is turned over the fire until the exterior is completely charred. The ivory, thus exposed to a moist, intense heat, and yet well protected from the flames, is removed so hot that it can hardly be touched. Water is poured over the straightened piece which is then pressed between two logs. Bent ivory hatpins are easily straightened if put into a section of the fruit stalk of plantains and treated in the same manner. This process may be the key to the lost art of ancient Greece and perhaps explains the presence of extremely large, flat pieces of ivory required in the production of their colossal gold and ivory statues.

[2] Not until 1910 did Greeks and Hindus flock into the northeastern Uele offering so high a price for tusks that ivory soon became scarce. In former days only the larger tusks found their way into the markets of the world, but later the chiefs collected even the smaller ones, and thus articles of ivory were rapidly disappearing. In fact, we often had to buy the ivory the artists needed.

Okondo!" A large deputation greeted us about a mile from the royal residence, and we soon discovered the king —poor slave to fashion—clad in an officer's old, shabby uniform. Although satisfied that, in this part of Africa at least, the days of kings had passed, we had no reason to complain. We were fortunate! The medicine man's oracle had favored us and Okondo unhesitatingly announced that our relations would be friendly. The reception was most enthusiastic and his behavior was as stately as could be expected of a man with 180 wives. His queens craved salt —as much esteemed in Mangbetuland as candy in America—and were far less dignified than His Majesty. For a pinch of it they parted gladly with their entire costumes, small pieces of bark cloth and decorative aprons twice the size of a hand, substituting the delightfully cooling leaves of banana trees. I was not surprised when the king ordered them to their huts and, as an excuse, pointed to his garden, remarking that "a swarm of grasshoppers might have visited the banana trees." I gave his foremost queens "as much salt as he could not lick away in the next month."

Although we thoroughly enjoyed the horseplay of the first day, we did not realize the admirable resources of this people. Great dances were given in our honor, sham battles[1] were fought, hunting parties sent out, and artists convoked to court. And to such an extent did they all exert themselves that the splendor soon rivaled that of Munza's time. When we expressed our regret at the lack of the great halls made famous by Schweinfurth's account, the architects were bidden to proceed at once. We had to start northward toward the southern Sudan, and laughed incredulously as we handed the king, in advance, the gifts we had promised to assure his domestic peace during the undertaking. Two loads of salt and one of brass wire for anklets and bracelets for his queens proved satisfactory. His promise was kept: one year as many as 500 men worked at the structure, of course with continual interruptions for dancing and drinking.

One might hope to find within the court large stores of ivory treasures accumulated for hundreds of years, as ivory by right belonged to the king. But at the death of a ruler barbarian custom demanded immediate destruction of his residence and all his property.[2] So it happens that only recent objects are found at the royal headquarters, and the Museum party was fortunate that, because of some superstition, the famous Okondo, last of these kings, was willing to part with the best he had, ordering other objects to be made by his most skilled artists. Old Queen Nenzima readily offered her advice in this task.

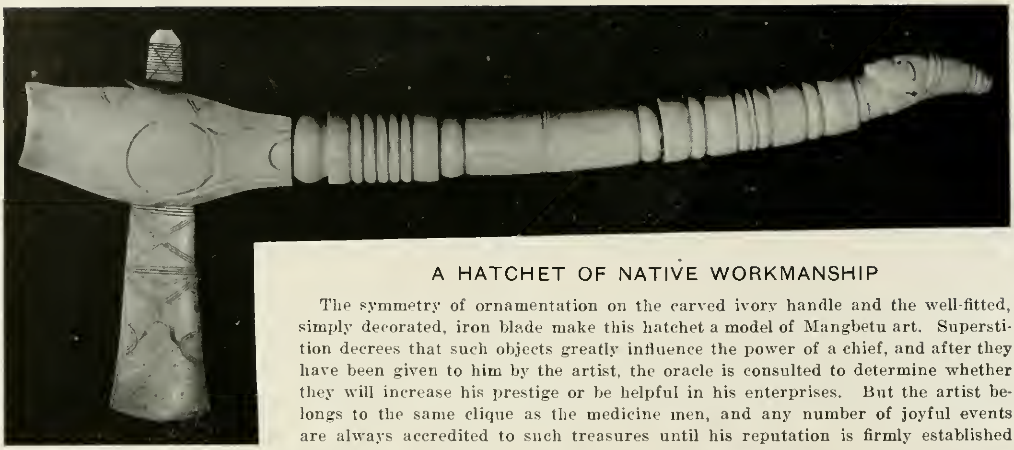
The great carved horns made of huge tusks naturally attract the attention

[1] AMERICAN MUSEUM JOURNAL, Vol. XI (1911), pp. 190–191.

[2] Unfortunately tradition also required the wholesale butchery of the queens who did not succeed in escaping. Some of these intimate associates were buried with him to furnish cheer in the fields beyond, while others were served as the main course at the new king's inaugural feast. So great was the popular regard for Queen Nenzima, formerly one of the powers behind King Munza's throne, and now a dignified matron past her sixtieth year, that three times she had escaped death at the massacre of queens, following the demise of rulers. Most pathetic and significant was her answer to my reiterated question whether no art treasures remained from the three former kings over whose harems she had presided: "There is nothing left, not a single object, except myself. I am the only thing, such a very old thing. Do you want to take me home?" As a result of this interview, I was presented with a necklace of her extremely long finger and toe nails, an emblem of dignity, and especially cut to show her high regard. In their belief, even a single hair falling into the hands of an enemy gives him power over them. Courteously revealing this, she shrewdly added that were I to give her all the loads the expedition owned, I had but badly repaid her trust. I quickly offered part of my thumb nail, regretting its comparative shortness but assuring her that now she would have the same powers over my person that I enjoyed over her. Upon my return two years later, her nails had grown again to a considerable length, and a second necklace cost me another finger nail which she wears on her bracelet (concealed in the hollow of a small wooden cylinder); her gifts to me are destined to show Museum visitors how long the nails of Mangbetu queens can grow.

QUEEN NENZIMA OF MANGBETULAND

Nenzima was the foremost of Okondo's one hundred and eighty wives, and is more than sixty years of age. She has been queen during four reigns, and is the beloved mother of her tribe. The abrupt changes from glory to nothingness that follow wars and revolutions have failed to dim her fame. Endowed with great wisdom, she is renowned as a debater in court; the righteousness of her motives lends her sufficient daring to oppose rudeness and cruelty, and her charming simplicity places her beyond reproach. When it is announced that she will speak, great numbers flock to court. She rendered important service to her people at the period of the Belgian occupation



A HATCHET OF NATIVE WORKMANSHIP

The symmetry of ornamentation on the carved ivory handle and the well-fitted, simply decorated, iron blade make this hatchet a model of Mangbetu art. Superstition decrees that such objects greatly influence the power of a chief, and after they have been given to him by the artist, the oracle is consulted to determine whether they will increase his prestige or be helpful in his enterprises. But the artist belongs to the same clique as the medicine men, and any number of joyful events are always accredited to such treasures until his reputation is firmly established

A Unique Record of Mangbetu Lineage.—This originally was an irregularly shaped block of diseased ivory, the base of a tusk the mate of which weighed one hundred and fifty pounds. It was held in high esteem as a relic by one of the king's relatives, and was a constant source of speculation as to its probable meaning until an artist's genius solved the riddle by showing that the protuberances coincided with the members of the owner's family and their descendants. He then carved the numerous faces which cover the reverse side as well as the one photographed

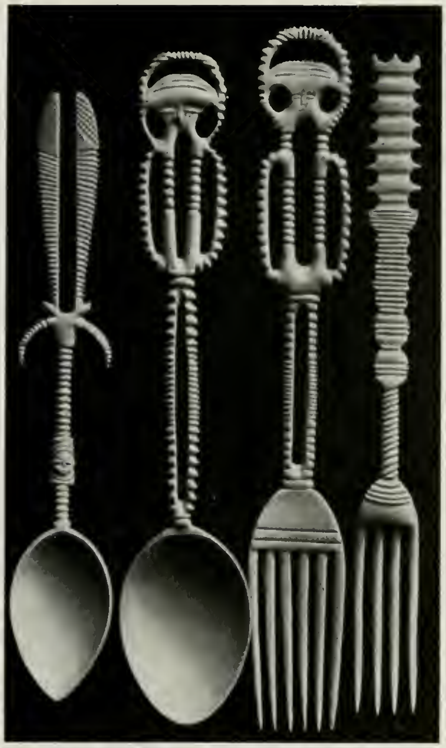
TRIBAL AND PERSONAL IDEALS EMBODIED IN IVORY CARVING

One would scarcely expect to find in ivory figures carved by Congo cannibals the embodiment of ideals. The figures, however, on the central piece, a mallet used to beat bark cloth, express, according to the artist, the supreme faith of these savages in mother love. The carvings on the box at the left express the unity of two friends. The female figure at the right is carved for the sake of beauty alone, as the Mangbetu have no idols; what appears to be a crown on the head is merely a conventionalized hairdress. The two small figures below and in front are three-headed boxes, showing the trend of Mangbetu ornamentation

RED CAMWOOD BOXES FROM MANGBETULAND

These three camwood boxes, with hollow sections of ivory, receptacles for such finery as iron and brass ornaments, beadwork, and talismans, are pieces that creditably reflect the artists' skill. Karibu, a Mangbetu, carved and put the boxes together, while Saza, an Avungura (of the Azande reigning class), engraved the hunting episodes on the ivory. The tops represent the large, conventionalized hairdress of a man and two women, while the foot of an elephant and bows of boats are seen at the base; encircling bands are symbolic of the roundness of a hut and therefore of family life.

The pictographs on these boxes are figured and explained on pages 550 and 551



FORKS AND SPOONS OF NATIVE DESIGN

The natives' instinctive desire for artistic expression is evident not only in their houses, which are decorated with various geometric designs carried out in three colors, depicting scenes from native life, but also in the humblest objects; even knives and other articles bought from traders are afterward beautifully ornamented.

These carved ivory spoons and forks were presented to us by a Congo artist as more suitable than our simple camp implements. In his enthusiasm he remarked that even these elaborate models would be far too simple and small for the king should he eat in the presence of the ordinary natives as most Europeans do. Okondo's food, like that of any high chief, was served in a hut to which no one had access while he ate, although on rare occasions his councilors or relatives were invited, when they, like all other natives, used their fingers. Oil or peppery sauce was much relished and was dipped up in a piece of mush in which the thumb had pressed a hollow. This took the place of a spoon

Saza, a particularly skillful ivory carver, enjoys an easy chair introduced into the Congo by white men and widely imitated by the natives. A wife and a helper are of great assistance in his work. On the ground lie the numerous ivory chips cut with his adz. He was particularly fond of engraving sketches of scenes from native life. He also eagerly copied in outline pictures from European magazines of which he had a great store

HE IS INSPIRED BY THE TRUE ARTIST'S LOVE FOR HIS WORK

The success of these ivory workers springs from their devotion to the work. It is a source of joy and inspiration to them. First—the ivory is roughened out with a native ax, second—the coarser carving is done with an adzlike instrument (the delicate carving which is done with long-handled knives is not shown here), and third—the surface is smoothed and polished with moistened leaves containing fine crystals of silica (for detailed explanation of process, see page 530)

FOR HOUSEHOLD USE AND FOR STRIFE

The great sickle-shaped show knives were carried hung loosely over the shoulder by the king and other prominent men when they were sitting in council, partly as proof of the wearer's readiness to strike; at other times, the knives were pushed under the belt. In a hand to hand encounter, using a knife like the largest shown, with sharp knobs on the edges of the blade, the skull of the enemy can be crushed by merely turning the knife. Experienced blacksmiths make three such large knives in about two days. So simple-minded are these cannibals that in former times it was considered a great honor by relatives of a captive if the king pierced the heart of the unfortunate man with such a curved knife, as he thus escaped the ignominy of being decapitated by the jailer

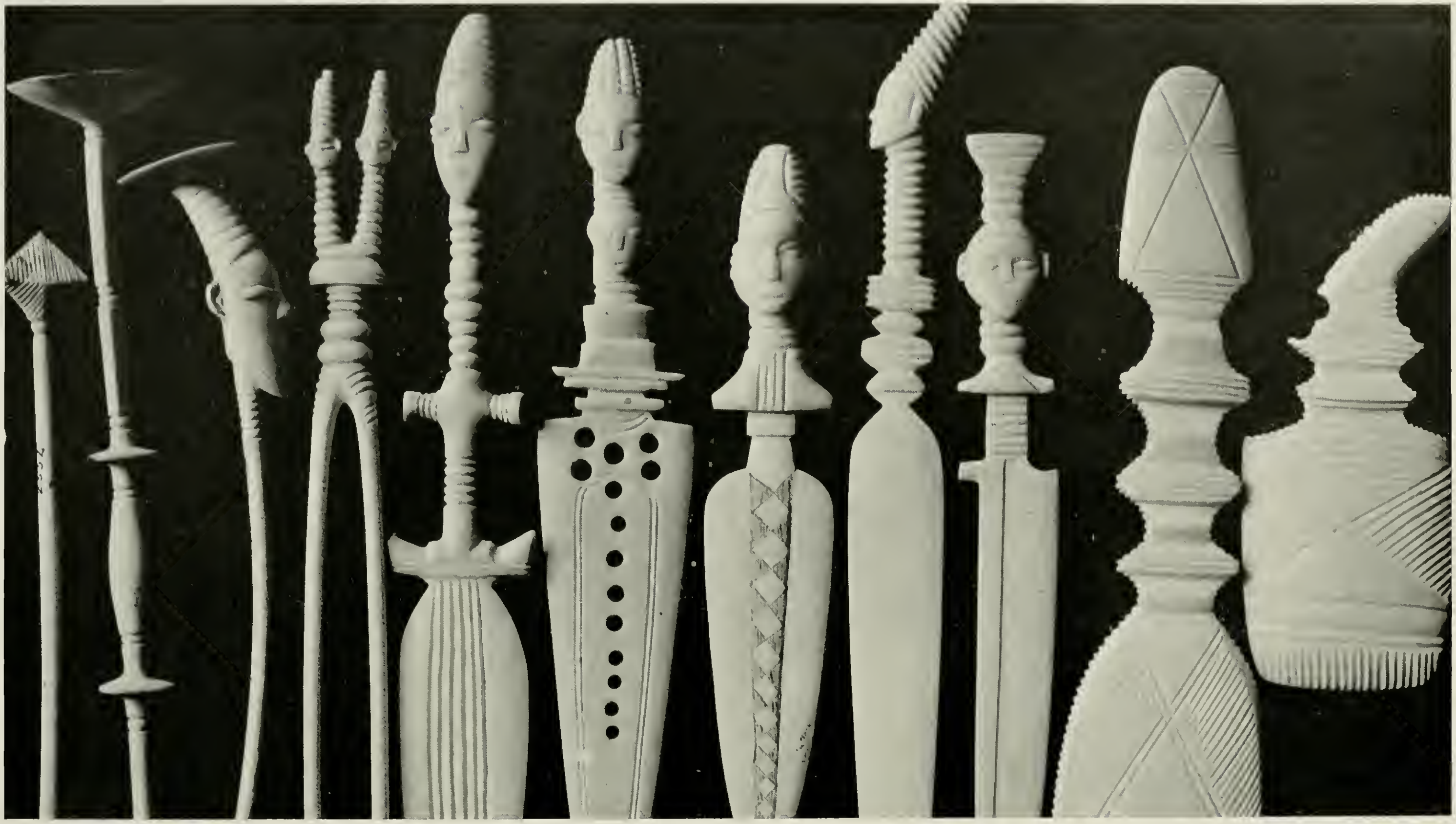
CARVED IVORY PINS FOR HAIRDRESS OR HATS ARE WORN BY BOTH MEN AND WOMEN IN MANGBETULAND

The incongruity of savage men wearing the most delicately carved ivory hatpins (something more than eighteen inches in length), recalls the beautiful orchids that grow on decayed trunks in the depths of the tropical forest. Only an experienced artist can hope to carve from the solid tip of an elephant tusk so slender a pin as these shown, topped with three large disks. No more wasteful design could be devised, for most of the ivory drops off in useless chips. All Mangbetu men of importance covet pins, most of which, however, terminate in a single concave disk, usually turned toward the front when worn, and supposed to represeut the radiance of the sun.

Fondness for decoration finds an outlet in elaborate hairdress. Bracelets, leglets, and necklaces are the other chief adornments. The string of blue beads worn by this chief's wife (at the left) supports shells from which the lead has been removed —ammunition used during the war with dervishes

EXQUISITE EXAMPLES OF MANGBETU ART

The first, fifth, seventh, and tenth are ivory ladles for stirring or serving mush prepared from bananas, millet, and sorghum flour. The second and eighth are combs to enhance further the often elaborate hairdress of the women. The third, fourth, sixth, and ninth are show knives, two of them with small figures on the conventionalized head, indicating the children of the owners



FURTHER EXAMPLES OF USEFUL IVORY CARVINGS

Four hat and hairpins (at the left) are followed by five show knives and by two line gauges used to trace designs on mud walls. From the intricacy and variety of pattern one would think that these Mangbetu artists must give considerable time to the study of their art, yet many follow the ordinary walks of life, turning to this work only as occasion arises, for a few years at most. At the first signs of old age, the Congo natives indulge in the privileges of patriarchal life

THREE, MANGBETU WOMEN

At the left, the simple arrangement of the hair and a fiber necklace indicate distress or mourning; in the middle, a rear view of Queen Nenzima's elaborate coiffure may be seen; and at the right, ivory pins are arranged much as a coronet; face and body are decorated with designs in black paint, which wears off in a few days.

The ease and luxury of the life at the Mangbetu court contrast strikingly with the dreary, burdensome life of the ordinary native woman. Small wonder that all girls in Mangbetuland crave admission to the king's harem. Eager competition ensues to obtain distinction by the arrangement of the hair and other decorative effects. Among their cherished possessions are ivory hairpins, which, far from contrasting unpleasantly with the jet black gloss of the hair, add much to their appearance. The Mangbetu women have the privilege of disposing of their treasures and some of the specimens now in the American Museum collection were graciously withdrawn from the hair and presented to us—for which we reciprocated, not with candy, but instead with a lump of salt, quite as "sweet" in their opinion

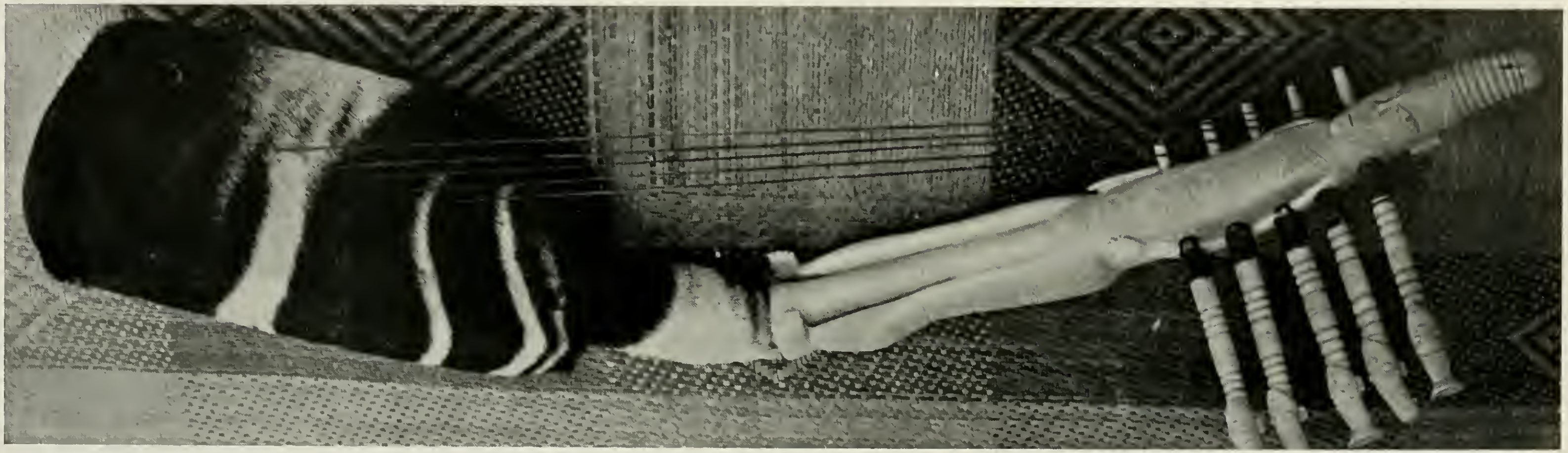
FROM THE CONGO COLLECTION OF IVORY HORNS IN THE AMERICAN MUSEUM

This series of carved ivory horns shows evolution from a simple hunting horn (below) to more pretentious examples. The horn in the middle has a peculiar charm, given by the beautiful lines, simple decoration, and mellow color of polished ivory. This example is closely rivaled by the smaller trumpet above, still more delicately finished and engraved with scenes from native life. The horn between has a clearer tone, however, than either of these; and is besides extremely light as it consists of a wooden tube covered with pieces of skin of the okapi and the leopard fitted into an elaborately carved ivory mouthpiece. The tooting of horns may imply a summons to joyful events, but it is also often a means of signaling information great distances in time of peace or war

A TRUMPETER OF THE MANGBETU COURT AND HIS IVORY INSTRUMENT

Court trumpets are carved from a single tusk and are sounded only at the king's request, usually to announce pleasant events which serve to increase the ardor of the performers. The musicians are as proud and careful of their instruments as are modern artists

A war horn contributes to the fame of its owner. This type of horn usually consists of an upper part of carved ivory into which is fitted a wooden tube covered with striped okapi hide and the skin from the inside of an elephant's ear. Each war horn is especially consecrated and to the inside are fastened talismans for success

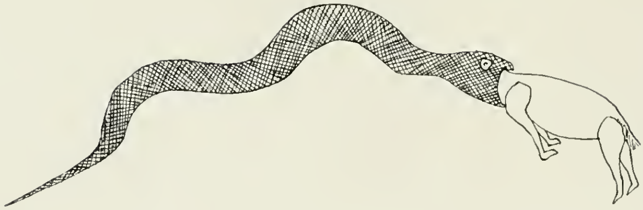


Numerous soft-toned musical instruments furnish evidence of the refinement of the Mangbetu. This specimen, Okondo's "harp," is covered with the skin of the mysterious okapi; it provided entertainment when the king was resting. It was always placed upon a mat so that "bad spirits" dwelling in the earth might not pollute it. The carved neck represents a conventionalized, well-tattooed human figure and the keys are richly ornamented, each terminating in a human head. The strings are of antelope skin

SMALL OIL DISHES CARVED FROM SINGLE BLOCKS OF IVORY

The Mangbetu take great care of the body, favoring the use of many oils, which they pour into small dishes or tiny calabashes for use. The owners are particularly proud of the distinctive form of their vessels, and often the more refined women, who are very vain, adopt some special scent for their oils. They also use powder made from various scented roots, beans, and other substances, and during festive occasions may anoint and powder the faces of their guests as a mark of special distinction

Two of the oil dishes shown here, the mottled forms with an effect recalling the grain of bird's-eye maple, are made of diseased ivory and are highly prized. Notwithstanding that these are rather heavy pieces, one is pleased to note a feeling of delicacy and restraint in the work that any modern artist might envy



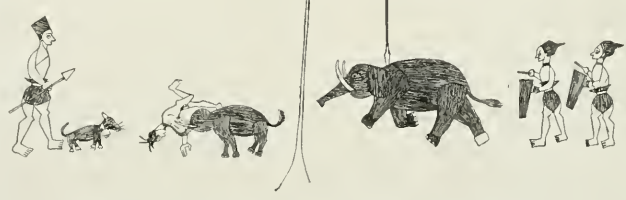
This is a cannibal artist's first attempt to portray tragedies in animal life. These drawings and those which follow are mechanical reproductions of originals engraved by natives on the polished surface of ivory

first.[1] They are used during festivals. Their loud, trumpeting sounds form a fit accompaniment to dances, and add to the admiration of the throng of visitors who spread afar the fame of the court.

The uncommon pride Mangbetu musicians display is attributable as much to their skill in performing as to the beauty of the instruments. No description can do full justice to the frantic endeavors of a trio refreshed with drafts of millet beer. To this day they have lost nothing of their verve, and Schweinfurth's picturesque description of forty years ago still admirably fits such a concert.

Rather ceremoniously they moisten the inner surface of the horn to heighten the resonance. Awe-inspiring booming typifies the ominous trumpeting of an elephant's fury; hardly less deafening, but with greater swiftness of action, follows the charge of the lion. The short-cut roars of the leopard merge imperceptibly into the curious snorting of an attacking boar, while the bellowing of buffaloes, gravely wounded, is not to be forgotten. The yells of followers and the rapid tooting denoting the calls of excited spearmen are cleverly interpolated. More melodious strains accompanying the joyous dances of the fortunate hunters and the happy crowd form the grand finale.

Centuries ago, long before he had learned to smelt iron, primitive man, invading the great West African forest, probably celebrated with hollow horns his success in hunting. Echoing through the shades of the towering trees, the blasts quickly brought together those fond of carousal and good cheer. Even today the boys of hunting parties claim the horns of the larger forest antelopes as their share of the spoils of the chase, and on a rocky ledge they grind off the solid tips and proudly flourish the deeply resonant notes of their own simple trumpets.

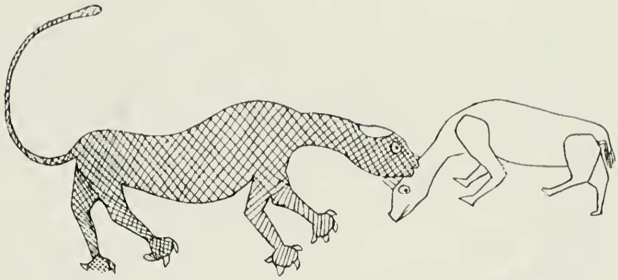


Pictograph from Congo ivory, showing how elephants come to grief for plundering native plantations.—The elephants, frightened by two men beating drums, are speared as they pass beneath the tree. An infuriated elephant charges one of the men, while the little dog (whose whereabouts is indicated by a clapper fastened to his collar) stands ready to track the scent of any elephant which escapes

The tusks of elephants were, and still are, reserved for the leaders in all strife. Although more difficult to work, horns of ivory produced louder sounds and, responding to the skill of the trumpeters, offered a con-

[1] AMERICAN MUSEUM JOURNAL, Vol. XV, No. 6 (Oct., 1915) and No. 8 (Dec., 1915).

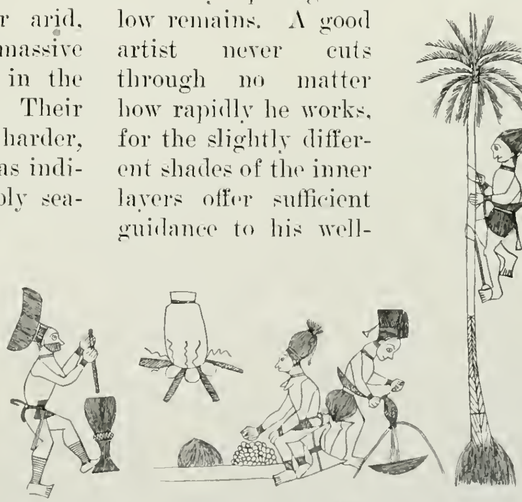
siderable variety of pleasing notes. Their size, however, was limited by the weight of the tusks, and hence only the hollowest, those of young bulls, were available. After the natives had learned to work with iron tools, the great chiefs soon derived part of their prestige from the size of the horns, for the larger trumpets could be heard at a greater distance. The well-known blasts represented the chief's full authority, for they transmitted the first summons to war and called the bravest to his side when he seemed lost in the fray.



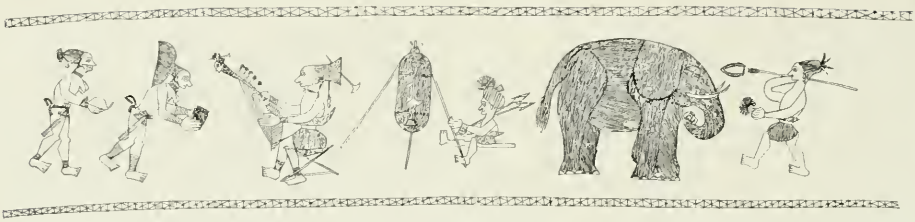
Further animal tragedies depicted in ivory by a cannibal artist.—A leopard springs upon a small antelope, crushing its skull; an African domestic hen worries a snake it has caught

To make a good trumpet is a difficult task, but gracefully curved tusks with a large cavity extending more than two thirds of the length considerably facilitate the work. These are common among elephants foraging in the districts where grows an abundance of succulent food, such as in the luxuriant rain forest; whereas tusks from elephants grazing on the rather arid, northeastern plains are more massive but with a smaller cavity as in the greatly reduced female tusks. Their texture is finer and the ivory harder, however, due to slower growth, as indicated by the concentric, probably seasonal layers.

With a flexible rod the artist measures the extent of the cavity, near the narrow end of which, on the concave side, the mouthpiece is placed. Using only an adz and knife, he carves the hole for this mouthpiece, and in less than an hour the first blasts announce his success. For ordinary horns, the massive top is cut off somewhat beyond the mouthpiece, forming a terminal fingerhole by which the pitch of the tones is controlled, as in a flute. But trumpets must be light, for they are brandished in every direction by the constantly pirouetting musicians. The solid ivory, from which artists of other lands fashion their treasures, flies off in useless chips until a mere shell around the naturally tapering hollow remains. A good artist never cuts through no matter how rapidly he works, for the slightly different shades of the inner layers offer sufficient guidance to his well-



Ivory pictograph of palm-oil manufacture.—The native at the right is ascending an oil palm to gather the nuts. He uses climbing ropes, standing on one while he moves the other higher. The nuts are boiled in the caldron (above at left). In a mortar (extreme left) the pulp is loosened from the kernels which are then separated out on a mat (middle). The oil press (at the left of the palm) is made of a flexible tree bent over, to which a troughlike, wickerwork basket with a loop at either end is fastened. The pulp is placed in the basket and by slowly turning a stick inserted in the loops, the palm oil is forced through the meshes into a wide dish on the ground



Ivory pictograph of elephant hunting.—The hunter makes music while his wives bring him wine and food (at the left). He sets up his shield and awaits the dictum of the oracle. Hearing that success will accompany his efforts, he proceeds to the hunt, holding in his left hand a yellow flower that is to render him invisible. He kills the elephant by severing its trunk

trained eye, and when in doubt he holds the ivory to the sunlight.

The king's trumpets are carved in heavy relief, with bands and parallel lines as the main embellishment. There may be other motives, such as canoes or human faces, but a conventionalized female figure or head is the most typical. This has evidently been adopted in honor of Queen Nenzima, the famous diplomat, who took part in all deliberations, and is perhaps responsible for the fact that the Mangbetu have adopted woman suffrage to a certain extent—a fact the more remarkable because women were kept in complete bondage by all the neighboring tribes.

The finest example of a war horn we have ever seen was prepared by the most skillful of Okondo's men, Karibu. As usual only the upper half is of ivory; the lower part consists of a carefully fitted wooden tube covered with portions of the hides of elephant and okapi. Mangbetu superstition has endowed these animals with extraordinary powers, that by the magic of the medicine men are concentrated in these fragments of skin and can be transferred to the owner of these charms. The elephant, the king of all beasts, is supreme in power, whereas the mysterious okapi is supposed to retaliate by wiping out his human aggressor, his family, and all who live in the same village. It is said that sounds of such war trumpets are liable to bring misfortune to renegades and enemies alike.

The Mangbetu natives make rings of carved ivory after the fashion of those they have seen worn by white men. These rings show the fancy of the natives for conventionalized heads and faces

The subjects of Zebandra, another Mangbetu chief, boasted that their battle horn contained the medicine of doom for others. There were the finger bones, teeth, hair, and other dried portions of slain enemies bundled together in unusual harmony and fastened inside the hollow. The spirits of these victims were supposed to hear the notes of defiance, and the sounds, pass-

Pictograph of hunting and fishing.—One party has been successful in the forest. The boar, suspended from a pole by loops cut and pulled up from its own hide, is borne by two men, while a third follows, carrying the hunting nets. The fishing party, too, has been fortunate, its success represented by the proverbially large fish. The second figure in the boat, a little boy, eagerly awaits an opportunity to spear a fish; the two other spearlike implements are oars. In the group of three at the right, the leader of the party (in the middle), on returning home, threatens his flirtatious wife with severe punishment for her conduct with a warrior (extreme right). To appease his anger, she offers him in one hand a bowl of wine, and in the other, leaves to wipe his perspiring brow

ing across the fragments of the remains, were to carry such disaster to opponents as they themselves had experienced.

The great chiefs of the Spartan-like Azande, who conquered parts of Mangbetu territory, tried to imitate the wonders of the court of the Mangbetu king, for they recognized the importance of favorably impressing the natives enslaved by them. A few of the ivories in the American Museum collection show the work of Azande artists. Sasa especially decorated the horns with valuable records of customs and beliefs from the native's point of view. Without any previous sketch, these pictographs, often direct from actual scenes, are scratched on the well-polished ivory horns with the sharp point of a knife. From time to time the artist rubs his thumb over a piece of charcoal and passes it across the engraved line causing the picture to stand out clearly in black.

The only ancient ivory carvings found in Africa are those from Egypt, assigned by Petrie to about 7000 B.C. Although Assyrian and Phœnician ivories date to the ninth and seventh centuries B.C.,[1] subjects from about 4000 B.C. indicate that even then elephant tusks must have formed a valuable article of commercial intercourse.

The first piece of carved ivory we came across in the Congo was at Avakubi. Dr. Rosati, the resident physician and a great sportsman, showed us an interesting club, a smooth, nearly cylindrical piece of brown ivory about eighteen inches long. Natives, he told us, found it of service in breaking the bones of their victims—whose bodies were then soaked, to render them more

[1] *Ivory and the Elephant*, by Dr. George Frederick Kunz, pp. 8–13.

Pictograph of buffalo hunt.—When the wounded buffaloes charge, one native climbs a tree, another shoots poisoned arrows, while a third feigns death, illustrating the native belief that even an infuriated buffalo will not hurt a "dead" man. Hunters with spears come to the rescue, and the women at the extreme right carry home the spoils, a buffalo head and a basket of meat tender, in a part of the river inaccessible to crocodiles.

The largest tusks were always proudly carried home by the successful hunters and often exhibited in the villages as a matter of rivalry. Stanley, in recounting his famous trip down the Congo in 1877, mentions "a temple of tusks" seen at Basoko, and states that ivory was "as abundant as fuel." He records the finding of ivory horns, pestles, and mallets, and we know that much of the ivory first exported consisted of such roughly carved native implements.

Africa, so long the dark continent, for six thousand years has furnished raw ivory and, in the last few centuries, by far the greater amount of the world's supply.[1] Elephants formerly swarmed there; but, victims of the trader's greed, they disappeared as steadily from all sections as access was rendered more easy. The Ivory Coast (Guinea) and South Africa, once famous for the export of tusks, constitute the most striking examples of regions from which the elephant has virtually been exterminated in recent times.

[1] Asia's contribution of ivory has been comparatively small, for the tusks of Indian elephants, never as large as African, are often absent in the female; the supply of prehistoric ivory from mammoths has become available only recently although used for many years in China. The records of a single tusk of the African elephant are: in weight, 236 lbs. (British Museum), in length, 11 ft. 5 in. (New York Zoölogical Society, National Collection of Horns); whereas for the Indian elephant the record weight is 109 lbs., and the length, 8.9 feet.

No other substance used in art was procured at such exorbitant cost, and yet it served for the admiration of only the few. The gradual destruction of a kingly beast would have meant little in comparison with the desolation and distress loosed upon poor natives who happened to own tusks or lived where elephants were abundant. Ivory trade for a long period was identified with slave raids of Arabs, dervishes, and other irresponsibles.[2] The tusks were literally borne to the coast upon a stream of human blood, caravans of mistreated humanity. Those ransomed by relatives before they were impressed into such dreadful porterage were lucky indeed; in general, a large tusk bought freedom for the unfortunate captive who otherwise would have become a slave. Now the ivory trade is everywhere under governmental control and follows established commercial principles. Though money was seldom used in the northeastern part of the Belgian Congo before its introduction in 1911, Greeks and Hindus bought ivory, principally in exchange for mules and donkeys. Chiefs, arrayed in old, gold-braided uniforms and looking for a steed, were eager customers. Cheap guns and powder also were acceptable, and contraband whiskey has always proved the most lucrative merchandise.

[2] Herbert Ward, *A Voice from the Congo*, Charles Scribner's Sons, New York, 1910.

Among the tribes far to the interior of Africa, such as the Mangbetu, wars are waged only on land, but if enemy boats accidentally meet in mid-river, as pictured here, the occupants make no attempt to throw spears. They try to capture one another instead. The dugouts are dragged to land, and warriors (shown at either end) decide the issue.

Th only canoes used are hollowed from a huge tree trunk, and it takes experienced natives from two to six weeks, according to the size of canoe desired, to chisel one out with ax and adz. A few tribes also char the inside to render the process of hollowing easier

Research in Science

THE PAST TEACHES THAT IT MUST NOT BE RESTRICTED TO UTILITARIAN PROBLEMS: THE WHOLE HORIZON MUST BE SWEPT FOR FACTS: THE ULTIMATE PRACTICAL VALUE TO MAN OF ALL GENERAL AND ABSTRACT INVESTIGATIONS SURPASSES BY FAR ANY MONETARY COST

By WINTERTON C. CURTIS

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THERE is an exhortation, supposedly epitomizing the wisdom of practical life. "Don't waste your time speculating on why black hens lay white eggs. Get the egg." This is, doubtless, good advice in business affairs and appeals to the average man as a sensible doctrine. But as we shall show, those who have done most for the world in a practical way have often been the men who speculated on just such problems as this—and who solved them. Today the man who gets the most eggs is he who in breeding and rearing his poultry follows the methods established by the scientific study of heredity, of selection, and of general physiology. And it is worth remembering that the scientific workers who established the more important of these facts were not lured to their work by the prospect of financial gain, but grappled with biological problems because of a conviction that knowledge of such matters was indispensable to human welfare.

If we analyze the "getting of eggs," as it goes on in the varied commerce of our modern world, we find that industry everywhere is rooted in the facts of science. Not uncommonly, whole fields of commercial enterprise go back to some simple but fundamental scientific generalization. Thus, the canning industry is founded upon what the biologist terms "biogenesis," or the fact that there is no life save from preëxisting life. For since putrefaction is an incident of the growth of microscopic forms in organic materials, there can be no putrefaction where all living germs have been destroyed, by heat or other means, and where new germs cannot obtain access. The chemical processes which underlie so many industries have all been built upon the fundamental theory of chemical combination, which was elaborated during the latter half of the eighteenth and the first half of the nineteenth centuries, while in physical science, the generalizations regarding the indestructibility of matter and energy are similarly important.

We all recognize that only by painstaking effort can scientific knowledge be obtained. But we commonly fail to recognize the nature of the scientific studies which preceded the discovery of many facts applicable in our daily lives. Science is the foundation of life in civilized communities as well as of modern industry; and the scientific discoveries of the present will, if we do our share, be as vital in the lives of future generations. We should understand definitely that the distinction between "pure" and "applied" science is an artificial one, because no line of separation exists. On every hand, discoveries of a theoretical and general nature are of practical value; and, conversely, the practical achievements of science are a continual stimulus to further investigations along theoretical lines which, in turn, influence practice in wholly unexpected ways.

Any research that promises substantial additions to our knowledge is worth doing in the present, because in the past such work has often yielded results undreamed of at its inception. The history of science urges us to the continuation of theoretical and nonutilitarian investigation, however much we may be tempted to press the more obviously utilitarian lines of study. Research along lines immediately useful will take care of itself, for we are all convinced that it pays big dividends. But where the immediate return is not in evidence, it requires a certain faith in the outcome which can be held only by those who know what has happened again and again in the history of science.

It is, therefore, important that teachers and preachers of science emphasize this phase of scientific progress. Scientific men have not made this item of their creed sufficiently clear to those who are not scientists. As they have opportunity, they should preach to the public as well as to one another the need for investigation unhampered by utilitarian demands. The oneness of science should be emphasized to the end that the public may understand how science advances, and that the public like the scientist, may live in the faith that knowledge of natural phenomena is always worth more than it costs.

There is not so much danger that we shall fail to appreciate research in applied science—how to grow thirty bushels of wheat where ten grew before—how to produce a new antitoxin. But there is danger that we fail to see the other side, that the men capable of doing creative work as investigators be unable to find a livelihood, and that in the present, as in the past, the advance of science may depend too largely upon the chance meeting of brains and means. To show that this danger is real, not imaginary, we may say that in zoölogical science there are in the United States today few positions in which a young man of promise may earn a living in pure science. He may teach, with small chance for investigation; he may find limited opportunities in the applied zoölogy of government or state service or of commercial enterprise; but for the man who gives promise of being competent to do the pioneering demanded by pure science, there is almost no opportunity for a living. A like condition obtains in many lines of science other than zoölogy. This failure to provide opportunity for the man of promise is a shame upon our civilization, for we are drying up the springs which feed the fountain.

Conspicuous ability as an investigator is rare, and every effort should be made to discover the man giving promise of such attainment. When found, he should have his chance, should be given clearance papers for a voyage into the unknown. Men who have this ability, who, standing upon the ground already mapped, can see the distant mountains, and whose imagination pictures the path across the intervening valley, are like the explorers of a virgin continent; they "yearn beyond the sky-line where the strange roads go down." And our race has come out of barbarism because the desire for knowledge has impelled men of this adventurous spirit, in spite of discouragement and misunderstanding, persecution and death, to search after the facts of science in what is for man the last "dark continent"—the realm of nature.

> "We were dreamers, dreaming greatly,
> in the man-stifled town;
> We yearned beyond the sky-line where
> the strange roads go down.
> Came the Whisper, came the Vision, came
> the Power with the Need,
> Till the Soul that is not man's soul was
> lent us to lead."

This stanza from Kipling's "Song of the English" is chosen as a text in an analogy between the "nature searcher" and the explorer. Incidentally, it shows that science has not destroyed the opportunity for imagination. For, although "the old order changeth," there remains in our thinking that which brings the emotional appeal of epic verse; for here, indeed, men do contend with gods and strive to wrest from them the knowledge which shall make our future more secure.

The history of almost any line of scientific investigation, if traced back, will afford illustration of the matter in hand. The following three cases which I have chosen are representative and have often been used in my teaching:

1—Microscopic organisms, which have been a subject of careful investigation for several centuries.

2—The development of the fresh-water mussel (a case where I can lay claim to some first-hand knowledge).

3—The study of heredity, a field of investigation which is still in its infancy.

Knowledge of the Microörganisms of Human Disease Began in Theoretical Non-utilitarian Research

Our present knowledge regarding the microscopic organisms which are the cause of disease is recognized today as of life and death importance for the whole civilized world. But this knowledge had its beginning in investigations which were of questionable value when judged by the utilitarian standards of the past. Society might well profit by this bit of history and assume a far-sighted policy in dealing with scientific investigation in the present.

That many diseases are caused by minute organisms, living as parasites within the bodies of animals and plants and so producing the derangements called disease, is a fact made familiar to the public during recent years; and we are making such progress in the discovery of germs hitherto unknown, of antitoxins, of vaccines, and the like, that even the antivivisectionists may some day be converted. Today, diphtheria is no longer the dangerous and often fatal disease it was even twenty years ago; and if we take the precautions already well tested, there is no danger that yellow fever will again scourge our Gulf cities, or bubonic plague devastate Europe and America as it still devastates the Orient. We have conquered typhoid fever, at least in cases of local epidemics or where large bodies of men are sent into dangerous territory, and no man can foresee where our control of disease will end.

Have you ever considered how we have attained to this mastery over disease? Do you know what is the history of this knowledge we now have, and whence came this body of facts which now grips us even unto matters of life and death? I do not refer to the most recent chapters, as heralded in the newspapers or current magazines, when an antitoxin for diphtheria or a method of preventing typhoid fever has been announced. These are but the recent pages of a book long in the making, to find the title-page of which we must turn back through many years and to matters having little apparent connection with what is now before us.

To test the truth of this last statement, let us trace the course of man's discoveries regarding the microörganisms, taking as a convenient starting point the year 1676 when the Hollander, Antony van Leeuwenhoek, discovered with the microscope, which had but lately come into use as a toy and source of amusement, what he described as "little animals observed in Rain, Well, Sea, and Snow Water as also in Water wherein Pepper had lain infused."[1] Leeuwenhoek's discoveries were, I suppose, regarded as useless by all his contemporaries save a few, by whom the work was highly esteemed. Some small means enabled him to devote a generous part of his time to study; and at the end of a long life he had examined with his microscope pretty much everything he could lay hands upon in both ani-

[1] See Kent, W. Saville, *Manual of the Infusoria*, for quotations from, and an account of, the work of Leeuwenhoek.

Courtesy of Henry Holt and Company

LEEUWENHOEK, THE FIRST GREAT MICROSCOPIST

To know the history of our present control of disease through the destruction of its microbes, we have to go back to Holland and the middle of the seventeenth century, when Antony van Leeuwenhoek was making what the world thought useless discoveries of bacteria and protozoans. The microscope, then just invented in a simple form, was little more than a toy, but it so fascinated Leeuwenhoek that it is said he gave a great part of his life to study with it and examined almost everything he could lay his hands on. It is recorded that he had more than two hundred instruments with an incredible number of lenses which he ground himself. It was his discovery of the flow of blood in the capillaries connecting the arteries and veins that was the final proof of Harvey's theory of the circulation. This man's work is only one instance of the ultimate practical value of theoretical research: most of the biological discoveries of greatest value in industrial and medical science have been made in the course of studies in pure science. Can we not make it possible that more of the young men of America have a chance to do scientific research? The Leeuwenhoeks of the future are among them

MENDEL, THE WORLD'S MOST FAMOUS STUDENT OF HEREDITY

Gregor Mendel (1822–1884), abbot of a monastery at Brünn, Austria, through experiments made in his garden, chiefly with peas, demonstrated a law of inheritance which was one of the great biological discoveries of the nineteenth century. This law is based upon his discovery that, in cross breeding, the parental characters are not blended but retain their individuality to such an extent that in subsequent generations they may be separated and recombined like the cards in a pack. Mendel's interests were along theoretical lines and not in any way utilitarian, yet so important was his discovery that today Mendelism is becoming a household word. The most successful breeder of animals of the future will be biologically trained and will know every twist and turn of the latest Mendelian formulæ (See page 562)

mate and inanimate nature. Among other things he discovered some of the larger bacteria, many protozoans, the passage of blood from arteries to veins through the capillaries (the one link needed to complete Harvey's evidence for the circulation), and he was the first to describe the human spermatozoön. He thus became the first great microscopist.

> "We were dreamers, dreaming greatly,
> in the man-stifled town;
> We yearned beyond the sky-line where
> the strange roads go down."

Despite crude and imperfect microscopes, knowledge of these animalcules grew apace, and during the eighteenth century the more important types were recognized. Their discovery reopened the discussion of spontaneous generation, which, a few years before Leeuwenhoek's first observations, had been discredited in the case of insects and larger organisms, and a bitter conflict was long waged between the opposing forces. During this struggle facts were established which not only aided in the final triumph of our conception of biogenesis, but also resulted in extensions of knowledge useful in other directions.

With the advent of the cell theory in 1839 and with marked improvements of the microscope, the distinction between multicellular and unicellular organisms was established, while the age-long controversy was closed by Pasteur in his studies upon disease and fermentation, Tyndall in his examination of the floating matter of the air, Dallinger and Drysdale, who first observed the complete life cycle of a protozoan, and a host of others. And here, these "nature searchers," who since the days of Leeuwenhoek had been pressing their forces into the seemingly useless fields which teemed with microscopic life, joined with the men long baffled in their fight for human lives, and gave to medicine the support needed in reaching the vantage ground from which to discover a new horizon line in the "germ theory of disease."

For a long time, physicians had known that certain diseases were "catching." "The pestilence that walketh in darkness," was no idle figure of speech. An analogy between the spread of disease and the spread of living organisms had been pointed out for centuries. But only in the nineteenth century, in the generations of our fathers and grandfathers, did the medical men, aided by the investigators who had ventured into the wider domain of abstract science, show that the germ is so truly the cause of infectious disease that without the microscopic germ the disease does not exist.[1] Since the firm establishment of this germ theory, now the "germ fact" of disease, investigations in this direction have received increasing support, until in recent years we have seen the establishment of institutions for general medical investigation, like the Rockefeller Institute in New York City or the Cancer Laboratory in Buffalo. And so immediate have been the results, we may well believe that laboratories of this character are destined in the near future to be generously supported by state and private beneficence.

The point for us is that these recent triumphs in an applied science had their beginnings in the days of Leeuwenhoek, and that this attainment has been possible because of the work of investigators who did not consider the immediate utilitarian values of what they sought, because of the labors of men who persevered in the belief that all facts of nature are worth while and who died in the faith that somehow, sometime, the facts they had established would find a place in man's scheme of the universe.

[1] First-hand contact with the medical discussion of this period may be obtained in Oliver Wendell Holmes's essay upon puerperal fever, written in 1843. This is well done and has the advantage of being found in almost every library.

"Then the wood failed—then the food failed—
then the last water dried—
In the faith of little children
we lay down and died."

Did our time allow, and could we go through this history in more detail, we should see how the more important of the earlier workers were students in pure science attempting to make what were termed in the earlier days "contributions to knowledge"; we should realize how the long fight over the question of spontaneous generation was for centuries only an abstract and academic matter of no seeming value in everyday affairs; we should learn how the burden of this pioneer work was borne by men who were given scant public assistance and little recognition at the time—who followed no path of least resistance.

"On the sand-drift—on the veldt-side—
in the fern-scrub we lay,
That our sons might follow after
by the bones on the way."

The lesson for us is plain. Are we in this day of enlightenment doing much better by the workers in pure science? We hail extravagantly the successful investigator in applied science, like Edison, and he is well rewarded; although what he gets is insignificant compared with that allowed by society to its swashbuckling captains of industry. But we do not provide for the man of promise in abstract science a chance to keep at his work, in the hope that he may make real contributions to knowledge. We are greedy over the finished product, while we turn out, to starve or teach, the young men among whom the Leeuwenhoeks of some future science must be found.

The criticism is that our civilization, although made possible by the control of nature which science has brought, is not offering adequate opportunity for further investigations. We are neglecting that which might lead to things as undreamed of as was the germ theory of disease, when Antony van Leeuwenhoek discovered certain "little animals observed in Rain, Well, Sea, and Snow Water as also in Water wherein Pepper had lain infused."

Knowledge of the Life History of the Fresh-water Mussel, Which Allows Control of the Pearl and Button Industries, Was Gained in Theoretical Research

The details of the life cycle of the fresh-water mussel were discovered after years of study by those adventurers of science who struck into the "hinterland" of nature, where lay no beaten trails; and the facts established in this earlier period and with no utilitarian aim have during the past twenty years been turned to account in commercial enterprise.

Briefly, the life cycle of the mussel is as follows: The sexes are separate, the spermatozoa are discharged freely into the water. These enter the body of the female with the respiratory water currents and there fertilize the eggs contained in brood-pouches which are formed by a modification of the gills. Development now begins and continues until a larval stage, known as the "glochidium," is reached. In this stage the young are discharged into the water. The glochidium, which in size is near the limit of visibility for the unaided human eye, now rests upon the bottom of the stream and must perish before many days unless accidentally brought into contact with a fish. In the latter event, the glochidium fastens itself upon a fin or gill, whereupon a growth of the fish's epithelium takes place and, in the course of a few hours, the glochidium is completely enclosed within the tissues of its host. Thus securely placed, it undergoes development to a stage in which it is able to assume the life of the parent mussel. It then drops from the fish to the bed of the stream and takes up an existence which is continued throughout life. Two points are of importance in this cycle.

Courtesy of the United States Bureau of Fisheries

Shells of mussels artificially reared and two of the four buttons which have been cut from the shells. —The manufacture of pearl buttons from mussel shells began in 1891 and the rapid increase in the business soon threatened the destruction of the mussels. The United States Government in consequence entered upon a series of investigations as to the practicability of propagating mussels artificially. This is a commercial problem, yet success depends upon a knowledge of the life history of the mussel, which has been gained by various investigators in theoretical work. The life history is unusual: after the young mussel develops from the egg to a larval form called "glochidium," barely visible to the naked human eye, it is discharged into the water where it develops further or dies, depending on whether it has an opportunity to attach itself to some fish. If chance favors it, it takes up the life of a parasite until far enough developed to leave the fish, drop to the bottom of the stream, and enter upon the life of the adult mussel. The task, therefore, of artificially breeding mussels, involves the bringing together of suitable fish and the young, almost microscopic, glochidia. Investigations have shown that a moderate sized fish may successfully carry from one thousand to two thousand of these parasitic guests

Courtesy of the United States Bureau of Fisheries

Part of a group of ponds for experimental work at the United States Fisheries Station, Fairport, Iowa.—This is an experiment station for the propagation of mussels as well as for fish culture. It was established by act of Congress in 1908. The mussels in the illustration above were reared in the pond in the right foreground. Work is carried on at the station to determine what species of fish are best suited to act as hosts to the parasitic young of certain species of mussels, and to ascertain the length of the period of parasitism and the life history of the young mussels thereafter, as well as the possibility of rearing them in ponds or in floating crates

The glochidium is a stage at which development ceases and death ensues unless the larva becomes attached as a parasite upon a fish. The gaining of this favorable environment within the fish's tissues is wholly accidental; and so many glochidia perish that they must be produced in enormous numbers in order that the chances of destruction be overcome and the continuance of the species assured.

When we examine the paths followed in the establishment of the facts above outlined, it happens that the trail again begins with Leeuwenhoek. Before his day it was not even known whether there existed in these lowly organisms anything comparable with the "maleness" and "femaleness" recognized in higher forms. Their whole mode of generation, whether spontaneous or by means of eggs, was a matter of dispute. In his efforts to solve these fundamental, but at the time wholly academic questions, Leeuwenhoek turned his microscope upon the fresh-water mussels and discovered the innumerable eggs and larvæ which crowd the brood-pouches. These he correctly interpreted as the young of the mussel in which they were found; and it is clear from his descriptions that he saw enough of their development to justify his opinion that mussels, like the more familiar forms of animal life, arose from eggs. In the subsequent advance of our knowledge two periods are conspicuous, one marked by a mistaken hypothesis, the other by the discovery of the parasitism. The first period, which extends from 1797 to about 1830, was ushered in when the failure to secure stages beyond the glochidium led to the so-called "Glochidium Theory," which maintained that the larvæ were not the young of the mussel in which they were found but a wholly different species living within the mussel as a parasite. This theory had the one advantage of all incorrect hypotheses: it aroused opposition which in turn called forth investigations. These showed once for all that the glochidium was the young of the mussel in whose brood-pouch it was found.[1]

Disproof of the glochidium theory left the facts regarding the subsequent

[1] In passing, it is of interest that the word "glochidium," by which we still designate these larvæ, had its origin at the period when the supposed parasites were described as a species which parasitized the mussel and were named *Glochidium parasiticum.*

Courtesy of the United States Bureau of Fisheries

Seining fish in Lake Pepin, Minnesota, for mussel propagation, and transferring the fish to the infection tank.—The supply of fish for this purpose is obtained chiefly by seining in the public waters. Overflow ponds near the course of rivers which under natural conditions dry up leaving the fish to die, are seined out, and those species suitable for infection with mussels are used in that work. Afterward, these, together with the other fish taken, are liberated in the river, thus reclaiming large numbers of fish which otherwise would be lost—as well as propagating the mussels stages by which the larvæ reach the condition of miniature adults, an unmapped territory where all trails went blind, and only in 1866, when a young German investigator[1] made the somewhat accidental observation of glochidia living as parasites upon fishes, was the clew discovered and the work of following the later stages made possible. During this final period, the post-glochidial development became well known and the earliest stages of egg and embryo were reëxamined in the interests of fundamental research upon development throughout the animal kingdom. Most important of all for illustration of the point here made, is the fact that, from Leeuwenhoek's beginning, all this work was part of an attempt to understand the nature of individual development in the animal world. Through it all, the direct pressure of utilitarian consideration is nowhere to be found, but rather a belief by the investigators that the facts were worth knowing because they gave a broader horizon to the landscape of nature.

In 1891 the first pearl button was cut from a fresh-water mussel shell. The business soon became a substantial industry and, within ten years, the destruction of the mussel beds in the Mississippi seemed imminent. At the request of the manufacturers, the United States Bureau of Fisheries undertook a brief survey and offered some wholesome advice, all of which was disregarded with the opening of new sources of supply in Arkansas, Indiana, and along the Ohio. Seven years later, under the stress of a still diminishing supply, the manufacturers again approached the United States Bureau of Fisheries with the result that the Bureau made an extensive study of the mussel with a view to its artificial propagation. The results of this investigation have now been brought together[2] and, since there are still many fundamental questions involved, the government has constructed, at Fairport, Iowa, a station for the investigation of these and all other problems of fresh-water biology, and as a part of this station, a hatchery for the rearing of mussels by artificial means.

While much remains to be done before the rearing of button mussels is established upon a commercial basis, the results are encouraging, and we may hope that before many years the supply of raw material will be drawn from beds artificially produced and maintained. As this work in applied science advances, it is conceivable that the men who have dealt with these practical problems may win popular recognition greater than that given to any of their predecessors during the two hundred and fifty years since Leeuwenhoek. Be this as it may, I do not hesitate in saying that to the earlier workers belongs the larger measure of recognition, that theirs was the more unique attainment; since between the two there is the difference between the man who broadens a beaten trail and him who penetrates territory wholly new.

The Future Structure of Society and Character of the Human Race Are Likely to be Controlled by Knowledge of the Workings of Heredity: This Knowledge Was Gained by Investigations not Aimed to be Utilitarian

In the field of heredity we have known so little, have so failed in the discovery of landmarks until very recent years, that biological science is only beginning to get its bearings and hew its way into the wild. We stand

[1] Leydig, F., *Mittheilung über den Parasitismus junger Unioniden an Fischen in Noll.*" Tübingen, Inaug-Dis. Frankfort a. M.

[2] Lefevre, G., and Curtis, W. C., Studies on the Reproduction and Artificial Propagation of Fresh-water Mussels, *Bulletin of the Bureau of Fisheries*, Vol. XXX, 1910. See also the miscellaneous papers by other investigators, in United States Bureau of Fisheries *Bulletins* since 1910.

as those who have just effected a landing upon a new continent, whose supply camps are established, whose axmen are out, and who are beginning the march. This is a field of investigation where discoveries are so new that men have not yet grasped the importance of them and set the facts to work in ways to suit the need. This is a problem of the future, and as such, appeals the more strongly to our imagination. How is it that we have come thus far upon our journey?

The fact of hereditary resemblance must have been recognized since man first gave attention to the breeding of domesticated animals, or first saw that his own offspring was like himself. But heredity remained rather the plaything of the philosopher than the problem of the scientist, until the manner of individual generation had become established and the germ cells recognized as its physical basis. All the earlier work upon reproduction and development, all the investigations which centered around the discussion of spontaneous generation, all the studies which led to the cell theory were necessary to establish our present position, and to give the investigation of heredity its point of departure. With these things behind it, heredity has become a subject of prime interest in present-day biology, and only in the last quarter century has our attack begun. Two men stand out as pioneers of the recent advance—Mendel, whose work was the earlier done but the later known; and Galton, who should be credited with collecting valuable data and with arousing public interest by his eugenic propaganda, although his supposed "law" appears of small importance when compared with the law enunciated by Mendel.

Without attempting an explanation of either the Galtonian or the Mendelian theory of heredity, a word may be said in illustration of an essential difference between the two. We are all familiar with the tables published by insurance companies, which tell us the expectation of life for a man at a given age. I am, say, thirty years of age. The table says I may expect to live until I am sixty-four. This is well so far as it goes. It is comforting to feel I have that much lease on life, even though life is half spent. And this knowledge does very well for life insurance companies, since it can be applied to thousands of policyholders with a degree of certainty which places the whole superstructure of the insurance business upon a stable foundation. In my particular case, however, this kind of certainty is not satisfying, since it can tell me nothing of my own or any other individual's duration of life. Though I die tomorrow or live to be a hundred, my life merely counts as one item in the statistics upon which such tables are based. These insurance tables allow us to make prophecies for populations, not for individuals, and this is essentially the nature of Galton's law of heredity. It attempts to say what will be the inheritance on the average, but leaves us in the dark as to what will happen in the individual case. If, on the other hand, after looking me over, the life insurance company were able to say that, barring death by accident, I would become an octogenarian, or to say that inability to resist disease would cut me off at forty, then we should have the kind of prophecy it is possible to make in cases of Mendelian inheritance. For here we can, by proper testing of the individual, foretell the characters he will transmit to his descendants. Galton's law is then of value as a statistical statement, but Mendel's is a guide to a fundamental analysis of heredity.

The discovery of the Mendelian phenomena was not the result of any feverish search for utilitarian values. Mendel's interests were along theoretical lines, and the account of his experiments remained buried in an obscure publication until after the same phenomena had been rediscovered by later workers about 1900. And now, with not two decades of the twentieth century gone over our heads, Mendelism is becoming a household word. So many facts have already been accumulated and so revolutionary are some of the conceptions, we begin to doubt whether our other theories of heredity have had any value whatsoever. And we look forward with hope, because we at last seem to be upon firm ground and to have found a way of advance.

So great is the importance to mankind of accurate knowledge, and hence control of heredity that the results which must inevitably flow from the obscure beginning made by Mendel, the Abbot of Brünn, are not easily appreciated. Already the breeding of domestic animals is feeling the impetus, and the superstitions which have clouded the efforts of practical breeders are becoming things of the past. The breeder of animals in the future, who would have large success, must be biologically trained, and must know every twist and turn of the latest Mendelian formulæ; for the same laws hold good in the insects as in man, in the horns of sheep as in the colors of poultry. Breeding will shortly become an exact science, demanding extensive biological training and a thorough knowledge of the shorthand which the Mendelian worker has invented for the visualizing of his complex phenomena.

For the human race, we may some day breed better men—although, of course, the time is far distant when any selective mating will be possible, save as we develop a social tradition that makes us feel disgraced if we marry where the stock is clearly defective, and save as we enforce a rigorous prohibition of the right which conspicuously defective individuals now have to inflict their full quota of descendants upon society. These things will come slowly, for the social organization is discouragingly stable, and we cannot be oversanguine when we contemplate the attainment of perfection at some future period. As Huxley put it, "if the temperature of space presented no obstacle, I should be glad to entertain this idea of ultimate human perfection; but judging from the past progress of our species, I am afraid that the globe will have cooled down so far, before the advent of this natural millennium, that we shall be, at best, perfected Esquimaux."

For all practical purposes, however, it is enough that man may improve his condition in the course of a century or so, a thing we obviously do accomplish in some degree. And we may expect material advance in the near future, if we do no more than prohibit what is clearly bad, while giving social approbation to the kind of matings which make for better men. But shall we stop here, once we recognize the facts? We have given up—among individuals, if not among nations—the cherished right to knock the other fellow on the head if he disagrees with us; and the type of mind which desires progress rather than precedent believes that the future will see the surrender or restriction of other rights now regarded as fundamental. It may even come to this matter of marriage and giving in marriage. Already we are making the attempt to prevent hereditarily defective individuals from reproducing their kind, a thing which can be safely attempted only when the facts of heredity are fully known for the particular cases in hand; while the eugenic propagandists are leading the thoughtful and conscientious members of society to consider their obligations in the light of heredity.

When we really get beyond the present "sky line," we shall do more than this. For the future will demand better brain and more of it than the past, and a sound body to go with the better brain. It has been said that "the rulers of the world have been big eaters";

which is probably true to the extent that those who hold their fellow men effectively in hand are, commonly, men and women of some brute force. One might say, as the converse of this, that the thinkers of the world have been below the average in physical attainment. For, while it cannot be stated accurately, it seems clear that nature exacts heavy penalties for much intellectual effort and that for most of the race physical toil, even though arduous, is still the most wholesome of all activities. How to realize the old Greek ideal of the beautiful body and the beautiful mind is still afar off.

Our present results indicate that heredity, and not environment or education, leads to permanent progress. If this is so, the application of the facts of heredity to our species will be one of the great problems of the future, and we see now that we are on the right track and that adequate knowledge, and hence control, of heredity may be possible sooner than we had thought.

What we have seen in the history of man's study of the microörganisms, in a more restricted case like the fresh-water mussel, and in the broad field of heredity, will be found in other lines. Facts apparently remote from present needs come to be the very life blood of a subsequent generation. There are, doubtless, barren fields, but almost any fact of nature is worth studying, since only by continued searching do we find that for which we seek. In our quest for facts, we must so advance that no spot is left wholly unexplored; for we cannot tell what importance any part of the field may assume. We cannot afford to concern ourselves today merely with what seems useful, since the more important advances of the past have so commonly been made through fields which at first gave small promise of value.

To some extent, the needs of practical life have induced men to explore the unknown territory of nature. But to a greater extent investigators have been led into this territory by their attempts to learn more of nature irrespective of utilitarian values. We should, therefore, spare no effort to make such investigations possible. The recent history of science indicates that a larger amount of research is now in progress, "where the strange roads go down," than at any time in the past, and that the more important part of this work is being pursued without the incentive of immediate gain. Workers in science should, in the face of the very general failure of the public to appreciate this situation, consider the ways and means to a better understanding. The case should be presented to the people and to students in scientific courses in a way to make all understand that science is not "just a lot of this bug business," as I heard one man say of zoölogy, but "a man's job" which appeals to the imagination and which taxes to the limit the intellectual resources—a task we must take up where our forebears laid it down.

"Follow after—we are waiting
  by the trails that we lost,
For the sound of many footsteps,
  for the tread of a host.
Follow after—follow after—
  for the harvest is sown:
By the bones about the wayside
  ye shall come to your own!"

"How Shall I Learn to Teach the Blinded Soldiers?"

By WALTER G. HOLMES

President and Manager of *The Matilda Ziegler Magazine for the Blind*[1]

NOT a week passes that several persons do not come to me and ask what they must do to learn to teach the blinded soldiers.

When I ask what experience they have had with the blind, I usually get the reply that they have had none, and often they tell me that they have never known or talked with a blind person. I then advise them to look up someone who is blind, among the 75,000 already blind here in this country, and who needs help. Then they ask, "What can I do for him?"

On one occasion I advised a lady to find some blind persons who lived circumscribed lives and take them out to "see" the world; take them for a walk; take them to a theater; read aloud to them; take them to a museum; or, best of all, take them to the park or the woods. She asked, "Why, what good would that do them, they can't see?" And such a woman thinks she can teach the blind soldier—can lift him up and make him feel that there is yet a place for him in the world, to be useful and happy!

The word "see" has two meanings—to see with the physical eye and to see or comprehend with the spiritual eye—and possibly it is through the spiritual eye after all that the most of our pleasures come.

If one wants a practical demonstration of this let him take a healthy normal blind person into the woods; there show him the trees and their various sizes, explain the bark of this and that tree, and its leaves. Let him touch with his fingers the growing grass or soft mosses; let him touch and smell the blossoms of the growing plants. His sense of smell being quickened, perhaps he may get a deeper fragrance from the flower than you do. His sense of hearing has been more cultivated than yours and he will detect a sweeter note in the bird's song than you do, and will hear more in the singing of the tiny insects that fill the grass and the trees than ever comes to your ears. You would give such a person a day of infinite joy, and food for happy thought and reflection for days to come, and you would go home realizing that the blind can "see" if we will only help them to do so.

You will find your blind friends asking you the color of each article or flower. Of course, if they have ever seen they will recall just what this or that color is, but if they have never seen they will also get a satisfaction, for they have a mental picture of each color—incorrect no doubt—but who knows that their mental picture of it may not be more beautiful than any glowing color our eyes have ever seen?

I once asked my brother, blind from infancy, to tell me his ideas of color, for he always asked the color of each new article he "saw." He told me that he got great satisfaction from knowing the color of things, but I found the realization of each color came to him as a sound. He said he knew that "red" was a dazzling color and that

[1] *The Matilda Ziegler Magazine for the Blind*, of which Mr. Holmes is president and manager, is a monthly publication financed for the last ten years by Mrs. William Ziegler of New York City, at an annual expense of about $25,000. Ten blind girls, two of whom are deaf as well as blind, are employed in collating the sheets of the magazine. The magazine is sent free each month to every blind person in the United States and Canada who can read.

A blind girl is operating the Braille typewriter which uses a system for the blind invented by a French teacher, Louis Braille, in which the characters are represented by raised dots. The "touch method" in typing here reaches the point of perfection

A deaf and blind girl reads proofs of *The Matilda Ziegler Magazine* and records errors on the typewriter. Useful employment removes the greatest burden, idleness, from the shoulders of the blind

when one told him a thing was red it came to him as a shrill whistle; he knew that the foliage was green and a restful color, and when told a thing was green it came to him as soft music. My brother's sense of hearing is so acute that he can tell when we are passing telephone poles or lamp-posts at the edge of the sidewalk from six to ten feet away. If we are driving along a country road, he can tell by the sound when we are passing a tree and when we are in open country or in woods. This comes from the law of compensation—he has to depend on sound and he has cultivated this sense. I have heard it said that the blind can tell color by touch, but I have never seen one who could, and I do not believe that there is anyone who can do this. I do know a blind lady, though, whose sense of touch is so acute that she can tell the denominations of paper money. She really feels the ink in which the numbers on the bills are printed.

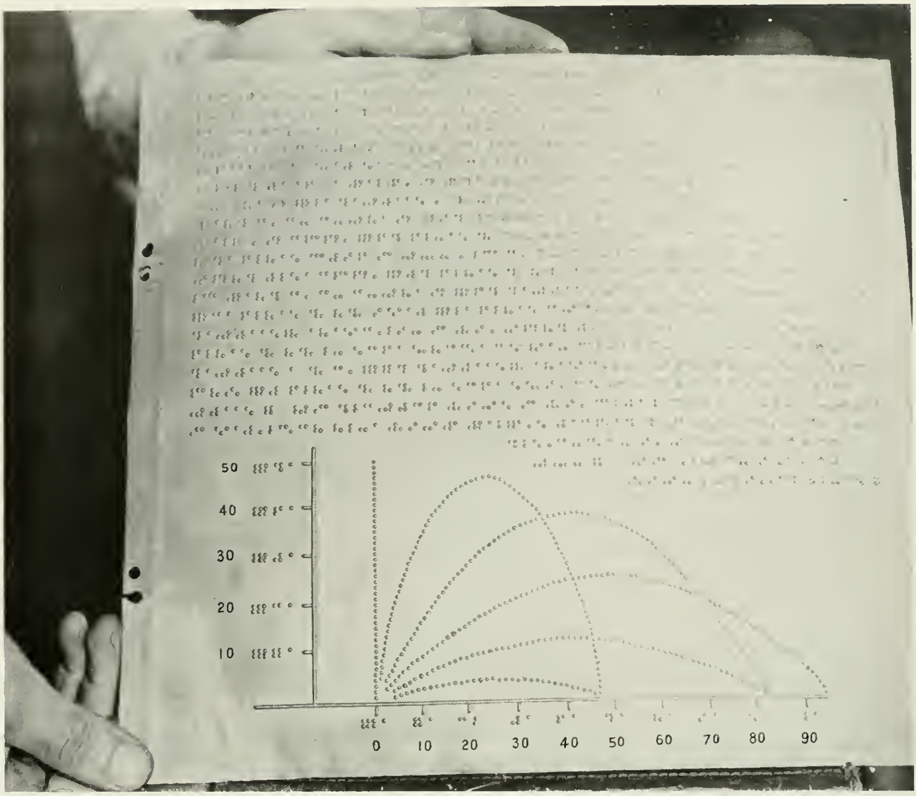
The blind, as a rule, have a keen sense of humor, which is surprising to the average person who supposes that they think gloomy thoughts only. One blind person once said to me, in complaining that most of the literature printed for them dealt with religious matters: "They seem to think that we blind can have no pleasure in this world and must always be thinking of and preparing for the next."

I remember, on one occasion, my brother and I called to see a very pious old relative in a distant state, who had never met him. She wanted in some way to express her sympathy for him and she said: "Oh, James, you should be so thankful that you are blind, as there are so many wicked things in this world that you cannot see." At once he replied, "Well, Cousin Sarah, there are a lot of them I'd like to chance one eye on."

The blind do not want sympathy—they want to be treated just as other people are treated, and they do not want to be reminded constantly of their blindness, of which they already know enough by experience. A blind girl once said to me, "I wish my friends who knew me before I lost my sight would help me to forget that I am not normal, because I am, except that I do not have my sight. They are always sympathizing with me and sympathy makes me weak."

It is interesting to note that sooner or later there comes to all blinded people a sense to detect obstacles in front of them. I have wondered if this faculty came from sound, a sort of echo, or if it came from a pressure of the atmosphere which they felt on nearing an object. Psychologists have attributed it to the latter, but I believe it comes from the former, for I have heard blind persons "clucking" or making a slight whistling sound when walking in unfamiliar places. They told me they were "sounding" to see if anything was in front of them. I am confirmed in this belief by the fact that a girl in my office, who is both deaf and blind, does not have this sense of detecting objects in front of her. This girl, however, has the sense of touch developed to an unusually high degree. I can write in ordinary script with the

Blind girls collate the sheets of *The Matilda Ziegler Magazine*.—The one week of each month which finds them thus engaged they call their "week of happiness," as they are then profitably employed. Much of the world's work could be done by the blind, and the present shortage of labor is calling attention to the fact



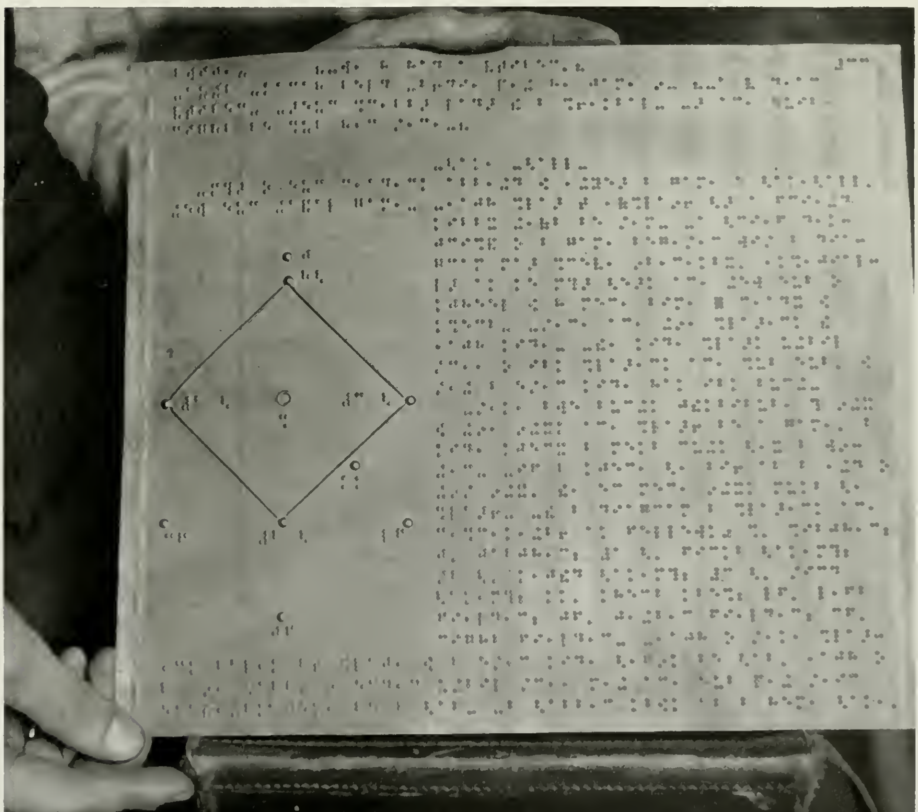
The range and angles of the "Big Bertha," the gun which has been shelling Paris of late, are set forth on a page of *The Matilda Ziegler Magazine*. The scale of miles shows the heights and horizontal distances reached by the shells. The blind take as lively interest in the events of this world as most other people, and naturally do not appreciate the apparent attitude of many of their friends that they should only be preparing for the next

point of my finger in the palm of her hand, and she can comprehend it as rapidly as I can write it, or she can hold her hand on mine as I write with a pencil and read what I write. This girl gets a pleasurable sensation from placing her hand on the piano as it is played. She knows in this way a dozen pieces, and will repeat the words of the songs, going slowly or rapidly as you play them.

The American Museum of Natural History of New York is doing much in its special work for the blind,—the program of which is changed monthly, where they can feel the objects exhibited,—and also in its course of lectures for the blind. It has arranged with the boy scouts that they act as guides for the blind who have no one to bring them, and it is one of the finest sights to watch one of these husky boys carefully leading a stooped old blind woman or man into the lecture hall; and it may be that he has gone away over to Brooklyn to get her. I wonder, too, if the public knows that the American Museum furnishes the car fares for those blind who are unable to pay. It is done gently, with no suggestion of charity that so hurts the blind, but the almoner sits at the door and asks, "Cannot I give you car fare for you and your guide?"

A few weeks ago I took our deaf-blind girl (Katherine McGirr) to the American Museum, and as the editor of this Journal and I walked with her, I placed her hand on one of the tusks of the big elephant, and then on its trunk, and at once she exclaimed, "Oh, a big elephant!" She told me she had never "seen" an elephant before, but knew it only from the descriptions she had read. She was greatly interested in a human skeleton—its smooth skull—its loose teeth—its ribs and its long fingers and toes. The big meteorite gave her great pleasure and she asked its weight, which necessitated my getting the information for her that it weighed 37,-107 lbs. This girl rarely ever forgets the hand of a person she has met once or twice. She tells the hands by the lines along the back and at the knuckles, but if the hands have just been washed and softened with soap she has difficulty in recognizing them.

I had the pleasure of spending an evening recently in the home of Miss Helen Keller. I was accompanied by a young blind woman who sings beautifully, and of whom Miss Keller is very fond. As she sang, sitting at the piano, Miss Keller stood behind her, and by lightly resting the first finger of her left hand gently on the singer's lips and the little finger on her throat she got not only the words but the melody of the songs, her lips sometimes moving as she herself also repeated the words. Occasionally in the ecstasy of delight Miss Keller would move her right hand up and down, slowly or rapidly with



The Matilda Ziegler Magazine gives its readers a description of baseball. This game is greatly enjoyed by many blind persons, when with friends who describe the hits, home runs, and so on, as they occur. Blind persons have, as a rule, a keen sense of humor and are not at all of the gloomy turn of mind usually attributed to them

TWO DEAF AND BLIND GIRLS EMPLOYED ON *THE MATILDA ZIEGLER MAGAZINE*

One is reading the magazine to the other, telling her by the manual alphabet what she reads. To those not accustomed to dealing with the blind their facility in communicating with each other by this means is marvelous.

Many are asking today what they can do to help the soldiers blinded in the war. There are many ways, but first let us realize that we have 75,000 blind in the United States already who need help and whom we can assist in a multitude of ways to become normal and happy the music, and at times would throw back her head as she drank in the song. It was a beautiful picture I shall never forget. One of the songs was of roses, "the red for joy and the white for pain." When it was finished Miss Keller said, "Oh, I think the tone of your voice is so splendid on that word 'white.'" Another song was "Pitter, Patter, Little Drops of Rain," and she tapped her fingers on the singer's shoulder in accompaniment with the drops of rain on the windowpane. Later we walked in her flower garden and she knew every flower as I plucked it and showed it to her, naming at a moment's touch the pansy, the larkspur, the rose, and other flowers.

What do the blind get out of a study of nature?[1] They get all and perhaps more than we do, but the shame is that thousands of blind sit *idly* in their homes—some of these too poor to be called homes. Meanwhile there are thousands of persons ready to teach the blinded soldiers and get the glamour that would come from that, and yet seldom give a thought to these others who could get so much pleasure from a friendly chat, a walk, or anything to take them out of their narrow lives and give them a chance to "see" and taste and smell and hear and feel the beauties of nature that abound just outside and beyond their narrow walls. It was Miss Keller who said, "The burden of the blind is not their blindness but their idleness." The fault that they are idle is not theirs—it is ours. We who have been blessed with sight are blameworthy. We can give the greatest pleasure to these blinded ones by helping to make them normal, happy people, and we can, too, find employment for them and lift this burden of idleness that is greater than their blindness. At any rate we can give them hours and days of pleasure, and I will guarantee that each of us will get for himself even greater pleasure in doing it.[2]

There are 75,000 blind in the United States. It is not likely that there will be 750 blinded soldiers, possibly not one fourth of this number. There is plenty to be done, you see, for all our blind at home in addition to the needs of the war blinded; and, besides, the Government and the Red Cross stand ready to do for every one of them.[3] Let us, at least, become better equipped to help the soldiers, by learning more of the neglected already blind, and of their needs.

[1] If one wants to read a fascinating story, let him get the book of the blind naturalist and writer, Clarence Hawks, *Hitting the Dark Trail*, published by Henry Holt & Co.

[2] Just now when there is a scarcity of labor everywhere, if we look about, with a visit to some neighboring factory, we may be able to find where the blind can fill many of these needed places. A manufacturer called on me a few weeks ago and during our conversation said, "I wonder if there is any work in my place a blind person could do!" I said, "Let me go with you and see." I saw at once that there was, and the next morning two blind girls were at work there getting, and earning, $1.25 a day. Another girl has been added since. Not one of these girls ever earned $3.00 a week before with her knitting and similar work. The work is the manufacture of spark plugs, and the girls assemble, wrap, and box these plugs.

[3] A "Red Cross Institute for the Blind" has been established on the grounds of the Military Training School for Blinded Soldiers, at Cold Spring Road, Guilford, Baltimore, at the request of the Surgeon General of the United States Army. The Institute, located on a beautiful country estate, is planned to supervise the activities of blinded marines, sailors, and soldiers, after they enter civil life and to supplement the training given at the Military Training School for the Blind.

The "Committee of Direction of the Institute," as appointed by the Red Cross War Council, is made up as follows: Mr. Henry B. Wallace, chairman; Lieut. Col. C. H. Connor, vice chairman; Alfred E. Shipley, M.D.; Mr. James P. Munroe; Mr. M. C. Migel; and Lieut. Col. James Bordley, director of the Institute. The hope is that the war-blinded men can be placed in positions which will utilize as far as possible the training, experience, and interest of their work before the war. The Institute will coöperate with the educators and other workers for the blind, including libraries, the *Ziegler Magazine*, and other printing plants for the blind, in the production and distribution of study and reading matter.—THE EDITOR.

Note on the American Museum's Work with the Blind

THROUGH the Jonathan Thorne Memorial Fund, established in 1910, the American Museum has been enabled to develop greatly the educational work for the blind of New York City which was begun in an experimental way during the previous year. This work has been conducted along the line of public lectures for adults and of classes in the Museum for children. In addition, the schools are provided with Museum specimens of mammals, minerals, birds, and ethnological objects for use in their class work, together with small plaster cast models of these, and also with large relief globes of the world. Blind children in New York City have such limited opportunities for coming in contact with natural objects that the use of such material as the Museum affords is in itself a revelation to them, stimulating the imagination and widening the mental horizon. School work is thus made more interesting for both pupil and teacher. The number of totally or partly blind children in the grades in Manhattan, the Bronx, and in the Washington Street School, Newark, New Jersey, is in the neighborhood of ninety. These children, in classes of from nine to ten, are brought to the American Museum by their teachers, who select the day and hour most convenient for themselves. Here the individual needs of each child are met by special instruction, since there is of necessity considerable variation in age, intelligence, and degree of blindness. Pupils are allowed to handle the objects used to illustrate the lesson and are encouraged to ask questions. Talks are given by Museum instructors upon topics selected by the teachers from a list submitted to them at the beginning of the year. The list of topics for the spring of 1918 included the following: "The Earth and Neighbor Worlds," "A Journey to Africa," "Animals of the Seashore," "Animals which Fly," "Trees, Buds, and Twigs," "Baskets and Pottery of the Indians," and "The Story of the Stone Age." Also a number of talks given last year on similar subjects were repeated by request. The Museum appreciates the value set upon the instruction, as evidenced in the regular attendance of the classes and by numerous letters received from the teachers of the blind children.

Besides the blind children, the number of sightless adults with whom the Museum endeavors constantly to keep in touch is about seven hundred. Invitations are sent to all these for the free lectures prepared by the Museum especially for them. Wherever necessary carfare to and from the Museum is advanced and boy scouts kindly volunteer to act as guides. The attendance at these lectures is usually about three hundred. The animals, birds, or flowers which form the subject of the evening talk are placed on exhibition in the foyer of the Museum where they may be handled by the audience. (See note at the bottom of the opposite page.) Among speakers at these evening talks to the blind have been Messrs. Ernest Harold Baynes, Louis Agassiz Fuertes, Ernest Thompson Seton, Charles Crawford Gorst, G. Clyde Fisher, and Admiral Robert E. Peary.—ANN E. THOMAS.

One "good turn" of the boy scouts of New York City is to act as escorts to the lectures for the blind at the American Museum of Natural History

GETTING AN IDEA OF THE WORLD WITH THEIR FINGERS

By means of these globes, which are loaned to those public schools of New York City and Brooklyn which teach the blind, the children get their first conception of what the world is like. They realize that it is round, that it inclines on its axis, and they learn to locate its principal cities and chief physical features. They feel the heights of the mountains and the flatness of the deserts and run their fingers along the courses of rivers. When they have discovered the character of a country they are told the history of the people who occupy it, and they are allowed to handle specimens illustrating clothing and implements and native animals. Blind children who have taken a number of lessons can point to any place mentioned. They may make a journey by sea from New York southward and across the Panama Canal, or a trip by train across the continent and thence to Japan, stopping at the Hawaiian Islands on the way.

The American Museum has fifteen such relief globes, twenty-six inches in diameter. They were designed in consultation with the late Gertrude E. Bingham, supervisor of classes for the blind in New York City, and were executed by Howells' Microcosm, Washington, D. C. Great care was used in preparing them. A trial globe was made and corrected after experimental work with the children

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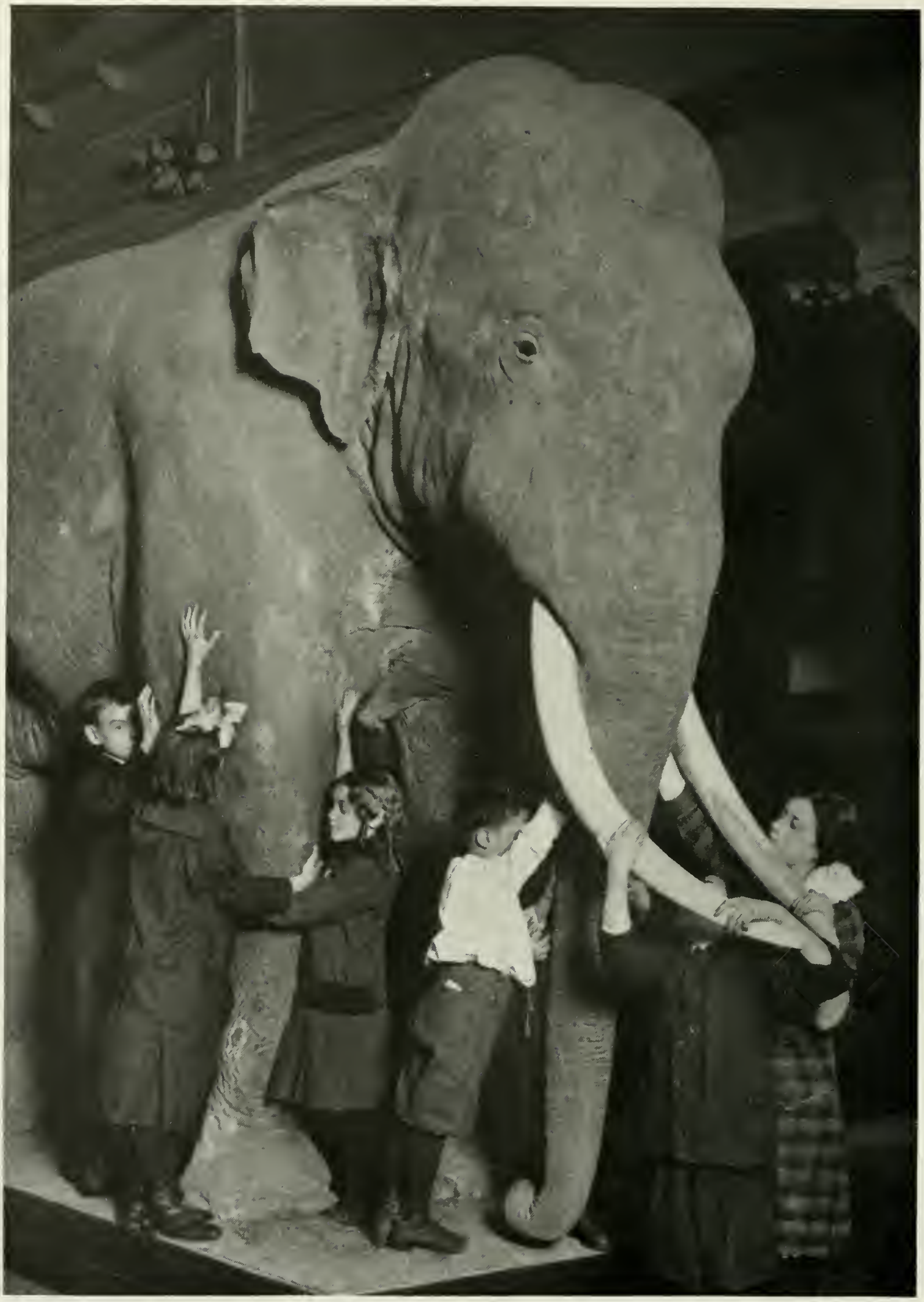
NOTE.—The flashlight photograph reproduced on the back of the cover of this number of the JOURNAL shows a group of blind and partly sighted persons examining mounted specimens of wild birds in the foyer of the American Museum. It is not difficult to tell from the expressions on the various faces which of the group are wholly blind and which have been surprised by the flashlight. Opportunity is afforded both before a lecture and afterward to see the objects lectured about. On the occasion of a wi'd-flower lecture the foyer is gay with masses of the fresh field and tree blossoms; before a bird lecture there are tables covered with the mounted birds and with bird nests. In all cases instructors are at hand to answer questions. The interest of the blind in nature is very genuine. They are especially glad when they "see" a bird or flower they have heard about but have never touched before, or when they see one perhaps known in years gone by when they were not blind. After having made the acquaintance of the birds in this way they take special pleasure in listening to the whistled bird songs

IMAGINATION AND THE SEEING HAND

The suffering is deep that comes from a sense of unworthiness for life, of limitation which unfits one to give service to those he loves, and to take his place with others as a normal, useful member of home and society. This suffering is thrust upon children of sensitive nature who are blind. They need help in such study and play as will give them a broad vision outside themselves and a courage of spirit to fight their way into helpfulness to others and even full self-support when they are grown. Blindness does not mar the power to learn or to attain to great knowledge or wisdom; it merely requires a different channel through which sensations shall enter the brain. It does not hinder the association of ideas or formation of theories as in any child who can see. It does not hinder the action of the imagination. In fact the blind build up a very real and vivid world—and as we all know, the most beautiful world is that of the imagination. There might even be the question whether, other things being equal, one sees better with the hand or the eye. Surely it is true that the touch of the hand is very real and near, leaving nothing uncertain. This blind child can put together her reading and her various touch impressions and visualize the traveler in Arctic snows quite as well as can the child who has gained her ideas of snow and snowshoes through her eyes

HAND AND FINGER MEMORY

He knows his household pets—especially his dog. Now, from his opportunity at the Museum, his mental vision is reaching out to include the wilderness animals. A blind child's hand becomes acutely sensitive to line and surface. It soon learns to recognize innumerable fine distinctions and slight modifications which carry to his mind a quick identification of objects. He reaches out his hand from his darkness and it is as if the light shone; he reaches it out from his isolation and he is not alone. Helen Keller, speaking of the value of the sense of touch for the blind, says in connection with her dog: "He loved it [her hand] with his tail, with his paw, with his tongue. If he could speak, I believe he would say with me that Paradise is attained by touch; for in touch is all love and intelligence." There is good evidence for the assertion that in the education of children who see we attach too little importance to the value of the sense of touch

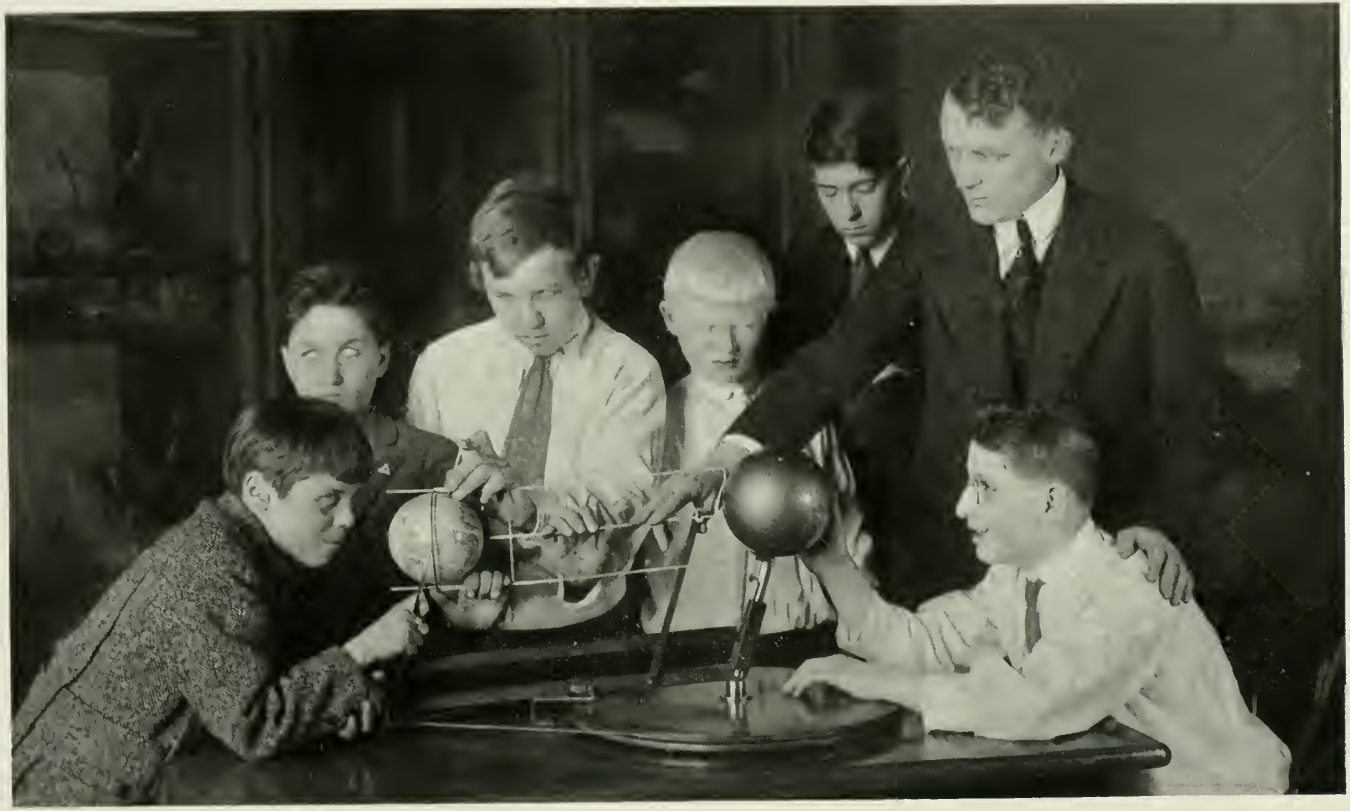


BLIND CHILDREN LIKE "TIP," THE ASIAN ELEPHANT

Fortunately for the children of the blind classes, many specimens exhibited in the American Museum are not under glass. The children cannot quickly grasp through the sense of touch the idea of the whole of a large object, or such a thing as a garden or a room, but they can get acquainted with the parts, and the mind makes the combination. The American Museum has had made especially for use with the blind classes small plaster models (one inch to one foot) of elephant, buffalo, giraffe, camel, and hippopotamus, from which an idea of the shape and pose of the whole can be gained before studying the real object. One small blind boy, passing his fingers over the face of "Caliph," the great hippopotamus in the African hall, remarked that it must have a good disposition as the corners of its mouth turned up

PART OF A CLASS OF BLIND IN THE AMERICAN MUSEUM

The American Museum can give opportunities to these children not easily found elsewhere. For instance, it furnishes models illustrating methods in the history of transportation,—moccasins, canoes, pack horses, prairie schooners, steam cars, sail and steamboats, hydro-aëroplanes. It also has an accurate model of the Panama Canal. In New York the greater number of blind children and children partly blind come from the homes of the poor. As a rule they are not highly gifted intellectually. In other words they are just like the masses of all other children, except that they start with a definite handicap. The public schools of New York now provide study classes and teachers for partly blind children, with suitable medical attention and provision of raised type. These children however, recite and receive instruction in the regular classes. Not isolating the children from normal children results in an adaptation for the later time when they must earn a livelihood among normal people



WHETHER FOR HAND OR EYE, A SPIRIT OF INQUIRY IS THE THING

A class at the American Museum with apparatus to show the earth and the sun, direct rays of the sun (represented by wires) and rotation of the earth on its axis. It is easy for the boy's hand to read from this the cause for night and day and for summer and winter. The boy in the middle is not blind but pure albino. He sees with great difficulty because of the flood of light unrestricted by pigment in the iris.

The thousands of blind children in America, too young to go to school or to get the help from classes at the Museum, are wholly dependent on the mother. Will she give the special effort necessary to make her child learn through the sense of touch to know her and carry on normal childish activities in the home, so that for this blind child there will be the same result as for the child who gets its impressions by imitation and the quick understanding of the eye? Every such mother would wish to read Helen Keller's paper on "The Training of a Blind Child" (See *Out of the Dark*, pp. 188–207, Doubleday, Page and Company, 1913)

BLIND CHILDREN AT THE AMERICAN MUSEUM, "VISUALIZING" LIFE IN THE ARCTIC

Peter is learning how the Eskimos build their summer home. He has a piece of real sealskin to put over the tent poles. Bessie, in the background, an extremely bright girl, is looking at a model of an Eskimo's winter igloo (blocks of plaster represent the blocks of ice). Other children are examining a model of Mene, the Eskimo who came down with Peary. Rose with the curls is caressing one of Peary's dogs (mounted).

When Peary gave one of the American Museum's evening lectures to the blind, Mr. Holmes, of the *Ziegler Magazine for the Blind*, provided every member of the audience with a flat relief map showing the Arctic lands and the water about the Pole. The Museum also had ready for examination before the lecture and afterward a number of Eskimo dogs (mounted) hitched to a sledge actually used on one of the Peary expeditions, so that the method of harnessing common in the eastern Arctic might be studied.

Names closely connected with the initiation of work for the blind in New York City are those of Mark Twain and Joseph H. Choate

Photograph by E. O. Hovey

LIKE A STRANGE WARSHIP OF THE NORTH

Great icebergs come from the glaciers at the head of Disco Bay or drift along the coast of Disco Island as they float southward from the glaciers of Melville Bay. Often large fleets of them ground on the bars east of Godhavn, where the sunshine and warm currents break them up into fragments. They burst apart with noise like heavy cannonading and, as the fragments topple over, they set up huge waves that break high and fiercely upon the adjacent shore or die out far from their origin

The Danish Arctic Station at Godhavn

By W. ELMER EKBLAW

Research Fellow in Geology, University of Illinois, and Botanist on the Crocker Land Expedition, 1913–1916

TO THE perseverance and industry of one man, "a man with a vision," Denmark owes one of her most important colonial institutions, the Danish Arctic Station at Godhavn. Unique among scientific laboratories in its far Arctic situation and in the character of its work, it exemplifies what can be done by a man with a firm conviction and inflexible determination. To Morten P. Porsild, director of the station, who never once wavered from his resolute purpose of establishing upon a firm and permanent basis the scientific survey of Greenland—Denmark's Arctic colony—belongs the credit for making possible much of the research that is yielding such valuable results in the problems of Arctic biology, geology, meteorology, and in the study of the Eskimo. Once he had conceived the plan of establishing the station, he did not rest until it was fulfilled.

The Danish Arctic Station was established as a base from which to prosecute the geographical and geological survey of Greenland, the investigation of its plant and animal life, the study of the various physical and chemical phenomena peculiar to the Far North, and to train young scientists interested in Arctic exploration and research in the technique of northern travel and investigation. It was to serve also as a station to which scientists of lands other than Denmark might come for opportunity to work out special problems presented by the North. In all these aims the station has been unusually successful.

The funds necessary for the establishment of the station were furnished Herr Porsild by private subscription, but after the work had once demonstrated its value, the Danish Government took charge and now appropriates 10,000 crowns a year, not quite $3000, for the maintenance and activities of the station. This appropriation includes not only Herr Porsild's salary, but all the expenses of equipping and conducting the station, a sum that seems all too small for the many activities in which the director so successfully engages. The station was established in 1905 at Godhavn, on the south coast of Disco Island. Herr Porsild on an earlier journey to Greenland had decided upon Disco Fjord as the best locality in which to build the station, but when the time came for its construction, circumstances determined that Godhavn, farther to the east, in latitude 69° 14′ should be selected.

Godhavn, the capital of the province of North Greenland, is really an excellent place for the station, perhaps the best on the whole coast. The middle portion of the west coast of Greenland becomes almost ice-free early in April and remains so until late in November. Thus Disco Island is usually accessible to ships throughout this period. This fact in itself makes Godhavn a desirable place, but the presence of open water for so long a time each year, and its proximity throughout the whole year, also have a direct influence upon the climate; even in midwinter the weather is not so severe as along the coast farther to the south or north.

In addition to these fundamental advantages, Godhavn possesses for the biologist unique superiority of position in lying beside the "hot springs" for which Disco has long been known. These springs are neither large nor extensive, nor so warm that they modify the general temperature of the part of the island where they issue, but their relatively warm waters, four to five degrees above zero, even in midwinter seep down through the talus and soil of the slopes and create conditions favorable to the growth of many plants and the life of many invertebrate animals, found elsewhere much farther south. In these warm habitats many life forms have their northern limit.

In summer a most luxuriant vegetation flourishes on the slopes watered by these warm springs; willow heath, waist high, grows almost everywhere over the rocks; archangelica flourishes in the richer soil along the springs themselves, and its young stalks furnish the people with greens not unlike asparagus; ferns of several species are abundant on the rock ledges; and most remarkable of all, five species of the orchid family flourish, flower, and reproduce themselves. Two of them grow in such profusion on the narrow flats along the shore that in walking over them one crushes so many blossoms that the air becomes sweet with their perfume.

Besides these and the many other interesting plants, numerous rare mosses, many of them of far southern distribution, grow in profusion. Many insects and other forms of invertebrate life likewise find in these warm areas their northernmost home. Two species of earthworms live in this sub-polar outpost, hundreds of miles north of any others of their kind.

In winter when deep snows blanket the island, the snow drifts down from the mountains over the springs. Then the warmth of the water gradually melts out caves and rooms, where even in midwinter flies and snails feed and are active. If a hole be punched in the roof of one of these subniveal caverns, the steam pours out into the frigid air as though a volcano in miniature had burst forth.

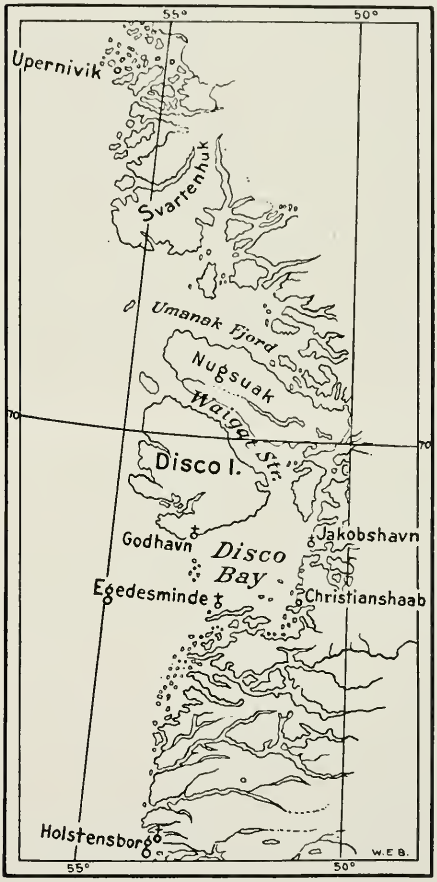
Morten P. Porsild and his youngest son.—To Morten P. Porsild, director of the Danish Arctic Station, belongs the credit of making possible much of the research that is yielding such valuable results in the problems of Arctic biology, geology, and meteorology, and in the study of the Eskimo. Even though he is forty-five years old, he can tramp all day with a heavy pack over his shoulder, or drive through rough ice a team of ten unruly Eskimo dogs

Of these spring-watered, hothouse-like plots, Herr Porsild has made reservations where the unusual life forms and luxuriant vegetation may be preserved, and their habitats remain unchanged. He has posted conspicuous signs, with notices in Eskimo, defining the limits of his reservations; since he hunts and fishes almost not at all, he felt justified in explaining to the Eskimo that because he did not disturb their eider duck, or seals, or salmon, they ought to leave to him his plants and bugs. The Eskimos were amused and pleased at his way of putting it, and have respected his reservations most scrupulously.

Godhavn lies on a splendid little harbor quite sheltered from icebergs and the fierce southwest storms that sweep the coast. It nestles at the foot of frowning basalt and sandstone cliffs more than two thousand feet high, cut by two deep gorges near the village. Down one of these gorges flows the Red River, up the valley of which sledging to the interior and across to Disco Fjord is rather easy after the first autumn snowfall. East of the village several seams of lignitic coal outcrop not far from the shore line, and afford an abundance of first-rate fuel. Not far east of the village, too, is the basalt exposure from which telluric iron is obtained; it was this telluric iron that Nordenskjöld considered meteoritic, and which led him to declare that if the pieces he obtained were part of the country rock, then the whole island was a meteorite.

The Danish station at Godhavn is not large but it is very well planned and constructed, and very well furnished and equipped, not only as a scientific laboratory but also as a home for the director and his family, and for the men who work with him there from time to time. It is a frame building about twenty meters long and fifteen or more wide, two stories high. It includes the residence of Herr Porsild, several guest rooms, a large laboratory, an equally large library and herbarium, a good dark room, and a small observatory.

The laboratory is well equipped with chemicals; physical instruments such as balances, thermometers, and barometers; surveying instruments; cameras



Just beyond the boundary of the map at the north is the northern limit of the Danish province of North Greenland and the beginning of Melville Bay. The scenery of the west Greenland coast is comparable with that of Norway; in fact, no other known land of such size as Greenland has so many bold precipices, deep fjords, and valleys along its coasts. Often mountain peaks from six thousand to seven thousand feet high stand less than two miles back from the sea. At Jakobshavn is one of the most active glaciers in the world, with an average velocity of fifty feet a day, discharging great quantities of icebergs into Disco Bay (the glaciers of the Alps average from one to three feet a day). A Danish government boat makes one trip each summer between Copenhagen and Holstensborg, and attempts to go on to Godhavn, and later to Upernivik if good luck attend it. Communication with Melville Bay and regions farther north is only by special dog sledge from Upernivik, and if weather conditions are bad, often all the way from Holstensborg

Photograph by Morten P. Porsild

The Danish Arctic Station, Disco Island, West Greenland, seen across a backwater lagoon.—The flagstaff in the middle distance is planted on gneiss; the wall behind is of basaltic tufa ("Osterli") with rich vegetation; in the far background at the right may be seen the top of the Skarvefjeld, 3200 feet elevation. Herr Porsild's laboratories are in the right wing of the building, the living rooms occupying the left wing

and photographic material; and nearly all the instruments that a field scientist requires. A powerful motor boat, "Clio Borealis," properly arranged and equipped for dredging as well as for travel, is connected with the station. Running water from the warm springs supplies the whole station nearly all the year.

The library contains thousands of volumes, needless to state nearly all of scientific character. Herr Porsild's friends and acquaintances are legion, and through them he has acquired large numbers of standard works in science, including periodicals, from all parts of the world. By no means exhaustive or complete, his is nevertheless a very good working library.

Herr Porsild, himself, is peculiarly well fitted, both by temperament and training, to direct the activities of the station. He is a powerfully built man, six feet tall, and broad in proportion, sturdy and healthy as the Viking stock from which he springs. Even though he is forty-five years old, he can tramp all day with a pack over his shoulder, up and down the steep, rough slopes of Disco. He has become an expert dog driver, and throughout the sledging season is out in all kinds of weather and in all kinds of ice conditions, thinking nothing of the hardships or the hazards of the trail.

Under Arctic conditions such as those that surround him, most men possessed of good nature, cheerful philosophy, and genial sense of humor would lose them in a few years, but he has retained all. Throughout the year he is either out of doors busily engaged in investigation and research, or in his library, herbarium, or laboratory, studying or developing the results of his outdoor activities, and it would be hard to find anywhere a man more happy and content in his work and station than he, more capable of making the most of life.

His family comprises his wife, a capable, motherly woman who undoubtedly has been his strong support in all his undertakings: three sons, of whom two are almost ready to complete their courses in the university at Copenhagen, while the youngest, his father's pet, has not yet left home; and a daughter, who thus far has been taught by her father and mother, in Greenland. To his children Herr Porsild is as kind and indulgent as he can well be, but he maintains a just and rigorous discipline.

Fru Porsild manages her household as thoroughly and scientifically as the master does his station. Her guests are made to feel at home from the moment they enter her door until they leave. She keeps an Eskimo cook and an Eskimo maid, both of whom she has carefully trained. Eskimo girls are quick to learn when tactfully instructed, and those in Fru Porsild's service are very efficient. The Danes say that the Eskimo women cannot be excelled as nursemaids. With the aid of these two Eskimos, Fru Porsild is able to keep her home as clean and orderly as if she were in Denmark, the land of scrupulously kept homes.

The three boys are splendid fellows. Of the two in the university at Copenhagen, the elder, Thorbjorn, has followed in the steps of his father, taking up botany as his particular subject; the younger, Erling, is studying to become a merchant. The youngest, the baby of the family, not yet seven years old, is the joy of his father's heart. Thorbjorn expects to take up his father's work some time as director of the sta-

Photograph by Morten P. Porsild

The motor boat "Clio Borealis" of the Danish Arctic Station, lying in front of the glacier Eqip Sermia, 69° 45′. In this motor boat Herr Porsild has traveled far up and down the west Greenland coast during the years he has been engaged in Arctic study and exploration

Photograph by Morten P. Porsild

The face of the glacier Eqip Sermia, discharging into Disco Bay.—The rough cordilleran portion of the surface of this glacier indicates that the ice is afloat over the bottom of the bay

tion. With Godhavn as a base, he is planning to explore and study Baffin Land as thoroughly as Greenland has already been investigated.

Men of many countries besides Denmark who have made this station their headquarters while they have been at work in Greenland, testify to the hospitality and courtesy extended to them by Herr Porsild and his good family. Among those who have stayed at the station at one time or another are Swedes, Norwegians, Germans, Swiss, Austrians, and Americans. Dr. Thorild Wulff, the celebrated Swedish ethnologist and botanist who perished of starvation when with Rasmussen's expedition across the ice cap of Greenland last year, has worked there. One of the first men trained at the station was Mr. Lauge Koch, the young Danish geologist, who has apparently acquitted himself so creditably with Rasmussen's expedition. Herr Porsild states that one of the most delightful guests he has entertained was Ossian Elgstrom, the Swedish artist and cartoonist, who spent the summer of 1915 in Greenland studying native art.

The art of the Eskimo is primitive,

Photograph by E. O. Hovey

View of a part of Godhavn, showing the pastor's house and the church in the distance.—The Eskimos are exceedingly faithful in their church attendance, but when the weather is favorable for hunting the men usually do not observe Sunday. This photograph gives a good view of the Skarvefjeld, one of the commanding headlands along the south coast of Disco Island. Tidal currents are so strong at the base of this headland that the sea ice there is rarely safe for sledge travel and a detour must be made over the highland back of the mountain but Elgstrom found so much of interest that he has published a highly entertaining book as a result of his studies. Under the encouragement of Herr Porsild a number of Eskimos at Godhavn are attempting to portray their life and environment in water color and crayon; they do very well considering that they must develop their own technique without any instruction or guidance.

That Herr Porsild is thorough in his methods of training young would-be Arctic scientists, no better evidence is needed than the record that Lauge Koch has made as an associate of Knud Rasmussen. Except for the summer that Koch spent with Herr Porsild on Disco Island, he had had no field training whatever until he accompanied Rasmussen by dog sledge from Holstensborg to North Star Bay. Although a novice at sledge work, he drove his own team of dogs the latter half of the trail, lived almost exclusively on seal and walrus meat for a month after having just left the "fleshpots" of Denmark, and successfully completed a most careful survey of the entire shore of Melville Bay.

Now word comes from Greenland that Koch survived a journey which was too much for so experienced and tried a traveler as Dr. Thorild Wulff;—not only survived the journey, but achieved the most important results attained by the party. Herr Porsild said last summer while I was his guest, "Oh, Koch will come out all right! He learned here how to adapt himself to difficult conditions. He found out that Arctic exploration is no child's play, when he was here with me; I sent him out on several long tours with Eskimos with whom he could converse only by signs, with barely enough food to get back safe, and to places where the mosquitoes almost ate him alive. And yet he always did what he set out to do, although I must say there were times when he looked a little rebellious."

The work accomplished by Herr Porsild and the other men who have made the station their base is extensive. Herr Porsild has already published many important papers, not only in botany, but in zoölogy, anthropology, ethnology, and divers other sciences. He has completed exhaustive studies of the flora and the vegetation of the west Greenland coast; he has studied the habits of the Arctic salmon, of the caribou, of the narwhal; he has investigated many of the old Eskimo ruins and kitchen middens, and delved deep into former and present arts and customs of the Eskimo; and he knows the history and geography of Greenland as no one else

Photograph by E. O. Hovey

Two native Greenland women living at Godhavn.—Their richly adorned trousers and boots are almost their chief pride. Usually they wear also a heavy bead collar of complicated design that extends down over the breast, shoulders, and back knows it. Even now he has great volumes of manuscript ready for publication. To the series of studies which the government of Denmark plans to issue in 1921 to celebrate the two hundredth anniversary of the Danish occupancy of Greenland, Herr Porsild will be one of the most prominent and extensive contributors.

While I was staying at his station he worked every day, and regularly far into the night, on two comprehensive reports which he was then preparing for the anniversary series. One of them was a "Phytogeography of Greenland" and a study of the origin of the Greenland flora, and the other, a complete history of Greenland which he was preparing in collaboration with Pastor Osterman of Jakobshavn. This latter work necessitates a study of all the old records and documents in the archives of the Royal Danish Greenland Company and those of the Danish Government.

Generally Herr Porsild is busy at field work throughout the summer, traveling along the coast in his motor boat. Both northward and southward he still has large unknown fields to engage his attention, many problems for which to find the solutions. In winter he is often kept to the station for weeks at a time by storm or bad ice, but whenever sledging is possible he is loath to stay indoors.

His particular hobby is road making. From the wharf where the ships unload their cargoes and take on the blubber and skin, to his scientific station, is a distance of almost, or quite, a kilometer, the way leading over rock ledges, little bogs, and around little embayments. All this distance he has built a roadway, a genuine Roman highway, of rock and sand filling. He has built it up over the bogs, and blasted it through the rock ledges, until now it is smooth and level as a boulevard.

Like all Danes he is intensely patriotic, and although he is not so provincial as to consider Denmark the only God's country on the globe, he would be reluctant to make his home in any land except where waves his beloved "Dannebrog," the venerated national flag of the Danish people. On all special occasions, on all holidays, and whenever a ship comes into port, the rose-red flag with its white cross must be raised on the tall flagpole above the station. And in nearly every room of the station, as in all the Danish homes in Greenland, stands a conventional little metal flagstaff with a miniature "Dannebrog," constant reminder of the homeland.

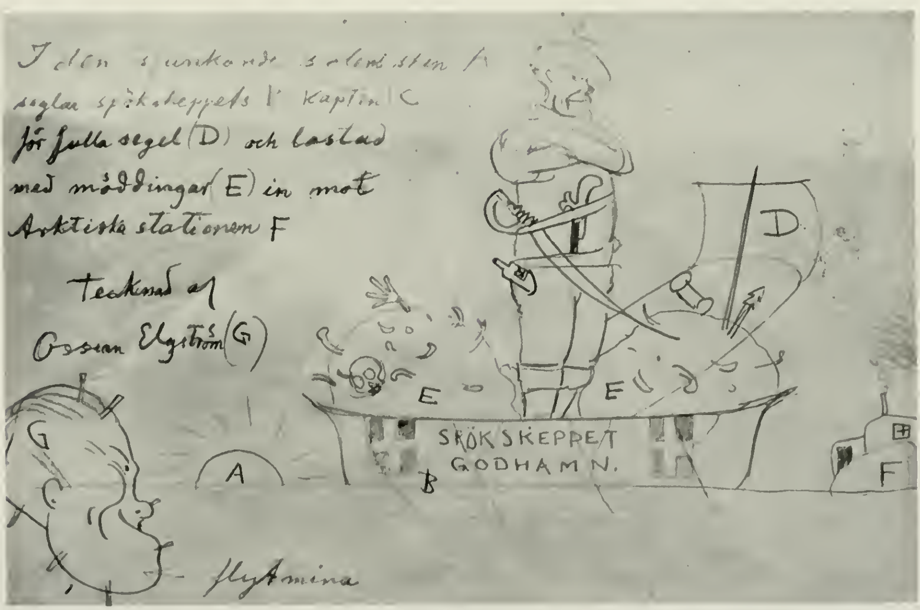
For Germany Herr Porsild can have but little sympathy. Exiled from his home in Schleswig not many years after the Germans seized the province, he cherishes a deep grievance against the conquerors. But he says little about the matter; not so, however, his assistant, Herr Nielsen, or the governor, Herr Olsen. Both of these men have been hussars in the cavalry regiment of Captain J. P. Koch, Danish army officer, famous because of his Arctic explorations, to whom the word "German" is said to be a red flag.

Among the Eskimos of the coast, Herr Porsild is considered a remarkably good man. He can converse with them in their own language, and never fails to help them whenever the circumstances justify aid, and his means and facilities permit. In times of accident or illness he is their emergency physician and surgeon. A few years ago when the dread "cadaver infection" seized the natives of the village, he did all he could to stop its ravages, without thought of his own danger. After successfully evading infection for several days, he finally contracted the disease. One of his hands showed that it had attacked him there; like a Spartan he stripped off all the skin on the back of his hand, and saved himself.

It is by such ministrations and experiences as these, and by his sound, careful advice, that he has won the confidence and respect of the natives, in like measure as he has won the friendship of the Danes. The Eskimos come to him with all their tales, and traditions, and discoveries—a constant mine of information and data for him.

Few men are better versed in the tales and traditions of the Eskimo than he. And of tales and legends they have legion. One of the most interesting stories accounts for the southern flora and fauna of the island. They say that Disco with its luxuriant vegetation at one time lay much farther south, off a prosperous village. In this village dwelt a great hunter who was also a sorcerer. Tired of going around this island every time he went out to sea, he finally decided to tow it away. By his magic power he was able to do this without trouble. Pulling a hair from his head he attached one end to the island and the other to his kayak, and started northward. He proceeded without mishap until he reached the spot where the island is at present situated. Just as he was about to pass Nugsuak Peninsula, an old woman, a rival magician, laughed derisively to see him working so hard. Her ridicule spoiled his charm, the hair by which he was towing broke, and Disco settled to its present site. Ever since that time, the island has retained its southern climate and vegetation.

If the Eskimos were still as superstitious as they used to be, Herr Porsild would surely seem a magician or *angekok* to them. And in all truth they would not be far from right. By the magic of his purposeful character and determined personality, he has achieved the establishment of his station and the wonderful results that have come from it. To him and others like him is due much of the extensive knowledge we have of Greenland, knowledge much more thorough and complete than our knowledge of Labrador or the regions about Hudson Bay, territories much nearer to us, and much more accessible.



Hitherto unpublished cartoon by Ossian Elgstrom, the Swedish artist.—Translation: In the rays of the setting sun (A) the specter ship—referring to the specter-like transparency of the little Eskimo skin boat (B)—with its captain, Herr Porsild (C), and its sails all set (D), and laden with kitchen-middens rich in material for archæological study (E), sails toward the Danish Arctic Station (F). Drawn by Ossian Elgstrom (G), a floating mine

Photograph by Morten P. Porsild

FROWNING BASALT AND SANDSTONE CLIFFS

Great cliffs more than two thousand feet high, on both sides of the Waigat, give to that narrow passage of the west Greenland coast a scenery as grand as any in the world. The photograph was taken at an altitude of one thousand feet over the sea on the south coast of the Nugsuak Peninsula. The formation shows fossiliferous sandstone overlaid by basalt

Photograph by E. O. Hovey

ICEBERG GROUNDED NEAR ENTRANCE TO GODHAVN HARBOR

This iceberg was photographed in the summer of 1915. The arch is probably a remnant of the walls of a subglacial stream. For two weeks of the summer of 1917 another beautiful iceberg arch, strikingly suggestive of the *Arc de Triomphe,* lay off Godhavn Harbor. The shapes assumed by icebergs are innumerable and fantastic

Photograph by E. O. Hovey

A LOOKOUT HOUSE OF WHALE BONES BUILT A CENTURY AGO

The entrance to the ancient harbor of Lievely (this name, given by the navigator Scoresby, being afterward changed to Godhavn) is around the low ridge at the left. The harbor has been used for three hundred years by all Arctic expeditions. The beacon or "lookout house," about a mile from the point of land at the mouth of the harbor, is made of whale bones and turf. It was erected about one hundred years ago by whalers who made the harbor their hunting base. The lookout stayed in the house while he kept careful watch over the sea for any whales cruising about. Whenever a whale appeared the lookout signaled to his fellows on the ship in the harbor by firing a small cannon that is still in position. Carved on the walls of the hut are the names of many visitors to Greenland, some of them famous in exploration. A few years ago, when the Danish Government repaired the hut and painted it as a beacon with the design of the Danish flag, the names and initials were as

Photograph by Sergeant G. W. Rice
Courtesy of Charles Scribner's Sons

A GENERAL VIEW OF GODHAVN HARBOR

Innumerable splendid harbors may be found along most of the west coast of Greenland when the ice is gone. This shows the harbor of Godhavn in summer, from an elevation on the northerly shore. The water reaching to the horizon is Disco Bay extending into Baffin Bay. The settlement at Godhavn may be seen at the left of the center, on the far side of the harbor. Since this picture was taken, in 1880, the narrow passage of water across the cape has been obstructed by the elevation of the area, so that only in severe storms does water extend quite across. (A woodcut from this photograph was published in 1886 in Greely's *Three Years of Arctic Service*, Vol. I, p. 28.)

This illustration and the five immediately following are from photographs taken by Sergeant George W. Rice, official photographer of the Lady Franklin Bay Expedition, known as the Greely Expedition, which went north on the S. S. "Proteus." The photographs were made in 1880 and 1881, by the wet plate process, on 8 × 10 plates. The plates were left at Fort Conger, where they were found by Admiral Peary, together with all the relics abandoned by Greely when he retreated from Fort Conger to Cape Sabine in 1883, and were brought to the United States in 1902

Photograph by Sergeant G. W. Rice

GODHAVN IN 1880

A detail of Godhavn Harbor after a snowstorm in summer, showing the buildings of the settlement

Photograph by Sergeant G. W. Rice

LAST CHAPTER IN THE STORY OF A GREENLAND ICEBERG

Occasionally, under the influence of wind, small broken-down icebergs drift into the harbor of Godhavn

Photograph by Sergeant G. W. Rice

NORTH SHORE OF GODHAVN HARBOR AFTER A SUMMER SNOWSTORM

The mountains forming the background to the north of Godhavn Harbor show the innumerable layers of basalt one above another. High at the left can be seen one pinnacle of basalt left standing of the twelve which were there at the time of Scoresby's visit. He christened them "The Twelve Apostles." In the three hundred years since that time, eleven have disintegrated and crumbled away, leaving the present monument, the last "Apostle"

Photograph by Sergeant G. W. Rice
Courtesy of Charles Scribner's Sons

AN ARCTIC WATERFALL

There are numerous such streams from the heights on the north side of Godhavn Harbor, where the flow of water is temporary, however, lasting only until the snowcap has been melted away. Farther north Disco Island has a permanent ice cap

Photograph by Sergeant G. W. Rice

PAN ICE AT GODHAVN AT THE TIME OF THE GREELY EXPEDITION

Looking eastward in Godhavn Harbor, showing the ice breaking up in the summer of 1881

Photograph by Ensign Harlow

ADMIRAL SCHLEY'S RELIEF SHIPS AT GODHAVN

Ships that were under the command of Admiral Schley on their way to rescue the Greely party in 1884.—In later years Admiral and Mrs. Peary stopped at Godhavn, climbed the mountains, and built a cairn on the crest of the snowy ridge to the left of the point on which stands the last "Apostle," a cairn which is still standing although the record they placed in it has been removed. A beautiful glaciated knoll of the gneiss on which Godhavn is built appears in the foreground

Stefánsson Returned After Four Years of Arctic Exploration

By CLARK WISSLER

THE Arctic explorer, Vilhjálmur Stefánsson, visited New York and lectured at Carnegie Hall for the benefit of the American Red Cross, October 31, on the experiences and results of his 1913–1918 Canadian Arctic Expedition. One object of this expedition was the discovery of new land above the known Arctic Archipelago. It had been thought that perhaps a large body of land lay off the north Alaskan coast and the seeking of this land was the main purpose of the Northern Section of the expedition, the Southern Party making scientific explorations of the country around Coronation Gulf.

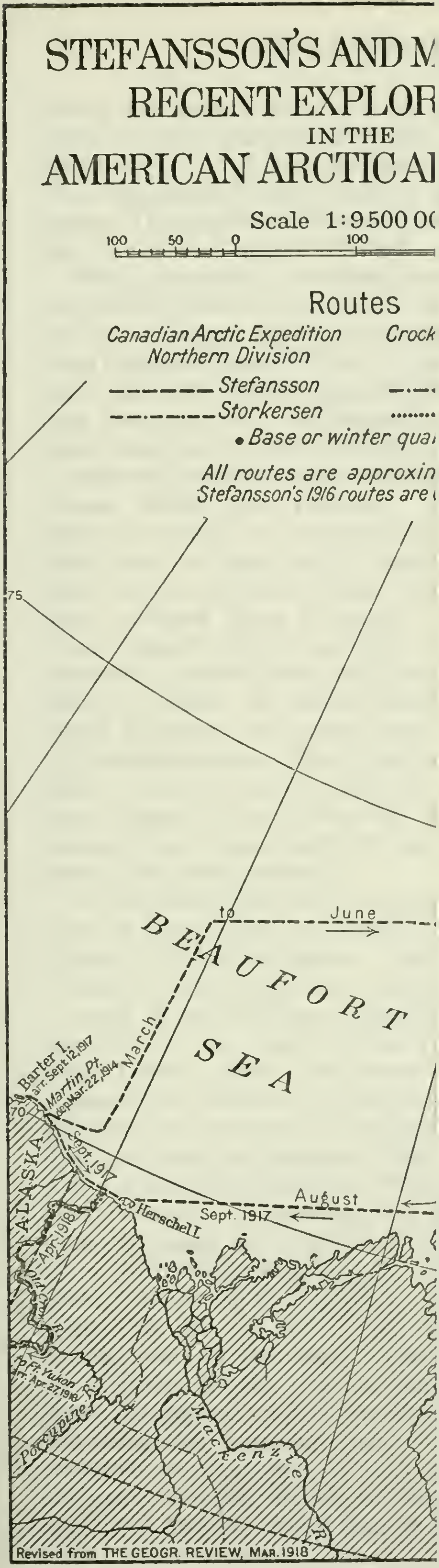
New land was found by Stefánsson, but in the form of three new islands on the upper border of the Arctic Archipelago. This discovery adds a considerable area to the known land surface of the earth, about three thousand square miles. On the other hand, the position of these new islands indicates that they are the outer edge of the great archipelago just off Hudson Bay, and Stefánsson's soundings offshore seem to indicate deep water, thus suggesting that no new land is to be expected in the unknown area north of Alaska.

The First New Land, of about the size of Ireland, discovered June 15, 1915, was fully surveyed in 1916. It lies between Prince Patrick and Ellef Ringnes islands, with its western tip at 77° 55′ N. latitude and 114° 30′ W. longitude, its extreme northwestern corner at 79° N. and 113° W., and its eastern tip approximately at 78° 30′ N. and 108° W. The various prominent land angles, capes Murray, Malloch, Mamen, Beuchat, and Mackay, have been named in honor of scientists on the "Karluk" who lost their lives.

The Second New Land was discovered on June 13, 1916, between Ellef Ringnes and Axel Heiberg (its northern tip lying in 80° 12′ N. latitude and 100° W. longitude)—with several smaller islands off the east shore between the new land and Axel Heiberg. The Third New Land, discovered on August 3, 1916, occupies with the First Land the sea north of Melville Island. By looking at the map it will be seen that these new islands lie in a line with Prince Patrick Island, Ellef Ringnes, Axel Heiberg, and Grant Land, forming what would seem to be the abrupt edge of an archipelago platform. Stefánsson reports that all the new lands as well as Ellef and Amund Ringnes islands show clear evidences of extensive elevation of coast lines, which is still in progress.

Of very definite scientific value will be his tidal observations, with instrumentally determined local time at Cape Isachsen, Hassel Sound, and the southern tip of the Third Land, tied up with observations at the historical Parry Rock at Winter Harbor on the southeastern coast of Melville Island, where tidal observations were made in the summer of 1820. Tide records were kept also at Cape Kellett on southwestern Banks Island, and in Prince of Wales Strait.

Another important work of the expedition was the mapping and correcting of formerly delineated coast lines and surveys in the Arctic Archipelago. A stretch of about fifty miles was charted along the eastern coast of Prince Patrick Island, that McClintock and Mecham did not cover when working in the region sixty-five years ago. The northeast corner of Banks Island, at John Russell Point, was found to be mapped a full degree too far east. The coast of northeastern Victoria Island, which the work of Hansen and Ristvedt had left incompletely explored, was mapped by a party under Storker Stor-



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Revised from THE GEOGR. REVIEW, MAR. 1918

Courtesy of The American Geographical Society of New York kersen, the western part of it in the winter of 1915, and the eastern part in the summer of 1917, with the discovery of an island about twenty miles in diameter. The coast lines of Isachsen Land also were checked up and rectified.

When proceeding southward from the Second Land in July, 1916, over the ice of Hassel Sound, he reached King Christian Island (77° 41′ N. latitude), his route here crossing MacMillan's from the east. Stefánsson continued southward to Finlay Island (77° N. latitude), finding a small new island between Finlay and Paterson. His work here breaks up the supposedly large island of eighty miles diameter shown on the Admiralty Chart, Isachsen's combined King Christian and Finlay islands (1901), proving them two widely separated, very small islands (King Christian 15 miles diameter, Finlay 12 miles) with a sea depth of 172 fathoms between. Much work was done in a survey of the interior of Banks Island. Large lakes were discovered, rivers traced, and the watersheds of the island marked.

Like all other such heroic undertakings, the story of this one is full of incidents of a thrilling nature. One is the finding of a copper tube enclosing a record of the McClure Expedition, deposited on the northern shore of Banks Island in 1851. The document is signed by McClure and announces that from the given spot (John Russell Point) he saw the waters of Melville Sound and thus discovered the "Northwest Passage." Stefánsson had intended to return to civilization by way of the Northwest Passage and the well-sailed route to the St. Lawrence. Although he was not able to do this through failure of his ships to coöperate with him, he gives it as his opinion from observations of ice movements, that navigation is no more likely to be hazardous or interrupted by this eastern route through Prince of Wales Strait and Melville Sound than by the western route with the rounding of Point Barrow.

At Dealy Island off the southeastern shore of Melville was found an old food cache of the Franklin Search days, placed there by Captains Kellett and McClintock in 1853. Strange to say, a great deal of the food was still usable.

Bituminous coal was discovered in many localities, for instance, at both of the expedition's two camps on Melville (at Liddon Gulf and Cape Grassy). Generally speaking, no driftwood, such as has come from the Yukon and Mackenzie rivers and is to be found on Banks Island and along the mainland, was discovered in any of the new lands. Also no musk oxen were found in any of the new islands or in Ellef or Amund Ringnes; and no traces of bears were seen in these regions except on the southern coast of Ellef Ringnes Island; while the species of caribou is only about one half the size of the caribou of the mainland. Bears, musk oxen, and caribou abound on the eastern coast of Melville Island.

Stefánsson has established his ability to live and to have his expedition live on the resources of the North Polar country for an indefinite length of time. He has carried forward the work of his expedition for four years, often with very large parties of white men and Eskimos, without the loss of a single man in the field parties; and what is most remarkable in the light of previous polar history, without the death of a single dog from starvation or disease.

Mr. Stefánsson has been delegated by the Canadian Government to proceed to the Pacific Coast to pay off the crew of the "Polar Bear," lately arrived in port from the North. He is expected to return shortly to New York City to prepare a final report upon his scientific observations to be submitted to the Canadian Government. It is hoped that he will give the Journal the pleasure of publishing an account of some phase of his remarkable work.

EXCAVATED AREA OF THE AZTEC RUIN, 1917

Ponderous walls rising in their dignity from the midst of cultivated fields attest the original magnificence of the structure of which they were a part. Compare with diagram on the page opposite. The drum-shaped building in the left foreground is all that shows above ground of a subterranean clubhouse or ceremonial chamber the interior of which is shown in the illustration on page 604

Further Discoveries at the Aztec Ruin

By EARL H. MORRIS

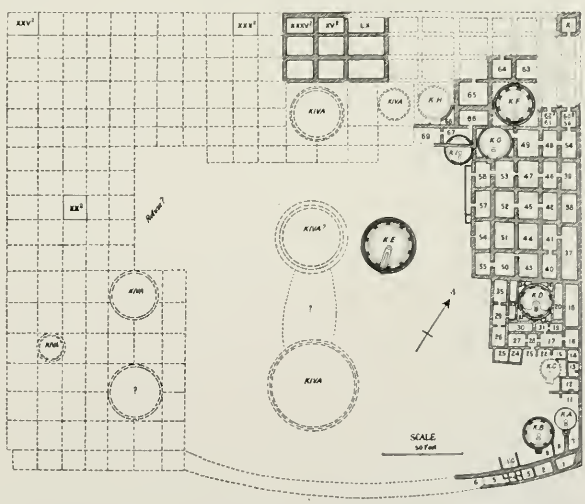
Illustrations from photographs by the Author

Introductory Note.—An article appeared in the American Museum Journal for February, 1917, describing the great prehistoric Pueblo community-dwelling in northwestern New Mexico, commonly known as the Aztec Ruin, and the conditions under which its excavation was begun by the American Museum of Natural History. The March number of the Journal for the same year contained a brief discussion of the more important specimens which were unearthed in the now famous ruin during the field season of 1916. Since these articles were written, the Museum's expedition has spent six months (previous to the summer of 1918) in intensive exploration of the Aztec Ruin, and for the benefit of those who wish to keep in touch with the progress of the work, the following description is given of the results of the field season of 1917.[1]—The Author.

SIXTY-NINE secular rooms and eight ceremonial chambers, comprising a part of the south wing, all of the east wing, and a part of the north wing of the Aztec Ruin, now stand completely freed of débris. The ponderous walls, stripped of the shroud of earth which for centuries protected them from the elements, and more recently from the even less considerate hand of man, rise clear before the eye of the visitor, their battered dignity attesting the original magnificence of the structure of which they were a part.

A glance at the accompanying map gives a more definite image of the ground plan of that part of the ruin which has been excavated, and its relation to the area which remains to be cleared, than can be imparted by written words. The excavated part falls into three divisions, based upon differences of masonry and relative time of construction.

The southeast corner of the ruin, that is, the convergent extremities of the east and south wings, was carelessly constructed of cobblestones and adobe, the latter in some places having been used to the exclusion of more durable materials. Consequently the disintegration of these walls was rapid, and today none of them is more than four feet high. What relation this poorly built section may have borne to the main structure offers a perplexing, but an important problem. Because of the identity of construction with the evidently more

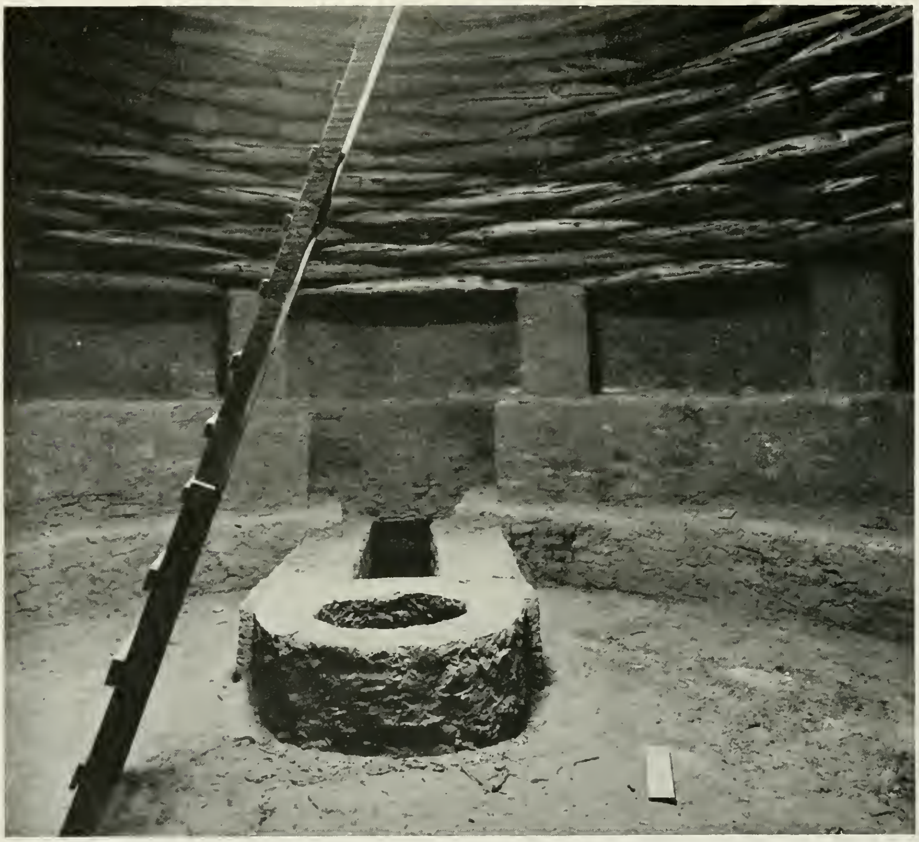


Ground plan of the Aztec ruin showing the relative proportions of the excavated and unexcavated sections at the close of the field season of 1917. Shaded walls indicate the parts of the ruin which are cleared (see cut on opposite page). Comparison of this chart with that of 1916 (appearing on page 86 of the Journal for February, 1917) will show the amount of work accomplished during the season of 1917

[1] Publication of this article has been delayed until the work of the season of 1918 is nearing completion. For facts on the more recent excavation and reconstruction of the Aztec Ruin, see note which will appear in the December issue of the Journal.—The Editor.

ancient small ruins which surround the pueblo on all sides, at first one would be inclined to correlate these walls with an older structure which underlies the southeast corner of the pueblo, but inasmuch as they form a definite and integral part of the great ruin, it seems more justifiable to suppose that they represent temporary buildings, hastily erected to complete the predetermined outline of the fortress-pueblo and poorly constructed because they were intended to be torn down to make way for the more permanent, compact, many-storied buildings which the demands of a growing population necessitated.

Adjoining these tumbled-down walls on the north there is a series of rooms, numbers 16–36 inclusive, whose masonry, although much superior to that described above, is markedly inferior to the masonry of the main ruin. This inferiority is due, however, not to a lack of skill on the part of the masons, but to the choice of building material. The walls were erected of iron concretions which weather out of the clay strata of neighboring hills. Intensely hard, and irregular in shape, they could not be faced with primitive tools, and walls built of them were of necessity rough and unlovely to the eye. On the



A kiva with reconstructed roof.—The entrance is through a hatchway in the center of the roof (see view above ground on page 602). The excellent architectural principle involved in the construction of this type of covering for a circular chamber is one of the highest tributes to the mechanical skill of the ancient Pueblos. Pillars of masonry support the roof, which is a cribbing of timbers in the form of a truncated cone. With its flat top and sloping sides, this sort of roof has the strength and permanence of a dome, and the neatly dressed timbers placed in regular rows impart beauty and dignity to the chamber which they enclose

A kiva or ceremonial chamber at Aztec in process of excavation.—The charred contents of this chamber told of a grim catastrophe. At one side of the room lay a few calcined bones of an adult, and against the opposite wall were clustered the carbonized bodies of four children. Bones and flesh were reduced to slaglike masses of charcoal, rendered bluely iridescent by burning body fats; coverings of cloth and matting were fused to the flesh, retaining perfectly their original texture. Pottery vessels, bone and stone implements, and ornaments of shell and turquoise were scattered about the room, where last used or laid aside. Apparently the five individuals were overwhelmed and burned alive together with most of their material possessions

A burial chamber in the east wing at Aztec.—The bowl and vase appearing in the lower right hand corner of the photograph were resting upon the breast of a skeleton covered from throat to thighs with beads and pendants. To recover these last the earth was passed through screens. First one with quarter inch meshes was tried, then one made of window screening. As many of the beads were so small that they passed through even such fine meshes without difficulty, the earth was sacked and taken to camp, where one patient assistant labored for seven days with a flour sieve and a magnifying glass before the last of the beads was separated from the black dust. There were seventy feet of them when strung—more than forty thousand in all

In this section through refuse which had lain buried for five or more centuries can be seen a plaited yucca sandal, a wooden disk strung on a long cord, and packed all about them corn husks, yucca leaves, and strips of cedar bark. As if by a conspiracy of nature the five feet of refuse of vegetable origin which covered the floor of one room at Aztec had been completely shielded from dampness, and from it were taken a quantity and diversity of ordinarily perishable specimens never surpassed in the history of southwestern exploration

neat a piece of construction as has been found in the entire ruin.

Because of the thickness of the standing walls, and the depth of the débris which was removed, it seems indubitable that the structure of which rooms 16–36 give the ground plan was at least two stories in height. The east wing was built long before this section was erected, as proved by the fact that three feet of refuse of human origin had accumulated on the ground occupied by the later structure before its foundations were laid. One may venture the statement that this "unit house" was an architectural unit added to the pueblo to accommodate a social unit —a family, clan, or secret society—which desired to become affiliated with the larger village and had been received as an integral part of the community.

The remainder of the ground plan of the excavated area, namely, the main east wing and the east end of the north wing, seems to have been built at about the same time. The longitudinal walls are continuous, and the masonry uniform throughout. Quarried sandstone blocks are the building material, and these were faced and laid with admirable precision. In this quarter the pueblo was at least three stories in height, descending terrace fashion toward the court. Some of the walls stand to a height of twenty feet—well up on the second story. Two rooms (59 and 61) on the

contrary, the kiva (ceremonial chamber) belonging to this part of the house, built of quarried sandstone, is as

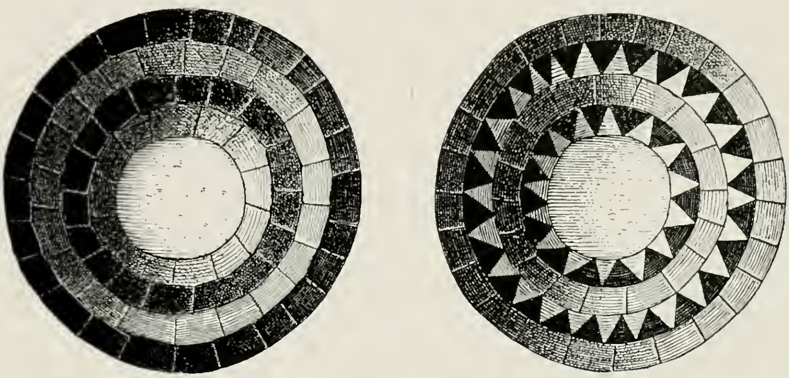
ground floor retain their original ceilings of cedar beams covered at right angles with smaller poles, and surmounted by a layer of adobe mud which formed the floors of the rooms above.

A very long period of continuous, or at least of recurrent occupancy, is denoted by the successive decay and rehabilitation of the northeast corner of the pueblo. Walls collapsed, ceilings fell, quantities of refuse were thrown into the abandoned chambers, and then new floors were laid over the débris, and new walls were raised above the partly ruined structure, some conformable with the older walls, some resting upon the artificial fill. Such secondary construction is apparent where kiva F now stands. Detritus from the upper walls completely filled the rooms of the first story. During the process of rehabilitation, the débris was leveled, obstructing partition walls were torn out, and the foundations of kiva F were begun at the level of the original second story, about eleven feet above the court. In consequence this kiva stands perched high in the air, not subterranean as was the normal position of these ceremonial chambers.

With few exceptions fire consumed all of the ceilings of the east wing, especially those of the upper stories. The thick usually unbroken walls offer such formidable barriers to the spread of a conflagration that it seems evident that fire was intentionally set from room to room.

The upper several feet of the walls, although held in place by the débris which enclosed them, were greatly disintegrated by the action of frost and moisture. In addition in many places strains developed before the actual collapse of the higher walls had so weakened the remaining parts that they would not have stood long after the earth was taken away from them. The tops of all the walls were removed, and those that threatened to fall were torn down and replaced with new masonry, so that as the repaired part of the ruin now stands it will remain for a long time without much decay, a monument to its aboriginal builders.

Kiva E, situated in the open court, is one of the most interesting of the chambers which have been excavated because of its rather close similarity to the kivas still in use among some of the Pueblo towns of the Rio Grande Valley. Although mostly subterranean, to allow



Mosaic pendants were fashioned with great skill and evince considerable artistic appreciation. Twenty were found upon the breast of one skeleton. In each case the inlay was applied to the convex surface of a disk of shell, the individual fragments being held in place with pitch. These two mosaics have central disks of pink stone. Alternating concentric rings of turquoise and gilsonite (a jetlike substance) complete the design of the left disk, but in the right one a fourth element was added. The first and third rings consist of alternate triangles of gilsonite and galena crystals, and the second and fourth of turquoise for the covering of the conical roof with earth, a concentric retaining wall, slightly greater in diameter than the kiva itself, was erected above ground. In order to give an idea of the features of a completed kiva and to present the architecturally excellent method by which these circular structures were covered, the roof of kiva E was reconstructed as shown in an accompanying illustration.

A gratifying number of specimens were found in all parts of the ruin which have been opened—so many in fact as to surpass all expectations. Nearly every room yielded something which will contribute toward the ultimate reconstruction of the material culture of the Pueblos of the Aztec region, even to its most intimate detail. A few discoveries merit individual mention.

The contents of kiva D were mutely eloquent of tragedy and destruction. Fire had raged in the furnace-like chamber, and had consumed or thoroughly carbonized everything inflammable that it contained. On the floor at one side of the room lay a few bones of the calcined body of an adult, and against the opposite wall were clustered the charred remains of four children. Burned to a crisp, these little bodies came out in chunks of slaglike substance, pitted and honeycombed by bubbles of gas, and bluely iridescent from the burning of the body fats. The carbonized cotton cloth of garments, and rush matting, were fused to the flesh and still adhered, retaining perfectly their weave and texture. Strewn about the floor as they were last used were many articles of household economy, cooking pots around the fireplace, food bowls and drinking vessels leaning against the walls, smaller bowls and ladles in cupboard-like niches in the masonry, and stone axes, bone implements, beads and ornaments scattered here and there where they had been carelessly laid aside.

Of several possible conclusions one seems most acceptable. These five persons were trapped and burned alive in the kiva, either by accident, or by the hand of enemies. As it would be next to impossible for the roof of a kiva to catch fire accidentally, it is almost certain that, perhaps for superstitious reasons, enemies within the village sought to destroy these unfortunate creatures, or that they were the victims of an attacking party that stormed and burned a part of the pueblo.

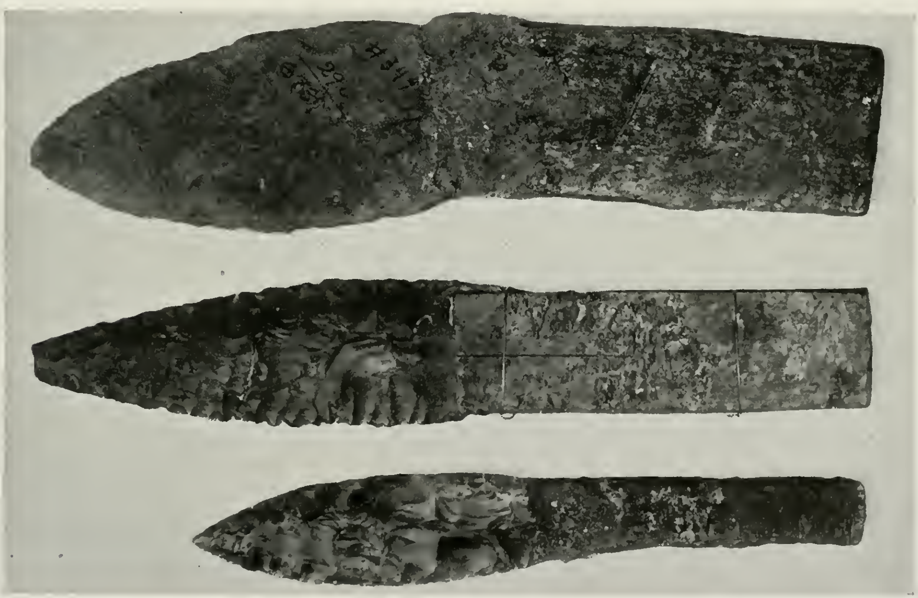
Room 41 was one of the richest burial chambers which have been found in the entire Southwest. In common with the other rooms of the east wing, after having ceased to be used as a dwelling place, refuse was thrown into the abandoned chamber. When about twelve inches of ashes and potsherds had accumulated on the floor, for unknown reasons it was desired to put away the dead in this room. The ashes were scraped from along the south and west walls into a heap in the center, and the bodies of at least two adults and three children were laid in the shallow depressions. The high station of these individuals may be judged from the quantity and variety of mortuary offerings which accompanied their mortal remains. More than forty pottery vessels were grouped around the bodies —food bowls, drinking mugs and pitchers, tiny cooking vessels, dippers, vases, and graceful jars shaped like the bodies of birds, each with a head in full relief. Piles of arrowpoints, sticks of pigment, both red and yellow, and hundreds of long polished bone tubes were interspersed among the pottery.

About fifty thousand beads and articles of personal adornment were the most conspicuous element of the mortuary offerings. One body was covered from throat to thighs with beads and pendants. Strands of turquoise lay against the skull where they had been attached to the ears, while strand after strand of beads of stone and shell encircled the neck, and anklets of shells surrounded the bones of the lower limbs.

The smallest beads are disks of black stone one twenty-fifth of an inch in diameter, about three thousand of them making a strand six feet in length. Another mass of thirty-one thousand was sifted from the earth and restrung into a strand fifty-seven feet long. These beads are of the same material as the former, but of slightly greater diameter. From these tiny specimens the disk-shaped beads range in size up to pieces of turquoise as large as one's thumb nail. Marine shells were worn in great numbers, *Olivella* shells, pierced and strung whole, *Conus* shells truncated and worn suspended bell fashion, and abalone shells cut into great iridescent disk pendants. Some large disks of shell were covered with elaborate mosaics set in pitch. A disk of pink stone formed the central element of each design. This was surrounded by narrow concentric rings of turquoise, gilsonite (commonly but erroneously called jet), and galena crystals, repeated in the order given until the periphery of the shell was reached. Turquoise and gilsonite were fashioned into representations of frogs and insects, and skillfully mounted with gum upon thin bone backings which were grooved on the inner side so that the ornaments might be strung on a cord like beads.

The skill with which the minute beads were drilled, and the masterly execution and beauty of the mosaic ornaments, mark the prehistoric Pueblo artisans as jewelers of no mean ability, especially when it is remembered that they accomplished their ends without the aid of metal tools.

The bodies which were placed in room 41 were not covered with earth by human agencies. Long after their



What are commonly supposed to have been spear points were the blades of knives. Three have been found with their wooden handles intact, one in a rat's nest, the other two buried upon the breast of a woman. The keen blades of agate or quartzite were cemented with pitch into slots gouged out of the ends of the handles, which were strengthened with a wrapping of cord or sinew that extended a short distance upon the blades. The keenness of the blades and the rigid attachment of the handles made these implements effective tools or weapons, as necessity might demand burial, the second story room above them was used as a granary. Fire of unknown origin burned away the ceiling beams beneath the granary, and several hundred bushels of corn fell down upon the burials. Naturally the corn caught fire, and the terrific heat generated during the carbonization of the cereal damaged many of the shell and turquoise ornaments, and completely destroyed whatever wrappings and textiles may have shrouded the dead.

While the greater numbers of specimens were taken from burial chambers, many scientifically important objects were recovered elsewhere. Most of the rooms of the east wing contained large quantities of refuse which had been dumped into them by the occupants of other quarters of the pueblo. Such quantities of material could not accumulate and be cast aside without including a good many articles that would not have been intentionally thrown away. Some beautiful bits of handiwork were sifted from this rubbish, beads, pendants, one shell bracelet set with an inlay of turquoise, and a few hammered copper bells, being the most noteworthy.

It is evident that in artistic appreciation and manual skill no Pueblos before or since have surpassed those of the Aztec region. During the very long life cycle of this culture center indigenous arts and crafts were developed to a very high degree, especially architecture, ceramics, textiles, and the manufacture of jewelry. Although surrounded by wide stretches of mountains and deserts, these Pueblos were not isolated provincials like their neighbors of the Mesa Verde, but were familiar with distant lands whence they obtained through primitive commerce things of beauty and usefulness not afforded by their immediate environment, among which may be mentioned turquoise from the valley of the Rio Grande, copper bells and macaw feathers from Mexico, ornamental pottery from southwestern New Mexico and Arizona, and sea shells from the Gulf of California and the shores of the far Pacific.

Graceful bird-form vessels, each with a head in full relief, doubtless were intended more for ornamental or ceremonial use than for direct utility. About thirty thousand beads were buried in the representation of a turtle-dove shown at the right

Samuel Wendell Williston (1852–1918)

By ONE OF HIS STUDENTS

TO HAVE been one of Williston's students was a greater privilege than most men and women at the time realized. Students worked with him, feeling that he was one of them, unaware of marks to be gained, but impelled by the interest of the subject in hand and fired by their leader's enthusiasm. Ever helpful, he was slow to censure, and quick to recognize and encourage good work. Unconsciously he inspired those he taught to emulate his achievements, and many are his students who have distinguished themselves in medicine or science.

Dr. Williston was equipped with a wonderfully trained, analytical mind, he was quick to determine essentials, to follow logically lines of development, and to deduce salient facts. But, having arrived at results, he was careful to separate facts from probabilities, clearly stating reasons where evidence was faulty, that others might not be misled. Eminently fair in admitting the opinions of others, he was an ideal investigator.

He was born in Boston, Massachusetts, July 10, 1852. While still a small boy, his family moved to Kansas, then a frontier state, and settled at Manhattan. His early education, lacking the facilities of modern common schools, was acquired under conditions that would have discouraged any mind less determined. He tells us that he learned his letters from the name and description in cast iron on the front of the kitchen stove. While a youth, he gained much experience in railroad construction, helping to survey one of the first railroads in his part of the State. Studying in a doctor's office later, he became convinced that he must have a college education. At the Kansas State Agricultural College he received the degree of B.S. in 1872 and A.M. in 1875. There, under the influence of Professor Benjamin F. Mudge, the great explorer of the natural history, geology, palæontology, and economic resources of Kansas, his career as a scientist was determined. He was field assistant to Professor Mudge in several exploring expeditions.

In 1876 he went to Yale University as assistant to Professor O. C. Marsh, and here he obtained the degrees of M.D. and Ph.D. He became demonstrator of anatomy, then professor of anatomy, and was health officer in the city of New Haven from 1888 to 1890.

In 1890 he was called to the Kansas State University as professor of historical geology and anatomy, and later was also dean of the Medical School which he organized. This was the period during which his influence was most felt by student bodies. In state educational matters he was a wise counselor and an originator of methods and practice. When the Kansas State Geological Survey was organized in 1895 he was placed in charge of the department of palæontology and was influential in determining the high character of the work done. Many of his discoveries of fossil marine reptiles were brought about in relation to this work.

Although loath to leave his work in Kansas, he felt that the offer of the University of Chicago permitted greater opportunity for research, and he accepted the chair of professor of palæontology there in 1902, a position which he held until his death in August, 1918.

In Chicago his class work was with graduate students, and during the first six years he continued publications on Cretaceous reptiles. During the last ten years he devoted most of his life to securing and describing a vast series of North American Permian fossils, and at the time of his death was engaged upon a general work on reptiles.

—BARNUM BROWN.

The Demand for Cheap Food

By L. H. BAILEY

From an address given at the dedication of the Administration Building, New York Agricultural Experiment Station, Geneva, New York, August 31, 1918

EVERYONE of us looks to the improvement of agriculture in the reconstruction period which will follow the war. We are concerned that agriculture shall have proper attention when again we put together a society that is now shot to pieces. We want to keep our schools in which agriculture is taught, our colleges of agriculture, our experiment stations in which truth is discovered. Very good: we shall improve the occupation; yet agriculture cannot take its proper place in human society by internal improvements alone. We must have a new kind of public view on the question. The larger remedies lie with the people.

The Standard of Living

The past generation has been known by its attention to the standards of living. We recognize that there can be neither democracy nor effectiveness without sufficient income to enable the citizen to acquire the essential goods of life. The tenement system has been overturned. The sweatshop is being abandoned. Slavish piecework has been virtually eliminated. Child labor has been made illegal. We are standardizing the wage, the length of the day's work, the conditions under which labor is performed.

The justification of all this effort lies in the human result. We are willing to pay more for pig iron, for shoes, for furniture, for books, for transportation, if only the fair standards of living can be maintained. No one raises a voice for cheaper workshop commodities for the benefit of the consumer and at the expense of the worker. Yet the public still wants cheap food.

We go even farther than this with the workshop products. By every means we endeavor to eliminate the risks of workers. The compensation laws, and various insurance plans, are of this order. We recognize that society cannot be stabilized unless the workingman is protected and his personal hazards reduced to the minimum. Yet the farm people, far outnumbering the factory men and producing our fundamental supplies, work always and necessarily against the hazards of nature and carry the risks imposed by the Almighty. These risks cannot be averted; but society must carry the insurance.

The demand for cheap food is fallacious. Pressing down the cost of food has one or all of three results on the producers of it (and its effect on the producers is a vital concern with us as citizens of a state): we reduce the standards of living of the producers in our own country; we exploit the cheap labor and cheap lands of new and remote countries; or we live on the products of peasantry in other countries. These three are the same, considered in the human result. If we are glad to meet the problem of maintaining the standard of living for workingmen, we must be equally glad to maintain it for farmers. There are reasons why we should not attempt the same program for farmers as for workingmen: our problem is to be willing to pay as much for farm products as is necessary for the maintenance of the standard of living on the farms.

We are building great fleets. Every soul of us is glad of it and proud of the enterprise. We rejoice at every new launching. The submarines will not sink these fleets. After the war we must find water to sail them on. We are looking forward with much anticipation to the extensions of our commerce. We shall send away our manufactured products. We shall bring back the raw products, much of it in foodstuffs and hides and other agricultural supplies. Shall we be alert to see that the farming people are as well protected as are the industrial people? We can run no risk of lowering the standards of income on our millions of farms.

As a whole the public appears to be careless of the standards of living on farms. We demand cheap food in the interest of the consumer. Many discussions in the press, on the platform, and in conference, might be cited as indication. I content myself for the moment with a reference to an interesting discussion of the importance of importing Chinese labor to reduce the cost of food, appearing lately in a magazine. It is representative of a class. We may lay aside the agricultural misconceptions of this and similar articles. "A million such laborers," the article says, "distributed throughout the country would so increase the food supply and so lower the cost of the necessaries of life that the laborer who now earns $3 a day would then be able to buy for $3 more food than he can get for $5." I do not think any such result could be attained; but even if so, is it safe and worth while (except possibly as a war experiment) to produce food in North America on a Chinese scale of living? It assumes that "the average American does not like farming. The sons of the prosperous farmers do not take kindly to the tilling of the soil with their own hands. They prefer the excitement and the diversions and the stimulus of the life of city and town, and they leave the farm for the office and the factory. The average American laborer also finds the occupation of the city and town more congenial than farm labor. . . . The same reasons that have denuded the farm of labor have denuded the household of servants." Labor goes where it is best paid and most secure. It is not controlled very much by sentiment. It would go from city to country if the inducements were sufficient. And as for servants, it is the hope of democracy that all persons may better themselves. This writer affirms that the Chinese laborers would relieve the native laborers, allowing them to find employment elsewhere. This statement of the case is its condemnation. We cannot have a democracy with two very unlike standards of living in the producing populations,—an American standard for the industrial workers and a Chinese standard for the agricultural workers.

And now I come to the most dangerous fallacy of all,—to the notion that food production is only an economic question, and that our problem is to produce the greatest quantity at the least cost. Human success and democracy require the best development of the individual as a starting-point. The first crystallization of democracy is in the home. Without the training, free coöperation, and discipline of the home, there is no democracy. Farming is preëminently the occupation of home making. The home is part of the farm. We speak habitually of the "farm home." The workingman does not domicile in the shop nor does the manufacturer live on the factory premises. The purchaser of a farm looks always at the residence as part in the valuation. The purchaser of a factory or a steamboat does not inquire about the residence of the owner: he may not know where the residence is; it may be in another city, or the owner may live in a flat where it is agreeable to neither the landlord nor the janitor that he have a family large enough to constitute a school in democracy. No public action is justifiable that so lowers the standards of income on the farm as to lessen the fullness and the protection of the home. Verily, these homes are of the backgrounds. All the responsibility and the permanence of the occupation enter into the farm home.

The service of the farmer to society is not merely as a producer of supplies. The rural range is a type of life, and one of the seed-beds of citizenship. It is our nearest approach to a permanent society. It does not move itself in search of work, nor ever find itself out of employment, nor is it ever closed by strikes or lockouts, not even temporarily suspended by commercial conditions. It is as much a part of the order of things as the face of nature against which it works. The standard of living maintained in these backgrounds is therefore an elementary consideration in the welfare of society.

We are to be convinced, therefore, that it is at least as important to maintain standards of income in the open country as in the industrial pursuits. It is the public temper to blame the farmer himself if his standards of living or his efficiency are not high in any case, saying that he is ignorant and ambitionless. We do not say it in the same way of the industrial workers. This assumption that the fault lies with the farmer is really at the bottom of much of our legislation and is responsible for a wide extent of loose thinking. Certainly we must make better farmers. All progress rests on personal excellence. Certainly also must we not make farmers the wards of society as we seem to be doing with the workingmen and for which the workingmen themselves will suffer in the end. But we must be ready and glad to pay for food what it costs to produce it plus a good living margin.

It will now be asked whether the standard of living is not, in fact, sufficiently high on the farms. I am not today discussing the family standard itself, but only the income without which it cannot be high enough to meet the needs of democracy. We recognize the high type of character bred by our best farms, and the generous scale of living there maintained; yet this does not release society from its part of a plain obligation. We may at once dismiss the glowing accounts of a class of popular writers, who would make us believe that farmers are the best off of our people. Nor am I especially considering the conditions of war time. We are to remember that the farmer does not make a profit in the commercial sense. He receives a return for his labor. I know that there may be exceptions, and not all that is classed as farming is really such. The exceptions prove the rule and they never can become the rule; and some of the profits attributed to farming are the results of speculation or the selling of fertility long stored by nature in lands only recently opened.

The fairest way we know to measure the farmer's net earning is by means of the labor income. This is the sum left after all working or business expenses and the interest on the investment and the unpaid family labor are deducted. It represents the income the farmer receives for his labor, beyond what home supplies he may use from the farm itself, which supplies are, of course, subtracted from his potential sales. Probably for the country as a whole the labor income will not exceed about one dollar a day. If it rises to twice this figure, the price of land begins to increase.

The Cost of Food

We are justified, of course, in reducing the cost of food by such means as will not endanger the plane of living of those who produce it. We shall learn how to eliminate many of the extrinsic costs between producer and consumer. We shall supply the farmer more knowledge of his occupation, eliminate the incompetents, stimulate helpful organization, and in other ways improve the business itself. Never shall we need to cease such efforts. How far we can apply to agriculture the so-called efficiency methods of quantity-production of the factories yet remains to be determined. We are to consider the results on the homes as well as in commodity wealth. The copartnership and corporation plans of farming have not been successful, and there is little hope that they can succeed outside exceptional circumstances. The private farm colony plans are foredoomed, also, except perhaps in an unusual condition now and then.

Many persons not on farms expect that farming must lend itself to the big-business type of organization, with expert management on a large scale and intensive departmentalizing of the business. This subject I am not to discuss here; I wish only to point out that even if it were to succeed, we could not expect to reduce the cost of food thereby. As soon as farming is industrialized, the home element is eliminated, all labor must be hired outright, the going wage must be paid, and salaried managership must be met. At the same time we are facing lessened fertility. All this would at once greatly increase the costs. At present much of the effort in food production receives no direct wage, for women and children contribute to it. Even if the farm women do not labor in the fields, the keeping of the farm home (which is part of the farm business) devolves on them, as well as much of the management and oversight. All the efficiency methods we could apply on the workshop plan probably would not offset the unpaid or insufficiently paid labor available under the present organization and methods. The world has had cheap food because we have not paid those who produce it and have lived on stored or original fertility.

I see no hope for cheap food, on the old basis. That basis is gone forever. No longer do we look for cheap lumber or cheap paper or cheap clothing. We know that new levels have been reached. We know that new adjustments will have to be made, and that if the consumer suffers, other remedies must be found than merely to force down prices. If the cost of food is too high for the consumer, the subject is of course open to investigation, but we are not to assume that a penalty is to be applied to the producer.

In the past we have been able to obtain cheap food in this country in great abundance, because of our vast extent of very fertile land. We can no longer live on the easily stored riches of the soil. Much of the farmer's income goes back into the soil to improve it. Reduction of his income means soil robbery; this means an impoverished people. Pinching the farmer is pinching the land. For a time, perhaps, we could maintain ourselves by importing the produce of new lands in other parts of the world; but the day could not be far distant when we should find ourselves faced with disaster. To maintain the producing power of its land is the first responsibility of any people in this century. No longer can we expect to live by foraging, by chance, and by skinning the earth.

The Reconstruction

In all the plans and prophecies for the reconstruction of society, I see nothing that places the agricultural situation in its proper proportion. Agricultural affairs must play a prominent part in international relations. We are sending abroad commissions and agencies to review situations, but little to study agriculture in its international aspects. It will be inexcusable if, when we try to bring the peoples together again, we shall not consult the opinion of those who till the earth and produce the supplies for the support of all of us.

Certainly, also, we shall need a body of experts, raised for the purpose and acting under national authority, to study agriculture in terms of reconstruction.

In spite of all our education in agriculture and our fondness for quoting the crop figures in the world's finance and the departures we have fostered here and there, we are apparently not yet in sight of comprehensive cohesive agricultural policies. We are yet in the epoch of doing pieces of work, not having arrived at the visualizing of a society conditioned on the earth.

In the meantime, capital and labor are vocal. Many interests are planning definitely for reconstruction. The boldest pronouncement yet made on the reconstruction of society is the report of the Subcommittee of the British Labor Party, proposed for consideration by the party. It is a clear, definite program. It is ambitious, striking at fundamental considerations, and holding no reverence for traditions. Because of its definiteness it will make headway.

Yet this great program, although mentioning the land and the farmer incidentally, virtually ignores the agricultural range as a concept in the social order. Even though it proposes to broaden the Labor Party in England to include "all workers by hand or brain," yet it practically excludes many of them by holding to the panacea of labor organization and control. This self-sufficiency seems to be characteristic of the attitude of the group we know as "labor." It assumes that it speaks for society, and that it holds the magic for democracy. It is proposed to "build society anew," and "what the Labor Party intends to satisfy itself about is that each brick that it helps to lay, shall go to erect the structure that it intends, and no other." This sounds like intolerance and dominion, and is anti-democratic in its expression. The tenor of the report is to assume the right of way for trade-unionism, even as against government.

What we speak of as "labor" is a minor element in society as compared with the farm element. Probably even in Europe it does not represent more than 20 per cent of the population as against perhaps 50 or more per cent of the agriculturally rural population. Probably 75 per cent of the world's population is yet pastoral and agricultural. The major part of the population can never be industrialized. These rural people are neither industrial workers nor capitalists; or, rather, they are a combination of the two. They constitute a great buffer range of the people that are not yet set over as antagonists against other ranges. They lie outside the usual classifications of "workingmen" and "brain workers" and do not come within the vision of the Subcommittee's report when it declares that "the policy of the Labor Party in this matter is to make the utmost use of the trade-unions, and, equally for the brain workers, of the various professional associations."

It is not my purpose now to analyze this great program. I am in sympathy with much of it and with the evident needs of the workingman. I admire its statement of the case. We must largely accept its underlying philosophy that social and economic values belong to society; we foresee a vast enlargement of its desire for a share rather than for wages. I wish only to use the pronouncement as illustration of the ease with which we overlook the rural side of society in our great plans of social reconstruction. This reconstruction must not rest alone on the demands of the workshop, nor on "employment," nor on wage scales, nor on profit-sharing. The attitude of "labor" toward the day's work can never be that of the farmer. There are wider ranges of the population in which unemployment is not a major problem. Nor am I convinced that its "democratic control of industry" would be much more than its control in the interests of labor and urbanism.

Nor, again, does the "common ownership of the nation's land" provide a solid foundation. The production from the earth does not rest on the same natural necessities as does the manufacture of commodities in the workshop. The ownership of land provides the program that in the industries is supplied by the organization. We shall find the peasants of Russia dissatisfied after a time with any plan of public ownership of all farm land; the farmer naturally desires to own his farm. Such private ownership does not carry the menace to society that may be carried by organized or corporate industries.

The Problem

Now we are ready to agree, I trust, that we have before us a politico-social question of the first magnitude. The problem is not measurable by statistics (nothing expresses so little, and obscures so many facts, as figures). The trouble with society is its enmities and antagonisms. For fifty years, the great antagonism has been between capital and labor. This problem still overshadows all others. We think we begin to see solutions in the legacies of the war. But there arises another antagonism, between the consumer and the producer. This has grown with our urbanism and with our relative neglect of the rural civic and social problem. If the consumer and the producer develop attitudes of hostility to each other, it will involve the whole of society and split it wide open. It will raise an agrarian question of far greater danger than the political agrarianism of some of the other countries. The immediate task before us is to put these great questions before the consumer with fairness, sympathy, and all candor. If we are to make the most of our responsibilities, here or anywhere, we must come into harmony on the question of the supply of food. This means a real coöperation in spirit and in practice between the producer and the consumer, with a determination on both sides to avoid the hateful enmities that have riven society in the name of capital and labor.

The Application

Today we celebrate at an experiment station. What is its relation to our problem?

Its primary function is to aid in the increasing of production by contributing knowledge and the confidence of science. While we are feebly debating the ways of getting cheap food, we are running straight into the problem of obtaining food enough at any price. We cannot forever scatter over the earth and pick up our supplies. Labor is becoming mobile, agricultural labor with the rest; it goes where rewards are greatest, and this means that rural labor goes to cities and to industries; the great government-controlled industries of war time and thereafter will hasten this movement. Democracy, for which we are fighting, will release the serfs and unchain the castes; the land may suffer. Population is increasing. The standards of life are rising. The maintenance of armies utilizes great tracts of land that might produce crops. The people waste their supplies. We look to new areas of virgin land to make good our needs, but this only defers the issue and breeds incompetence in the people; it is a weakening policy.

This skill must be paid for. If we are to educate the farmer to greater effectiveness as an occupationist and to increase his training as a citizen, we must see that he is able to get the value of his education and to have the essential advantages of life. Rather than try to force down the cost of farm supplies to old levels, we must remember that these old levels have often been too low and that our problem now is to place them where they belong in relation to other values.

To develop skill in the farmer requires institutions with good equipment, the best and ablest investigators and teachers, freedom of these officers to devote their best efforts to their work rather than to be diverted by governmental interferences, patience on the part of the people to wait for results that come only in their due time and season. You say this costs money. Yes, much money. You would not appreciate the work if you did not pay what it is worth. We are now destroying property and supplies. I suppose that more money and treasure are being expended this day in destruction than have been appropriated for agricultural research in the history of the world. We have not yet passed the destructive phase of our evolution.

The Platinum Situation in the United States

WHILE, during the Great War, the use of platinum for catalyzing processes in the production of concentrated sulphuric acid for the manufacture of explosives, for dehydrating nitric acid, and for aëroplane and other war machinery, has been made especially prominent, the wide employment of it in electric appliances of various kinds is at least of equal importance. Large amounts of platinum have been used for dental work, because of its durability and its resistance to the action of acids. The latter qualities have made it of the greatest possible value also for various chemical vessels, such as crucibles and retorts. Within the last ten or fifteen years it has been employed by manufacturing jewelers in many ways, such as for watchcases and for other of the smaller ornamental pieces, and for precious stone settings, more especially for diamond settings.

Because of the increasing demand for platinum in the war industries, the War Industries Board decreed that after October 1, 1918, the use of this metal in the manufacture of new stocks of jewelry or for other nonessential purposes should be prohibited. The same law applies to iridium, palladium, osmium, ruthenium, rhodium and compounds thereof. It is said that the Government has a sufficient supply on hand after commandeering the stock of unmanufactured metal, and the prohibition, therefore, does not extend to platinum jewelry already made up, which can be sold as heretofore—that is, by manufacturers or dealers licensed by the War Industries Board. The decree is the result of a special emergency act to effect Government control over platinum, iridium, and palladium, passed by Congress October 6, 1917, and amended July 1, 1918. The situation at that time, after a careful survey, was recognized as serious. Platinum in the United States sold in 1890 at $16 a troy ounce and is selling now at $105 a troy ounce, five times the cost of gold. This situation arose directly from the embargoes of 1915 put upon exportation from the countries at war, England, France, Germany, and Russia, and from the practical cessation of the Russian supply, followed by increased demands after our entry into the war. Prior to the war, Russia had furnished 95 per cent of the world's entire stock. The cutting off of the Russian supply, the principal source of the metal, the imperative need for it for war purposes, and the consequent stringent measures taken by the various governments to restrict its exportation, have operated to limit its use greatly, and have also induced an active search for substitutes which might prove more or less satisfactory. To this end alloys of gold and palladium, gold and osmium, or gold and nickel have been used with fairly good results in many cases. The shortage has also stimulated the search for platinum, not only in the metallic deposits of various parts of the United States, but throughout the entire world, and several new, minor sources have come to light. It is possible that a change in metallurgical methods may furnish a quantity of platinum and palladium in place of that not now available from Canadian sources, and that the resources of the United States and Colombia may be developed to greater extent.

There is good prospect from the development of deposits in Japan, where a considerable amount of platinum and palladium has been obtained by electrolysis from certain copper ores. Brazil also offers good and constantly improving prospects; here platinum is to be found in a number of localities, often combined with palladium. Tasmania has recently sent out a notable amount of osmiridium, one of the allied platinum metals and one of the most useful substitutes for the latter in many of its uses. The copper ores of Canada, especially those of Sudbury, Ontario, can be made to supply a very large amount of palladium and a considerable quantity of platinum also, by systematic treatment. In all these regions, however, except the last named Canadian locality, the deposits are widely distributed, and many new ones must be added to those already reported in order to give full promise of an important addition to our much needed platinum supply. Unquestionably, if our best hopes should be realized in the constitution of a newly and firmly organized Russia, that land will again be able to resume her platinum output, although the necessity for seeking new and promising fields will in no wise be lessened by this, as we have always to bear in mind the prospect of a natural diminution of the Russian deposits, which have been so long and so extensively exploited. Should the new region in the Ronda Mountains, Spain, come up to the expectations when, by the removal of the economic obstacles incident to the war, the requisite capital and energy shall have been directed thither, this field also may come to be a source upon which we can count for excellent results.

Of the 5,000,000 or more ounces of platinum already in existence, it has been estimated very conservatively that catalyzing processes have claimed 500,000 ounces, dental uses 1,000,000, chemical apparatus 1,000,000, electrical devices 500,000, and jewelry 500,000. These estimates are probably set rather too low in view of the fact that the total production of the metal has certainly been as much as 5,000,000 ounces; indeed some authorities have placed the total Russian production alone as high as 7,000,000 ounces. This was crude platinum, of course, and would furnish only about 5,800,000 ounces of the refined metal.

In the period from 1900 to 1917 the imports of unmanufactured platinum and of bars and ingots into the United States, have had a total weight of 52,767.2 kilos, or approximately 1,696,711 troy ounces, and a total value of $48,981,879. To this must be added imports of crucibles, retorts, and the like, worth $2,302,236, giving a total value of platinum in all forms of $51,284,115. Of course, a good proportion of the import was crude platinum. For the fiscal year ended June 30, 1918, the imports of unmanufactured platinum, and of bars and ingots, weighed 1613.1 kilos, or 51,862 troy ounces, and were worth $4,572,614; the retorts, vases, etc., were valued at but $2547, giving a total of $4,575,161 for all platinum imports to the United States. Of this Colombia contributed $2,241,744 (27,030 troy ounces), just about one half of the total value and a little more than one half the weight. A single special shipment of 21,000 ounces from Russia, acquired for $2,000,000, accounted for most of the remainder.—George F. Kunz.

Notes

Since the last issue of the Journal, the following persons have been elected members of the American Museum:

Life Members, Miss Marie Louise Peckham, Lieutenant Harry F. Guggenheim, Messrs. H. Benis, Charles Watson Boise, Everett Masten, and Albert Houghton Pratt.

Sustaining Member, Mr. Gardiner H. Miller.

Annual Members, Mesdames Lyndon Connett, R. G. Hazard, Julie Kahle, R. S. Koch, Romaine A. Philpot, R. Llewelyn Rees, Misses Mary Allen, Sarah M. Post, Messrs. Richard M. Andrews, Frank Carlson, Albert J. Erdmann, Charles J. Fay, John W. Frothingham, Louis B. Hubbard, Robert Parker Lewis, Edwin F. O'Neill, Arthur Smith, Sidney Smith, and Bret H. Whitman, Jr.

Associate Members, Messrs. G. W. McFarland, L. H. Somers, and Dwight Winter.

The Board of Trustees of the American Museum, at its meeting on November 11, adopted a resolution electing to life membership Mr. Albert Houghton Pratt, in recognition of his gift of negatives and motion pictures to the educational work of the Museum. Lieutenant Harry F. Guggenheim was also elected a life member in recognition of his generous contribution to the anthropological department.

The British Educational Mission to the United States, composed of distinguished representatives of the universities of England, Scotland, and Ireland, was entertained at luncheon by the trustees of the American Museum on October 10. The Mission came to this country to develop, if possible, closer coöperation between British and American institutions, and to strengthen the bond of sympathy and understanding between the two nations. At the close of the luncheon the party made a tour of inspection of the exhibition halls of the Museum. Much interest was manifested in the Jesup collection of North American woods, and the Darwin hall elicited praise for the skill manifested in the preparation of specimens, especially those dealing with public health problems. The food conservation exhibit was studied, and in the department of education the nature study collections and the method of coöperating with the classes for the blind and with the city schools and libraries received special attention. The members of the mission were: Dr. Arthur Everett Shipley, Vice Chancellor, University of Cambridge; the Reverend Edward M. Walker, fellow and librarian of Queen's College, Oxford University; Sir Henry Miers, Vice Chancellor, University of Manchester; Sir Henry Jones, professor of moral philosophy, University of Glasgow; Dr. John Joly, professor of geology and mineralogy, Trinity College, Dublin; Lieutenant Robert Nichols, Oxford University; Captain H. A. Smith, fellow of Morgan College, Oxford University.

C. S. Pietro, Italian sculptor, whose work is represented in the American Museum by the busts of John Burroughs and Charles L. Sargent, died of pneumonia at his home in Pelham Manor, New York, on October 9. When taken ill he was engaged on a piece of sculpture intended as a gift to France, believed by some to be his most important work. Mr. Pietro was born in Palermo, Sicily, and studied art in Rome. He came to the United States ten years ago, at the age of twenty-two. Other works executed by him are portrait busts of John Muir and Charles R. Van Hise in the University of Wisconsin and of J. P. Morgan and Elihu Root at Harvard University.

Mr. Carl E. Akeley, of the American Museum, has devoted all of his time during the last eighteen months to matters pertaining to the war and service to the United States Government. One of the enterprises has been the manufacture of the Akeley Motion Picture camera, an instrument originally designed by him especially for use as a naturalist's field camera. Photography as it has had to be carried on at the front during the Great War has presented conditions so nearly paralleled in peace times by the conditions accompanying big game hunting that it was quite natural for the Government to turn to this particular camera and adopt it as an instrument of military service. The camera had not been manufactured commercially previous to the participation of the United States in the war; Government orders, therefore, made it necessary to establish a factory, the entire output of which up to the present time has been delivered to the United States Army.

Mr. Akeley, as consulting engineer in the Division of Investigation, Research, and Development of the General Engineering Depot of the United States Army, also has been called upon for service in the development and production of many mechanical devices in connection with field searchlights, sound ranging instruments, and other wartime apparatus. He has been special assistant to the Chief of the Concrete Ship Division of the Emergency Fleet Corporation, a position for which he was especially well qualified from his experience as inventor of the cement gun, recognized as an important tool in the construction of concrete ships. In addition, an extensive line of experiments with concrete has been carried on in connection with the Bureau of Standards at Washington for the purpose of determining the combinations which would result in a medium embodying maximum strength with minimum weight.

While in the midst of these interests, Mr. Akeley conceived, and with the sanction of President Henry Fairfield Osborn of the American Museum of Natural History, worked out the details of a plan whereby the American Museum building with all its tremendous resources and peculiar fitness for such service might be placed at the disposal of the United States Government for use as a convalescent and rehabilitation hospital for disabled soldiers. In the development of his idea Mr. Akeley pointed out that should the Government decide to accept the offer, there were unique possibilities not only in the building itself for easy conversion into hospital wards without retiring any large number of exhibits, but also in the resources at command through the service of the staff of instructors and artists and the equipment and facilities of laboratories, studios, and shops, for mental entertainment of patients and industrial occupation of convalescents. The details of the plan were elaborated by a special committee appointed by President

Osborn, consisting of Dr. C.-E. A. Winslow, Dr. R. W. Tower, and Mr. Akeley. The matter is now awaiting the final decision of the War Department.

Important explorations in the Huerfano Basin, Colorado, have recently been completed. This little mountain basin is situated in a recess of the Front Range not far from Pueblo. It is of interest to palæontologists as a few fossil teeth and bones had been found in it of geological age apparently between the better known Bridger (Middle Eocene) and Wasatch (Lower Eocene) faunas. It was first explored by Mr. R. C. Hills, of Denver, and subsequently in 1897 by Professor H. F. Osborn and Dr. J. L. Wortman for the American Museum. In 1916, Mr. Walter Granger, assisted by Mr. George Olsen, undertook a more thorough search for fossils which was completed this summer, 1918. The collection obtained is a considerable one, although mostly fragmentary, and will be of much scientific interest. The best specimen in it is a very perfect skull and jaws with part of the skeleton of *Tillotherium* (a rare extinct beast which looked a little like a gigantic rodent but was not at all related to the true rodents) discovered in 1916 by Mr. Olsen. The formation in which these fossils are found is a volcanic ash or tuff of about five thousand feet thickness, indicating the considerable and long sustained volcanic outbursts which must have taken place in this region at the time when the Huerfano mammals flourished. The stratigraphy of the formation was carefully studied by Mr. Granger, accompanied during part of the time by Mr. Hills, who has devoted many years to the study of the geology of this vicinity, and who is at present curator of geology and mineralogy in the Colorado Museum of Natural History. The scientific results of the Museum expedition will be published later in the American Museum *Bulletin*.

The establishment of the Katmai National Monument by executive order of President Wilson, dated September 24, 1918, is regarded as the first step in making this remarkable region of Alaska accessible to the public as a national park similar to Yellowstone and Yosemite. The area embraces the Valley of Ten Thousand Smokes, the volcano of Katmai, and considerable outlying territory. It was visited last summer by one of the expeditions of the National Geographical Society.

Mr. William deC. Ravenel has been placed in immediate charge of the administration of the United States National Museum at Washington with the title of administrative assistant to the Secretary.

The Mission of the French Scholars to the United States visited the American Museum of Natural History on November 12, accompanied by Dr. William H. Carpenter, provost of Columbia University. The Mission was received in the Board Room by Professor Henry Fairfield Osborn and members of the scientific staff and then proceeded on a tour of inspection of the educational methods employed by the Museum in handling its exhibits. The members of the Mission included: Dr. Theodore Reinach, of the Institut de France; Professor Emmanuel de Martonne, of the University of Paris; Professor Fernand Baldensperger, of the University of Paris; Professor Charles Cazamian, of the University of Paris; Dr. Etienne Burnet, of the Pasteur Institute (Paris); Mr. Charles Koechlin, composer and critic of music; and Mr. Seymour de Ricoli, art critic and secretary of the *Gazette des Beaux-Arts*.

For several months past a series of experiments with various patterns of life preservers have been conducted at the New York Aquarium by a committee headed by Director C. H. Townsend. The tests have been made after the building was closed to visitors for the night, the large sea water tanks serving admirably for observation. First the flotation of the life preserver as worn by a fully dressed man of average height was tested; sufficient weights were then attached to its lower edges to maintain it at a water line marked while it was in use and it was then left to float for twenty-four hours or longer. It will be remembered that the first vessel to reach the scene of the "Titanic" disaster found only one body afloat, although bodies with properly attached life preservers continued to come to the surface for several days. Naval officers and steamship men have been present at the experiments, but so far the details of the report have been submitted only to the authorities at Washington.

THE final results of the Museum's investigation of the archæology of the Zuñi tribe are soon to be published in the *Anthropological Papers*. This concludes one section of the Museum's extended studies of archæological and ethnological problems in the Southwest. By a reconnaissance of the ruins in the Little Colorado River drainage, which takes in a considerable area in Arizona and New Mexico, Mr. Leslie Spier has been able to trace tribal movements in the western part of the Pueblo area. He finds that about the time the Indians gave up living in small, isolated dwellings and began to build the great communal houses or pueblos, there were two tribes living in this area, one in what is now the Apache country in the White Mountains of Arizona and the other near the present Zuñi pueblo in New Mexico. After a period of parallel development, the New Mexican group left the area, while the White Mountain group moved north to the Little Colorado where they presumably joined the Hopi Indians. Again after a period of common development the Zuñi left this group, moving northeastward to their present location, while the Hopi seem to have left the river for the northern Arizona desert. On the basis of this historical sketch of Mr. E. H. Morris' work at the Aztec ruin, and of Mr. N. C. Nelson's along the Rio Grande, the members of the Museum staff are constructing a chronology for all the archæological remains in the Southwest.

THE fourth meeting of the American Society of Ichthyologists and Herpetologists was held at the Brooklyn Museum, November 15, 1918. Previous meetings have been held at the Museum of Comparative Zoölogy, Cambridge, Massachusetts, November 16, 1917; at the Academy of Natural Sciences, Philadelphia, March 8, 1917; and at the American Museum of Natural History, March 8, 1916. The present Brooklyn meeting was opened with an address of welcome to the Society by Director Fox of the Brooklyn Museum. Mr. J. W. Titcomb, New York State Fish Culturist, spoke of fish conservation in New York State. Dr. Bashford Dean told the Society of the late Dr. Charles R. Eastman's work on fossil fishes. Dr. William K. Gregory, of the American Museum of Natural History, illustrated with figures of the skeletons of dinosaurs the correlation between habit, muscular development, and skeletal form. Dr. E. Uhlenhuth, of the Rockefeller Institute for Medical Research, showed how a study of the blind Texan cave salamander indicated the connections of subterranean waters, and suggested that a study of such nonmetamorphosing amphibians had an important bearing on our knowledge of the glands controlling metamorphosis.

Officers were elected as follows: president, Dr. Leonhard Stejneger; vice presidents, Dr. Bashford Dean, Dr. Barton W. Evermann, and Dr. Thomas Barbour; treasurer, Dr. Henry W. Fowler; secretary, Mr. John T. Nichols. Mr. Carl L. Hubbs, of the Field Museum, Chicago, was elected to the Board of Governors.

MR. ROY C. ANDREWS, leader of the Second Asiatic Zoölogical Expedition, writing under date of September 18, to the president of the American Museum, describes a recent journey made to Urga, in outer Mongolia, a picturesque town made up of about 2000 Russians and 3000 Chinese, with 35,000 llamas. The trip was made by way of the many century old caravan trail across the Gobi Desert—a region not a "desert," however, but a vast rolling Siberian prairie. About 2000 antelopes were seen of three species, and Mr. Andrews states that individuals racing parallel with the automobile and passing it must, at a conservative estimate, have reached a speed of sixty miles an hour.

THE scientific results of the American Museum Congo Expedition are now being published in separate volumes of the *Bulletin*. A revision of the Vespidæ of the Belgian Congo by Mr. J. Bequaert has appeared as Article I of Volume XXXIX. This volume will also include a paper by Mr. Karl P. Schmidt on lizards, turtles, etc., and one by Dr. J. A. Allen and Mr. Herbert Lang on the insectivores. An extensive paper on Congo Mollusca by Dr. H. A. Pilsbry, of Philadelphia, is in press as the first article in Volume XL.

DURING the last month Mr. Roy W. Miner, of the American Museum, has co-operated with Dr. Robert Underwood Johnson, president of the New York Committee of the Italian War Relief Fund of America, in the work of examination, selection, and preparation for shipment of a number of compound microscopes suitable for bacteriological work, to be forwarded to Italy for use in the field hospitals. Many of the microscopes were donated, ten being given by the American Museum of Natural History. Others were purchased by the Italian War Relief Fund. Two shipments have already gone and another, the final one, is in course of preparation. The lens requirements for these instruments are important as the character of the work to be done demands a certain equipment embodying high magnifications, which the ordinary student's microscope does not often possess.

A COMMISSION on the study and control of epidemic influenza has been appointed by Governor Whitman of New York State. Dr. Hermann M. Biggs, State Commissioner of Health, is chairman; Dr. Walter B. James, vice chairman; and Dr. C.-E. A. Winslow, secretary.

IN addition to the brief description of the American Museum's work with the blind printed in this number of the JOURNAL (page 572), we give here a quotation from a letter to the Editor from Miss Frances E. Moscrip, Inspector of Classes for the Blind in New York City: "It gives me great pleasure to express my appreciation of the American Museum's work accomplished in connection with the blind and sight conservation classes of the public schools. The expensive relief globes which have been furnished to all of the classes are daily a source of information and delight, not only to the blind and partly sighted pupils but also to the normal pupils who are associated with them. Several principals have told me how envious they felt that the globes could not be furnished to the whole school. You would hardly recognize some of the globes, they are so dotted with principal cities, lined with important rivers, steamship and railroad routes, and marked with mountain ranges and interesting peaks. The alternating days and nights and the changing seasons have been explained and clarified also through the use of these wonderful globes. Nothing that has been furnished to the special classes in the schools, however, can take the place of the little excursions the children make to the Museum. On these occasions your instructors have acquainted them with Indians, Eskimos, Oriental peoples, and their interesting manners and customs. I well remember the delight of one child who took a ride on a fully equipped Eskimo sled, drawn by a dog with all his trappings. The child's imagination supplied the snow and cold and other features of a real trip in polar regions. The work in connection with the native birds and domestic animals has stimulated the child's interest in his surroundings and in the study of geography. Intimate knowledge of flowers and cereals gained at the Museum lectures is one which might never be acquired from Nature herself nor from the studies in school except in a more limited measure. Many of the older pupils, especially the high school students, have appreciated the evening lectures, and the assistance the Museum has rendered in defraying the expenses to and from both the afternoon and evening lectures has made possible the attendance of many who could not otherwise have taken advantage of them."

The JOURNAL hopes to publish in the December issue an account by Miss Moscrip of her work with the sight conservation classes in the New York public schools.

MR. GEORGE CHAMBERLAIN, assistant in the department of publications of the American Museum, died on October 29, 1918, after a long illness. He was a native of England, and came to the United States in 1897, and had been in the employ of the Museum since February 6, 1909. He is deeply missed by a large circle of acquaintances and friends.

MISS MARTHA RYTHER, a well-known textile designer in New York City, connected with the firm of H. R. Mallinson & Company, is conducting a class in textile design which meets at the American Museum every Wednesday afternoon. The membership of the class is made up of designers in the textile and garment industries and members of the Keramic Society of America. The study is based upon the large resources of the Museum in original documents of Peruvian and other prehistoric textile material.

AN ARTICLE on "Ancient Peruvian Textile Designs," in a recent issue of the *British* *and Latin American Trade Gazette*, calls attention to the adoption by United States textile manufacturers of ancient designs of Peru and speaks of the advantage possessed by this country in having large collections of Peruvian specimens in our museums. Thousands of pieces of cloth of ancient manufacture, of unrivaled technique and coloring, and displaying a great variety of original artistic designs, have been brought out of Peru by collectors. The Peruvian's mastery of the art of coloring and fixing the dye had reached such perfection that the ancient patterns have remained bright and beautiful after thousands of years. For some time past American designers have been making studies from these cloths and the patterns created have been adopted eagerly by manufacturers for both cotton and silk fabries. The *Trade Gazette* believes that these designs will appeal with equal force to customers of the Old World. The Peruvian textile collections in the American Museum, which have been the chief source of inspiration to New York designers, number about one thousand pieces.

The leading article of this number of the Journal, "A League of Free Nations," by President Charles R. Van Hise, of the University of Wisconsin, was delivered as the opening address before the Wisconsin State Convention of the League to Enforce Peace, November 8, 1918. President Van Hise has been closely connected with America's war activities. At the request of the United States Food Administration in the early part of 1917, he prepared a course of lectures on "Conservation and Regulation in the United States during the War," which were printed and used in the universities, colleges, and normal schools throughout the country. During the summer and autumn of 1918, in company with a party of editors, he visited England and France, and as a guest of the British Ministry of Information, was granted full opportunity to understand the war effort of Great Britain both at home and in the field. The fundamental purpose of this visit, from which he has just returned, was to cement more firmly the union of English speaking peoples.

In order to develop the scope of usefulness of the files of lantern slides on educational subjects, a representative of the American Museum visited the New York State College of Forestry at Syracuse University recently and selected a number of negatives showing practical and approved methods of reforestation, lumbering, fire protection, and forestry in general. The courtesy of the State College of Forestry in lending its negatives for this purpose is greatly appreciated.

Mr. G. K. Noble, research assistant in herpetology at the American Museum, enlisted as second-class seaman in the United States Navy in April. Later he was assigned to the First Naval District Officer Material School, at Cambridge, Massachusetts, from which he was graduated on October 14 with the commission of ensign.

Guide Leaflet No. 48, *Insects and Disease*, by Messrs. C.-E. A. Winslow and Frank E. Lutz, has been issued from the American Museum press. Much valuable information about insects and their intimate relation to health conditions among mankind is embodied in its seventy-three pages. Twenty-two pages are devoted to the common fly. Latest scientific methods of dealing with insect pests of the household, and the remarkable results which have been achieved in wiping out typhoid and other malignant diseases spread by insect carriers, are clearly set forth.

The food conservation exhibit prepared by the department of public health of the American Museum which was on view in the gallery of the concourse of the Grand Central Station in the spring of 1918, and later formed an important part of the food show held at the Grand Central Palace in the summer, was brought back to the Museum and is now established in the center aisle of the forestry hall. This application of American Museum demonstration methods to problems of national mobilization for war service has met with wide commendation. The exhibit is pronounced by representatives of the United States Department of Agriculture to be the best food exhibit yet prepared, and its details have been studied and copied by food educators throughout the country.

The American Museum War Relief Association, composed of employees of the

American Museum of Natural History and members of their immediate families, has issued a summary of what has been accomplished since its organization in May, 1917. Among its activities is the work of three departments under the Red Cross which have devoted themselves to the preparation of 920 bandages and 28,755 surgical dressings, and the making of 688 hospital garments and 331 knitted articles. Red Cross membership receipts during this period amounted to $313. Garments knitted for other organizations than the Red Cross totaled 256 sweaters, 108 wristlets, 147 scarfs, 367 socks, and 137 helmets. The total amount of money raised from Museum employees and other sources was $2,281.76 of which $1,610.22 was expended in various ways such as for sewing and knitting materials, surgical dressings, comfort kits and knitted outfits for the Museum boys in service, and the support of one French and one Belgian orphan. A balance of $671.54 was reported in the treasury on October 30. The Association has also collected more than two tons of clothing for Belgium and France.

Close rivals to the wonderful modern improvements and inventions of warfare have been some almost forgotten weapons resurrected during the World War. Among these were various forms of armor, as exemplified in the steel helmets and trench shields used by all the armies,—the heavy breastplates of the Germans, the lighter breastplates for attack worn by the English, and the armored waistcoats of the Italians. The armor workshop at the Metropolitan Museum of Art under the supervision of Major Bashford Dean made many experiments in the manufacture of armor models for our American soldiers. This workshop, unique so far as known, was established originally for the repair and preservation of one of the greatest collections of armor in the world, including the Riggs Collection which contains some of the rarest pieces on the market since 1850. In the armor collection of the Metropolitan Museum there are about ninety kinds of anvils, several hundred types of hammers, curious shields, and instruments the very knowledge of which has today almost disappeared. All these were studied by American designers, and the ancient implements actually were used to manufacture models in the workroom. In direct charge of the work under Major Dean, is M. Daniel Tachaux, the descendant of a long line of armorers. His skill is known to collectors the world over. Born in Blois, France, M. Tachaux went to Paris in the early seventies and was apprenticed to the famous Klein, who was brought from Dresden by Napoleon III to clean and repair the armor in the beautiful Château of Pierrefonds. Ten years ago he came to New York and was appointed assistant to Professor Dean. When war was declared and there was need of skilled workers on models of armor, this department of the Museum was placed at the disposal of Secretary of War Newton D. Baker. In November, 1917, Major Dean, because of his lifelong study of the subject, was commissioned Major in the United States Army and sent abroad by the United States Government to study the needs of the army on the Western Front. On his return late in January, he began to work out designs for armor in accordance with his observations and with suggestions from General Pershing and the Ordnance Department. These designs were carried out by M. Tachaux, and no fewer than twenty-five different types of armor defenses were made in experimental lots by various factories, numbering from a score to many thousands of pieces. They comprise all that was best in ancient armor. Helmets, shields, breastplates, and even leg guards and arm guards were made. These last were suggested by the study of hospital statistics in France and England, in which it appeared that more than 40 per cent of the casualties suffered were leg wounds and 33 per cent arm wounds. It is interesting to note that so completely were armored defenses studied in the past that there is scarcely a technical feature that was not worked out in elaborate detail by the old-time armor makers.

The castor bean (*Ricinus communis* Linnæus) has lately attained fame in the winning of the war, owing to the fact that the oil contained in the beautifully mottled seeds is the kind which induces the machinery of an aëroplane to do good work. The United States Government has contracted with Florida growers for thousands of acres of castor beans to produce oil for aëroplanes. The best grade of oil is obtained by hydraulic pressure.

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 1917:

Attendance in Exhibition Halls	786,151
Attendance at Lectures	115,802
Lantern Slides Sent out for Use in Schools	63,111
School Children Reached by Nature Study Collections	1,104,456

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 the JOURNAL. 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.

The various Classes of Membership are as follows:

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

They have the following privileges:

An Annual Pass admitting to the Members' Room
Complimentary tickets admitting to the Members' Room for distribution to their friends
Services of the Instructor for guidance through the Museum
Two course tickets to Spring Lectures
Two course tickets to Autumn Lectures
Current numbers of all Guide Leaflets on request
Current copies of the AMERICAN MUSEUM JOURNAL

Associate Membership

In order that those not living in New York City may associate with the Museum and its work, the class of Associate Members was established in 1916. These Members have the following privileges:

Current issues of the AMERICAN MUSEUM JOURNAL—a popular illustrated magazine of science, travel, exploration, and discovery, published monthly from October to May (eight numbers annually), the volume beginning in January

A complimentary copy of the President's Annual Report, giving a complete list of all Members

An Annual Pass admitting to the Members' Room. This large tower room on the third floor of the building, open every day in the year, is given over exclusively to Members, and is equipped with every comfort for rest, reading, and correspondence

Two complimentary tickets admitting to the Members' Room for distribution by Members to their friends

The services of an Instructor for guidance when visiting the Museum

All classes of Members receive the AMERICAN MUSEUM JOURNAL, which is a magazine issued primarily to keep members in touch with the activities of the Museum as depicted by pen and camera; also to furnish Members with reliable information of the most recent developments in the field of natural science. It takes the reader into every part of the world with great explorers; it contains authoritative and popular articles by men who are actually doing the work of exploration and research, and articles of current interest by men who are distinguished among scientists of the day. It takes the reader behind the scenes in the Museum to see sculptors and preparators modeling some jungle beast or creating a panorama of animal life. It shows how the results of these discoveries and labors are presented to the million public school children through the Museum Extension System. In brief it is a medium for the dissemination of the idea to

which the Museum itself is dedicated—namely, that without deepening appreciation of nature, no people can attain to the highest grades of knowledge and worth.

Publications of the Museum

The Scientific Publications of the Museum comprise the *Memoirs, Bulletin* and *Anthropological Papers*, the *Memoirs* and *Bulletin* edited by Frank E. Lutz, the *Anthropological Papers* by Clark Wissler. These publications cover the field and laboratory researches of the institution.

The Popular Scientific Publications of the Museum comprise the *Handbooks, Leaflets*, and *General Guide*, edited by Frederic A. Lucas, and the JOURNAL, edited by Mary Cynthia Dickerson.

POPULAR SCIENTIFIC PUBLICATIONS[1]

HANDBOOKS

NORTH AMERICAN INDIANS OF THE PLAINS
By Clark Wissler, Ph.D. — Paper, 25 cents: cloth, 50 cents

INDIANS OF THE SOUTHWEST
By Pliny Earle Goddard, Ph.D. — Paper, 25 cents; cloth, 50 cents

ANIMALS OF THE PAST
By Frederic A. Lucas, Sc.D. — Paper, 35 cents

DINOSAURS
By W. D. Matthew, Ph.D. — Price, 25 cents

TEACHERS' HANDBOOK, PART I, THE NORTH AMERICAN INDIAN COLLECTION
By Ann E. Thomas, Ph.B. — Price, 10 cents

TREES AND FORESTRY
By Mary Cynthia Dickerson
A new edition in course of preparation.

HEALTH IN WAR AND PEACE
By C.-E. A. Winslow, M.S., M.A. — Price, 25 cents

ANCIENT CIVILIZATIONS OF MEXICO AND CENTRAL AMERICA
By Herbert J. Spinden, Ph.D. — Cloth. Price, 75 cents

ILLUSTRATED GUIDE LEAFLETS

THE COLLECTION OF MINERALS
By Louis P. Gratacap, A.M. — Price, 5 cents

NORTH AMERICAN RUMINANTS
By J. A. Allen, Ph.D. — Price, 10 cents

THE ANCIENT BASKET MAKERS OF SOUTHEASTERN UTAH
By George H. Pepper — Price, 10 cents

THE MUSICAL INSTRUMENTS OF THE INCAS
By Charles W. Mead — Price. 10 cents

THE SAGINAW VALLEY COLLECTION
By Harlan I. Smith — Price, 10 cents

PERUVIAN MUMMIES
By Charles W. Mead — Price, 10 cents

[1] Prices net; postage extra

The American Museum of Natural History

Scientific Publications

MEMOIRS

VOLUME I.—Zoölogy and Palæontology.
VOLUMES II–VIII.—Anthropology.
VOLUME IX.—Zoölogy and Palæontology.
VOLUMES X–XIV.—Anthropology.

VOLUMES II, IV, V, VII, VIII, X–XIV, and an ETHNOGRAPHICAL ALBUM form the **Memoirs of the Jesup North Pacific Expedition**, Volumes I–X.

MEMOIRS—NEW SERIES

VOLUME I.—Zoölogy and Palæontology.
VOLUME II, part 1.—Palæontology; part 2.—Zoölogy.

BULLETIN

VOLUMES I–XXIV; XXV, parts 1 and 2; XXVI–XXXVII; and XXXVIII, parts 1–14.

ANTHROPOLOGICAL PAPERS

VOLUMES I–IX; X, parts 1–6; XI; XII, parts 1–5; XIII; XIV, parts 1 and 2; XV, part 1; XVI, parts 1–3; XVII, parts 1–4; XVIII, parts 1–4; XIX, part 1; XX, part 1; XXI, part 1; XXII, parts 1 and 2; XXIII, part 1; XXIV, part 1.

MONOGRAPHS

A Review of the Primates. By D. G. ELLIOT. 3 volumes.

Hitherto Unpublished Plates of Tertiary Mammals and Permian Vertebrates. By COPE and MATTHEW.

A more detailed list, with prices, of these publications may be had upon application to the Librarian of the Museum.

FLASHLIGHT PHOTOGRAPH IN THE FOYER OF THE AMERICAN MUSEUM FOLLOWING A LECTURE ON BIRDS BEFORE THE ADULT BLIND OF NEW YORK

(SEE PAGE 573)

THE AMERICAN MUSEUM JOURNAL

FOOD FOR OUR ALLIES — GRAHAM LUSK
ON SOUTH AMERICA — THEODORE ROOSEVELT
CRUISE TO A LAND OF PEAT
FINGER PRINTS —— SURGICAL GRAFTING

THE AMERICAN MUSEUM JOURNAL

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

December, 1918

VOLUME XVIII, NUMBER 8

The American Museum Journal

Volume XVIII

CONTENTS FOR DECEMBER

Number 8

Mary Cynthia Dickerson, *Editor*

Published monthly from October to May, by the American Museum of Natural History, New York, N. Y. Subscription price, $1.50 a year.

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

The Journal 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 members 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 AMERICAN MUSEUM JOURNAL

THE AMERICAN MUSEUM JOURNAL, 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 One Dollar and Fifty Cents a year. The JOURNAL 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 the JOURNAL. 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 the JOURNAL. Price lists and complete data may be obtained from the Librarian.

CLARK WISSLER, OF THE AMERICAN MUSEUM, AUTHOR OF "THE AMERICAN INDIAN"

The following is quoted from a review of the book which appeared in the *American Anthropologist* (N. S. 20, 1918), by Professor A. L. Kroeber, of the University of California:

"Dr. Wissler has looked almost wholly for mass results: and he has got them in a degree that makes all previous efforts in the same direction seem feebly puny. In the power of practical organization displayed, the book is characteristically American.

The author evinces remarkable balance of judgment. . . . He looks into everything and faces any aspect impartially; if his conclusion comes out tentative, he is willing to have it so. He steers a mean course, equally clear from the Scylla of mere depiction and the Charybdis of theory spinning. The evolutionist, migrationist, and other snares that so regularly enmesh those with a weakness for deduction, never touch him. It is a pleasure to feel his apparently instinctive aversion to anything but inductive reference. . . . He has moved forward the science of anthropology. The book traverses a long route; and there is scarcely a point touched but something is established which before was vague or obscure or postponed or unorganized"

—See "Review of Wissler's *The American Indian*," page 646.

THE AMERICAN MUSEUM JOURNAL

VOLUME XVIII DECEMBER, 1918 NUMBER 8

The Food Supply of Our Allies

STORY OF HOW KNOWLEDGE OF THE AMOUNTS OF IMPORTED MEAT, FATS, SUGAR, AND CEREALS NEEDED DURING 1919 BY BRITAIN, FRANCE, AND ITALY, WAS SUPPLIED TO MR. HOOVER

By GRAHAM LUSK[1]

Professor of Physiology, Cornell Medical College, and Scientific Director of Russell Sage Institute of Pathology

ABOUT 1750, Benjamin Franklin observed in *Poor Richard's Almanac* that wherever there was famine there was disorder, and wherever there was disorder famine followed in its train. This has been the keynote of the present world situation. Lack of hygiene and sanitation does not cause disorder. Soldiers have lived incrusted in the mud of Flanders but have maintained their morale when well nourished. The Russian peasant is firmly convinced that the louse is necessary for health because this vermin leaves his body only in the event of his death. If cleanliness were as much desired by the people as food, then the streets of our cities would be kept in perfect order, and no dirt would be allowed to accumulate upon them. Indeed, Tolstoy teaches that the desire for cleanliness is a cultivated extravagance and not an instinctive impulse. The call for food is, however, insistent and instinctive and must be satisfied or social discontent arises.

The food situation of the Central Powers a year ago, so far as can be ascertained, was that because of the supplies they had obtained in Russia they were somewhat better off than they had been a year before. There are some indications that Germany believed that after the treaty with Russia there would be plenty of food for Germany. The supplies, however, proved disappointing because the vicious circle of disorder and famine had had its evil effect upon the Russian crop production. If time is spent in pillage and cheering the red flag, there is no labor to produce a crop, and if the farmer's crop is stolen from him, there is no incentive for him to raise one. Not only this, but the German conquerors had a first right to such crops as might be raised.

On account of the free access to the sea, the position of the Allied Powers, as regards the food factor, was superior to that of Germany, and yet here, too, were difficulties. The submarines in March, 1918, were sinking vessels faster than they could be built. Englishmen looking out to sea on the coast of Cornwall in southern England could frequently see ships go down with their precious cargoes of food on board. Furthermore, ships were needed for the transport of American troops and munitions to Europe. Everything was done to reorganize the situation. The

[1] Member of the Interallied Scientific Food Commission and American delegate, with Professor R. H. Chittenden, to the meetings of the Commission held in Paris, Rome, and London, in 1918, for the purpose of examining scientifically the interallied program for food supplies.

Shipping Board brought ships from all over the world, from the remote trade routes in the Pacific, and put them to work on the short line between Europe and America. The ships were no longer under orders from their owners, but an interallied board of men of genius and capacity directed whether a ship should go here or there in accordance with the situation. England, who owned most of the ships, did not have the deciding voice if Italy's need was at the moment predominant. Here, indeed, was interallied government control which could be effective only through the renunciation of many national rights in the interest of world welfare. The working out of such a scheme is prophetic of the success of a League of Nations. It was the same way with the food question. Theoretically at least, we were all pledged to eat at a common table in the interests of a common victory over the war lords of Berlin.

The beginning of the present year witnessed an effective propaganda on the part of Mr. Hoover's Food Administration for the saving of wheat on the part of the people of the United States. Our usual surplus carry-over of the summer before had all been exported, and our crop of 1917 was only just equal to the necessities of our own people, which amounts to an annual per capita consumption of five bushels or 500,000,000 for the whole country. Our own people had never worked so hard, they had never been so well paid, and the natural tendency was toward a larger consumption of all food materials. The response to the appeal was whole-hearted. Several of the southern states pledged themselves to eat no wheat until the next crop was harvested, and corn bread became the bread of every patriotic citizen. The supply of corn meal for this purpose is practically unlimited in America, since Indian corn is always our greatest crop, reaching in 1917 more than 3,000,000,000 bushels. Under ordinary circumstances only 6 per cent of the corn crop is used for human food. The rest is used as fodder for cattle. The number of pigs raised is quite proportional to the size of the corn crop, and in the spring of this year Mr. Hoover was able to offer to the Allies in one lot 450,000 tons of pork products. This single offer was sufficient to give an ounce of pork apiece to the 43,000,000 of the civilian population of Great Britain daily for a year and to provide about 20 per cent of its total requirement of fat. Such results were obtained by transforming the corn of our western states into fat pork, and by the fact that we gave up eating bacon and pork in order to save the material for our Allies.

At the beginning of the year, as we have seen, the Allies were threatened, first, by the submarine warfare: second, by our wheat crop shortage; and third, by the possible contingency of a second crop shortage which might eventuate in 1918. For that reason an Interallied Scientific Food Commission, which had been instituted by the Interallied Council at Versailles at the suggestion of Dr. Alonzo E. Taylor, was called together, Professor Chittenden and I sailing for Europe on February 6 to attend the meetings of the Commission.

It seemed strangely interesting to transfer one's thought from the behavior of food in individual dogs and sometimes in individual men, as I had been doing, to the consideration of the proper nutrition of 230,000,000 people in Great Britain, France, Italy, and the United States.

The Interallied Scientific Food Commission met in Paris the end of March; in Rome, the first of May; and in London, early in June. It was made up of two men from each country: Professors Gley and Langlois, of France; Starling and Wood, of Great Britain; Bottazzi and Pagliani, of Italy; and Chittenden and Lusk, of the United

States. The celebrated Professor Richet was a member at the opening meeting in Paris but was replaced by Langlois, and at the London meeting Pagliani was replaced by Menozzi.

Before the Commission was called together we had an opportunity to study the conditions as they existed in Britain. The Royal Society of London had established a Food Committee under the chairmanship of Starling, professor of physiology of the University of London. To this Committee came T. B. Wood, professor of agriculture in the University of Cambridge; Gowland Hopkins, of the same college; Noël Paton, of Glasgow; Halliburton, Hill, Sir Henry Thompson, Hardy, secretary of the Royal Society, and many others, all men whom we had known in happier years. This Committee had worked with great ability upon the various problems connected with the food situation, and their judgment had on various occasions determined the policy of the Ministry of Food under Lord Rhondda. It is only justice to say that the principles evolved by the Royal Society Food Committee were in their essence the fundamentals which the Interallied Scientific Food Commission adopted.

The food situation in Britain was quite different from that which existed before the war. Meat, fat, and sugar were all rationed, rich and poor alike receiving the same amounts. The quantities of these materials which were available were only one half their consumption before the war. The quantity of meat which was allowed to the civilian population of England and Scotland last winter was about the same in amount as that given to the inmates of the poorhouse in Helsingfors, Finland, in 1910. The quantity of fat in the diet was not far from the amount allowed in Voit's celebrated diet for a poor laboring man. The reduction in the quantities of meat, fat, and sugar amounted in value to the elimination from the diet list of one fifth of all the foods available before the war. To compensate for this, intensive gardening had produced a bountiful crop of potatoes, and artichokes had been grown in waste places to add to the food supply, but more than anything else, wheat from America added to the bread supply. The consumption of bread grains had risen from nine ounces per capita daily to nineteen ounces per capita.

Bread was not rationed, although plans were in readiness so that in case of necessity, that is in case the German submarine menace should actually become converted into an efficient blockade, it could have been rationed at a moment's notice. Fortunately, the British fleet held the sea, for Britain can raise at best only half enough food to support her population. It was the general political policy of the government to make bread freely available to all classes of the people. It was subsidized by the government so that flour, which could be made into bread, cost much less than corn, which was used for chicken feed. No one would eat to excess of the dark-colored war bread of which there was some complaint. Parenthetically it may be stated that there is always complaint about food, no matter what the condition of life. In general, food priority followed these lines: 1, the fighting forces; 2, the munition workers; 3, children.

We visited the Woolwich Arsenal, located in a fenced enclosure ten miles in circumference and employing 110,000 workers, of which 25,000 were women. The workers were fed in canteens managed and run by patriotic women. The food was good, plentiful and cheap, and the money paid for the food covered all overhead charges. Great ovens held piping hot potatoes, and vegetable pies were in high demand. The workmen preferred to share their meat rations with their families on Sundays and lived very largely upon a vegetarian dietary. Of course, it was more difficult to satisfy the palate without meat, but since the worker knew that from the King down all were sharing in the same deprivation, there was no social discontent. Six canteens were managed by the workmen themselves, and these, we were told, were the least satisfactory of the establishments. We were shown one canteen in which 800 girls were given their food. This canteen was painted white inside and the girls wore rubber soled shoes when walking on the floor, their occupation precluding the introduction of a particle of gritty dirt into their shop.

Variety was not always obtainable, especially in the individual country home. A friend of mine had a farm in Sussex upon which lived sixteen farmers. His men complained that when they came home to dinner there was frequently nothing but bread to eat. When there is no meat at many of the meals and little butter or margarin, it is easy to see how bread alone could become distasteful. If one introduces bread through an artificial opening into the stomach of a sleeping dog he cannot digest it. Only after eating it with appetite does the gastric juice flow so that digestion takes place. So my friend sent to Scotland and bought 350 pounds of cheese and rationed it among the farmers at the rate of five pounds per month per family. This changed the condition of the men completely. An old proverb of the ancient medical school of Salerno reads, "No digestion without cheese." And Shakespeare makes one of his characters say to another,[1]

> "Why, my cheese, my digestion, why hast thou not served thyself in to my table so many meals?"

Despite individual difficulties, it was the general consensus of opinion that the people of Great Britain had never been so well nourished as during last winter. The undernourishment of large masses of the people, such as existed before the war, had entirely disappeared. Children in London looked well fed. Wages were higher than they ever had been. It was the general feeling among those who had to do with the problem that an ample food supply must be provided for all the people in any policy of reconstruction after the war. By what process or plan this could be achieved I was never informed. It seems certain, however, that the peace and calm of Great Britain last spring were due to the food policy of her rulers. At night the darkened streets of London were as safe to walk in as any place in the world, and this is in contrast with authentic reports that crime in Berlin and other German cities was constantly increasing. In Germany the rich man could buy food which the poor man was unable to obtain.

The British policy as regards live stock was directed by the knowledge that there was a limited quantity of feeding stuffs in the country and that these should be largely applied to the production of milk first for children and then for adults. Cream was forbidden except on a physician's prescription and real butter was almost impossible to obtain. Instead of butter, one was given a little pat of margarin usually made of coconut oil.

In 1871 began the era of cheap bread grains imported chiefly from America to England, and gradually the wheat fields of England were converted into pasture lands for fine cattle and sheep. Cattle fodder was also imported and meat production acquired great proportions. Last year the idea was to plough up the grass land, to decrease the number of animals supported, and to feed to such animals as could be raised only those food materials which could not be eaten by man. The carrying out of such a program meant doing violence

[1] *Troilus and Cressida*, Act II, scene 3.

to the hereditary traditions of the agricultural community where individual profit had been supreme and the welfare of the state of secondary importance. In time of war, however, the safety of the state rises above the personal profits of an individual. It was realized that a decrease in the number of animals maintained would decrease the amount of fertilizer for use upon the soil, and so it was proposed to employ artificial fertilizers, such as ammonium sulphate, for the renewal of the soil. Professor Wood showed that the relation between the number of manure-producing animals and the size of the crops was exaggerated in the minds of the farmers.

The arrangement was such that the home-grown meat was divided among the civilian population, and the army and navy were provided by importations from the United States and the Argentine.

In May, however, the importations of American pork were on so large a scale that it could be purchased without giving up one of those precious meat coupons which four times weekly allowed an individual to purchase an amount of meat not exceeding five ounces, including bone.

The English army ration was a pound of meat and four ounces of bacon daily. Our own army ration of meat, having descended from British custom, was established by George Washington in 1792 at one pound of meat per day. The French army receives two thirds of this amount or 300 grams daily. The Italians have heretofore received less than this, but having been brigaded with French and English troops, they have acquired a taste for meat.

Major Ewing, who had charge of the nutrition of the Canadian troops quartered in England, gave a talk before the Royal Society Food Committee one day last winter and described how, in former years, he had cared for the provisioning of various gangs of men who were pushing a branch railroad from the Canadian Pacific Railroad up a valley in the Canadian Rockies. The Italians of the party lived more economically than the men of other nationalities and refused to buy meat. Their labor became poor and the situation was most unsatisfactory. Finally the company ordered that each man must have deducted from his wages at least $15 a month for food whether he ate it or not. This resulted in the Italians eating meat and in a great improvement of their working capacity. This experiment, however, does not show whether the benefit was derived from the meat itself or from the fat present in the meat.

Some American workmen leave a standing order with the butcher for a pound of meat a day or even two pounds. Wood in England has shown that it takes five times the quantity of fodder to produce a pound of dry human food in the form of steer-beef than it takes to produce an equal value in terms of milk, veal, and cow meat. The moral of this is that eating beef in large quantities is a distinct social loss to the community. The fodder used to produce steer-beef would produce a fivefold food value if it were used in dairy farming. The English have attempted to divert their reduced fodder supply so that it shall produce a maximum amount of human food.

The reduced meat dietary had no evil effect upon the British population last winter, and it is extremely doubtful whether the large quantities of meat prescribed for soldiers is in any way necessary. Colonel Murlin has found that when the choice is left to the men themselves, the troops in our home camps take less than three quarters of a pound of meat a day, or not far from the ration of the French soldiers, whose physical efficiency is unquestioned. With so many other precedents in the melting pot, it may in future be possible to change the army ration established by George Washington and to reduce the quantity of meat to a more rational level.

In France bread was rationed; two thirds of a pound daily was allowed to civilian adults, about half a pound daily to children, and increased rations were given to people doing hard work. Bread cards were used and each coupon was dated. On May 16 at the railway station at Tréport on the French coast I was refused a piece of bread because I had only a coupon dated May 14. The difficulties of provisioning northern France last spring were due largely to difficulties of transport, the Germans having broken up important lines of railway. Préfet Mirman at Nancy told me that it was difficult to get flour to his people. I understood there was plenty at the ports of France. At the American Red Cross Hospital at Toul I was told that until the first of January it had been easy to get chocolate for the supper of 250 refugee children who were cared for there, but since that time chocolate had almost disappeared from the market.

In Italy wherever we went we found that a large plateful of either rice or macaroni was the prelude to the ordinary luncheon or dinner. Neither the French nor the British cared for this invariable introduction to a meal, while the Italians dining in London felt that the meals were unsubstantial. The national psychology of food is indicated by the English attitude toward corn bread. They did not like it. An editorial note in the *Pall Mall Gazette* stated that it was good news to hear that the bread supply of Great Britain was assured and that it was to be hoped that pig's food would be diverted in the direction intended by nature.

The Interallied Scientific Food Commission held its first session March 25, 1918, two days after the beginning of the bombardment of Paris by the Germans with the long range gun. The problems were to determine the quantities of food needed by each nation, the quantities produced by each nation, and the difference between these values which would represent the quantities of food to be imported by England, France, and Italy, and the exportable surplus of the United States.

The Commission decided to accept as the basic standard for the food requirement of each nation the quantity of food which would be taken by an "average man." The diet of an "average man" was defined as one containing 3000 calories "as utilized" or, allowing for waste, 3300 calories "as purchased," and 75 grams (about 3 ounces) of fat. It was resolved that meat was not a physiological necessity, especially when milk, cheese, and eggs in addition to vegetable proteins were present in the dietary. It was obvious, if a diet contained 3300 calories and was composed of foodstuffs ordinarily available, that there would be ample protein in the food.

In order to determine the requirement of energy in terms of calories for a mixed population of men, women, and children, it was necessary to establish the relative needs of food according to age and sex. The following figures were accepted as a basis:

Relative Need of Food according to Age and Sex

Age in Years		Relative Food Needs
0–6		0.5
6–10		0.7
10–14		0.83
14 and over	women	0.83
14 and over	men	1.00

A woman at rest requires seven per cent less food than a man of the same size. The average woman is four inches shorter than a man, and, therefore, is of smaller size. The average woman cannot do the same amount of physical labor as a man. The women workers in the Woolwich Arsenal actually ate only about three quarters the amount taken by the men workers. The values given for children are much higher than those accepted in former years, but accord more fully with modern knowledge.

Reckoned on this basis, the food requirements of the United States are presented in the following table:

PROVISIONAL ESTIMATE OF THE CALORIC REQUIREMENTS PER DIEM OF THE UNITED STATES OF AMERICA

Age in Years	Number of Individuals	Calories Per Person	Man Value	Calories in Millions Per Day	Per Cent
0– 5	14,384,000	1,500	0.5	21,576	9
6–13	15,003,000	2,300 *	0.77	34,507	13
14–18 M.	5,129,000	3,000	1.00	15,387	6
14–18 F.	5,084,000	2,500	0.83	12,710	5
19+ M.	33,770,000	3,000	1.00	101,310	38
19+ F.	31,073,000	2,500	0.83	77,683	29
	104,443,000			263,173	100

* Average of 2,100 calories between 6–9 years, and 2,500 calories between 10–13 years.

This amounts to 2,520 calories "per person" per diem. For the whole people for a year it reaches 96 million million calories per annum "as utilized," or 105.7 million million calories per annum "as purchased."

for the representatives of the United States to hand to Mr. Hoover from the Interallied Scientific Food Commission a statement of the monthly needs of meat, fats, sugar, and cereals of each of the three European allied countries during the coming year. Previous to that time there had not been an ordered knowledge of the food requirements of the different peoples, but rather a competition to see which nation could do best for itself.

Chittenden and I calculated, so far as we could from the imperfect data then available, what our exportable surplus would be in terms of calories. That is to say, how much food fuel we could put into ships and send abroad to maintain the bodies and souls of those allied with us for the saving of civilization.

And the other nations calculated their needs in calories and the calories to be imported. They then determined how many tons of fat each country required in order to give 75 grams per average man. Subtracting from this the quantity of fat produced in the country, there remained an amount of fat to be imported in the form of meat, oil seeds, or dairy products. If the calories in these fat imports be deducted from the total calories to be imported, it leaves a remainder to be covered in small part by the importation of sugar, but in greater part by the importation of wheat and other cereal grains.

After this fashion it was possible

We who are here cannot appreciate all the strain which has fallen upon those in Europe. Our valor is attested equally with theirs, but England and France have fought for four years, we for four months. More closely than ever before we are drawn to England, with Westminster Abbey; to France, the home of Lafayette; and to Italy, with the Eternal City.

Lord Derby said the other day in Paris: "It is not too much to hope that, in that reconstruction of a new world, the Allies of today, in war, will be the Allies in peace, and that, side by side, England, France, and America will from this broken world reconstitute a new world, a better world, a world worthy of our sacrifices, and still more a world worthy of those who have laid down their lives on the sea, in the air, and on the land for the sacred cause of Liberty and Justice."

HOME OF THE HAVASUPAI INDIANS

In a tributary gorge of the Grand Cañon, protected from human intruders by almost unscaleable castle-like walls of rock, dwell the Havasupai Indians. The only approach from the cañon's rim is by a difficult twelve-mile trail winding under precipices and over narrow ledges until it descends to the oasis on the rocky floor three thousand feet below. (This trail enters the cañon at a point in the extreme middle distance of the photograph.) This valley floor is very fertile, maintained so by a system of irrigation ditches leading from small dams in the stream which flows through the gorge—"Cataract Creek" (hidden in the photograph by vegetation except for a short distance in the extreme right foreground). Each day in summer from sunrise until the heat of late forenoon, the men, women, and children of the tribe work in the fields, which stretch from cañon wall to cañon wall, cultivating crops of corn, beans, and squash, and caring for the small orchards of peach and fig trees. The Havasupai, like the neighboring Pueblo, provide against cold and famine by storing a year's supply of corn in the caves of the cañon walls. During the winter they retreat to the high plateau, where wood is more abundant and where they can hunt deer, antelope, and mountain sheep

The Havasupai of Cataract Cañon

A TRIBE OF INDIANS HIDDEN IN THE GORGES OF THE GRAND CAÑON OF ARIZONA PRESERVE THEIR PRIMITIVE LIFE

By LESLIE SPIER

IN the midst of unusual surroundings nothing seems strange, and that I found myself received as "ambassador from the white people" by the little known tribe of Havasupai Indians seemed quite in the order of normal happenings—after I had threaded the trail that swings through gigantic gorges to their cañon home. Certainly, they replied to my requests, if, in the outside world Havasupai modes of life were unknown to white people, the head chief himself would supply the needed facts, and would even requisition from the tribe such material as would make a suitable collection.

A month of traveling through the camps of the Apaches in central Arizona had left little expectation of finding a people less touched by civilization than they, even among the still primitive tribes of the Southwest. Late in the summer I arrived at the Grand Cañon and, with a party of Indians, made the journey westward across the forest-clad plateau to Cataract Cañon, the tributary gorge in which the Havasupai live.

Manakadja, hereditary chief, and his wife, Gwagwathgwave, are splendid types of old-time Indians. Dignified, courteous, and hospitable, they placed information and possessions freely at the Museum's disposal. They are shown wearing "civilized" clothes, for, following the Government assistance given during and after the flood in 1910, which washed away nearly everything the tribe possessed, the Indians never returned to many of their primitive industries. In fact, we secured for the Museum the only remaining example of a stone knife which they said they had forgotten how to make

From the rim of Cataract Cañon there is a three-thousand-foot descent into the narrow valley, and into this abyss the trail bravely plunges. At first it stretches away in easy stages, twisting through the pine trees or between cliffs which converge overhead, always descending. At last it arrives at the brink of a precipice, whence the cañon floor drops away in a series of titanic steps. The break reaches from wall to

MIDDLE REACHES OF CATARACT CREEK

The creek bursts from the rocky cañon floor in full magnificence, winds its way through the curves of the gorge, and rushes on to join the Colorado River. Occasional cloudbursts on the high plateau above pour their waters over the cliffs to swell the creek. It then becomes a torrent, filling the cañon and taking everything in its path. The Indians rely on this creek for irrigating their crops, as in Arizona rains are always infrequent and usually torrential

wall, completely cutting off the direct descent. A quick turn to the right, however, allows us to follow the trail out on to a narrow ledge hardly wide enough for the passage of our horses. Back and forth the trail winds, following the folds of the rock wall—here running out to pass a promontory, there returning into a cleft. To us, looking back, the horsemen appeared like tiny beads threaded on the ledge that suspended them in mid-air—always clinging to the face of the cliff which towers overhead close on the one hand and drops away on the other side with nauseating precipitancy to the rocky floor below. Now we entered a cleft deeper than usual and arrived at the head of a great fall of rock, down which the rough trail zigzagged in bewildering fashion to negotiate the last drop of five hundred feet to the cañon bed. Following the example of my Indian companions, I dismounted and led my horse—not in the least envious of one foolhardy Indian boy who rode ahead, jumping his horse like a mountain sheep from rock to rock. Arriving at last on the comparatively level floor of the cañon, we mounted our horses again and rode rapidly forward along the arid bed of Cataract Creek. Still descending, through cactus thickets and over great rocks, we came finally upon the Havasupai oasis, fully twelve miles from our initial plunge over the rim.

Here Cataract Creek bursts forth in full volume to dash away along its rocky bed for about two miles before it tumbles in a series of cascades down another thousand feet or so to join the Colorado River. Over the dense thicket of willows and cottonwood trees that fills the cañon from wall to wall drifts the blue smoke from camp fires, in ethereal strata.

Set among the trees and difficult to delineate in the dusk are the brush-covered houses: some of these are rectangular with dirt-strewn roofs and brush walls; others are shaped like our own wall tents, but so low and so covered with dirt as to seem mere sand mounds; still others are rough log cabins such as the Navaho build: but the greatest number perhaps are dome-shaped, brush-thatched structures like huge beehives. Around them stretch fields of corn, beans, and squash, dotted with peach and fig trees, irrigated by ditches leading from the little dams which divert the current of Cataract Creek.

The life of these Indians of the cañon depths was most interesting to study and to enter into. With dawn the camps are awake, and after a hasty meal, men, women, and children are off to the fields. The early morning hours witness an almost feverish activity—planting, hoeing, reaping, or the more strenuous household duties and native crafts, such as scraping and tanning the rapidly drying deer hides; for with

The Havasupai still make fire on occasion with two dry sticks, one of which, the "drill," is held with its point against the other and then steadily twirled between the palms until a glowing heap of wood dust collects on the hearth. When this photograph was taken to illustrate the method, a brisk fire was made in less than a minute. When traveling, the Havasupai carry short fire sticks, the drill being set in an arrow shaft for use sunrise in the cañon—as late as nine or ten o'clock—the heat precludes any further exertion.

The heat of the day is spent at the "club houses"—the sweat lodges which are a part of every camp. Usually only the most popular will be in use at one time; during the morning word will pass around that Kathoda or Wodo is going to make a sweat bath. There a dozen men will gather during the afternoon, each to enter the lodge the prescribed number of times, the sacred four. The lodge is the usual little beehive structure made air-tight by its blanket covering, hardly large enough for three or four men to crouch in beside the red-hot stones on which they sprinkle water to fill the lodge with steam. The extreme heat is terrifying in the intense blackness—but a plunge afterward from the doorway into the icy creek produces an almost ecstatic exhilaration. Then, joining others awaiting their turn outside the lodge, one stretches out on the sand, listening to the muffled songs or prayers for rain that come from the sweat house, and gossiping or discussing affairs of state with one's neighbors.

Or, if you prefer, you may stroll over to Tohawoga's where there is always a group of women gambling or weaving baskets, with occasional "bronco busting" for *divertissement*. But when the heat abates in the late afternoon, camp life suddenly springs up again; the men go off to gather in the last crops of the day, women leave to prepare the evening meal, and the acrid smoke begins to drift through the cañon as the shadows lengthen.

With abundant crops and a plentiful water supply the Havasupai have no fears except of rocks which may come tumbling from the heights above, and floods that infrequently pour through their cañon home. Men and women till the fields as the neighboring Pueblo do, and like them, they store a year's surplus corn in the rock granaries which line the cañon walls on a ledge high above the reach of floods. Deer, antelope, and mountain sheep abound on the plateau and in the gorges of the Grand Cañon. Work in skins is man's

Sinyella makes a dress. Work in skins is the province of the men alone; they hunt and skin the deer, tan the hides, and make the clothing, even the women's dresses (which are merely pairs of long aprons, worn back and front, and belted with a Pueblo girdle). This style of skin dress, however, as well as the men's leather leggings and shirts, is no longer in vogue, but moccasins are still made and worn province alone, and from these skins the Havasupai still make moccasins, although the leather leggings and shirts and the man-made woman's dress are no longer in vogue.

The life of the Havasupai is epitomized by their baskets: simple and practical, yet with an infinite variety of uses. There is the conical burden basket in which the housewife carries home on her back the corn from the field; there is the heart-shaped pitch-covered jug for fetching water from the creek; shallow trays of coarse weave are for dry seeds and fruit, and similar baskets made water-tight hold liquid foods—and formerly were used as receptacles in which to boil food with heated stones; still other baskets are fire-proofed inside and seeds are roasted in them by being tumbled about with live coals. Metal vessels now stand all day on the fire where formerly it was native pottery that offered the continuous feast to visitors. Without her baskets and her grinding stones the Havasupai woman would feel lost.

Such simple worldly goods have offered little temptation to raiding enemies, but the difficulties of ingress into the cañon probably have proved the most effective barrier to the aggressive Apache and Paiute. The cañon Indians for their own part claim an unmatchable lack of military spirit, maintaining that their numerical inferiority—the tribe probably never numbered many more than the 175 of today—would not permit reciprocal raids, while abundant harvests at home aroused a feeling akin to contempt for seed-gathering plateau dwellers.

Harvest time brings the year's chief social diversions: the one great communal dance, and visits of the traders from foreign tribes. Food is abundant then; to quote their words, "Every day we have enough to eat, but at harvest time we eat all day." The village is a halfway station in the aboriginal trade route still flourishing in northern Arizona. The Havasupai first journey to the Hopi villages, where Navaho and even Zuñi from still farther east are met. Here buckskin and horns of mountain sheep are traded for woven products, and then comes the return journey, cautious because of fear of

Bows have their tempers, and no unseasoned haste produces a perfect weapon. Therefore, certain living trees are trimmed and trained to grow straight-grained, then are cut and scraped to size, and carefully fitted with string and arrows. The effective distance of the arrows is about thirty yards, although their range is much greater

TWO TYPES OF HAVASUPAI HOUSES

The brush-covered lodges are set among the trees where it is difficult to see them. Every man builds several—and then spends his days and nights, weather permitting, out of doors. Some of the houses are log cabins like the Navaho *hogans;* some are shaped like our own walled tents, but so low and sand-covered as to seem mere mounds; still others are rectangular with dirt-strewn roofs and brush walls, while the greatest number are brush-thatched structures resembling huge beehives, built in a style which these Indians claim as peculiarly their own

A SAFE RETREAT FROM FLOODS OR COLD

Wasamema's family retreats to the safety of this cave in the cliffs when floods threaten the home in the fields below. Such caves in the rocky walls are also snug refuges before summer sunshine tempers winter winds, and even in summer the less hardy members of the tribe sometimes take refuge here from continued inclement weather. These caves were once inhabited by a prehistoric pottery-making people who, it is supposed, built the only stone structure to be found in the valley plundering Navaho. Later, the Walapai and Mohave from the west congregate in Cataract Cañon, to share the Havasupai harvest and to trade skins and other down-river products for the blankets and belts of the Pueblo.

Late autumn sees an exodus from the cañon up on to the pine-clad plateau, where snug winter camps are made in the dense thickets. Here good firewood is plentiful and the hunting grounds are near at hand. Running water is not to be had, but little reservoirs to catch the occasional rains or melting snow undoubtedly served in the old days, as similar "tanks" do for their few cattle today. Winter cold, because of its humidity, is raw in the cañon, so the last dwellers to leave in the fall and the earliest to arrive for spring planting often turn troglodytes for a time, seeking refuge in the little caves along the foot of the cliffs. Sometimes continued inclement weather in the summer will cause the less hardy to leave their leafy shelters amid the jeers and gibes of their neighbors and huddle in caverns in the rocks. Curiously enough, as the Havasupai themselves recognize, these same caves were once inhabited by a prehistoric pottery-using people, who built the only stone structure in the valley, a little pueblo atop a low mesa.

Beautiful and fertile as the cañon is and secure from the depredations of warlike neighbors, it is by no means safe from nature's ravages. According to the Indians' account, in the spring of 1910 "it snowed four days, it rained four days" (I suspect again the artistic use of the sacred four), and with a sudden thaw, the thousands of miles of watershed drained by Cataract Creek let loose their floods down into the cañon. I saw such a flood on a minor scale, when the water poured over the rock walls until the cañon looked like a gigantic Niagara. In the flood of 1910, the people fled to the refuge of the cliffs, with the loss of only one blind old woman, while they watched the seething flood, which filled the cañon from wall to wall, complete its destruction below. Houses, horses, cattle, trees, crops, even the soil itself went in the rush of the waters. Thanks to prompt Government intervention the Indians were safely tided over to the next year's harvest. The United States Government's active interest of that time came to stay, and the cataclysm of the flood of 1910 marked a turning point in these people's lives, for by it they lost those connecting links with much of their ancient life to which they now have no incentive to return. The only stone knife that survived the storm, for example, was obtained for the American Museum, and they protested that with the subsequent disuse of stone tools they had forgotten how to make them. Literally, out of sight is out of mind in matters of a people's adaptation to life. But while the less serviceable arrowheads and skin clothing were never made again, the old-time everyday customs and industries sprang up anew, and, except for the effects of desultory schooling, their social life took on its old complexion.

So much of the old life of the Havasupai still remains: take away their guns, horses, clothing, metal tools and pans, and one finds that even their material existence, like their social life, is that of yesterday. Although Father Garces stumbled on the community in 1776, the California emigrants of '49 swung south past their cañon through enemy territory, and not until rediscovered by a railway exploring party in 1858 do we again hear of their existence. There was no regular intercourse with the outside world until recent years; in fact, many of the tribe claim to remember the "first" white man who came to them about forty years ago. But it is their geographical isolation which must be given the credit for their backwardness, not their mental outlook, which is a curious blend of an avid interest in things beyond the cañon's rim and a well-founded complacency toward life within its walls.

A HAVASUPAI "CLUB HOUSE"

During the intense heat of the day no member of the tribe works in the fields, so, while the women attend to domestic matters, the men gather to gossip at some one of their various sweat lodges, or "club houses." These are huts of the low beehive type, but covered over closely with blankets to make them air-tight. Of the large number of lodges around camp only a few are likely to be in use on any one day. Three or four of the men crawl under the blankets into the lodge, where they sprinkle water on hot stones, producing conditions similar to those of a "Turkish bath." When thoroughly steamed they crawl out again and plunge headlong into the icy water of Cataract Creek. The exercise, as we may well imagine, is highly exhilarating. To get the full magical benefits, however, four men must enter the lodge at a time and each must reenter four times

Photograph of women of the Blackfoot tribe, illustrating the decorative art of the Plains Indians

Review of Wissler's "The American Indian"[1]

By ALBERT ERNEST JENKS

Professor of Anthropology, University of Minnesota

THIS new book by Clark Wissler, of the American Museum, presents in a singularly unbiased and unpedantic manner a critical summary of the important anthropological facts of the New World. It is, besides, a cyclopedia of anthropological sources for the Western Hemisphere.

No one in America, or elsewhere for that matter, is better equipped than Dr. Wissler to prepare such a book. His thorough theoretical training is combined with extensive practical field experience. To these is added a most valuable development due to a free opportunity in a great museum to plan his departmental work for a long period of years and systematically to work out his plan. He holds in his hands the anthropological purview of the Western Hemisphere—so far as scientific data are now available. Not until an immense amount of new data has been collected is it conceivable that another book will be likely to appear in the field Dr. Wissler has covered. The success of his endeavor is the occasion of keen appreciation on the part of his colleagues in America and the rest of the anthropological world.

[1] *The American Indian:* An Introduction to the Anthropology of the New World, 435 pages, with illustrations, maps, complete bibliography, by Dr. Clark Wissler, Curator of Anthropology, American Museum of Natural History, New York City. (Douglas C. McMurtrie. 1917.)

The book presents many facts of commanding interest to the layman, while complete bibliographical references to all specific contributions in the discussions are given, thus enabling the critical student to satisfy himself from the accepted sources.

Up to and including Chapter XIII, Dr. Wissler gives most successful discussions of the subjects of Food Areas, Domestication of Animals, and Transportation, Textile Arts, Ceramic Arts, Decorative Designs, Architecture, Work in Stone and Metals, Special Inventions, Fine Arts, Social Grouping, Social Regulation and Ritualistic Observation, and Mythology. Distribution maps greatly assist the reader to visualize the areas discussed.

In the first chapter, on Food Areas, we are told that there were in the New World eight distinctive food areas, each with its outstanding staple of preëminent importance. From north to south, roughly, these are as follows: caribou, salmon, bison, eastern maize area, wild seeds, area of intensive agriculture (to the exclusion of hunting), manioc, and guanaco. The layman will be impressed with the extreme importance of the food contribution of the aboriginal men of the New World to the economic life of today by the following partial list of exclusive world staples: lima beans, cocoa, maize, potato, peanut, tobacco, tomato, and turkey. Because of the broad sweep of view before the author, he presents such summaries as that in all food areas except the area of intensive agriculture the people were seasonal migrants, all agriculture was by hand power, artificial fertilization was extensively practiced, as was irrigation, and also alternation of certain crops. Most of the industrial complexes connected with foods developed by the Indians were adopted, and have been retained with surprising completeness, by the white immigrants in America.

Other interesting facts brought out in succeeding chapters are that in spite of the millions of milk-producing animals in the Americas, the natives nowhere used milk or its products; they trained no animals for draft, but used only hand power. Cloth was made of many fibers—such as wool, cotton, and hemp, yet the "tailoring art" centers around skin garments instead of cloth garments; it appears to have had its invention in Asia and from there spread to America, and to Europe relatively late.

The author's conclusion, under the discussion of "Decorative Designs," is that decoration is primarily realistic while symbolism connected therewith is derived from the completed decoration. A personal experience of my own may be illustrative here, and suggests as well that we often overdo explanations in our attempts to find definite meaning in all details of primitive culture. I was one day photographing a large collection of Pima baskets in Arizona. Two very old Pima women came along, and I asked them which of the designs they liked best. Without hesitation they selected three patterns. (They were old designs, associated in mind with the girlhood days of the withered old women.) When I asked the names and the meaning of the three different patterns, the women hesitated, conferred, and one of them finally said, "That one is turtle, because it looks more like a turtle than anything else." The other two they would not name. They told me that Pima basket makers searched over the desert areas picking up the large decorated red potsherds so common there. They carried home those of which they fancied the designs, and reproduced them, as nearly as they could, on their baskets. They sought decorative patterns; they named them if and when they had to do so.

Dr. Wissler's conclusion that "the art of making bronze was known in the New World, although the real purpose of the process may have been the facilitation of casting," rather than the hardening of the metal, must be understood not to apply to the so-called copper implements so abundantly made from float or quarry copper of the Great Lakes area.

Under the head of "Fine Arts" are presented a few specimens of native literature. I must be content with calling attention to half a dozen lines from "an Inca hymn" (pages 141–2), which is one with the vocal yearning of the great souls of all ages and races of men:

> "O Uira-cocha! Lord of the universe,
>
> . . . . . .
>
> My eyes fail me
> For longing to see thee;
> For the sole desire to know thee.
>
> . . . . . .
>
> Oh hear me!
> Oh choose me!
> Let it not be
> That I should tire,
> That I should die."

The time has surely passed when there is longer justifiable excuse for the "orthodox" religionist of today to say that all scientific researches of necessity rob modern men of spiritual yearnings and life. On the contrary, intimate knowledge of primitive peoples compels the anthropologist to see nothing plainer than that from earliest times the truly great men have struggled in a ceaseless endeavor to understand the purpose and meaning of God in their workable relations with the other men of their time.

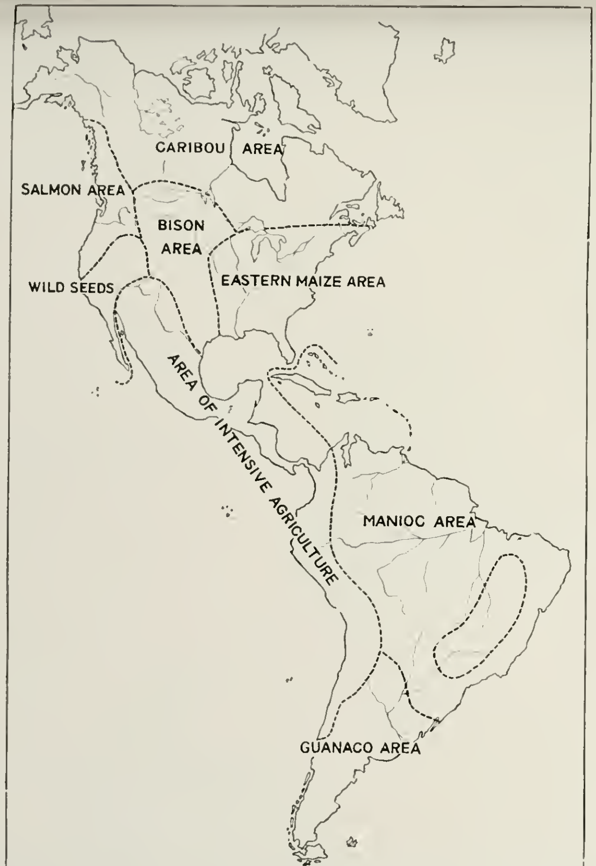
Dr. Wissler's study of western culture shows that, whether the anthropologist studies the most measurable facts of culture or the less material traits, he finds unchallengeable claims to the unity of the culture of the New World.

Chapters XIV to XXI, inclusive, constitute the most original part of the book. First the great social groups are presented by descriptive text and map —such as the California area, the Eskimo area, the Amazon area. Then the archæological areas are similarly presented. Next, the author brings together what facts are now accepted on the chronology of New World cultures; the facts of linguistic classification follow (where Powell is justly given credit for probably as perfect a presentation of pioneer work as any pioneer scientist ever performed in so difficult a field). The very recent scanty data enabling an attempt at a somatic classification lead Dr. Wissler to conclude "that our best lead in the development of a somatic classification is to seek for correlated distinguishing characters in each recognized culture area."

Many interesting, new, and suggestive conclusions are drawn by the author from this broad sweep over the New World as he thus has spread out before him the entire area multifolded, yet diversified by the several criteria of classification just enumerated. Among them are the following: "Language and blood seem to spill over the edges [of geographic areas] far more readily than culture" (page 336); "The location of food areas laid down the general lines of culture grouping" (page 337); "The origin of a culture center seems due to ethnic factors more than to geographical ones" (page 339); "While the environment does not produce the culture, it furnishes the medium in which it grows, and that when once rooted in a geographical area, culture tends to hold fast" (page 339).

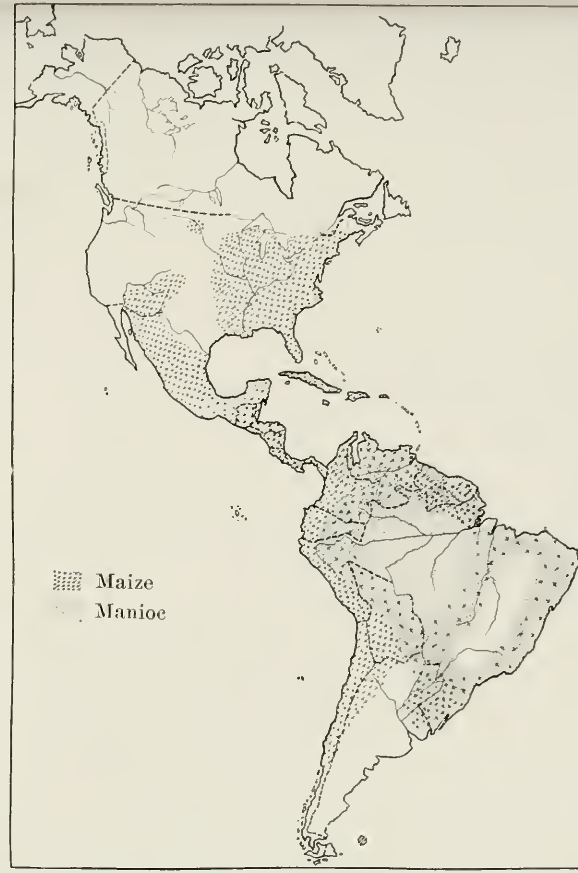
Dr. Wissler has, in this volume, rendered a most valuable service to anthropology. Such a book could not have been prepared earlier in the field covered, and while the unsolved problems, as noted through the pages, are numerous, their statement will assist new students to visualize the problems, to attack them with greater intelligence and more reasonable hope of success.

FOOD AREAS

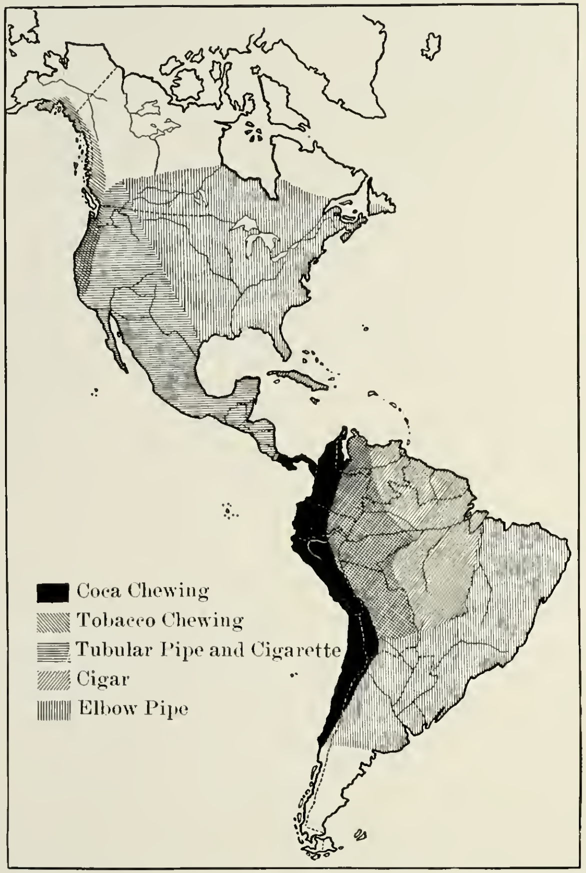


Different groups of mankind specialize on some one kind of food, which naturally is the food most abundant and most easily procured. Throughout the habitat of the caribou, or American reindeer, in northern North America, two groups of generally differing tribes, the Eskimos and the Canadian Indians, placed their chief dependence for food and clothing upon this animal (the Eskimos depended upon the seal when the caribou migrated southward); farther south, the Plains Indians in early days relied upon the bison. Along the Columbia River, in which at certain seasons salmon congregate in immense numbers, a distinct food area occurs; while below, in California and eastward, acorns and smaller seeds formed the principal food supply of the Indians. On the plains of Argentina, in South America, the guanaco replaced the caribou of the north in the economic life of the natives. Between these two hunting regions lay the agricultural area, where maize, manioc, and other crops were cultivated. It is the assumption that the type of agriculture which prevailed originated with one highland tribe of Central America and was then diffused to the north and the south. One proof of the independent origin of the agriculture of the New World lies in the fact that before the discovery of America all the more than forty food plants known to have been grown by the Indians were peculiar to the New World, both the particular species under cultivation and their ancestors

WHERE MAIZE AND MANIOC WERE CULTIVATED



Only two of the native food plants cultivated by the original inhabitants of the New World rose to the level of staples: maize and manioc. Maize, the more widely distributed, was used from Maine to Chile; manioc was confined chiefly to those parts of South America too warm and moist for maize growing. Around maize the art of agriculture appears to center. It is believed that the plant was developed from a wild grass in the Maya habitat, Yucatan, whence it was carried to the farthest limits of cultivation under native methods. The similarity of these methods throughout the maize area indicates a close connection between the spread of agriculture and the life of the early peoples. A full knowledge of the history of maize would throw much light on the development of the higher cultures of Mexico and Peru, and the probability that all varieties of corn that we still grow on our American farms were in existence by 1492 is an impressive suggestion as to the age of these early civilizations. Comparison of this map with the pottery distribution map, page 651, reveals a close agreement in the agricultural and pottery-making areas, suggesting that these two important industrial arts came into existence among the same people, or were invented at the same place, and were thence diffused outwardly over the two continents, probably at about the same time and in the same manner



NARCOTICS

The best known aboriginal narcotics were tobacco and coca. The use of coca still prevails (in the region represented by the darkest area on the map), and has spread to the natives of other parts of both North and South America, as well as to the whites themselves. The narcotic element in coca is cocaine which is a modern derivative. The native simply chewed the dried coca leaves, mixed with lime or other alkalis, that is, pulverized ashes or shells ground fine in mortars. This custom of mixing narcotics with alkalis is also practiced by chewers of tobacco in the territory adjoining the coca area and on the Pacific coast of North America. The appearance of this particular trait in two such widely separated areas and its analogy with the betel nut culture of Melanesia is a puzzling ethnological problem. Taking snuff also was correlated with the chewing habit. Smoking was the most widely distributed method of using tobacco. Three aboriginal ways can be localized: with the true or elbow pipe in the greater part of the United States and Canada and in the lower Atlantic side of South America; with the cigar in the West Indies and the greater part of the Amazon country; and with the tubular pipe, to which the name "cigarette" is applied, in Mexico, Central America, and the western United States. These methods grade one into the other

ABORIGINAL METHODS OF ANIMAL TRANSPORT

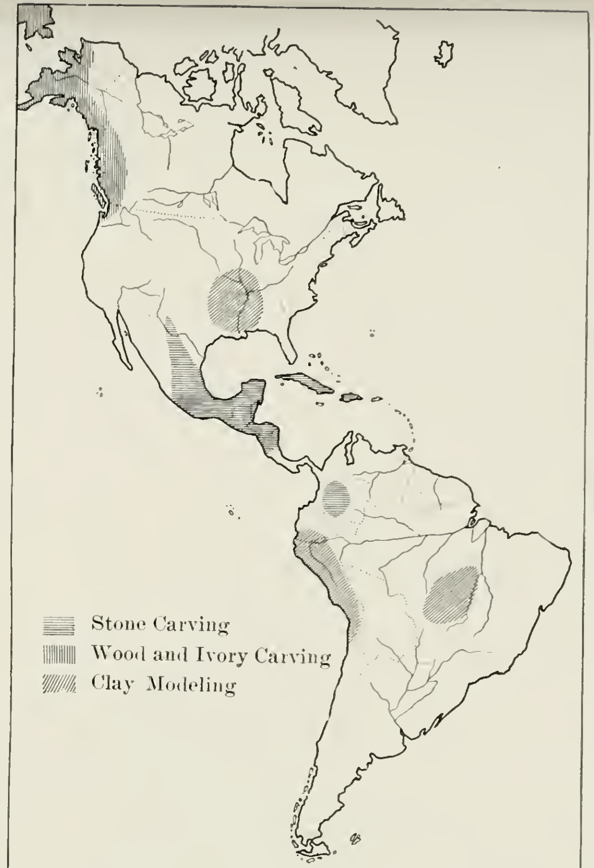
Before the introduction of horses into America only two animals are known to have been used for conveying burdens, the dog in North America and the llama in South America. The use of the dog in transportation was restricted almost entirely to the caribou and bison areas, with a sledge in the most northern part and a toboggan in the forested regions where the snow was too soft for sledge runners. The travois of the bison area was a primitive vehicle consisting of two trailing poles with a platform or net across them for carrying the load. Whether dog transport was introduced into North America from Asia or the reverse is a question that cannot be answered without further research. The complete absence of dog transportation in South America suggests that this institution was introduced from Siberia, for the practice is continuous from Scandinavia to Greenland. The agricultural areas made little use of animal transport; from Ecuador north to the Colorado River there is no evidence of anything but human carriage, but in Peru the llama was used. This animal has little more carrying capacity than a large dog, but is particularly well adapted for mountain travel and even today has not wholly been replaced by mule or horse

WHERE POTTERY WAS MADE

Mexico, the Antilles, and northwestern South America were the great pottery areas where the manufacture rose from being mere women's work to the rank of a genuine industry. From here the ceramic arts spread over North America (except in the case of the Alaska-Siberian pottery), covering virtually the same general region as maize culture which traveled by the same route. The potter's wheel was unknown in the New World, and as a rule vessels were built up by spirally winding slender clay rods; although around the Great Lakes, in Alaska, and a few other places the molding was done from a single block of clay which is, presumably, the more primitive method. Occasionally traces of the coils were left for ornamentation, but in general the clay was scraped smooth and to the desired thickness. Contrary to the Old World custom, glazing was not understood except for ornamental purposes, but in pottery paints the New World ranks high, both vegetable and mineral colors being used and made permanent by the proper firing.

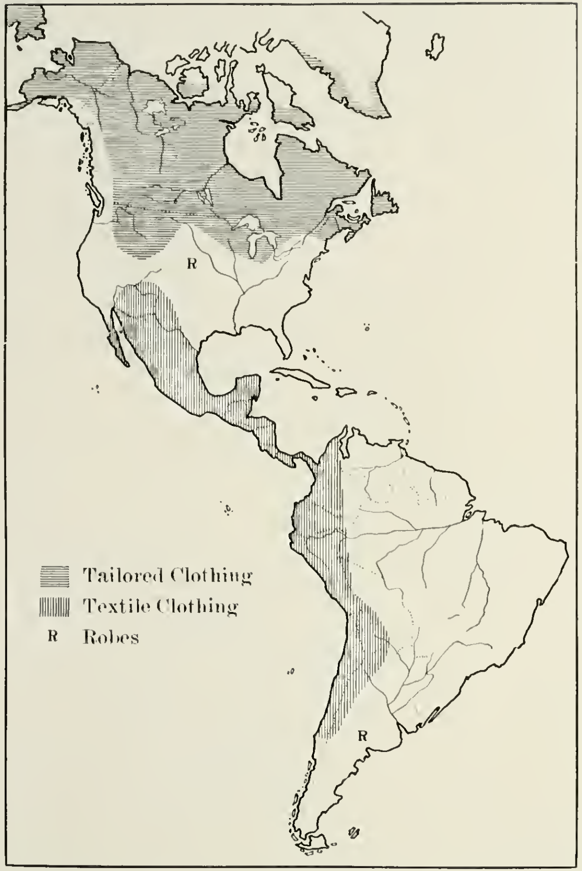
Regional classifications of pottery are based largely on vessels made for ornamental and non-utilitarian purposes, for almost everywhere the cooking pot tends to be oval or hemispherical, and as we pass northward the pottery becomes more and more of this latter type. In North America the aboriginal pottery industry has survived only in the southwestern United States

SCULPTURE, CARVING, AND MODELING



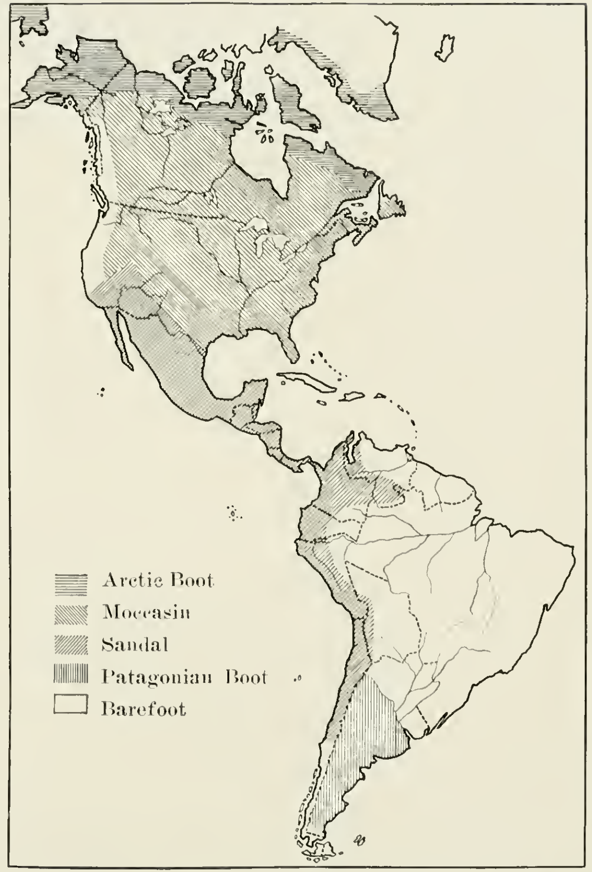
The center of New World sculpture was Yucatan, where stone carving was one of the most distinctive traits of the ancient Maya culture. From here it spread in a lesser degree through Mexico and Central America, but never reached north of the Rio Grande nor to the Incas of Peru. The best Maya work is to be seen in the famous stone turtles of Quirigua, although most of the carving was in low bas relief, little more than drawing. Wood carving, the leading art of the north Pacific Coast and Eskimo areas, begins with faint traces at the California border and grows stronger northward. Its geographical center is in Queen Charlotte Islands, where are found great carved totem poles and grave figures together with an endless array of smaller wooden objects. Still farther north, wood becomes scarce and ivory takes its place as a medium, until eastward along the north coast of Alaska the art of carving gradually disappears. Clay modeling reached its highest level in Peru, where animals and natural objects were represented with great fidelity, and human heads so well modeled as to suggest portraiture. The work was limited, however, to small vessels and figures, and nowhere among the Incas do we find anything like the life-size pottery figures of Mexico. On the whole, however, the aboriginal artists cannot claim high rank either as sculptors or stone carvers when their productions are judged by the classical standards of the Old World

TYPES OF DRESS



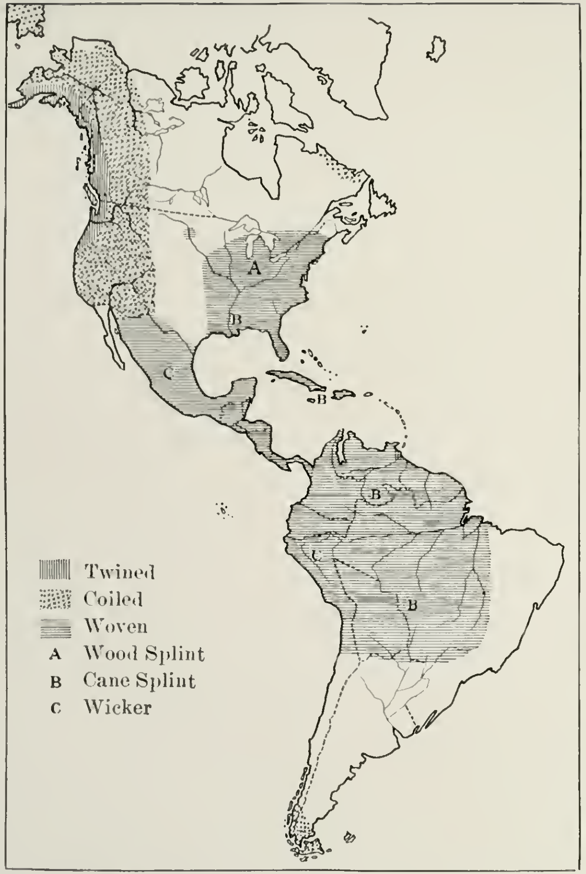
In the north, throughout the reindeer and caribou area, well-tailored skin garments were worn, completely covering the body. The Eskimos and the caribou-hunting Indians cut out pieces of skin and fitted them together in intricate patterns, like a modern tailor, producing local fashions. The art of tailoring thus appears to have originated in connection with skin garments instead of cloth garments. It probably began in China, whence it spread to Europeans, then to the reindeer hunters in Siberia, and thence across the bridge from Asia into the New World. Along the Pacific Coast the aboriginal Indians were but scantily clad, while the entire maize area and extending down into Patagonia was distinguished by the use of a breechcloth merely, although a capelike robe hanging from the shoulders was sometimes worn. In Mexico and the Andes region, where the art of weaving reached its height, garments retained the angular form in which they came from the loom. Skin ponchos of the bison area so closely follow the form of the woven garments as to suggest historical relation

FORMS OF FOOTWEAR CORRELATED WITH TYPES OF DRESS



The moccasin, or skin shoe (with its modifications in the Arctic and the Patagonian boot), was the prevailing form of footwear in the New World except in the textile area where sandals were universally worn. On the bison plains a hard sole was substituted on the moccasin in place of the soft one found in the forests. Considering the geographical relation, this idea may possibly have intruded itself from the sandal wearers of Mexico. Going barefoot was the custom in the salmon area of the west coast of North America and in the southern half of the eastern maize area. Thence it extended through the Antilles and down the eastern side of the Andes to Patagonia. Here a leather moccasin again appears, but in the extreme south the Fuegians have a tendency to go barefoot. There are thus no apparent climatic reasons for the nature of the footwear, and the chief correlation with dress in general is the universal association, both in the Old and the New World, of woven garments with sandals

BASKET MAKING



Basketry in some form is almost universal among primitive peoples, and in the New World it is difficult to find a tribe absolutely ignorant of the art. Two methods of manufacture, coiled and woven, apparently have separate histories. Coiled basketry reached its highest development among the Pomo Indians of California, where some of the finest baskets in the world were made, and from this center it extended throughout the western highlands of North America, from the Mexican border to Alaska. It is also found in eastern Siberia, in northern Labrador, and in Patagonia. Coiled baskets were made water-tight and used for cooking (hot stones were dropped into their contents). Woven basketry is found over the greater part of both continents, excluding the hunting regions. A common feature of the basketry from the Great Lakes southward into the manioc area was the use of splintlike materials, usually cane, but of splints of wood where cane was not available, as in New England The chronological relation of coiled and woven basketry is an interesting problem

SOCIAL GROUPING

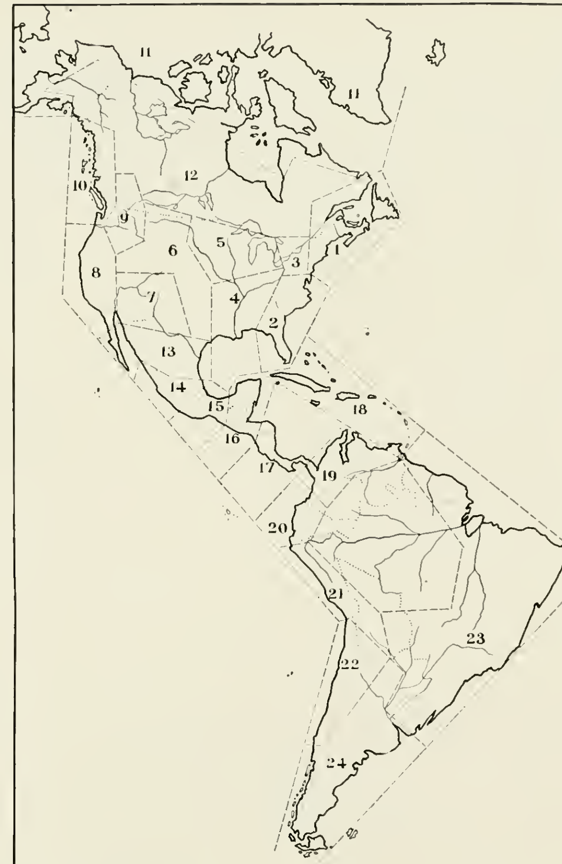
Among American Indians the nucleus of the social group was usually the family. Some energetic leader drew around himself his immediate family and relatives and then also such friends as had confidence in his leadership. Throughout the hunting and fishing areas of North America such groups exist as "bands," a number of which come together occasionally for tribal affairs. Each individual is known by his personal name, together with his band name, but like us, if his specific blood lineage is to be kept track of, it must be through his own memory.

Among peoples of considerable intensive culture, especially in areas where agriculture was practiced (compare this map with the map of food areas, page 649), closer organization was found; in such cases the term "gens" is used for the group when the name descended through the father, and "clan" when it descended through the mother. Some of these groups are "exogamous," that is, the social regulation demands that individuals with the name of the same clan or gens cannot marry

HISTORIC CULTURE AREAS

Various parts of the Americas are very different topographically. Fitted into this topography, and adapted by culture, native tribes may be grouped into fifteen geographical areas; namely, 1, Plains; 2, Plateau; 3, California; 4, North Pacific; 5, Eskimo; 6, Mackenzie; 7, Eastern Woodland; 8, Southeastern; 9, Southwestern; 10, Nahua; 11, Chibcha; 12, Inca; 13, Guanaco; 14, Amazon; and 15, Antilles. The origin of these areas was of course the result of the accidental arrival of people there, but once these people became adapted to the environment, the social habits at the basis of culture were hard to change. Thus the culture became more and more stable, resisting even admixtures in blood or language—which probably were infrequent, as migration seems usually to have been limited by topography and the boundaries of the geographical area. The boundaries on the map are, of course, diagrammatic. Each area, however, contains a typical culture as a center (in the Plains Area certain tribes, Blackfoot, etc., form the type center; the North Pacific center is among the Tlingit, etc.; the Southwestern type is the Pueblo). Between these culture centers are tribal groups having intermediate cultures.

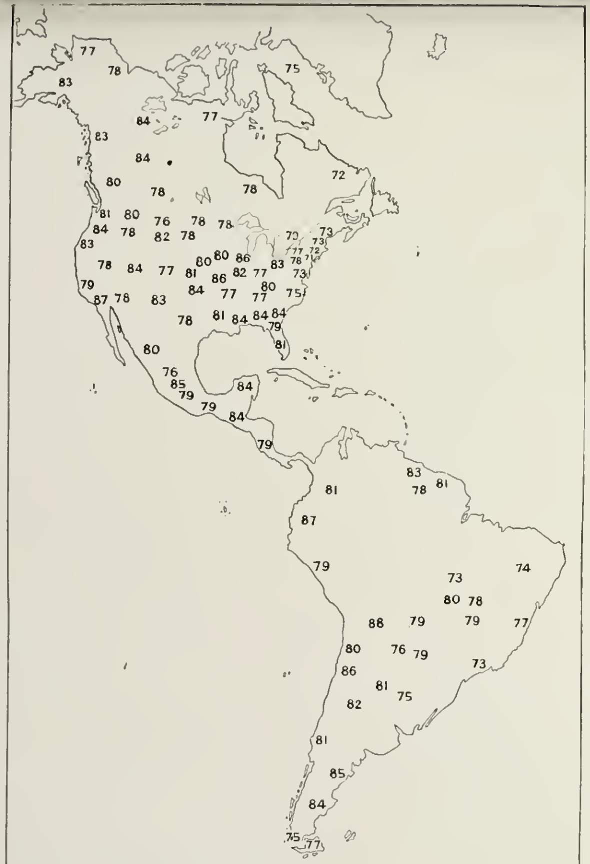
The period of time covered by historic culture is recognized as shorter than that of prehistoric culture. Dr. Wissler points out that to realize the aim of historical reconstruction, there is need especially for a great deal more stratigraphic field work and study of pottery in order to allow chronologies to be worked backward from historic times.



PREHISTORIC CULTURE AREAS

Counting from the simple cultures at the north, through the intensive civilizations of Central America and Andean South America, to the simple fishing culture of Patagonia, the following characteristics of certain of the areas are typical: (1) *North Atlantic*—Shell deposits and rock shelters; (3) *Iroquoian* — Triangular stone arrow points; (4) *Mississippi-Ohio*—Burial mounds; (7) *Pueblo*—Community houses of many chambers around a court; (15) *Oaxaca*—High type of stone masonry—as also in Yucatan (16), and Peru (21) — with original quarries showing the use of stone tools; (16) *Yucatan* — Great cities, carved monuments, dated hieroglyphs; (17) *Panama*—With resemblance to Colombia (19) but individually excelling in gold work, cast, hammered, and alloyed with copper; (23) *Atlantic Highlands*—Urn burial; (24) *Patagonia*—Shell mounds.

Comparison of the two maps reveals similarity, eleven of the fifteen historic areas corresponding with prehistoric areas, and the other four (7, 8, 10, 11) embracing two or more centers of the earlier culture. The one map is separated from the other, only arbitrarily of course, by the discovery of America. A large part of the archæological material already dug out from ruins is probably historic, and further exploration will have to determine what, if any, independent prehistoric cultures ever existed here as are so conspicuous in the Old World where Stone Age cultures underlie later cultures of Neolithic time and these in turn those of the classical and historical periods



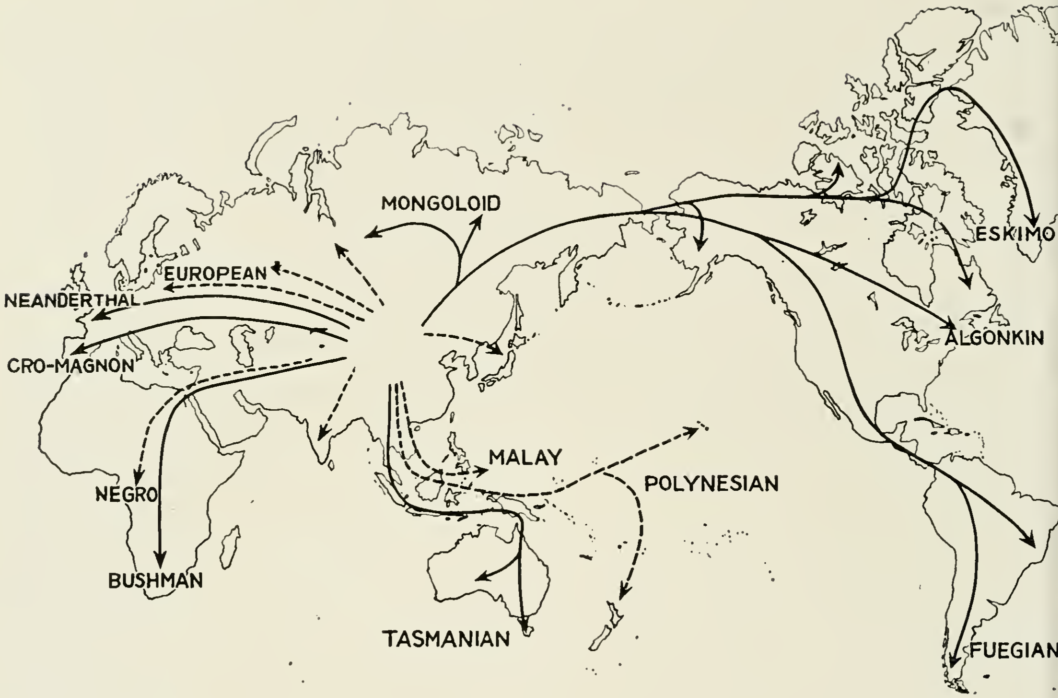
VARIATION IN HEAD FORM

All the peoples of the earth are closely related, but comparisons, especially of hair, skin color, and head form, allow us to classify them. All New World peoples have black, straight, moderately coarse hair. The skin color of all is brown ranging from yellowish to dark chocolate. The head form, known from skull measurements and measurements of the heads of living subjects, approximates an intermediate position between whites and negroes. The figures on the map indicate the cephalic indices of the various tribal groups in their geographical positions ("cephalic index" equals maximum breadth of head divided by maximum length—represented in per cent). Although there is probably but one general type of head form in the New World, the plotting on the map shows that, as an inheritable biological character, head form tends to vary within wide limits. Among the various Indian tribes we find not only very long heads but also some that are extremely broad. The tendency seems to be for any large isolated group of fairly homogeneous human beings to develop two variations in head form, one tending toward round-headedness, the other toward long-headedness. In other words, head form, like many other characters, tends to vary. That there is some lack of stability in head form among other races is probable, because investigations among the immigrant population of the United States reveal rapid changes in cephalic index

AREAS ACCORDING TO BODY CHARACTERS

Members of an inbreeding local group of natives come to resemble one another, like the descendants of one family. As a consequence continually increasing differences arise between groups. It is often possible to distinguish from a portrait alone Navaho, Apache, Pawnee, Teton-Dakota, Patagonia, or Eskimo. Adjacent groups, however, if fairly stable, mix to an extent tending to obliterate the differences. As in the case of stature, for instance, it is found that a group of tall natives is always surrounded by others more or less tall, and a short group by other short groups, without abrupt demarcations. Thus New World areas based on general similarity of inherited characters (such as stature, pigmentation, and head measurements), have type centers with radial variation from these centers and intergrading just as have the areas based on cultures (see page 654).

In fact, on comparison of this map with the map of historic cultures, we see that the distribution based on physical characteristics closely follows that of culture. Further, Dr. Wissler makes clear that not only body characters and culture but also stock language, although independent human phenomena (the same language and the same blood being found associated with different cultures), always tend toward dispersion around the same geographical centers



COMMON ORIGIN OF AMERICAN NATIVES

Shown on map of general dispersion of mankind from a center in Asia (broken lines represent most recent movements)

From the great resemblance of all the peoples of the New World to one another, we may assume that they are of one stock. This common stock shows affinity with the yellow-brown Mongolian race of Asia. It entered the New World through the narrow northwestern route and spread out over the two continents, eventually becoming isolated in inbreeding groups, undisturbed until the occupation by the white population.

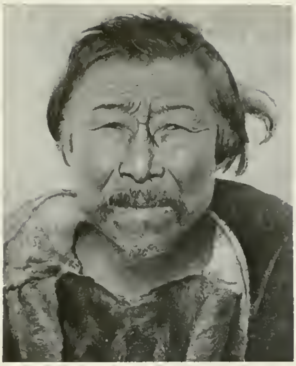
Dr. Wissler presents the question of the American native relative to the action of the polar ice cap which four times at least is known to have crept down from the north to cover the Asian bridge into the New World. He considers it reasonable that the peopling of the New World was interglacial and contemporaneous with the peopling of the Old World and not entirely postglacial (with an estimated age for the American culture of 20,000 years only), and that the return of the ice in the "Glacial Period" cut off the hemispheres from each other, leaving the diverged branches of stock to develop independently. The indirectness and narrowness of the bridge from Asia, added to the accumulations of ice which still hover about it, probably prevented the entrance of wave after wave of peoples such as poured over Europe.

The map indicates the dispersion of the branches of mankind other than this Asian-American, classified by certain anthropologists into two great groups: the Polynesian-European with fair skin and straight or wavy hair, and the Australian-African with black skin and woolly hair. Some regard the former as the main stem from which the Asian-American and African-Australian diverged and specialized.

A later classification designates almost the entire original population of Europe, Asia, and the New World as the generalized type, "Eurasiatic," with the variants from this type occupying the outskirts of land farthest from the swarming center in Asia, namely, Patagonia, Greenland, Cape Colony, Ceylon, and Tasmania, the British Isles, and Canaries. This theory seems to correspond with facts of distribution and culture in the New World; outlying regions must have proved veritable blind alleys where primitive man was brought up short and where in some cases his descendants are still marking time

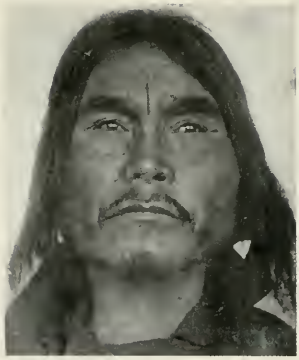
LONG-HEADED SKULLS FROM THE ARCTIC COAST SIMILAR TO THOSE FROM CAPE HORN

Photographs of four skulls (front and side views of each) to show similarity between those from the extreme outskirts of New World dispersion, that is, the Cape Horn region of South America and the Arctic belt of North America. The upper two are Eskimo skulls from the Arctic coast; the third is from a village site on Grande Island (150 miles northwest of Cape Horn), and the last is Yahgan Indian, from Cape Horn (see map, page 655, for comparison in cephalic index). That the New World was peopled contemporaneously with the Old World is suggested by a certain parallelism existing between the skulls of ancient man in western Europe and skulls of American natives. The breadth of face of the Crô-Magnon man, for instance, suggests a New World character; vague likenesses have been noted between certain Palæolithic races of Europe and the Eskimo; the two Cape Horn skulls above show close relationship with the Eskimo. That we thus find these primitive men of western Europe and the primitive men in the outskirts of the New World longer headed and broader faced than the races massed in the centers of population is suggestive that researches in Asia may some day disclose that these very early types of the two hemispheres came from a common stock



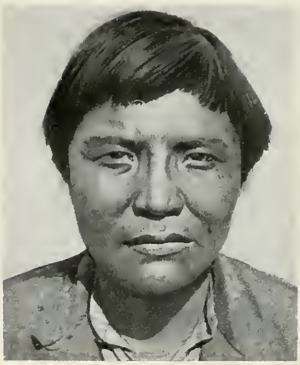
Koryak
Asia

Tungus
Asia



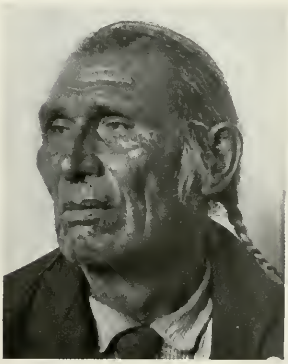
Eskimo
Smith Sound

Eskimo
Greenland



Loucheux
Mackenzie Area

Lillooet
Northwest Coast



Ojibway
Eastern Woodland

Blackfoot
Plains Area

Menomini
Eastern Woodland

ASIAN-AMERICAN TYPES OF MEN

In classifying groups of mankind certain common characters are taken into consideration. The hair, for instance, in the main indicates great stability as to type and often is made the basis of first classification. As the hair of the New World tends to be black and straight, and this is also a distinguishing feature of Asiatic peoples, particularly of the Mongoloids, this may be taken as one very strong indication of common descent

Shoshoni
Plateau Area, U. S.

Maricopa
Southwestern U. S.

Huaxtec
Mexico

Chorote
South America

Bakairi
South America

Mataco
South America

Chiriguano
South America

Patagonian
South America

Fuegian
South America

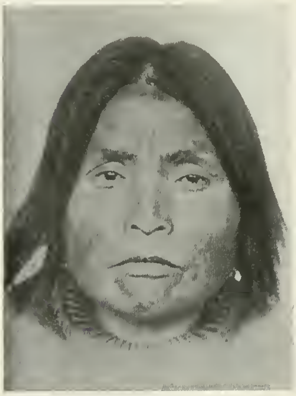
NATIVE AMERICAN TYPES OF MEN

Besides the similarity of hair in the American and Mongoloid types, there is also agreement in the broad face and prominent cheek bones, the small, partly closed eyes, and the comparatively thin lips (also in a peculiar cavity of the upper incisors). In the American type, however, the color is usually darker and the nose larger, the latter being both broad and long and often with a convexity in the bridge similar to that of Semitic peoples

Yakut
Asia

Koryak
Asia

Yukaghir
Asia



Eskimo
Smith Sound

Thompson
Plateau Area

Kwakiutl
Northwest Coast

Mohegan
Eastern Woodland Area

Dakota-Sioux
Plains Area, North

Wichita
Plains Area, South

ASIAN-AMERICAN TYPES OF WOMEN

As a rule, women are less subject to environmental influences than men, and consequently do not show the recently acquired and special characters of a racial or local type; hence, also, a racial character once acquired is retained by them with greater tenacity than by men. A comparison of women from northeastern Asia and North and South America shows striking resemblances throughout

Apache
Southwestern U. S.

Aztec
Mexico

Nahuqua
South America

Bororo
South America

Paumari
South America

Chorote
South America

Mataco
South America

Chiriguano
South America

Fuegian
South America

NATIVE AMERICAN TYPES OF WOMEN

That the women of America have remained more nearly like their Asian prototypes than is the case with the men is partly explained by the difference in the rate of growth in the two sexes. While women reach maturity earlier than men, they still retain more of the characteristics of childhood. Special race traits appearing late in development are accentuated only in the men

Courtesy of Charles Scribner's Sons

A TREE FERN IN THE HIGH ANDES

The tree ferns of the Andes, which look at a distance like palm trees, thrive best in the relatively temperate, moist, and shaded areas of the forested mountain slopes. (This photograph was taken in a government camp at an altitude of 7000 ft.) About a third of Colombia is congenial to these arborescent ferns which are interspersed among the oaks, bean trees, and luxuriant shrubbery, forming a perfect "ocean" of forest. Here the explorer finds an abundance and variety of wild life that is almost bewildering—as well as a superabundance of sand flies fleas, and malarial mosquitoes.

Mr. Miller took part in six of the eight expeditions sent to Colombia by the American Museum, under the direction of Dr. Frank M. Chapman, for the purpose of making an ornithological survey of that country. His collecting carried him into regions almost unexplored—some even unmapped—which he describes with care and accuracy. Transportation facilities, for the most part, were limited to pack animals and porters, and some sections visited were almost impassable to even these primitive trains. In fact, Amazonian Colombia is so little opened up that Mr. Miller is the first ornithologist to enter this large and zoölogically rich area. Mr. Miller's additional travels (see map opposite page 664) through ten other South American countries, extended over nearly six years, during which time he traveled about 150,000 miles. All were American Museum expeditions, including the Roosevelt-Rondon South American Expedition

A Faunal Naturalist in South America[1]

By THEODORE ROOSEVELT

SPECIALIZATION, like every other good thing, can be carried to excess; and no forms of specialization are less desirable than those which make of the outdoor naturalist a mere collector of "specimens," and of the indoor naturalist a mere laborious catalogue and describer of these specimens when collected. The outdoor naturalist ought to be able to do all the indoor work too; and he ought to have the power to see and to portray the life histories of the shy creatures of the far-off wilderness.

But it is well if he can go even beyond this. No man leads a hardier or more adventurous life than the collecting naturalist whose quest takes him to the uttermost parts of the earth. He works in the wildest lands, and on the shifting borders where the raw outskirts of civilization merge into savagery. He works with the wild men of the forest and the desert, and with the men only one degree less wild who do the most primitive work of civilization on the borders of the forest and the desert. If he has eyes to see he will have many a tale to tell; and if he can tell it aright the tale becomes an addition to that shelf of true stories of adventure in strange lands which is so fascinating a part of the great library of worth-while literature.

Photograph by Kermit Roosevelt
Courtesy of Charles Scribner's Sons

Mr. Miller, the author of *In the Wilds of South America,* with "Moses." — Mr. Miller's prime work everywhere, the work which is never neglected, is that of a keen mammalogist and ornithologist, but he is likewise an observer of men and manners, and a lover of beauty. He has written a book which will appeal to all cultured people who care for adventurous wanderings in out-of-the-way places, for studies of remote peoples, and for the gorgeous animal life of the tropics

Mr. Leo E. Miller is one of these men. At the moment he is a lieutenant in aviation, chief observer at Camp Jackson, South Carolina, and if the opportunity comes, all those who have seen him in times of hardship and stress in the wilderness know that he will make good. He has journeyed far and wide through the middle, the north, and the west of the great South American continent. He has seen the strange and curious things which are only to be seen by those who leave the beaten paths of travel. His prime work everywhere, the work which is never neglected, is that of a keen mammalogist and ornithologist. But he is likewise an observer of men and manners, a lover of beauty, and a well-read man of well-trained

[1] Colonel Roosevelt prepared this article for the JOURNAL during his recent stay at a New York hospital, showing his vast interest in natural history, his great energy even under the trying conditions of ill health, and his loyalty to the men whose work he had come to know personally on his expeditions.—THE EDITOR.

mind. He has written a book[1] which will appeal to all cultured people who care for adventurous wanderings in out-of-the-way places, for studies of remote peoples, and for the gorgeous animal life of the tropics.

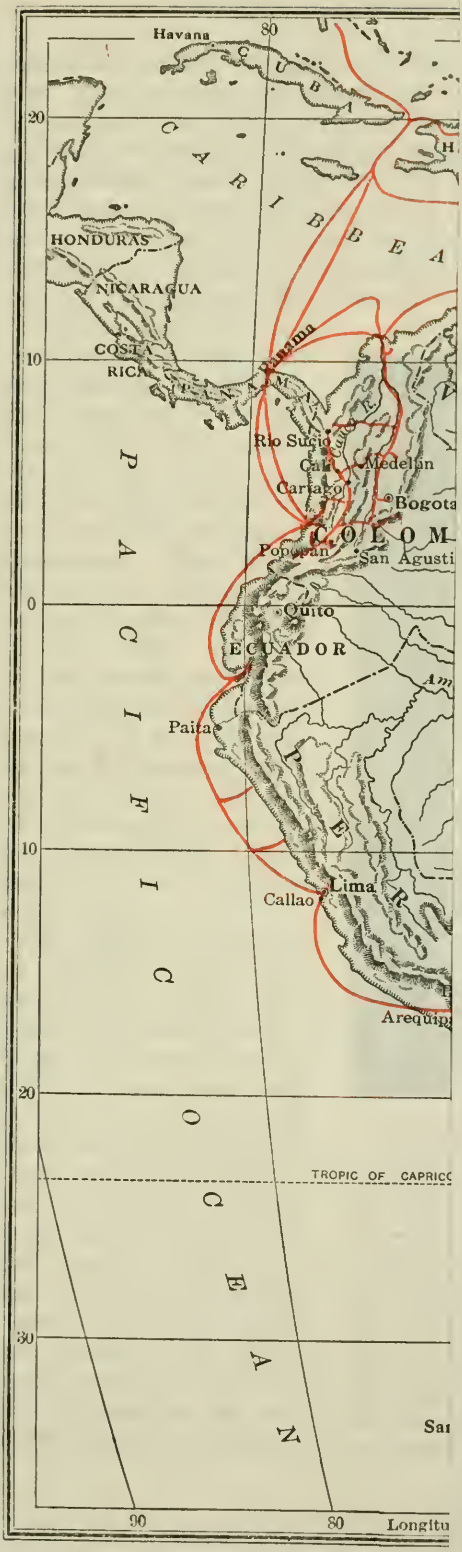
Mr. Miller's observations on natural history are full of interest to the layman who possesses an intelligent lay interest in science; and it is very much to be hoped that he will sometime publish a special book on South American birds and mammals, giving their life histories as many men and women have given the life histories of North American birds and mammals. In the tropics he went from the reedy marshes and steaming forests of the plain to the cold alpine pastures which lie just below the snow line of the stupendous Andean mountain masses. He tells of innumerable species of birds, beautiful in plumage, or odd of form and of habits; of gaudy macaws, always flying in pairs, no matter how large the flock; of the gold-bird's ringing whistle, uttered as the singer stands motionless in the forest gloom; of birds so shy and furtive that it is almost impossible ever to see them, and of other kinds so tame that they live in the houses and climb into the sugar bowl; of humming birds that literally get drunk on the strong nectar of certain plants; of huge nighthawks looking like ghosts as they crouched on forest trails in the impenetrable gloom: of cow buntings in which the habit of parasitic egg-laying, in spite of the small relative number of the hens, has made them a real menace to most other forms of small bird life; of huge masses of waterfowl, from grebes to flamingos, in desolate desert lakes. A special, and a most delightful, chapter is devoted to the quest of that flaming wonder of the bird world, the cock of the rock.

The glimpses we get of other creatures are equally interesting. There are squirrels and possums as small as mice; howler monkeys whose roaring is in sound more sinister than that of lion or tiger; sloths which when angered not merely claw but bite—to me a most unexpected bit of information; jaguars which kill horses and cattle but are rarely dangerous to man.

Then there are the smaller things—aside from the innumerable insect plagues—which do attack man. The piranha fish, the size of black bass (but more savage than any sharks), are occasional man-killers; and Mr. Miller gives a really extraordinary account of one spot in which immense swarms of vampire bats attacked the mules, the pigs, and even the human beings with a fury that was dangerous to life. There are writers who make the personal note too strong. Mr. Miller's fault is the reverse—and it is a real fault, insistence upon which is not to be taken as a compliment to him. He slurs over his personal experiences in a way which detracts somewhat from the value of the book as a record of first-hand observation. For example, I happen to know that once while he was in the water landing a canoe, an Indian who was with him was attacked and badly mutilated by a piranha; but there is no mention of the incident in the book. And the sudden attack on him by a bushmaster, the most deadly of all poisonous snakes, is narrated in a way which may be modest but which deprives the incident of most of its narrative value.

The accounts of the human beings among whom he sojourned are as interesting as his accounts of the wild life. In the tropical lowlands and in many of the Andean regions, man, although in his Indian form he has dwelt there for tens of thousands of years, still finds nature so hostile that his race-life is a constant and doubtful struggle against degradation and destruction. The natives often refuse to heed the

[1] *In the Wilds of South America*, by Leo E. Miller, Charles Scribner's Sons, 1918.


Havana
CUBA
CARIBBEAN
HONDURAS
NICARAGUA
COSTA RICA
PANAMA
Panama
Rio Sucio
Cali
Medellin
Cartago
Bogota
COLOM
Popayan
San Agusti
Quito
ECUADOR
Paita
PERU
Lima
Callao
Arequipa
PACIFIC OCEAN
TROPIC OF CAPRICO
Longitu

ROUTES TAKE

Courtesy of Charles Scribner's Sons

ROUTES TAKEN BY THE AUTHOR IN HIS SOUTH AMERICAN EXPLORATIONS commonest dictates of hygiene; in the past, great strange civilizations have sprung up, in the forest or on the high plateau, and then those who built them have perished utterly; and within historic times populous cities have risen, thriven, and then been wiped out of existence by mysterious and deadly sickness. Of the native races some persist in the presence of the invading white man, both perpetuating themselves and mingling with his blood, others are untamable and die rather than leave the savagery in which they have lived for untold generations. The whole chapter in which our author describes his visit to the rather despotic minion among the Yuracaré Indians is of especial interest. It was not until the south temperate zone was near that our traveler came out among conditions not substantially unlike those of our northern hemisphere.

Mr. Miller has written an admirable book; and the get-up, as usual with Charles Scribner's Sons, is as good as the book—which is more than can be said for certain good books recently written by other naturalists of repute and published by other firms. But I wish to make one protest, which is against the spirit of the times, which I know will go unheeded, but which ought to be made. A very few photographs like the Indian portraits by Curtis, are as good as pictures—they *are* pictures; good ordinary photographs serve a good ordinary purpose: but in a first-rate book there should be first-rate pictures, by first-rate men. They will be far better than the photographs upon which they are based and which gave them the needed foundation of accuracy in fact.

Mr. Miller with four of the negroes of Juntas de Tamaná on the west coast of Colombia.—He speaks of these as a miserable, sickly lot, too indolent to grow the plantains, yuccas, and other plants that thrive with a minimum of attention. This part of the San Juan River watershed, into which the naturalist's search for out-of-the-way places carried him, has rarely been visited because of its adverse climatic conditions, notwithstanding that it is noted for fabulous wealth of gold and platinum. Epidemics of malarial and yellow fever scourge the country. Rain pours daily, averaging four hundred inches a year, and when the sun does shine, the forests are turned into a steaming inferno under the tropical heat. After the return of the exploring party to the highlands, the members paid the inevitable cost of penetrating tropical wilds by spending several weeks on their backs recovering from the fevers with which they had become inoculated

AN INDIAN HUT IN THE YUNGAS OF CENTRAL BOLIVIA

"Yungas" is the name given to the fertile mountain slopes which have been cleared of forests and cultivated. Mr. Miller was invited to hunt birds and mammals on this plantation belonging to a citizen of Cochabamba, who visited it but three times a year to supervise the Indian laborers in picking and packing the coca leaves. This part of Bolivia is an agricultural paradise, yielding besides coca (the source of cocaine) many other tropical products, among them coffee, cocoa and sugar cane. Cultivation is on a small and primitive scale, however. The value of a plantation depends upon the number of Indian colonists settled upon it, so that the aim of the owner is to keep his Indians satisfied. These Indians of the Yungas are of better build and also of better disposition than those of the plateaus; their condition is much superior and they have lost some of the melancholy which seems to have fallen on all the natives subdued by the Spaniards. The Author gives an account of immense swarms of vampire bats which, at this place in the Yungas, attacked the mules, the pigs, and even the human beings with a fury that was dangerous to life

AT THE SNOW LINE ON AN ANDEAN PASS

In wandering from the beaten paths of travel the expedition was frequently forced to attach itself to such local travelers as might happen to be going its way. This picture shows the expedition in the Cuchicancha Pass, Bolivia, accompanying the mail carrier's train which makes the trip from Cochabamba to Chaparé at six-week intervals during the dry season. Travel through most of this country is by mule trains. At night the packs are piled together and covered, while the mules are simply turned loose, the leader wearing a bell tied to his neck. After they are rounded up in the morning any one of the number which has strayed off can be easily recalled by the loud ringing of the bell

IN INCA COSTUME OF FIVE HUNDRED YEARS AGO

The Author's accounts of the human beings among whom he sojourned are as interesting as his accounts of the wild life. This photograph of Quichua Indians was obtained in their remote mountain homes of Bolivia where man, although a dweller there for tens of thousands of years, still finds nature so hostile that his race-life is a constant struggle against degradation and destruction. The Quichuas, the prevailing stock in the central section of western South America, are the descendants of the inhabitants of the ancient Incan Empire, but today they are a cowed, fearsome, and melancholy people. Some of them persist in the presence of the invading white man, both perpetuating themselves and mingling with his blood, while others are untamable and die rather than leave the savagery in which they have lived for untold generations. All the tribes in the past shared in the general culture of the Incas, which they have in part retained. The women still wear homespun, dark blue or colored skirts and varicolored shawls, and the men knee breeches, blue shirts, embroidered belts, and the inevitable poncho, which represent, apparently, the traditional costume. The "trench helmets" they have on their heads are peculiar hats

THE WILDEST OF THE NORTHERN INDIANS OF SOUTH AMERICA

At Dabeiba, northwestern Colombia, Mr. Miller made the acquaintance of the Cuña Indians, a linguistic stock that has kept remote from foreign interference. The women are customarily clothed, but in the forests the men wear only a breech-cloth. Their large muslin sheets seen in the photograph were provided by the priest and worn only in town. The heavy necklaces of silver coins are a modern substitute for gold disks which they once hammered from metal washed from the mountain sands.

Even at the present time the Indians are numerically the main element of South American population. Over a large part of the continent they still live in their primitive state, while they form the "peasantry" of those sections reached by civilization. Mr. Miller found them useful not only as porters, but also in his bird and animal hunting where their bows and arrows and especially their knowledge of woodcraft enhanced the expedition's scope far beyond what it otherwise could have been

FIELD OBSERVATIONS IN BRITISH EAST AFRICA

(Mrs. Akeley and J. T. Jr.)

As I was using the binoculars, J. T. climbed to my shoulder to see too. We may doubt, however, whether she derived any benefit from the glasses—in fact, she preferred turning them around and looking in at the big end. Like a human child, she was inquisitive, "butting into" whatever we were about and using her hands and teeth with which to explore any strange or unusual object. She little needed any optical assistance, as she could distinguish familiar objects at great distances. She more than once proved that she recognized me far beyond the range of the unaided vision of members of the expedition. For things near at hand her sight was almost microscopic, and she would make a great fuss over picking from her fur some tiny speck of dust which we could scarcely see

Notes on African Monkeys

WITH THE PERSONAL STORY OF J. T. JR.,* WHO TRAVELED TWO YEARS WITH THE AKELEY EXPEDITION IN AFRICA, WAS BROUGHT TO AMERICA IN 1912, AND NOW MAY BE SEEN IN THE NATIONAL ZOÖLOGICAL PARK, WASHINGTON, D.C.†

By MRS. CARL E. AKELEY

Illustrations of J. T. Jr. in Africa from photographs by Carl E. Akeley

ON the Akeley African expeditions of 1908–1909 and 1910–1912, for the collection and study of elephants, the first for the Field Museum, Chicago, the second for the American Museum of Natural History, New York, I had splendid opportunity to observe many of the small African mammals. The black boys of the expedition would bring them in to me so that I had a "zoo" of considerable size at each camp—young antelopes, hyrax, and monkeys—although we carried few of the animals from camp to camp.

Greatest of all delights, however, were the long hours I spent watching such animals, especially the monkeys, in their own home life. During the weeks we were at "Tembo Circus,"[1] whenever it chanced that I did not accompany the day's hunt and was left alone in camp, I would go out, taking a black boy with me, and sit down under the trees, which were very high, from one hundred to one hundred and fifty feet. I would even lie down on my back in the grass—with the boy stationed on guard behind me so that leopards could not creep up unawares—and watch the *Colobus* monkeys[2] in the trees.

At first everything would be quiet, apparently with no monkeys to see. I would be sure, however, that they were seeing me. Soon their curiosity would get the better of them. One would peek out here, others there and yonder. Then they would come down a little closer to get a good look at me. Sometimes they would bark and scold. It is difficult to see *Colobus* monkeys owing to the wonderful way they have of hiding themselves among the leaves; also the black and white of their coats blend with the color of tree branches and with the black and white of the tree lichens. These monkeys have no thumbs, but the lack does not impair their grasping power, and as they travel from tree to tree they may leap twenty or thirty feet, their long plumed fur spreading in the air. They are very beautiful indeed as they sail downward, and to watch the *Colobus* mothers with their babies is a sight not to be forgotten. They are so careful and loving with them and are evidently as worried if the baby is hurt or sick as human mothers might be. I

[1] The name given to the camp near the spot where Mrs. Akeley shot the record Kenia elephant. See "Elephant Hunting on Mount Kenia," *The American Museum Journal*, November, 1915.

[2] This genus of monkeys will be illustrated in a succeeding issue of the JOURNAL in connection with a series of pictures of some of the habitat monkey groups in the American Museum.

* Named after Mr. J. T. McCutcheon, the cartoonist, who was traveling with the Akeley expedition at the time J. T. Jr. was captured.

† It is said that all African monkeys bite as they grow older. So it proved with J. T. We kept her until she was about eight years old, but she bit me twice, so we had to send her to the National Zoölogical Park. There she can get out of doors every day in her cage, which is large and kept very clean. She can play on the ground, dig up the stones, and eat the dirt as monkeys like to do. I go to visit her sometimes and she recognizes me. Apparently she has become very much accustomed to adapting herself to existing conditions. It is known that monkeys live a good many years. One at the New York Zoölogical Park is twenty-eight years old.—THE AUTHOR.

should say that monkeys probably make better mothers than very many of the natives we saw in Africa.

One incident that we witnessed in connection with the *Colobus* monkeys is hard to understand. We were studying them at Kijabi for a group for the Field Museum, and shot some of them for specimens to mount. When one of the young monkeys was wounded and fell to the ground, an older monkey came down out of the tree and killed the wounded one, and then made its escape.

J. T. with her "chamberlain" and full regalia. This picture with Allie, her "nurse," as we always called him, was taken immediately "on the equator" near Eldama Ravine in British East Africa. She rode on Allie's shoulder or head in our travels from camp to camp and was usually fed by him, but, as she was accustomed to a life on the forest-covered banks of streams, the glare of the sun made her sick, wherefore the umbrella. In going about their own business in their own way the guenon monkeys (*Lasiopyga*), to which genus J. T. belonged, are very wiry and agile. They travel through the forests, swinging from branch to branch, and even make long and warlike excursions into distant parts, but the strange monotony of human travel was very fatiguing to J. T.

The baboons are amusingly human in taking care of their babies—as I discovered during a two weeks' stay we made on the Lucania Hills. These hills are alive with baboons, hundreds and hundreds of them in troops or families,—one family used to come every night to sleep in a tree just back of our camp. The mothers with the young monkeys on their backs climbed the rocks; even though the wall seemed absolutely perpendicular, these baboon mothers would find a way up. The big old male baboon, weighing at least seventy-five pounds, would come down perhaps fifty yards nearer our tent than the mothers, who stayed with the babies on the rocks above. Here he would sit on scout duty, his chin propped on his hand, where he could see over the whole country.

Meanwhile, the mothers prepared their children for "bed" by taking them on their laps and picking off the burs and ticks. If one of the babies, with its head hanging over the mother's lap, would try to play, reaching out its hands to another baby on the ground, the mother would take it up and slap it and shake it just as human mothers do, then put it down again and go on with her work. And the baby would squeal and the other little one would run off. The one punishment was never sufficient, however, to teach the baby to lie quiet, and it would have to be spanked two or three times before it was ready for bed.

Then the children would scamper off up into the tree and we could hear them squealing and fighting for the best places—probably to get next to their own mothers. It grows dark very quickly in equatorial Africa and they have to hurry. One night we were awakened by a great commotion among the baboons. In the morning we found that a leopard had been there, and after that the baboon family did not come to its tree.

The natives are very much afraid of these baboons, which not only come down into the gardens and eat the corn and dig up the sweet potatoes, but also sometimes carry away little children. The old male is frightful to behold, a very vicious animal with long fangs. When we were hunting in a forest of Uganda, the natives came to us begging that we kill some baboons which had taken a child and which they could not drive out of their gardens. One of these baboons, later shot by Mr. Akeley, was the largest we had ever seen.

About the camp fire at night we never tired of talking over what we knew of the ways of these monkeys and of the other creatures in the African wilderness and of relating tales of our daily adventures. One evening the talk chanced to turn upon our zoölogical gardens at home in America, and we all fully and emphatically agreed that we did not believe in taking back these free creatures, monkeys, lions, elephants, or any others, to unnatural conditions and a life of captivity and homesickness. Some of the party cited the monkeys of our "zoos" as especially pitiable under the conditions of their imprisonment, so much so that there had been created in the minds of many people a feeling of repugnance for the whole monkey race. At this point I decided that I would capture and introduce to the company a *wild, free* monkey for comparison. But I had no idea at the time that the captive would prove of interest to me for so long a period of years.

So J. T. was brought into camp just to let the friends who were with us, Mr. J. T. McCutcheon and Mr. Fred Stephenson, see the difference between a wild monkey and the zoölogical park specimen. Our porters made a basket-like trap and baited it with corn, and the monkey was only frightened when the basket fell snugly over her. We judged she was six or eight months old; and she surely was just as saucy as she could be. She was not afraid of

An afternoon call on a little Boer girl of the Uasin Gishu Plateau (note the tender pride of guardianship in Allie's face). Monkeys are suspicious of strangers, even of monkey strangers outside their own clan, but they possess an underlying sociability easily developed into friendship. They have long memories for both people and their acts, and have been known to repay a grudge as well as a kindness after a considerable lapse of time. Among one another the members of any band of monkeys are likely to be affectionate, and monkeys probably make better mothers than many of the natives we saw in Africa. J. T. undoubtedly was lonesome for, because of the expedition's rapid change of base, she could rarely have other monkeys to play with for more than a week or two at a time

Near the summit of Mount Elgon, an extinct volcano of the East African highlands. J. T. suffered from the cold and from mountain sickness when taken into too high altitudes

J. T. admires bouquets of African wild flowers, but her appreciation is largely limited by her sense of taste. She liked to nibble many kinds of flowers, especially the wild gladiolus. Monkeys of J. T.'s species are mainly vegetarian, searching out fruits, bulbs, and berries, but they also very cleverly catch and eat caterpillars, beetles, white ants, and locusts. They readily distinguish between poisonous and edible insects, and it is even very difficult to trap them with artificially poisoned food as is sometimes attempted when they become agricultural pests. J. T. displayed great finesse in cracking and eating the eggs she could steal from the natives' baskets, a skill which betokened nest-robbing proclivities in days of freedom

J. T. makes herself at home for Thanksgiving Day luncheon in the high grass on the southern slope of Mount Elgon. Human food is quite to the monkey folk's liking. In fact what constitutes their major vice in the eyes of the settlers of British East Africa is the propensity for raiding grain fields and orchards in large bands. They feast on maize or fruit until they are "stuffed" and then cram their elastic cheek pouches for future use; but what is worse, they always destroy in their foraging far more than they eat

Stopping to pose for their photographs while crossing a small stream on Mount Kenia. Although here perched high and dry on Allie's shoulder, J. T. had by no means any dislike for water; monkeys are fastidious bathers, keeping both themselves and their babies scrupulously clean. If necessary, they can, in all probability, even swim a stream anyone, and at once bit a hole in Mr. Stephenson's mosquito boot.

We put a collar on her and tied her to the tent pole. She looked us right in the eye and told us what she would do to us if we should come within reach. Not that she made any sound. She did her talking by making faces at us and by dashing at us as she ran the length of her string. And she pursed her lips. I never saw another monkey do that. Later she would often do it when she kissed the companion monkey we had for her, or when anything pleased her very much, or after she and I became good chums and she hugged me in human fashion, opening her mouth in a funny little way to express her feeling.

She was so pretty and saucy that when we left the Tana River camp three or four days later, we decided to take her along with us. She rode on top of a porter's load. When we got into a new camp that night, she was so tired and hungry that she jumped on to my lap—her first acceptance of friendship—and sat there and ate a banana. I was a little afraid of her, but her teeth were so small then that she could not have injured me if she had attempted to bite.[1] After a while I began to brush her hair tentatively. She made a face at me; then she decided she rather liked the brushing—and after that she expected it every day.

From this camp we went up into the foothills of Mount Kenia after elephants. We did not pay much attention to J. T. during the first part of the trip, but she gradually impressed herself upon us. Monkeys seem to have individuality and I think it was J. T.'s personality which finally attracted us: she was so intelligent and so thoroughly able to take her own part.

We were all busy at camp, however, and left her alone with the black boys a good deal. At first I used to tie her to the tent pole, but she acted so afraid I made a little house for her; still she seemed terrified to death and would go up on the table and not sit on the floor. She slept on the table at night and sounds outside the tent seemed to terrify her. I soon remembered that she was used to living high in the trees, beyond reach of leopards and the many other ground-prowling enemies of her race. J. T. had no considerable generalized sense of fear; she was particularly courageous, and later, when she came to depend on my friendliness, from the vantage place of my lap she was afraid of nothing, and would defy anybody. She had definite fears, however, a few instinctive and others which developed from particular experiences.

Her instinctive fear was always very great during a thunderstorm. She would get under my raincoat, hold it tight together so that she could not see the lightning, and not come out until the storm was over. The storms in British East Africa are appalling in their intensity. Sometimes they come up so quickly that you can hear the rain long before you can see it. Particularly in the forest a wall of spray like that of Niagara would come up over the tree tops with a roar so loud that we would have to shout to each other and then could barely hear a voice above the storm. Such a storm would sweep everything before it, and if it came in the night the porters would rush to our tent and hang on to the tent ropes and see that the big trench dug around the tent to carry off the water had not filled up with débris washed or blown into it. I often wondered what the little wild monkeys did in such a storm. In the Uganda forest, for instance, there are so many dead trees and dead branches that the danger for the forest animals during storms must be very great.

When we went back to Nairobi, J. T.

[1] When their fangs begin to get long, these monkeys can give a very nasty bite. The teeth of the monkeys have a cutting edge like a saw, and monkeys of this species fight a good deal among themselves and even in play will bite each other.

went with us, again riding on a porter's load. I remember that we had made a very long march when we stopped for lunch, and the porter put her down, stuck a spear in the ground near our table and tied her to it. I can just see how she sat beside this spear and put her arm around it, almost falling over from fatigue and sleepiness, but squealing and trying to eat a piece of bread as she squealed and nodded.

It was after this that we decided to get a little black boy to take care of her. So Allie became her bodyguard. She rode from camp to camp on his shoulder or up on top of his head, and he always fed her. When we found that the sun and wind affected her eyes and made her sick on the long marches (for she was used to life in the shadow of green trees), we got an umbrella for her. Allie would carry the umbrella over her head—or she would sit on his head and help carry the umbrella herself.

When we went on to the Uasin Gishu Plateau, J. T. traveled with us by train. The Indian station masters, when a train pulls in, have the habit of following along the running board at the side of the train and looking in at the windows. One morning when one of these station masters stuck his head over the blind into our compartment, J. T., who was awake, resented the intrusion and promptly slapped his face. Her movements were always like lightning and the man was taken completely by surprise. He demanded her ticket. We laughingly referred him to the station master at Nairobi, and he must have written to him for when we came back to Uganda we were asked to buy a ticket for her or to put her in the baggage car. We observed, however, that he was careful not to put his head over the blind of our compartment.

J. T. went with us to Uganda and followed the elephants with us. She went to the top of Mount Elgon and Mount Kenia. She suffered from the cold at high altitudes and on Mount Kenia got mountain sickness and we had to send her back.

As a rule the black boy, with J. T. on his shoulder, followed after us. That is how it happened that in Uganda the elephants nearly got her. Allie heard the shooting and came up on the wrong side; the elephant happened to be one which had already charged us twice. The third time he came rushing on with a great branch in his trunk, but instead of charging straight at us, he went off to one side, and Mr. Akeley killed him just before he reached Allie and J. T. Mr. Akeley did not know they were in danger until he went over to the elephant after killing it and found the boy and the monkey fallen into a clump of grass and bushes from fright. J. T. did not like the forest life. Along the banks of the Tana River where she lived, the tree growth is never dense forest but merely open scrub.

We took her with us also across the Budango Forest and there she was very much frightened by the chimpanzees. We wanted to study these chimpanzees and get photographs of them, so treed two or three troops. But the big creatures broke huge branches from the trees and thrust them at us, all the while screaming horribly. "Baldy's" roar and scream in the monkey house at the Zoölogical Park in New York had not seemed one half so terrifying as was this screaming of the wild chimpanzees in the forest.

By this time J. T. had become an experienced traveler. She had dropped into our ways without any training. We never punished her and in fact never tried in any way to train her, being interested to see what she would do by just being with us. She learned things quickly and remembered. She learned most quickly about the things she liked best. She liked to take a bath, for instance. Judging from her great fondness for water I think the troops of

J. T. JR. AND SOME OF HER FRIENDS

J. T. impatiently frets while Billy Duiker, a baby antelope, gets his breakfast first. What disturbed J. T. was not so much that she had to wait for something to eat (she never outgrew her fondness for the nursing bottle) as that she was jealous at seeing Billy getting the attention she considered her right. Monkeys very strongly express their emotions, of which not the least is jealousy and its accompanying anger. J. T. took out these emotions on us by jumping the length of her chain and making faces. She readily made friends with other animals but she nevertheless expected to maintain a monopoly on our affections

This dog, after following us into camp and making J. T.'s acquaintance, refused to be separated from her. In spite of many and various friends, however, J. T. must have missed the companionship of her own gregarious kind

CURIOSITY; PLAY; WEARINESS; COMPANIONSHIP

J. T. is here photographed in the various occupations of investigating a Graflex camera, romping with one of the boys, resting on a chief's stool after a long march, and intent upon her reflection in a mirror. The mirror was one of J. T.'s constant playthings. I am inclined to think that she recognized the image as her own; at least she certainly knew it as one of her kind. She always slept with her face against the glass

IT WAS ALWAYS WORTH WHILE TO INVESTIGATE THIS POCKET

Whenever Bill went out with the hunt, he picked up something he knew would be of interest to J. T. and, on his return to camp, she lost no time in investigating the particular pocket in which he always put it. Monkeys acquire habits of this kind very quickly, a fact which is one of the clearest indications of their mental superiority over other animals.

Often, when talking at night around the fire in our African camp, we deplored the necessity that any of the jungle wild creatures should be taken to the unnatural conditions and homesickness of captivity. Think what must be the unhappiness of these intelligent monkeys, for instance, when shut up in little narrow cages even in a well-cared-for zoölogical park—after having lived a life of freedom in the wind and sunshine at the tops of trees monkeys of this species on the Tana River must have bathing places in the river despite their fear of crocodiles. In camp the black boy would bring her tub of water into the tent every day. She liked the water very hot and would always put her hand in to test the temperature before she jumped in. If it was too hot she would fly at the boy, and if too cold she would do the same thing. The boy would try to fool her sometimes by making it too hot or too cold, but she was not to be trifled with. She would play with the soap like a child, and would get into the water many times, jumping about and playing between times. When she had had enough she would go out on top of the tent and sit in the sun.

From the specimens that we see in the zoölogical parks we might judge that monkeys are not always as cleanly creatures as they are in nature. Monkeys of this species are very cleanly. They have a little woodsy odor, something like that of a squirrel, but their bodies are perfectly clean when they are caught wild. J. T. never could endure having her hands dirty, and if she got her fingers even wet while eating she would dry them immediately. The poor little monkeys in the zoölogical park get tired of trying to keep their hands clean. Their habit of extreme cleanliness, as well as their keen eyesight, is evidenced by their continually picking at their fur—which people interpret as meaning that they always have vermin on them. But J. T. would sit down and pick off from her fur every little speck of dust, atoms so small that they would not be noticeable to my eyes. When playing with other monkeys, she would pick off the dust from their fur, and when she and I became friendly it was her delight to try to discover tiny bits of dust on my hair—even my eyelashes and eyebrows would get the same treatment if I allowed it.

The powerful vision of this type of monkey was shown continually in J. T.'s behavior. She was very farsighted. On one occasion when she was with Mr. Stephenson and Mr. Akeley at the camp, she attracted their attention by constantly looking off toward one point in the forest. They could see nothing, but on taking the field glasses discovered that I was coming out of the forest with my black boy at just that point more than a mile distant.

Her vision for small objects, as well as her delicate sense of touch, was shown in the care with which she would rip fine stitches from cloth. Sometimes when I was sewing or reading and wanted to get rid of her I would give her some old garment and she would rip out the stitches without tearing a single bit of it—also if not interrupted she would rip the lace from the window curtains to amuse herself.

I am afraid she often was lonesome, in spite of the dolls she loved and slept with, the many comforts of her life, and her strong attachment for us. Gregarious life is instinctive in the blood of this species of monkey. But we seldom could have other monkeys for her to play with for more than a week or two at a time, because we never stayed very long at any one camp. At a camp in Uganda we kept a baby red *Colobus* monkey, but the little thing became so fond of J. T.'s black boy that it would cry and mourn whenever the boy left it. On Mount Kenia we brought into camp a female green monkey, a species in which the fur is tipped with yellowish green, in the manner of "tipped fox." While we had her she gave birth to a baby, but it was dead, and she would only turn her head away and not look at anyone, and hid the little dead baby by covering it with leaves and grass in the cage.

"Patch" proved J. T.'s best companion. But he did not enter her life until we were on the boat coming back to America. He was a little yellow monkey that was being brought over from South Africa. The passenger who owned him left the boat at Port Said but could not pay the fare for the monkey, which consequently fell into the hands of the captain. It was just after Patch had been down in the coalhole that J. T. first saw him, but she immediately put her arms around him, so the captain said she might have him. After that Patch and J. T. were inseparable.

That monkeys may be friendly with certain other creatures, as well as devoted to the companionship of their own kind, J. T. proved to us many times. She had two or three dog friends while she was in Africa. In Uganda a native African dog followed her into camp. One night this dog gave birth to a litter of pups just outside the tent. Early in the morning J. T. heard the puppies and gave a purring sound while she lifted up the blind of the tent to look out. On seeing her the dog turned over and licked her face and J. T. put out her hand and touched the dog, which then licked J. T.'s hand —and J. T. continued to sit there as if admiring the puppies. We took them out by the camp fire and J. T. went over to them there and softly put her hand on one of them and sat there and watched them. She always tried to kill a little bird or other young thing, but these puppies she did not attempt to hurt.

During Mr. Akeley's convalescence from the almost fatal mauling he had suffered from an elephant, J. T. was his faithful entertainer. Never before or since has she given such undivided attention to amusing one person, and she was a source of great help and cheer throughout the trying weeks

She was always greatly interested in the little black babies of the natives. She would ignore the mother and go straight to the baby, and sit down close beside it and look at it. If allowed, she would kiss it, pursing her lips, and opening her mouth and pressing it against the baby's face.

Of all her playthings and companions, none perhaps proved a source of more constant comfort to her than her mirror. What the workings of her mind were it was difficult to tell, but her reflection evidently stood to her as that of her own kind and as company. After gazing steadily into the mirror for some time at her own serious eyes, she would look back of the mirror as if searching for the monkey she saw in it. She always slept with her face against her mirror. In addition to this companionship, the mirror afforded her unending amusement and she was very clever in handling it and turning it slowly back and forth from side to side while she watched the changing reflections in it.

It was inevitable that her energy and cheer should infect the camp life and make us all very much attached to her. She often indulged in swift rough play and, from the human way of looking at things, was often mischievous. At one time we had a rooster and some chickens: it was her special delight to chase these around and around the tent and through the porter's yard—until one day the rooster chased her in return and frightened her out of her wits. The cook of the expedition was tormented continually by various tricks she developed. She would steal into the kitchen and, if he were out, would unhook every pot and pan from the roof where he kept them hanging, and so quickly that he could not reach her until the mischief was done. Many a time I had to mollify his temper by giving him another supply of tobacco when she had carried his away.

It was no unusual thing to see the black boys roll on the grass and howl at her antics, especially when she ate an egg or a locust. The locusts were two or three inches long and very strong, yet she was expert in catching them and holding them tightly by the legs so that they could not kick. The monkeys of this species like meat as well as fruit, and they not only eat insects and spiders but also, no doubt, kill the young of many small mammals besides robbing many a bird's nest. The natives brought hens' eggs into the camp to sell and J. T. would steal an egg whenever she could get the chance and go up on the roof of the tent with it. There, with the egg held firmly in her hands, she would crack the top and lick the fluid as it ran down the side. If the fluid ran a little too fast, she would get very excited, stand on one leg, and continually jump into some new position more ludicrous than the one before in her effort to keep the egg from getting on her fur.

Finally came the time at a Mount Kenia camp when Mr. Akeley had been mauled by an elephant and spent difficult weeks in recovering from his injuries. He used to get worried and become despondent because he was convalescing slowly and his work was making no progress. Sometimes when I saw the worry coming into his face, I tied J. T. to the foot of the cot, and wonderful playtimes would follow. She would pretend to be terribly frightened at any slightest movement of the bed covering and would jump wildly up in air like a playing kitten; she would never tire of playing hide and seek; she would watch demurely for an opportunity and snatch his pipe or tobacco and hide them at the foot of the cot out of his reach. When he was able to walk down the path from the tent she was not content unless she could ride on his shoulder; then she would jump down and play hide and seek from the grass, jumping out at him from unexpected places. She had never played quite in this way before and never did it afterward, and it seemed almost strange to us that she should help us out and cheer us when we needed the help and cheer so sorely.

ON THE BORDER OF THE EVERGLADES; PELICAN LAKE FIVE YEARS AGO

Against the sky line a solitary cypress spread its branches above the dense growth of pond apple trees (*Annona*), which were overgrown with moon vine (*Calonyction*), its multitude of blossoms showing as white dots in the picture. Near the shore grew bulrushes (*Scirpus*) and maiden cane (*Panicum*) and, at the water's edge, upright ranks of arrowhead leaves (*Sagittaria*) above a zone of pale green water lettuce (*Pistia*). Water hyacinth (*Piaropus*) also grew luxuriantly here, both along the shore and in floating islands in deeper water. The photograph shows the leaves with their oddly inflated stalks reflected in the lake's surface.

When cruising in Pelican Lake in 1913, both in sunshine and by moonlight, we found it one of the most beautiful spots we had ever seen. Also the forests of the hammocks were immense heron rookeries, and the waters abounded in alligators. Today the whole region is a waste, showing miles of bare lake bottom and acres of coarse weeds.

For many miles around Lake Okeechobee there is neither ordinary soil nor rock. Vegetation grows directly from a floor of "peat" or humus formed through the gradual decomposition of vegetable matter. Whether the area be the bottom of the drained lake or the dry land of a cleared hammock, it is everywhere only "peat." Near Moorehaven this peat formation resembles a gigantic sponge, trembling under foot with each step, yet the dwellings and concrete walks of the town are built upon it

Narrative of a Cruise to Lake Okeechobee

DESCRIPTION OF A LAND OF "PEAT," WHERE THERE IS NEITHER SOIL NOR ROCK, EVEN TOWNS BEING BUILT ON THE TREMBLING SPONGE OF VEGETATION.—NEED FOR GOVERNMENT PROTECTION OF SELECTED AREAS BEFORE THE FLORA OF THIS REGION, NOWHERE DUPLICATED IN OUR COUNTRY, CEASES TO EXIST

By JOHN KUNKEL SMALL

Head Curator of the Museums and Herbarium of the New York Botanical Garden

THE words "Everglades!" "Okeechobee!" "Big Cypress!" carry great fascination, particularly to the naturalist. Until recent years the regions represented by these names held many mysteries in their unexplored depths. Some of the mysteries have yielded, while others remain to be solved.

In continuation of a botanical exploration of southern Florida, I set out May 5, 1917, on a collecting trip to the Lake Okeechobee region in the Everglades. Wonderful changes have taken place in southern Florida within the last decade or two. Previous to that time anything in the way of modern transportation was wanting. What was then a matter of weeks is now a matter of hours. I had returned to Miami May 4 from a collecting trip to Big Pine Key and Key West, a distance in latitude of nearly one hundred miles, and the night of May 5 found me in the Everglades nearly one hundred miles farther north. Our party left Buena Vista early in the forenoon, on board the "Barbee," generously fitted out by Mr. Charles Deering. Aboard were Paul Matthaus, captain; Victor Soar, horticulturist; Charles T. Simpson, conchologist; Leban Bethel, crew and cook; and the writer. This classification, however, did not hold good at all times. It was a very democratic party: sometimes all members were officers, at other times they were all crew.

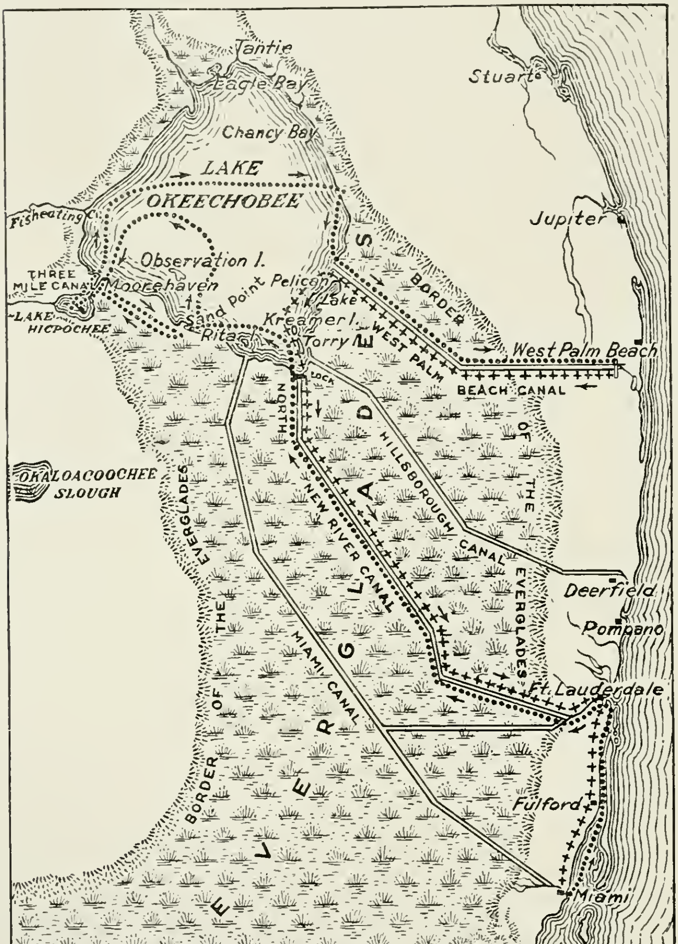
We were forced to go to Lake Okeechobee by way of Fort Lauderdale, as the Miami Canal was still securely blocked by politics and finance. (See map, page 686.) All went well until we entered New River Sound, a very beautiful spot in the inland waterway—but also a place where the unexpected always seems to happen. As we were about to pass from the sound into Lake Mabel, a severe electric storm accompanied by drenching rain and high wind suddenly broke upon us. We groped about until the close proximity of a bolt of lightning and an overpowering quantity of ozone brought us to our senses and we decided to throw over an anchor and wait.

After the storm passed, we proceeded into Lake Mabel, passed Fort Lauderdale, and went up to the source of New River at the rim of the Everglades and entered the North New River Canal. The water in the canal was exceptionally low owing to the prolonged drought. While entering the first lock the keel of the "Barbee" caught on the concrete sill amidships and there we hung, so nicely balanced that we were unable to move the boat forward or backward. We had to wait until the water rose sufficiently to float us,—perchance some boat ahead of us had gone through a lock many miles nearer the lake, or the tide may have risen.

Our real troubles, however, were only beginning. Again the low water and an imperfectly dredged channel delayed us. Before proceeding far we were compelled to reduce our speed to a minimum, for the stout bronze shoe on the keel of the "Barbee" began to touch projecting rocks along the bottom of the canal, and for a distance of about forty miles we scraped rock after rock, causing as much friction on our nerves as on the shoe.

Had it not been for the ingenuity of our captain we should have had to abandon the cruise. He created a ballast by pulling our rowboat aboard, setting it across the bows of the "Barbee," and filling it with water. This weighed down the bows, and thus elevated the stern with the propeller high enough to allow the boat to float safely above the rocky bottom. In order to counterbalance the delays and the loss of time caused by the reduced speed, we ran well into the night. Of course, plant collecting suffered neglect, but, fortunately, I had collected rather thoroughly along the banks of this canal in the fall of 1913.

After passing through the second lock, the sailing was smoother—at least



The southern part of peninsular Florida, showing about 120 miles of Atlantic coast, the narrow strip of high land adjacent to this coast, the area of the "Big Cypress" on the west, and the "Everglades" and Lake Okeechobee between.—The Everglades represent a wet prairie, partly dry in winter, submerged in summer, treeless except for the higher hammocks, like islands, along or near the borders, and the dense hammock surrounding Okeechobee (25 ft. above sea level). The region is impenetrable to travel, with no natural channels for navigation; hence the canals, four water highways from the coast across to Lake Okeechobee. When the channel is opened westward from Three Mile Canal and Lake Hicpochee, the last link will be completed in a water route across this part of Florida.

The expedition went to Lake Okeechobee from Miami by way of Fort Lauderdale, as the Miami Canal is not completed; but it found that North New River Canal needs to be deepened. The expedition's boat was able to keep its propeller from scraping the rocky bottom only by means of a ballast on the bow. Return was attempted unsuccessfully by way of the West Palm Beach Canal.

At least parts of the Everglade and Lake Okeechobee regions should be made state or federal reservations for the benefit of future generations of Americans. Florida is behind other states of the Union in not having reserved any of its forests or other natural features (except Royal Palm Hammock, together with some of the adjacent Everglades, called "Royal Palm State Park")

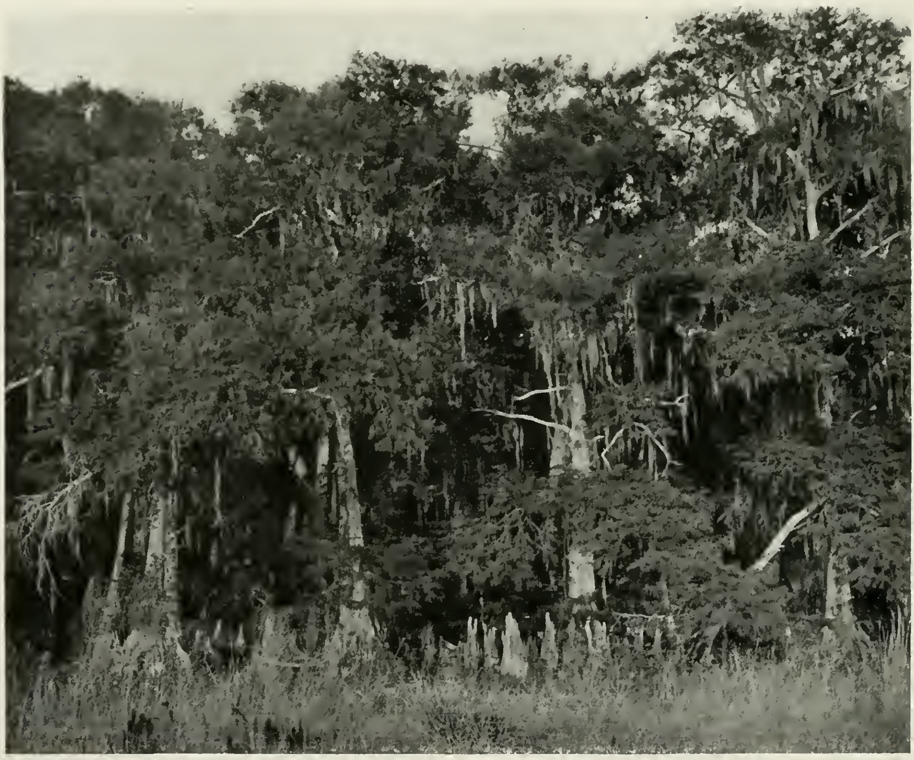
Looking into Lake Okeechobee from West Palm Beach Canal (see map, page 686), which has been dredged through a heavy sand ridge thrown up along this shore by westerly winds. Pond apple trees may be seen at the sides of the canal, and the tops of the cypress trees facing the lake are visible, rising above the pond apples

as far as the bottom of the canal was concerned. This lock is not a real one, but an improvised and homemade affair, and really a wonder! Each gate consisted of a score of separate pieces of planking which had to be handled piece by piece when the gates were opened and closed. But, fortunately, it dammed up enough water to float a boat of three or four feet draft and thus keep it from striking on the bottom of the canal. The lock at the edge of the lake is in the same condition as in 1913—that is, the place where it is to be is marked out on the canal banks.

Upon entering the lake we were lost. The water level was from five to seven feet lower than it formerly had been,

Defying alligators and giant catfish in the dark waters, we gradually maneuvered the boat into a deeper channel a quarter of a mile to the northward. The expedition's party on the "Barbee" was democratic, sometimes all were officers—and sometimes all were crew, as when the boat struck this bank of putty-like mud near Kreamer Island. The "Barbee" was generously outfitted for the expedition by Mr. Charles Deering, of Miami. Besides the captain and a man who acted as crew and cook, there were three scientists aboard, namely, a conchologist, a horticulturist, and a botanist

Pond apple trees, and water hyacinths set with their beautiful spikes of blue flowers, clothed the margin of Pelican Lake for a distance of many miles in 1913. Water hyacinth attained here a most extraordinary growth, sometimes three or four feet in height, a size greater than ever recorded elsewhere. Whether the species is native in Lake Okeechobee or an introduction from South America, can probably never be decided



Cypress trees (*Taxodium*) that fringe the hammock, their gray trunks and light green foliage outlined against a background of various broad-leaved trees. This is on the crest of the sand ridge just above the wide beach of the eastern shore. Land and vegetation are quite different here from farther south. Only a few small grasses and sedges grow on the sandy shore. Indeed, from certain plants found, it is thought that this was once a seacoast and instead of an uninterrupted expanse of water, great areas of lake bottom extended as far as the eye could see, with uncertain channels running here and there between them. We finally found our way into the lake between Kreamer Island and the southern shore and headed for Rita Island. On account of the low state of the water we passed the northern side of the latter island, and headed for Sand Point. Thence we attempted to pass between Observation Island and the mainland, but were confronted by a barrier in the form of a reef[1] of jagged rock extending from the island to the southern shore of the lake. It proved to be a ridge of rock placed nearly north and south at the southwestern corner of the lake, with Observation Island built up on the higher part. As the water stood at that time, the reef extended just under the surface for about nine miles north of Observation Island.

Darkness fell as we arrived abreast of Observation Island. We were bent on reaching the newly established settlement of Moorehaven, which is situated at the mouth of Three Mile Canal, a dredged channel connecting Lake Okeechobee with Lake Hicpochee. On the eastern side of Observation Island we were about twelve miles, in a direct line, from Moorehaven; but in order to reach it we had to sail many miles to the north to get around the end of the reef already described. Several times we imagined we saw the lights of the settlement in the distance, and subsequently learned that our observations were correct. Having been informed that there was a beacon at the northern end of the reef, we proceeded northward in the darkness, keeping along the edge of the reef by continual soundings. The beacon was supposed to be lighted at night, but after proceeding northward for a distance of nine miles or more no beacon light hove in sight, and the night was too dark to see the beacon itself unless we had happened to run quite close to it. Just how many times we saw the light of that beacon in imagination it would not be safe to record. When we thought we were fully twelve miles north of Observation Island, the lights of Moorehaven were very evident in the distance, and we could distinguish the outline of the western shore of the lake above Fisheating Creek. Assuming that we had in some way succeeded in rounding the end of the reef, or at least that we were far enough to the northward to round it, we decided to run on a southwesterly course, which would take us to the mouth of a canal recently dredged in the lake for the distance of about eight miles northward of the mouth of the old Three Mile Canal. Successive attempts were made but each resulted only in finding shoal water. Finally we seemed to get into deeper water. We increased our speed, when, to our surprise, the stout keel of the "Barbee" struck a rock. The boat jumped the rock and came down twice on other rocks. We all watched to see the water come in through a hole somewhere in the hull; but none appeared. This incident, however, determined us to spend the rest of the night at anchor.

In the morning we found the much sought for beacon in the distance. After we rounded it, we reached the northern end of the canal without incident, except for an hour's delay on some mud banks during the regular morning squall and rainstorm. At the entrance to the canal our real troubles in navigation began again. Up to within several hundred feet of the canal was deep water and within the canal was deep water, but the bar of hard sand at the entrance was covered with only one or two feet of water.

An old boatman within the canal was watching for the stern-wheeled steamer "Osceola," which was three days over-

[1] This reef is the one I was on the lookout for in 1913, at which time we evidently sailed over it twice without observing it. *Journal of the New York Botanical Garden*, 15: 76. 1914.

due on a thirty mile run across the northern part of the lake. As we lay piled up on the sand bar the boatman told us that it was possible to get a boat across the bar by means of the proper combination of time and labor. So we began our task. First we resorted to our water ballast again, placed the rowboat across the bows and filled it with water. Then the engine was set going at full speed and all hands jumped overboard. By pushing and pulling and lifting, the "Barbee" was moved inch by inch, and after an hour or two of this violent exercise on our part she glided into the canal. Everybody clambered aboard, and we were off on the final tangent of our course to Moorehaven.

We had finally reached an extraordinary portion of the earth's surface. There was present neither soil nor rock! All the dry land was built up of pure humus. We were in a land of "peat." For many miles in all directions there was nothing but vegetable matter in all degrees of decomposition, derived from both herbaceous and woody plants. This accumulation of "peat" extends around Lake Okeechobee. It is interrupted and partly obscured just back of the eastern shore by a sand ridge which represents the one-time bottom of the lake, blown out and piled up by strong westerly winds. At the southern and southwestern side the accumulation of peat is more massive than elsewhere, varying from three to fifteen feet in depth—or even more. Although this form of decayed vegetable matter is spoken of as "peat," the basis of true peat, sphagnum and the usual associated plants, does not enter into its composition. Furthermore, it is evidently not as acid as sphagnum peat, for all or nearly all cultivated crops may be grown on it in its virgin condition. No preliminary preparation is necessary, except the loosening up of the surface so that seeds may be planted.

The natural plant covering is the hardwood growth known in the southern United States as "hammock." The trees consist principally of cypress (*Taxodium*), strangling-fig (*Ficus*), pond apple (*Annona*), pop ash (*Fraxinus*), and elder (*Sambucus*). The growth is impenetrable except with the aid of a machete.

From the vicinity of Moorehaven around the southern side of the lake, the "peat" formation is remarkable. It resembles a gigantic sponge and walking on it is extremely tiresome. The mass trembles under foot with each step; yet, the concrete sidewalks, the houses, and other structures in Moorehaven are built directly on it.

We tied up to the bank of the Three Mile Canal in town for a time, then proceeded slowly down to Lake Hicpochee, where the canal terminates. This lake is a beautiful body of water to behold, with narrow and wide dimensions of about three and five miles respectively. It is the source of the Caloosahatchee River, and consequently one of the links in the chain of the transpeninsular waterway. We navigated our boat to about the center of the lake without difficulty, but out there we ran into a "Slough of Despond" of the most discouraging kind. This was a mass of black "gruel" of just the proper consistency to prevent the "Barbee" from moving forward or backward. To make things worse we could not move the boat by hand, as a pole pushed into the black mass would sink to an indefinite depth without appreciable resistance.

The propeller churned up this ink-black loblolly, with the aquatic plants, water moccasins, fish, and what not, without making progress. But a violent electric storm with high wind came to our assistance and blew us into a gruel of less dense consistency, and by degrees we drifted into deeper water, whence we were able to make our way back to the mouth of the canal. After this experience we realized the force of the information which had been given us by an old boatman as we entered the canal north of Moorehaven. He told us we could not navigate the upper waters of the Caloosahatchee River on a shingle! We do not think he exaggerated.

Once back to the canal, we set to work gathering live plants and herbarium specimens. It was interesting collecting ground, not only on account of the various strange plants, but also because of the uncertainty of the footing. Of course, walking was out of the question except where the dredge had dug into the bottom of the lake below the "peat" and thrown out some of the sand underlying the decayed vegetable matter. Even on this coating of sand one could not tell when he would break through and, in the twinkling of an eye, find himself waist deep or up to the armpits in the black loblolly—as one member of our party can testify.

The intervening territory between Lake Hicpochee and Lake Okeechobee is a collector's paradise. Naturally, water plants and marsh plants are much in evidence. In the lower ground arrowheads (*Sagittaria*), pickerel weed (*Pontederia*), pennyworts (*Hydrocotyle*), persicarias (*Persicaria*), pond weeds (*Potamogeton*), eelgrass (*Vallisneria*), and naiads (*Naias*) predominate. On the higher land, wild cucumber (*Melothria*) was rampant, while two kinds of mallows dominated the landscape; curiously enough these plants of closely related genera did not occur much intermixed. In some places, acres of open land as far as the eye could see, were covered with an almost pure growth of a species of *Kosteletzkya* having rose-purple flowers, while at other places, areas equal in extent were similarly clothed with a rose mallow (*Hibiscus*) which bears myriads of large light-pink flowers.

We returned with the "Barbee" to the Moorehaven public dock for the night, and the following morning set out afoot for an examination of the country between Moorehaven and Sand Point, about a dozen miles eastward on the southern shore of the lake and south of Observation Island. As we proceeded, the wonderful phenomena of the country gradually unfolded themselves. The natural features of that region are duplicated nowhere else, and unfortunately they are fast being destroyed. After about two years of the progress of civilization only remnants of the once unique pond apple hammocks and other plant associations are left. Moreover, we found many parts of the country afire. Over a large area fire had eaten into the "peat," and numerous subterranean fires were revealed by the smoke which came up through craters where the substratum had burned away and the superimposed "peat" and ashes had caved in. The same member of our party who the day before had fallen into the loblolly of Lake Hicpochee, fell into one of these craters and was partly buried in the hot ashes. Although this gentleman had never, either by word of mouth or action, led any of us to suspect that he believed in mediæval theology, he himself was now thoroughly convinced that if there was any place to be fallen into he was the predestinated man.

Fires were so numerous that the region might well be designated "The Land of a Thousand Smokes."[1] We had smelled the smoke that drifted eastward beyond the middle of the lake during the day and night we were hunting for the lightless beacon.

We passed through sections of virgin primeval forest, as well as through regions partly denuded and regions wholly denuded of all natural vegetation; thus we were treated to a panoramic view of all the stages of devastation. Following the final stage of destruction were

[1] With apologies to Professor Robert F. Griggs in *The National Geographic Magazine* for February, 1918.

ON THE PROTECTED EASTERN SHORE OF OKEECHOBEE

Hammock of this character once bounded the whole eastern shore of Okeechobee. Frosts, which sometimes devastate the western shores, do not touch the eastern, because the thirty-mile stretch of the waters of the lake tempers the prevailing westerly winds. In this sheltered region, therefore, the flora is more varied and of greater luxuriance, and harbors more tropical elements, both terrestrial and epiphytic. The hammock floor supports especially beautiful and abundant growths of ferns and fern allies of tropical nature. Little of such hammock is now left, however, and encroaching civilization and cultivation of the region for crops soon will erase the last vestige, losing to science, and to the people, the rich native plant life of this isolated part of the United States

One step in the process of making agricultural land out of dense hammock on the peaty shore of Lake Okeechobee (south side of trail between Moorehaven and Sand Point)

Denuded of its luxuriant vegetation, the spongy "peat," from three to fifteen feet deep, needs little ploughing to prepare it for planting

This shows part of a potato field of 200 acres. The "peat," without the use of any fertilizer, may readily yield each year two or three harvests of truck crops, such as potatoes, beans, onions, tomatoes, and peanuts fields of potatoes, tomatoes, onions, and other vegetables, hundreds of acres in extent.

In some places pond apple trees and ferns existed in association to the exclusion of nearly all other woody and herbaceous vegetation. Other areas were densely clothed with an impenetrable growth of southern elder, which bears flowers and fruits continuously throughout the year. Here and there were groves of the pop ash (*Fraxinus*), or of the live oak (*Quercus*). The cypress was represented usually by isolated trees. This cypress, for some reason as yet unexplained, occurred in two forms. If the tree trunk was only slightly or not at all buttressed, very numerous "knees" were produced from the roots in the neighborhood of the trunk; while if the trees had developed prominently buttressed trunks, very few "knees" or none at all appeared. Another interesting phenomenon observed was the association of the strangling fig and the cypress. Not a tree of the cypress was observed that did not have accompanying it a strangling fig. This phenomenon was particularly conspicuous as the cypress was devoid of its foliage and the fig was in full leaf.

Imagine a weed twelve feet high, with a stem a foot across! The water hemp or "careless" (*Acnida*) is a pigweed which quickly takes possession of the exposed bottom of Lake Okeechobee or of cleared hammock. It attains its giant growth in a single season, producing some wood and reaching the proportions of a small tree

A few miles east of the settlement we unexpectedly met a friend with a horse and wagon, which he kindly turned over to us for the day. We were thus relieved from carrying our burdens, but did not tax the horse with our own additional weight, as he seemed to be more fatigued than we by walking in the spongy peat.

The lowering of the water in the lake had naturally lowered the water table in the "peat," which normally contained a very large percentage of water. Being deprived of this moisture, the "peat" had shrunk, and in many instances the root systems of the trees were clearly exposed, particularly in the case of the cypress, where the connected system of roots and "knees" was beautifully demonstrated.

The decayed vegetable matter of this region forms a "soil" in which the most rapid growth takes place, and several crops of cultivated plants may be grown and harvested each year without the use of any kind of fertilizer. In many of the clearings intended for the planting of cultivated crops, annual weeds had appeared and were thriving. One native weedlike plant was conspicuous, a pigweed, botanically known as *Acnida* and popularly as "careless." This annual is a giant among weeds. It produces in one season a stem often more than twelve feet high and a foot in diameter. It is usually much branched, and bears myriads of flowers.

Soil, aside from mere decayed vegetable matter, however, was nowhere in evidence. We passed over areas of what had been formerly lake bottom, as well as the cleared forest lands, and found nothing but spongy "peat."

Later in the afternoon we collected on the prairie-like regions west of Moorehaven and also in the open places in and about the settlement, which probably a year or two before had been covered with saw grass. It was interesting to find how the garden flowers which the settlers had brought in the previous year had taken possession of this untamed soil. Phlox (*Phlox Drummondii*), evening primroses (*Raimannia Drummondii, Raimannia laciniata*), blanket flower (*Gaillardia*), zinnia (*Crassina*), and the flower-of-an-hour (*Trionum*), all grew with greater luxuriance in this wild state than I have ever seen them in cultivation. As a result of growing crops, there had escaped from the fields alfalfa (*Medicago sativa*), tumble-mustard (*Norta altissima*), cowpea (*Vigna sinensis*), beggar-ticks (*Meibomia purpurea*), and several large grasses.

Having used up the time our schedule allowed for our work here, we reluctantly started back through the Moorehaven canal for Lake Okeechobee. In dredging this canal, which is really a channel in the lake, there have been thrown up high banks of a mixture of white siliceous sand and sea shells, a deposit that was formed when the region was the bottom of an ancient sea. Although this material did not seem to have any available plant food in its

Compare this picture of the shores of Pelican Lake in 1917 with the photograph on page 684, showing the same area five years before (1913). The hammock has been destroyed, the water has receded, the humus, dried and cracked, supports only a rank growth of coarse weeds. Vast tracts in this region will be devoted to agriculture, but certain selected areas of unique interest and value should be conserved under Government control

CYPRESS STRONGLY BUTTRESSED AND WITHOUT KNEES

Cypress trees about Okeechobee occur in two very different forms, each the result of an effort on the part of the tree, apparently, to obtain a stable anchorage in the spongy humus for the great weight of top growth. In one form stability is acquired through a cone-shaped growth of trunk, broad and buttressed below. In the other, small woody protuberances called "knees" are thrown up by the roots. Cypress in the Okeechobee region is either buttressed or kneed, rarely both. Pond apple trees often show the same sort of buttresses when growing in soft mud (see upper photograph, page 688).

The clinging roots against the trunk of this cypress are those of a strangling fig (*Ficus aurea*), whose flat leathery leaves and dangling clusters of branches show against the feathery foliage and delicate flowers of the cypress. A flourishing colony of weeds has taken possession of the clearing. The edge of what is left of the original hammock appears in the distance. After no more than about two years' progress of civilization around Okeechobee, only such remnants of the unique pond apple hammocks and other plant associations are left

A CYPRESS TREE WITH NUMEROUS KNEES AND LITTLE BUTTRESSED

Fine branches seen among the cypress limbs are those of a strangling fig, which begins life in the form of a vine and depends upon the cypress for support. It is rare to find a cypress that does not harbor a strangling fig. This solitary cypress was photographed in a field recently cleared on the southern shore of Lake Okeechobee. In clearing land cypress is often left, perhaps only because so difficult to uproot composition, luxuriant vegetation had sprung up on nearly every part of the banks. Prostrate herbs, among them *Bramia*, formed dense carpets; while morning-glory vines (*Convolvulus*) formed mats. Plumelike bonesets (*Eupatorium*) and a brilliant yellow coreopsis covered large areas. A score of other kinds of bright-colored flowers were in evidence nearly everywhere. A milkweed relative (*Philibertella*), a stout vine, with stems and branches seventy feet long or more, ran over the shores and banks in much the same way as the railroad vine (*Ipomœa Pes-Capri*) grows on the seabeaches.

At the mouth of the canal we spent several hours in lifting the "Barbee" over the bar, as we had done when we entered. After she glided into deep water, we sailed up to the vicinity of the mouth of Fisheating Creek and then headed eastward for a point on the opposite shore of the lake about midway between Chancy Bay and Pelican Lake, which course represented the widest part of Okeechobee. We were soon in ten feet of water and then made rapid progress to the eastern shore.

Owing to the low level of the water, there was a very wide sandy beach partly carpeted with grasses and sedges. The hammock begins about the top of the ridge with a fringe of cypress. Back of this is a dense growth of maple (*Acer*), holly (*Ilex*), ash (*Fraxinus*), and pond apple (*Annona*). The herbaceous plant cover is so complete that one rarely, if ever, sees the ground upon which he is walking. One of the more interesting herbaceous plants here is the climbing valerian (*Valeriana*), a delicate vine with clusters of small white or pink flowers. Liverworts, mosses, and ferns cover nearly all the ground about the trees and also a great part of the tree trunks themselves. Several kinds of tropical ferns occur in profusion, evidently owing to the protection afforded by the thirty-odd miles of water lying to the westward. Everywhere we had been, both in the Everglades and on the western shore of the lake, vegetation had been killed or severely damaged by the almost unprecedented "freeze" of the preceding February; but on the eastern shore and in the hammock swamps behind it, there was not the least sign of damage from the severe frosts, and vegetation was as fresh and luxuriant as it apparently had been for ages.

After sunset we weighed anchor and proceeded southward to hunt for the beacon that marked the entrance into the lake of the West Palm Beach Canal. Fortunately, this beacon was lighted and we had no difficulty in finding our way into the canal, where we tied up to the bank for the night. At sunrise we moved into the canal for a distance of a couple of hundred yards, where sand and humus were piled up higher than elsewhere, and went ashore to explore a magnificent hammock which clothed the ridge that gradually sloped off into the Everglades toward the east.

This hammock is picturesque beyond description. The trees for the most part are pond apple. The trunks are strongly buttressed, apparently thus developed so as better to maintain an upright posture on the soft mud floor. Herbaceous plants and vines are present in abundance. The most interesting vine is a species of dew flower (*Commelina*), which grows in mats and in dense masses, often with stems and branches more than half an inch thick, climbing into the trees to a height of from fifteen to twenty feet.

Here, too, the milkweed vine, instead of growing on the ground, climbed into the trees where it formed tangled masses of stems and leaves on the tree tops. We found evidence again, in the presence of several tropical species of epiphytic orchids on the pond apples, of the protection afforded by the waters of the lake against the cold westerly winds. The tomato grew wild in the hammock and was laden with myriads of fruits no larger than a small cherry. Our cook gathered a supply from which he made us soup and stew, which we had for dinner as we started down the canal toward the eastern coast.

After we reached the Everglades several stops were made along the banks for collecting. The first was on the southern bank of the canal at the head of what was formerly Pelican Lake. Four years ago this lake was one of the most beautiful spots I had seen. When cruising in Okeechobee in 1913 we spent an afternoon and a bright moonlight night in Pelican Lake. Then it was filled with floating islands of the water hyacinth and water lettuce. It was surrounded by beautiful pond apple hammocks which were fringed with a growth of water hyacinth and water lettuce made up of plants more robust and larger than had previously been recorded. The hammock islands served as immense heron rookeries and the waters abounded in alligators of all sizes. Today it is a waste. The lowering of the waters of Okeechobee has changed these conditions and, instead of the paradise described, the exposed bottom of the lake as far as the eye could see supported a dense growth of the large pigweed "careless" (*Acnida*). The sight was disheartening.

Similar cases of unique areas that should have been preserved for future generations might be cited by the score. Many localities whose natural features are not duplicated elsewhere could easily have been made state or federal reservations, if the public officials had had the proper interest in such matters. In Florida, aside from Royal Palm State Park, there are no reservations for the preservation of the natural features, except those maintained by a few interested individuals, and a partly developed national forest. Steps for protection of selected areas should be taken at once by state or federal government. It is not yet too late to save much.

As we started down the canal a plague of horseflies overtook us. No matter how many we killed, their numbers seemed to increase. We passed through still another plague: the Everglades were covered with a moving mass of giant grasshoppers, known in some southern localities as "devil's horses." They are from three to five inches long, with stout yellow and black striped bodies. They are too clumsy to fly and their walk is decidedly awkward, and if birds did not dislike them for some reason, they would furnish a large food supply. The assemblage was moving northward. In many places the southern bank of the canal was a living mass, with myriads of grasshoppers in the rear pushing those ahead into the water where most of them were drowned. The few that reached the northern bank passed on into the Everglades.

Late afternoon found the "Barbee" approaching the pine lands back of West Palm Beach. At that point we came upon a large dredge that blocked the canal. Two boats that had preceded us were also held up. The dredge occupied the width of the canal and was in the act of digging a channel by its side to let the boats pass. While we were waiting for the completion of this channel, we were informed that the canal ahead was closed, that the county officials at West Palm Beach, wishing a road across, had filled in the canal and carried the county road over instead of building a bridge. In the face of such brilliant engineering work, there was nothing left for us to do but to turn around and retrace our course through the Everglades.

Although we had seen a part of the Everglades which would have been denied us had we known in advance that our course was blocked, we were exasperated at the loss of time, and decided not to stop until we reached Lake Okeechobee again. By continuous running we came to the end of the canal sometime between midnight and daybreak.

After a few hours' rest we set out to

hunt for the mouth of the canal to Fort Lauderdale. The channel between Kreamer and Torry islands was too shallow to be navigated and we were forced to run to the westward of both. Even out where formerly there had been deep water we found only enough to float the "Barbee," and all the way to the southern end of the lake we slid slowly along the smooth mud bottom, which was almost as level as a floor. At last a beacon hove in sight and we thought our troubles had come to an end, but as we neared it and turned into the indicated channel we ran up on a mound of putty-like mud. We decided that it was best for all members of the party to jump overboard and walk in different directions until some one should step into deep water. Thus, defying alligators and giant catfish, not to mention other strange animals that might have been prowling in the dark waters, we walked about that part of the lake until one member of the party reported deep water a quarter of a mile to the northward. We gradually maneuvered the boat into this deeper channel and finally found our way to the head of the canal leading to Fort Lauderdale.

As we entered the canal, truck growers begged us to carry their vegetables to Fort Lauderdale; but we could not assist them owing to the shallow water. After we passed through the first lock, in spite of our improvised water ballast, the keel of the "Barbee" repeatedly scratched the tops of submerged rocks. When we were within a few miles of the lower lock, although running at slow speed, the keel struck a rock a glancing blow. This turned the boat toward the side of the canal, where the propeller hit a rock with force sufficient to bend the shaft. The bend was not sharp enough to prevent the shaft from revolving, but each revolution was accompanied by an irritating thud. In this condition we crept along to the lock, where we tied up for the night, and in the morning made Fort Lauderdale by running the engine at the lowest speed possible as well as by taking advantage of the slight current of New River.

In order to save a day's time for further field work and to care promptly for the specimens we had collected, we telephoned to Buena Vista for an automobile. As soon as it arrived the party divided, and several members with the perishable specimens hurried to Miami, while others spent the day taking the boat down the coastwise canal.

From the scientific standpoint the cruise was successful beyond anticipation. The vegetation and structure of a part of our country which is nowhere duplicated were studied. Many geological data were discovered from the deposits of fossil marine shells, and a series of photographs obtained of scenery and of plant associations which in the near future will have ceased to exist.

The Grafting of Tissues

PRACTICAL VALUE IN REPAIRING THE WOUNDED OR DISEASED HUMAN BODY.—THEORETICAL VALUE, AND SOME OF THE FACTORS WHICH CONTROL SUCCESSFUL TISSUE TRANSPLANTATION

By LEO LOEB

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THE grafting of plant tissues is a well-known and practiced custom, one which has become so important that should the practice be discontinued, the present high grade of our fruit orchards, for instance, would completely disappear. Some remarkable results have been produced experimentally, such as the grafting of the nightshade on to the tomato. The great value, however, lies in the exactness with which cultural varieties can be propagated without the serious loss of type characters that inevitably follows from reproduction by seed. All of us are doubtless familiar with the results obtained by grafting a young twig of the double rose on to the root of the wild variety, obtaining thereby the beauty of the former and the hardiness of the latter.

In grafting animal tissues, transplantations succeed better among the lower animals than in higher classes, just as the regenerative power for injured or lost parts is on the whole greater in the lower forms. The more complex the organism, the more difficult it is to accomplish the transplantation successfully, the more must the various factors which control the phenomenon be carefully studied. Because of the very practical importance in replacing lost or injured tissues in man, much study and experimentation have been conducted by scientists in order to understand the process most thoroughly, and as a result of these studies much has been learned.

Grafting of tissues is a procedure used by the surgeon in cases in which there are defects somewhere in the body which are very extensive. Without grafting, such defects either would not heal at all or they would leave a scar which might threaten to interfere with the normal activity of the body. During the last four years, in dealing with the ravages of war on the human body, even the features of the face have been built up of grafted tissues in many instances. Defects in the skin are perhaps most frequently treated by grafting; but grafting of bone, tendon, fascia, and fat tissue is resorted to in certain cases.

It is therefore of great practical interest to analyze the factors on which successful grafting (transplantation) of tissues depends.

But of much greater importance is perhaps the theoretical interest that attaches to grafting of organs. The experimental method permits us to place a tissue under conditions which differ from those under which it lives normally. We can vary such conditions at will and thus we can obtain an insight into the factors which determine the life and growth of tissues in a normal as well as a pathological state. It is a mode of investigation which brings us in touch with the deepest problems of biology and pathology, namely, factors determining growth and life itself. Many diseases are caused by abnormalities in growth of various tissues. In diseases of the heart, liver, kidney, pancreas, thyroid, and other organs, abnormalities of tissue growth are often the underlying factor.

But there is in addition a disease which represents altogether an abnormality of tissue growth. This is cancer. Cancer is an abnormal, excessive, and continuous tissue growth or proliferation. In comparing the conditions which determine the growth of normal tissues with those of cancerous tissues, which latter we can graft in a way very similar to normal tissues, we obtain a deeper insight into the character of cancerous growth.

In the following we shall limit our discussion to a few of the factors which come into play if we graft a normal tissue from one animal to another or from one part of the body to another part of the same animal. The greater number of the experiments in grafting tissues are carried out in smaller animals, like guinea pigs, rats, mice, and rabbits.

In transplantation of animal tissue we are concerned in a general way with three conditions: (1) the character of the host, that is, the animal or tissue in which the graft is made; (2) the character of the graft, that is, the tissue to be transplanted: and (3) the relationship between the host and the graft. We know that a wounded tissue will heal much more rapidly and perfectly in a young than in an old person. There is something present in the young that is deficient or wanting in the old. Likewise a graft grows better in a young host than in an old one. This characteristic is particularly noticeable in experimentation on transplantable tumors in mice; it also applies, at least in certain cases, to the transplantation of tissues that are not abnormal. Experiments of this sort indicate that the young animals differ from the older ones in the character of the substances circulating in the body fluids. What then may these substances be? Are they the ordinary food constituents—the proteins, fats, carbohydrates, and mineral substances, or the two more elusive yet specific substances known as "vitamines"—both of which are necessary for maintenance as well as growth? Or are they special growth substances such as are known to exist in the *corpus luteum* of the ovary, in the thyroid, and probably in the pituitary gland?

Although these questions cannot be definitely answered at the present time, the results of many and varied experiments indicate that the advantage which the young animal possesses is not due to the quantity or quality of the food stuffs but more likely to some sort of specific growth substance. It has been shown[1] that substances circulating in the tadpole cause those remarkable metamorphic growth processes which occur in the life of the developing salamander. Tissue grafted on a tadpole from another tadpole undergoes metamorphosis at the same time as the host. Experiment has determined that the *corpus luteum* of the ovary gives off at certain times a substance which, circulating in the body of the host, will cause a placental structure to be produced. On the other hand, it has been found difficult to graft tissues in animals bearing young, but here there are indications that abnormal substances are circulating in the body fluid which exert an injurious influence on the transplant, or perhaps neutralize, in some way, the specific growth substances which are normally present.

The fate of the graft is dependent also upon the character of the grafted tissue itself. A good evidence of this fact is that growing embryonic tissue which is not yet fully differentiated is more susceptible to successful transplantation than adult tissue which is fully differentiated.

In each organ there are formed different constituents which vary greatly from one another in the ease with which they lend themselves to transplantation. On the whole, the simpler structures, the ones developing first on-

[1] Uhlenhuth, *Proc. Soc. Exper. Biol. and Medicine*, Vol. XIV, 88, 1917.

togenetically, and also those structures which have the greatest power to regenerate, best withstand the injuries resulting from the process of grafting. Thus, the excretory ducts are more resistant than the secreting portion of the glands, the small follicles of the ovary are more resistant than the large follicles, and the ordinary connective tissue cells are more resistant than the *corpus luteum*.

The transplantability of tissues, however, is greater than is usually assumed. The spleen tissue may live for a considerable period of time, if transplanted into near relatives. After transplantation of liver, carried out under favorable conditions, not only bile ducts and connective tissue may survive, but also the liver tissue proper. The liver cells even may multiply by mitosis under these conditions.

There exists a definite graded relation between the structure of a tissue and the amount of unfavorable conditions which such a tissue can tolerate without being destroyed. Such unfavorable conditions are always present after transplantation. Thus the excretory ducts can withstand a greater combination of unfavorable conditions than liver cells or the cells of the convoluted tubules of the kidney.

There are other more or less accidental factors which play a part in determining the result of transplantation. It is found that after transplantation of skin, the epidermis is destroyed in a number of cases even under otherwise favorable conditions, and this in spite of the simple structure of the epidermis which, as such, would readily lend itself to transplantation. The presence of hair (combined perhaps with the hardness of the keratin, its chief constituent which is constantly produced by growing epidermis) leads to its destruction. Almost invariably a piece of skin transplanted subcutaneously forms a cyst. Around the hair the transplanted epithelium is injured and the stimulus of the hair acting as a solid foreign body causes the connective tissue to grow. Along the hair this connective tissue pushes into the cavity of the cyst, gradually filling it and causing a destruction of the epidermis. Another accidental factor of importance occurs in grafting a lobe of the thyroid gland when it sometimes happens that fat adhering to the thyroid remains attached to the organ and is carried into the host together with the graft. The peripherally situated fat tissue prevents the thyroid from developing and consequently there is produced a deficiency in acini in the thyroid graft wherever fat tissue was adherent to the thyroid proper. Therefore great attention must be given to removing carefully all extraneous tissue in carrying out such transplantations.

Again, the fate of the graft is determined by the relationship between the transplant and host. Each individual belonging to a certain species differs from every other individual in the structure of certain proteins which are a part of all, or almost all, of the various kinds of cells as well as of the blood of each individual. Even children usually differ from their parents and from their brothers and sisters, in this respect. Greater than between relatives is the chemical difference between unrelated individuals; greater still is the chemical difference between different strains belonging to the same species. White mice, for instance, which have been bred in different countries and may be otherwise indistinguishable from one another, may show marked chemical differences, while between different species the chemical differences are greater still, and the differences increase the farther apart the species are in the genealogical system. Thus the fate of the graft depends upon the chemical relationship between graft and host. Generally it can be stated that the greater the chemical difference between graft and host, the greater will be the injury to the transplanted tissue; this is especially so in the tissues of the higher animals; it is apparently less so in the phylogenetically lower organisms.

In mammals we find that, on the whole, grafts can live indefinitely only after transplantation into the individual in which the tissues originated (autotransplantation). Some exceptions occur, however, to this rule—as, for instance, in the case of certain tumors, which can live and grow in other individuals of the same species; and perhaps the same may hold good in the case of a few particularly resistant tissues. After transplantation into other individuals of the same species (homeotransplantation) tissues usually die after a period of transitory life the duration of which varies in different tissues and different individuals. Even in nearly related individuals, grafts have usually a mere temporary existence, although in most cases they live longer than in individuals of the same species which are not related. It may be that occasionally the transplanted tissue lives in a near relative as well as it does after autotransplantation, but such cases, if they occur at all, certainly represent only a small minority. After transplantation into different species, tissues live a very short time, and they die the sooner the farther distant the species of host and transplant are from each other. In invertebrates, however, grafts may, under certain conditions, live permanently even in a strange species.

We have reason to assume that the chemical differences existing between graft and host lead to disturbances in the metabolism, or proper taking care of the food, by the grafted tissues. After transplantation into different species (heterotransplantation) these metabolic disturbances are so marked that the grafted tissues die either directly or after a short duration of life. After transplantation into other individuals of the same species some tissues are injured by the body fluids of the host to such an extent that they also die as a result of this chemical injury. Others, however,—and this applies especially to certain glandular organs,—suffer only a relatively slight metabolic disturbance in the new environment, a disturbance which as such would be perfectly compatible with the life of the tissues. However, this metabolic change in the transplanted cells attracts the lymphocytes of the host, which now invade the graft and help to destroy it; and, in addition, the connective tissue cells of the host may produce more fibrous tissue around a homeotransplant than around an autotransplant and thus interfere with the nourishment of the graft.

These two factors bring about more or less gradually the death of the transplant in cases in which the body fluids alone would not be sufficiently toxic to produce this effect. In general, the more sensitive a tissue is, the more susceptible it is to the injurious effects of those toxic substances which are present in all homeotransplantations.

While only autotransplanted tissues can live indefinitely, the temporary life of tissues taken from other individuals of the same species, or preferably from nearly related individuals, may be of great practical importance, inasmuch as it may permit the adjoining host tissue to repair defects in a much more efficient manner than could be accomplished through grafting of dead material or tissues taken from different species. The investigator is constantly faced by new problems. Also he is rewarded by new knowledge which promises to throw light on fields which apparently are far removed from that of tissue growth. Thus tissue grafting may serve as a method which helps to clear up problems of immunity.

Charles Richard Van Hise (1857–1918)

HONORED FOR A LIFE DEVOTED TO SCIENCE AND PUBLIC WELFARE—TO RESEARCH, CONSERVATION, AND EDUCATION

By CHARLES P. BERKEY

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PRESIDENT Charles Richard Van Hise, of the University of Wisconsin, whose death was recorded in November, was born at Fulton, Wisconsin, May 29, 1857. He was educated in the schools of Wisconsin, including the University, so that he was the product of a typical American public school system. He became the best known and most representative man of his state and one of the best known educators of America.

The University of Wisconsin gave him the degree of bachelor of mining engineering in 1879; bachelor of science, 1880; master of science, 1882; and doctor of philosophy, 1892. Honors of many kinds were showered upon him after he had made a world-wide reputation as a scientist and had come into prominence in the councils of education. The degree of doctor of laws was given by Chicago in 1903; Yale, 1904; Harvard, 1908; Williams, 1908; Dartmouth, 1909.

He began his career as a teacher in metallurgy, gradually changing to mineralogy and to geology, leaving that ultimately to devote himself wholly to executive and public service work. His first appointment to the teaching staff at the University of Wisconsin was in 1879 as instructor in metallurgy, in which position he continued until 1883, when he was made assistant professor and in 1886 professor of metallurgy. During part of this time, he was under the influence of the late Professor R. D. Irving, who was then preparing his great monograph on "The Copper-bearing Rocks of Lake Superior." This association with Irving and the attractiveness of the field that he represented finally led to an entire change in his life work and the field of his investigations. Under these influences he grew to such mastery that with Irving's death, in 1888, he was appointed to the chair of mineralogy to succeed Irving. His genius for structural geology and the attraction of the very complex field represented by the Pre-Cambrian rocks which had engaged Irving, led him out of mineralogy proper into this most obscure and at that time almost unknown field. The background that he had in chemical principles gained in his metallurgical experience and in mineralogy was, however, a firm foundation for the kind of work that he now set about and in which he made a signal success. In 1890 he became professor of archæan and applied geology. In 1892 he was put in charge of the geology department, in which position he continued until he became president of the University in 1903.

His fame as a teacher and investigator and his recognized leadership in the field of structural and metamorphic geology made his name honored in the annals of science, and his assistance was sought by other educational institutions and by organized surveys. He was, for example, nonresident professor of structural geology in the University of Chicago for a period of ten years, while caring for his own work at the University of Wisconsin. He had been connected with Irving on the Lake Superior division of the United States Geological Survey under Powell from 1883 on, and at Irving's death he succeeded to his position in that work also. In 1900, he was put in charge of Pre-Cambrian and metamorphic geology on the United States Survey, with the rank of geologist, which position he held until 1909. He was also at the same time consulting geologist for the Wisconsin Survey.

With his elevation to the presidency of the University in 1903, the energy with which he had developed his chosen science largely transformed itself into activities of a broader scope, connected with the executive work of his own institution, the welfare of the state, and with commissions on many matters of national importance. From 1908 to 1915 he was a member of the Wisconsin State Conservation Commission; 1909, a member of the National Conservation Commission; 1912, chairman of the Board of Arbitration between the Eastern Railroads and the Brotherhood of Locomotive Engineers; in 1915, chairman of the commission appointed by the National Academy of Sciences at the request of President Wilson to report on the Panama Canal slides; in 1909, he was made one of the trustees of the Carnegie Foundation for the Advancement of Teaching.

He was a member of many societies and influential organizations. Among those representing his scientific relations are the Wisconsin Academy of Science, Arts, and Letters, of which he was president from 1893 to 1896; the Geological Society of America, of which he was president in 1907; the American Philosophical Society; and the National Academy of Sciences, to which he was elected in 1902.

He was the author of many scientific and general articles. His most enduring contributions were in the field of geology connected with his elaborate and vigorous investigations of the principles represented in the complicated and very ancient formations of the Lake Superior region. The most important works of this type are: "Principles of North American Pre-Cambrian Geology," 1896; "The Iron-ore Deposits of the Lake Superior Region," 1901; "A Treatise on Metamorphism," 1904; and "The Geology of the Lake Superior Region," 1911 (with C. K. Leith), all issued through the United States Geological Survey. There are many other titles, but more are unnecessary. It is worth noting, however, that some of these titles represent very elaborate pieces of work instead of simple articles; for example, "A Treatise on Metamorphism," listed above, represents a great *Monograph*, Volume 47, of the United States Geological Survey, which is a quarto volume of 1286 pages.

President Van Hise has exercised a peculiarly pervading influence on geology, largely by reason of his genius for constructive investigations in a field of very varied relations and his ability to bring an obscure and baffling lot of data into an organized system. The principles that he emphasized or reworded and the applications of them that he made and suggested have modified the whole product of geological workers in those particular fields ever since his work became known. But his contribution to his chosen science and his influence upon his associates is almost equaled by his success in the broader field of administration and general public service. It has fallen to few of the scientists of our day to see his own work so widely used and so generally appreciated as is the work of Van Hise. His death came in the midst of his activities and before any of his remarkable powers were dimmed.

He was a man of positive conviction and vigorous expression, but, with it all, he kept so rigidly to the true scientific attitude in his zeal for truth that he roused few antagonisms and made practically no lasting enemies. His own native state—more than that—all America, and the whole world for that matter, wherever contributions to science and to conservation and to education are appreciated, may well honor the name of Van Hise, who throughout an active life has been a great contributor both to knowledge and to public welfare.

A World of Billions

By W. W. KEEN, M.D.

Emeritus Professor of Surgery, Jefferson Medical College, Philadelphia; Major Medical Corps, United States Army

"With the passing years, I am more and more impressed with the wonderful 'mechanism' of Nature, which to me bespeaks—God." [Quoted from letter to the Editor.]

OCCASIONALLY it is a great relief to turn away for a season from a review of the Great War with all its horrors, atrocities, and sorrows, and think about some wholly detached subject. Our passions are stilled, our emotions subdued, and our minds are freshened for a time.

"Does the title suggest the Liberty Loans?" you ask. No, not that. "Then the number of bushels of various grains in our harvests?" No, not that. "Then it must be the number of dollars spent every year or month or day by the various belligerents?" No, not even that. You will hardly guess it. It came to my mind in this wise.

Not long since, one morning as I was shaving, it suddenly occurred to me that there were only two means by which we could actually *measure* the growth of any part of the human body from day to day—the finger nails and the hair. During the Civil War, S. Weir Mitchell, George R. Morehouse, and I often compared the rate of growth, especially of the finger nails, for example, in cases of gunshot wounds of the great nerves of an arm, or of paralysis of one half of the body. We stained one or more corresponding nails on both hands with nitric acid or nitrate of silver. The new growth of the nails would be free from stain and would show the relative rate of growth on the two hands at a glance. But the growth of the nails is too slow to be a satisfactory index of daily growth. On the contrary, the hair, and especially the beard, grow so rapidly that in twenty-four hours the stubby outgrowth of each hair is long enough to be easily seen. It gives one an untidy appearance. "Unshaven" is equivalent to neglect of the proprieties, one might almost say, of the decencies of life. As I thought of it while my razor was rasping away the hair, I reflected that it introduced me into "a world of billions."

But this immediately brought to my mind another instance of multiplied billions, not the billions of cells in solid substances like the hairs, but the billions of cells in that life-giving fluid—the blood.

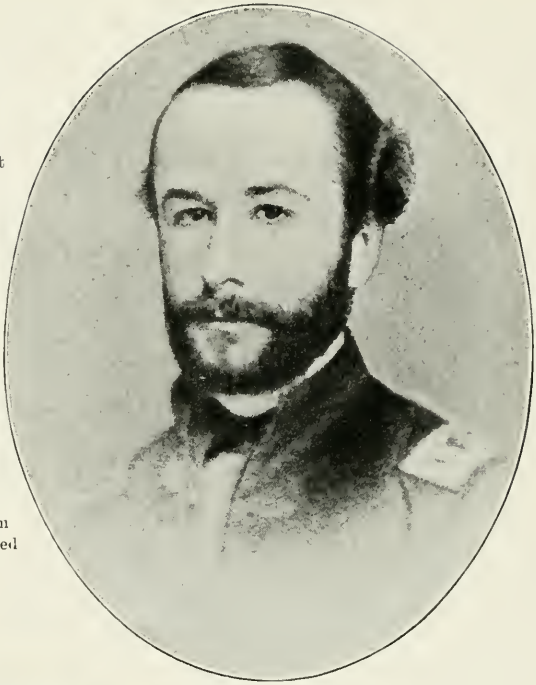
As is well known, the blood consists of a liquid in which float the red blood cells or blood "corpuscles." These are round, disklike cells about $\frac{1}{3000}$ of an inch in diameter. Besides these red cells there are other cells called the "white cells" or "leucocytes." These number several thousand in a cubic millimeter, but though of great importance, physiologically and pathologically, we may disregard them in our census of the blood cells.

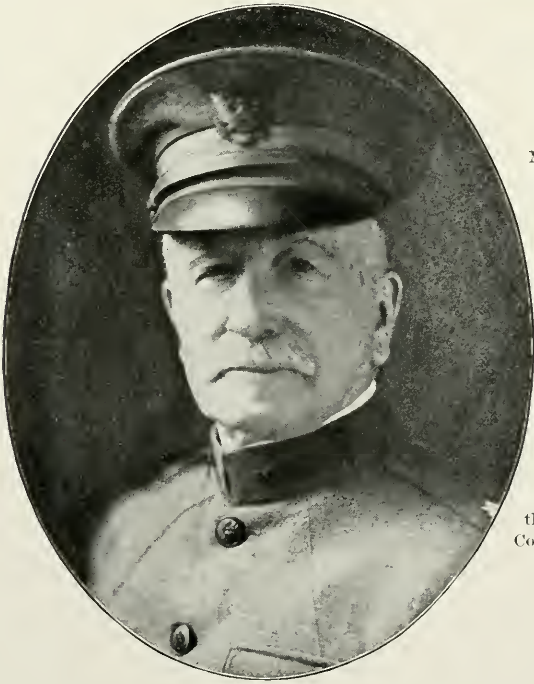
My friend, Prof. John C. Da Costa, Jr., of the Jefferson Medical College, at my request has furnished me with the following estimates:

The total amount of blood in a man weighing 144 lbs. and in good health is about 12 pints. The number of red blood cells in each cube of blood measuring only one millimeter ($\frac{1}{25}$ of an inch) on each side is about 5,000,000. Sometimes this rises to 6,000,000, 7,000,000, or even 8,000,000 in a cubic millimeter. The number of red blood cells in one pint is, therefore, on the lowest basis, approximately 10,240,000,000,000, that is, ten thousand, two hundred and forty billions.

A VOLUNTEER IN THE UNITED STATES ARMY 1861

Major Keen received his first commission in the United States Army on July 1, 1861. In 1862-1864, he served in the Ascension and Eighth Street general hospitals at Washington, D.C., the Satterlee Hospital, and with Drs. Weir Mitchell and G. R. Morehouse in the Hospital for Nervous Diseases and Injuries at Turner's Lane, Philadelphia. When the United States Medical Reserve Corps was established in 1909, he immediately volunteered for service and was commissioned First Lieutenant. In April, 1917, his rank was raised to that of Major





MAJOR W. W. KEEN 1917

Major Keen, of Philadelphia, is a man of international reputation and a pioneer in many branches of surgery. The foremost brain surgeon of America, he was one of the earliest to operate upon brain tumors. He has been connected for many years with the Jefferson Medical College of Philadelphia, as lecturer and professor of surgery, and is a member of many of the leading scientific societies of this country and Europe. (This portrait and the above reproduced through the courtesy of Houghton Mifflin Company)

I

Remarkable Activity in the World of Billions

The number of these red blood cells destroyed and renewed every day in the ordinary activities of life cannot be accurately estimated. But we can get an approximate idea.

No physical or mental process can be accomplished without the destruction and regeneration of millions, or more likely of billions, of these blood cells in bringing oxygen from the lungs to burn up waste tissue and to aid in building up new cells and new tissues.

You lift an arm, you eat a meal, you reason about anything—every one of these actions means the using up of the cells in the muscles of the arm, or of the muscular cells of the walls of the stomach, and the cells of the glands producing gastric juice, or of the cells of the brain. The blood is one of the agents in effecting these various processes, and billions upon billions of its cells are used up every day.

The loss of blood in accidents, wounds, and operations must be made up quickly in order to keep us in good health. In an accident or in any serious operation the loss of blood may easily amount to a half tumblerful, a tumblerful, or even more. A tumbler holds six ounces. A loss of half a pint, eight ounces, is not very uncommon. In a serious accident, such as a shell wound in France, attended with great hemorrhage, the loss might amount to as much as three pints—about one fourth of the estimated total amount in the body. Bierfreund estimates that such a loss may be made good in four weeks. In three pints of blood there would be about 30,720,000,000,000, that is, thirty thousand, seven hundred and twenty billions of blood cells. In every hour of the four weeks then there would be a regeneration of more than 45,000,000,000 of cells, or more than 760,000,000 cells every minute, day and night, for four weeks!

Not only are the blood cells destroyed and regenerated at this enormous rate, but all the tissue cells which make up the muscles, the bones, the brain and nerves, the liver, pancreas, spleen, kidneys, are being destroyed and regenerated day by day.

Confessedly these figures are only approximate, but even if they are, the impression of the *enormous* cellular activity of the entire body is justified. Is it not a wonder that the body does not get tired of doing such hard and never ceasing work?

But to return to the beard and the growth of each hair, which introduced us to the world of billions. The amount of daily growth of the beard may vary possibly from man to man, with health and illness, with the seasons, with the quantity and quality of the food, possibly from race to race, or with different latitudes from the poles to the equator. Even different parts of the beard grow at different rates—toward the margin of the beard near the eyes the growth is less rapid than on the cheeks and the upper lip.

The number of hairs in the beard it is impossible to count, but let us assume that it would probably be say 5000 on an average face. Then we must remember that the beard is only a small portion of the hair on the human body. Besides the hair on the face there are the hairs on the head, in the eye-brows and eye-lashes, and finally the fine lanugo or soft hairs which overspread the entire body, growing to groups of long hairs in the armpits and other parts of the body, but disappearing entirely on the palms of the hands and the soles of the feet. With age, we men at least, usually lose the hair on the top of the head which becomes bald over a smaller or larger area. On the ears the hair often increases markedly in length after middle life. Even in women a mustache not uncommonly develops sometimes to an almost disfiguring degree. I have seen in some male patients the ordinarily fine hairs over the body, arms, and legs develop into a hairy coat over nearly the whole body, quite comparable with that of the lower animals.

My problem was: How much does each hair of the beard grow every twenty-four hours; how many new cells are thus produced in each hair; and finally, what is approximately the total number of new cells produced in the beard each day?

Recently I collected the fragments of hair which I had shaved from my face and asked Professor Aller G. Ellis, of the Jefferson Medical College, to measure them and if possible give me an estimate of the number of cells per hair which must have grown on my face in twenty-four hours. He found that each hair had grown about one millimeter ($\frac{1}{25}$ of an inch) in the twenty-four hours, and that the number of cells in that length of one hair would be about 10,835. This would indicate a growth of more than 450 cells every hour, day in and day out. This, remember, is for the new growth of only *one* of the hairs shaved off. If now we accept 5000 as the number of hairs on the face alone, that would mean 14,175,000 new cells had grown every twenty-four hours, or nearly 600,000 cells every hour, or 10,000 cells every minute in the beard alone. Cut the figures in half if you wish. The fact is just as marvelous.

If we broaden the calculation to the hair all over the body, growing on the head at probably a somewhat slower rate and still more slowly all over the rest of the body, we would have a world of billions upon billions of hair cells, as of blood cells, produced every day.

The same enormous activity is seen in the destruction and restoration of the cells in many glands such as those that secrete the saliva which flows so abundantly when we chew our food; in the glands of the stomach, for its share in the digestive processes; in the glands lining the entire twenty-five feet of the intestine, producing the intestinal juice (*succus entericus*) so important in digestion. To these are to be added the enormous activity of the accessory organs of digestion, such as the liver, which secretes about twenty-five ounces (about $1\frac{1}{2}$ pints) of bile every day, and the pancreas, which pours out a large quantity of pancreatic juice to aid in digestion. To these must again be added the activity of the kidneys and of the millions of sweat glands. These two—the kidneys and the sweat glands—curiously enough are much alike. The skin might be called a kidney unrolled and spread out over the surface of the body, and conversely, the kidneys two portions of rolled-up skin placed within the abdomen.

In emergencies the skin may actually perform the function of the kidney. When I was a medical student—in the long, long ago, now verging upon sixty years!—I had in my own person a striking example of this "vicarious" action of the skin when my kidneys "struck work." I was very ill with a violent tonsillitis and a high fever—how high I do not know, for it was before the days of the clinical thermometer (!), but I should judge that it must have been 104° to 105° F. Lying in bed, I perceived a most disagreeable urinary odor. I first thought it was due to the neglect of the maid. But this proved not to be the case. I soon observed whenever I brought my hands near to my face as in taking a drink of water or using my pocket handkerchief that a whiff of this disagreeable odor was pronounced. Then I deliberately investigated the condition of my skin and found that it was doing nearly all the work of the kidneys—a most dangerous condition, which might easily be followed by uremic coma and speedy death. Prof. J. M. Da Costa, who was attending me, at once took the most vigorous means to stimulate the kidneys. These remedies, with hot drinks, a sharp purgative, and abundant drinking of water soon averted the danger. In the case of some patients the urea excreted by the skin has actually formed crystals on its surface.

How many billions, trillions, and quadrillions of cells in the blood, the hair, the innumerable glands of the intestines, in the liver, the pancreas, the kidneys, the brain, and the skin perish and are replaced every day no one can possibly estimate. That such huge armies of cells serve us every day, every hour, every minute of our lives day and night, in sickness and in health, and as a rule in orderly sequence so that the balance of health is maintained, or in case of illness is restored, gives one an idea of the wonderful mechanism of the human body—nay, of the whole animal and even of the vegetable kingdom, for only by the same nice adjustment of number and function of cells to the needs of the body of the man or the animal or the plant can health be maintained.

Moreover, the great strength of these minute cells is wonderful. We are all familiar with the bricks or even the heavy flagstones around the trunks of trees on our sidewalks which are lifted and tilted by these same little cells growing slowly but inexorably. I well remember seeing in the old churchyard at Jamestown, Virginia, a full-grown sycamore tree which had split a great bowlder in two. The little tree had found a chink into which it had insinuated its slender stem. Then these myriad Lilliputian cells, slowly but steadily increasing in number, had gradually thickened the tree trunk and finally had rent the stone asunder.

II

The Organization of the World of Billions

Every plant and every animal, including man himself, starts from one microscopic cell which multiplies indefinitely until the number mounts to millions and billions. The rapidity of this growth in some instances is almost inconceivable. The cholera bacillus multiplies from one to two; these two divide into four; these four into eight, sixteen, and so on *every twenty minutes*. In seven hours, provided it has room enough and food aplenty, *one* single cholera bacillus would have more than 2,000,000 descendants, and three hours later more than 1,000,000,000, and so on. These 1,000,000,000 in twenty minutes would become 2,000,000,000; in twenty minutes more 4,000,000,000. In twelve hours after the first single cell with which we started had begun to multiply, its descendants would number about 64,000,000,000,000, sixty-four thousand billions of cells. What *would* the number be in a week or a month!

Or again, consider the silkworm. In thirty days after being hatched from the egg it increases in weight 15,000 times; that is 500 times its original weight every day. We can get a more impressive idea of what this means by comparing it with a human baby. Were the same rule to hold, a baby weighing seven pounds at birth would weigh 3500 pounds the very next day, and when a month old would weigh 105,000, or more than fifty short tons, which, however, could hardly be called "short weight." If you will pardon the abominable but expressive argot of the street, that would be "some baby." But we may be somewhat consoled by remembering that both mother and nurse would be of corresponding elephantine bulk—made to "fit the job" as the exponents of efficiency would say.

But this is a gross, unimaginative way of looking at such a phenomenon. When we analyze it seriously, what a wonder world we enter upon! How these little silkworms must feed, feed, feed! Think of the abounding life of each microscopic cell. Every one has to multiply itself five hundred times in every twenty-four hours. Yet all goes on in an orderly manner, according to the law of its being, but with incredible swiftness, day after day.

In the development of a human or an animal body the increase is far more, however, than a mere numerical increase, although that in itself is a wonderful phenomenon. Among these multitudinous cells a wholly new factor soon comes into view. They do not all continue merely as multiplied duplicates of their predecessors but they begin to differentiate among themselves. Some will become first cartilage, that is, gristle cells, and later, when the blood carries to these cartilage cells lime and phosphorus and other mineral ingredients, these cells bathed in the liquid portion of the blood will pick out each its own required mineral compounds and will turn from soft, flexible cartilage to stiff, yet elastic bones—the skeleton of the animal.

Other cells will remain soft but will select those ingredients which are necessary to form the muscles—that is, the red flesh of animals or the white and dark meat of birds. These muscles acting on the bones as levers will move them so that we can lift the ribs and by the diaphragm depress the floor of the chest and thus aid further in expanding the lungs for inspiration; then we reverse the action, depress the ribs, compress the abdominal viscera, and so push up the diaphragm, thus compressing the lungs for expiration. Thus the alternate processes of breathing—a continuous function essential to life—are carried on. We are also enabled to regulate our breathing and our vocal cords in such a manner that we can speak or laugh, swallow or sing.

Still other muscles attached to our jaws permit us to eat, others to our legs allow us to move about, others to our arms and fingers fit them for labor or other useful functions.

But these muscles do not move of themselves. They require a stimulus connected with the center for our mental organization. Thus then the need for a nervous system—in fact, as I shall show, for two interdependent and correlated nervous systems. The first of these two systems is composed of the brain, the spinal cord, the nerves emerging from the latter, and the special end-organs in which the nerves terminate. From the skin by means of these special organs at the ends of the nerve fibers, impulses start and are carried to the brain. In the brain they are appreciated, for instance that the finger is in contact with a source of too great heat. The brain quickly decides that the finger must be withdrawn, and sends down to the proper muscles the order to retract at once. In such a case, long before the whole of this brief description has been read, the muscles have executed the order. This is but one example of a voluntary movement resulting from a sensation.

The second nervous system consists of the sympathetic system. At certain important points collections of nerve cells are gathered into small bodies called ganglia. These ganglia are connected with one another by a large number of nerves. The familiar "solar plexus" just in front of the spine at the level of the "pit of the stomach" is the largest and most notable collection of such ganglia.

The nerves of the sympathetic system are distributed to the muscular cells in the walls of every artery in the body. This muscular coat consists chiefly of circular fibers, which, by their contraction and relaxation change the caliber of the arteries and thus regulate the supply of blood to all parts of the body according to its needs.

For example, the eye is a very familiar instance. When a cinder gets into the eye, in a short time the white of the eye becomes very red or "bloodshot," but returns to its normal whiteness as soon as the foreign body is removed. The sudden redness of a young girl's "blushing" cheeks is caused in the same way.

Again, when we have eaten a meal, the stomach needs a very large and sudden increase in its supply of blood to elaborate the large quantity of gastric juice required for digestion. Instead of a rather dirty looking brownish yellow appearance, as when it is empty, the stomach (like the eye) at once becomes of a bright red color from the dilated blood vessels. As soon as the meal has been digested, the nerves stimulate the circular muscles of the arteries. By their contraction these immediately lessen the caliber of the blood vessels, and less and less blood reaches the stomach until at length the supply is only enough for the ordinary demands of the stomach in its period of inactivity, and it has reverted to its original brownish yellow color.

These sympathetic nerves are distributed not only to the muscular coat of the blood vessels but to many other muscular fibers which are involuntary, that is, not controlled by the will. We have an excellent illustration of this in the iris, the circular colored disk in the eye with a hole in the center which we call the pupil. This is constructed like a wheel with a circular hub and radiating spokes. The "hub" consists of circular muscles which, by contracting, narrow the pupil to a pin point. The spokes are radiating muscular fibers which pull the pupil wide open. We go out into blinding blazing sunlight. For a moment we wink and blink, or have to shade the eyes by the hand or by closing the eyelids. But in a few seconds the muscular fibers of the hub contract strongly, the pupil narrows down to a pin point, and the eye is automatically protected from the injury which it would otherwise suffer. On the contrary, we go into a darkened room. At first we may stumble over the furniture which we cannot see on account of the small amount of light entering the eye through the minute pupil. In a few minutes the pupil has been dilated by the "spokes," or radiating fibers, to a maximum, and we can see everything with perfect clearness.

All these changes, be it observed, are perfectly involuntary. They are accomplished for us, and in fact, in spite of ourselves. We do not order the blood vessels to dilate when a meal is eaten, or order them to contract when it is digested. We do not order the pupil to contract or dilate according to the brightness or the dimness of the light. In fact we cannot by any possibility control the caliber of the blood vessels of the stomach, or the size of the pupil. It is all done for us whether we wish it or not. And it is most fortunate that this is so. Suppose it had to depend on our conscious volition. Suppose, tired out and hungry, we ate a hearty meal and fell asleep! The stomach would get no increase of blood, there would be little or no gastric juice secreted, no digestion would take place. What endless confusion there would be! Before long we should surely perish! In the case of the pupil, the bright light might easily seriously damage the eye, or we could never see in a dimly lighted room.

In this rather long discussion we have almost forgotten that we were considering the differentiation of the rapidly multiplying cells into bone cells, muscle cells, and cells forming the brain, spinal cord, and nerves to control the voluntary muscles, and the sympathetic nerves to control the involuntary muscles.

If we examine a chicken embryo, we shall find even as early as the third day the well-recognized and differentiated parts of the organs of sight, of hearing, and of smell. When we remember the ultimate excessive complexity of these organs, especially of the eye and the ear in man, this faculty of differentiation causes our wonder and astonishment to become intense. By it cells that at first could not be distinguished from one another eventually develop into cornea, iris and pupil, lens, and retina—the retina alone having ten different layers!—and the strong and tough outer protecting fibrous envelope of the eye; the three bony semicircular canals of the internal ear lined with their soft membrane, the wonderful spiral cochlea in which are distributed the nerve filaments forming the ultimate organ of hearing: the three little bones of the ear attached to one another and by flexible membranes to the internal ear, and externally also to the drum of the ear.

And as if all this were not enough, there are certain other cells which become segregated—shall we say segregate themselves?—from the others and develop on an entirely different plan from any of the others. Some of them form a long hollow tube, the esophagus, followed by a dilated part, the stomach, and then the intestines. The stomach has a wholly different function from all the rest of this long tube, which is about twenty-five feet long in man and far longer in some of the lower animals. The stomach portion of the tube suddenly narrows again at the pylorus, the outlet from the stomach into the small intestine, and finally widens anew into the large intestine. Throughout its length this digestive tube is lined with different sorts of glands to aid the different stages of digestion. Connected with this long digestive tube are two large accessory solid organs—the liver to secrete bile, the pancreas (the "sweetbread" in animals) to furnish a juice to aid digestion.

At the same time other cells are segregated at one point to form the spleen. Its function is still, in part, as yet obscure. Its presence is not essential to life for many times it has been removed, and the patients get along without it, as they do also without any gall bladder or appendix.

Still other cells are segregated into two masses of cells which form the two kidneys. The character and function of these cells become wholly changed. Their secretion is wholly different from that of the glands in connection with the mouth (for saliva), in the stomach (for gastric juice), in the liver (for bile), in the pancreas (for pancreatic juice), in the intestine (for the intestinal juice) all aiding in digestion, that is, in the nourishment of the body. The cells of the kidney select from the blood such of the waste products as otherwise would accumulate in the blood and quickly threaten life. Hence their enormous importance. As a surgeon I would far rather operate on a patient with very grave heart disease than on one whose kidneys were seriously out of order.

The sweat glands of the skin as I have already pointed out are analogous to the kidneys, and supplement, or may even replace them.

All the stages of development of all these different tissues have been diligently worked out, chiefly in the fertilized egg of the hen. One can abstract an egg from an incubator at any definite time, one hour, two, three, four hours, or on the second, third, fourth, fifth day and so on, carefully open the egg shell, harden the embryo chick in certain fluids and then cut it into very thin slices which are kept in their serial order. These "serial sections" are so thin that the light easily passes through them. This enables us to study each one in detail. They can be cut also lengthwise, crosswise, or obliquely. By these means the embryologist can examine each section, each system, each organ, or even a part of any organ. By suitable stains one can differentiate and study the individual cells of the various tissues.

Occasionally accident will furnish a human embryo in which similar examinations by similar methods may be made. These absolutely establish the fact that the development, as studied in the chick and other lower animals and in the human ovum and embryo, follows exactly similar lines. Similar organs develop in similar ways. The whole vertebrate kingdom from the lowest animal consisting of only one cell to man, follows the same general plan although varying in details from animal to animal, and growing more and more complex as we ascend in the scale.

III

The Wonderful Powers Implicit, *i.e.* Infolded in the Fertilized Ovum

Having reviewed the enormous number of cells in the blood and the body—whether of man or other animals—and their orderly development by differentiation in structure and function, it will be of interest to consider the wonderful powers implicit—that is to say, which are infolded—in an ovum. These powers remain latent until fertilization takes place. Then they immediately start up into amazing activity. We can best study it in the development of the chick in the fertilized hen's egg as just indicated. From the moment when the hen begins to sit, hour by hour, there begins and goes on during the whole period of incubation (twenty to twenty-one days) the most marvelous growth and development. Within even the first three days there is developed, in the growth from the one single cell, a mass in which can already be distinguished the front, middle, and hind parts of the brain, the starting points of the eyes and the ears, even the pulsating heart can be seen, divided at first into only two separate halves. There is a beginning of the circulation of the blood. What will become the lungs, the liver, and the pancreas are recognizable. Later the fore and hind limbs of quadrupeds, the wings and legs of birds, or the arms and legs of the human body begin as little buds. The cartilages of the digits (fingers and toes in man) soon follow. Foster and Balfour[1] say that on the fifth day "the embryo of a bird does not materially differ in its early phases from that of a reptile or a mammal, even in the points of structure which are most distinctively avian" (that is, characteristic of birds). By the sixth day the distinction becomes clear.

In all this apparent "hurly-burly," as when a cell in the silkworm multiplies itself 500 times each day, or less swiftly in the cases of vertebrates, there is an orderly, almost uniform development of each animal after its kind.

For a moment let us limit ourselves to the consideration of the human body and ovum. Look at the symmetrical and asymmetrical organs of the body. We have two ears, two eyes placed always in front and not at the side of the head as in the fly, the horse, and many other animals, always at a certain distance apart, within a very slight maximum and minimum range; two ears, two arms, two legs, two lungs, two kidneys. Even the nose is symmetrical; but the two nostrils are fused into one central organ. The tongue also is composed of two symmetrical halves fused together. The bones of the head are as a rule in pairs, right and left, or if in the middle line, they have originated in two symmetrical halves as in the upper jaws (maxillæ) which are not fused together, while in the lower jaw (the mandible) the two halves are permanently united for its special function of biting and crushing the food. The ribs, right and left, correspond to one another. The complete or ideal vertebra consists of a body and a pair of ribs which are also joined together in front, not directly but indirectly, by means of the sternum or breast-bone. In the neck the ribs are suppressed, but have their representatives in little processes or knobs of bone. In the loins (the lumbar

[1] *Elements of Embryology*, p. 275.

region) there are also no ribs, but their representative vestiges are even more marked than in the neck.

Asymmetry rules chiefly in the internal organs. Most of the heart lies to the left of the mid-line of the body. As already stated it begins as two separate halves, which soon fuse into one heart with four cavities, two auricles and two ventricles. Each of these four chambers has a different function but all four are coördinated into one beautifully regulated organ. The heart is one of the most wonderful pieces of mechanism in the world, more powerful in proportion to its weight than any Baldwin locomotive, more delicately constructed than the finest watch; an organ, which must do, and—*mirabile dictu!*—does do its own repairs while busy at its work. It knows no Fourth of July or Christmas or Easter holiday, never even can know the joy and relief of sleep, "tired nature's sweet restorer." It begins its orderly, reiterated contractions and relaxations long before birth, and they cease only at death. It must continue them in health and in sickness, when its function is often sadly disturbed. In mid-career let it stop for but a few moments and death comes swiftly, almost instantly.

Sometimes, oddly enough, by a very early irregular development, asymmetrical organs are transposed, and then, as in *"Le Malade imaginaire," "nous avons changé tout cela"* is literally true. This is very rare, so much so that in a long and active professional life, I personally have never seen a case. When it occurs, the heart, stomach, and spleen lie on the right side, the liver and appendix on the left, and the large bowel reverses its course, running upward on the left side.

In this enormously complex machine, far more complex than any of man's making, a machine, all parts of which, like the heart, must be repaired without the omission of an hour's or even a moment's work, it is not surprising that things sometimes go awry. The wonder is rather that they almost always develop aright. Nature is persistently conservative. To this conservatism we owe it that most people are practically normal. Especially fortunate is this conservatism during the early development of the embryo. Then, every cell is working feverishly and at top speed, and a minute divergence of, it may be, even a single cell, followed by a progressively greater and greater divergence from the normal in its descendants, would produce an arrest of development here, or an error of development there; but only occasionally is there such a failure of orderly or of complete development. The result is a local, or even, it may be, a general failure in normal growth. If there is one deformity, therefore, there are very apt to be others.

The saddest of all of these errors of development are those cases in which there has been a defective development of the brain and hence a mentally defective child. How many scores, or I might even say hundreds, of such children have been brought to me with the fond delusion that, "He is naturally an unusually bright child, you know, but with a pressure on the brain." How often have I had to dash unfounded hopes to the ground! The children have been brought to me in the confident expectation that I could cure them by a surgical operation that "would remove the pressure on the brain." An explanation that the defective development was by no possibility to be laid at the door of either the father or the mother, but that the defect was prenatal, and had long preceded birth has often afforded the distressed parents some little comfort, although it can never wholly remove the heartache. The only hope for such children is in educating the more or less blighted faculties; a long continued, expensive business, and often with but a slight improvement as a reward for years of parental devotion. In other cases, such as cleft palate, harelip, and clubfoot, surgery holds out relief by operation.

Let us now go back again to the single cell of the fertilized ovum in which the human or animal body always begins. We have seen its development into many billions of cells which have become differentiated from one another and have formed many different tissues (bone, muscle, or nerve), and many different organs (brain, eye, ear, liver, or kidney), in which the ultimate cells differ enormously from one another, although all have had this common origin in the single cell of the fertilized ovum.

Think for a moment of the enormous powers latent in that single little microscopic, primordial cell! Nothing that I know of can for a moment compare with it. If we know its origin we can foretell its development into a horse, a bird, a fish, or a human being. We can foretell that it will show the racial traits of its parents to a greater or less degree: the white skin, the black skin, the yellow skin; the straight hair or the curly hair; the oblique or the horizontal eye; the racial nose of the Roman, the Greek, the Hebrew, or the Negro; the high cheek-bone of the American Indian. There are marked physical resemblances in many, if not in most cases, even to the features of the parents and the brothers and sisters which in turn may be transmitted to the next generation. Nay, more, in that tiny cell are contained the forces that make not only for the physical structure and the intellectual characters of his race, but also for those of his nation, and it may be, of his particular family. In it are contained *in posse,* and if fertilized and developed, *in esse,* the powers of a Newton, a Shakespeare, a Franklin, or an Abraham Lincoln.

Why should the little bud which is to become a human arm always develop at exactly the right place and not grow out on the front of the chest or on the back nearer the spine? Why should the human arm grow to its proper length and then stop, instead of growing far longer as it does in our simian ancestors? Why should the two arms (and the two legs) always grow to virtually the same length? Why should the human body grow for about twenty years and then stop growing?

The answer is evident. In that single, primordial cell there existed a force, a law of orderly development which compelled all these phenomena to take place, and to take place at the proper situation and in the proper sequence; and, when the proper time came, the laws enshrined in that primordial cell said to the lengthening arm and the heightening frame, "Stop," and they stopped!

As a rule each tiny egg develops in an orderly normal way the characteristics of its particular breed of ancestors. The sheep's ovum will develop into a timid adult, while that of the lion will be courageous and cruel; in the different breeds of horses one ovum will develop into a powerful draft horse, another into a fleet race horse; if it be a dog's ovum it will develop, it may be, into the swift greyhound, the fierce bulldog, or the fawning spaniel. If this be true of horses, dogs, and cattle, should it not be true of men? I firmly believe in the virtues, and alas, as the Great War has revealed them, in the vices, inherent in different breeds of men and of nations. Good blood is a great asset whether in horse or man.

I confess I stand in awe before such manifestations of power packed, one might say, into such a microscopic space. To me there is no other explanation of such a mighty gift save from an Almighty Giver—the Fountain of Life, the ever blessed God. I bow before Him in reverence and also in gratitude that we live in a world of such wonderful Order, instead of a world of blind Chance.

Characteristic coast scene of Bermuda.—The Bermuda Islands are of limestone formed through the centuries by coral polyps; the islands rest on the top of a suboceanic volcano. This discovery was made in deep well boring

"The Flora of Bermuda": A Review[1]

By JOHN W. HARSHBERGER

Professor of Botany, the University of Pennsylvania

THE Bermuda Islands have long attracted the American tourist because of their accessibility to New York City by a regular line of fast steamers. The number of visitors has been reduced greatly since the present war began, but there is every reason to believe that the popularity of these islands will be restored when the final treaty of peace is signed. There are so many attractions that it is hard to know where to begin in enumerating them. The blue sky and still bluer sea, rivaling the Bay of Naples in depth of color, the coral reefs, the bathing, the boating, the sailing, and the deep-sea fishing have long been famous. The geologist has been attracted by the interesting matters connected with the formation from the ground-up remains of corals and calcareous seaweeds of the rocks, the sands, the soil, and the limestone caverns with their stalactites. The character of the sinks and picturesque cliffs has also appealed to him. The recent discovery, described by Dr. Britton in the introduction of his book, that the limestone cap lies on top of rocks of volcanic origin, as revealed by deep well boring, is a matter of intense interest. The visiting geologist is informed that of the 1400 feet penetrated by the boring, the first 360 feet are in the limestones of the usual character known in Bermuda. Below them for 200 feet, soft yellowish to brown, often clay-like rocks are met, whose nature indicates that they are more or less decomposed volcanic tuffs. Below them blackish to gray compact volcanic rocks are found, of andesitic and basaltic appearance. The study of the section made from a chip indicates that this is a lava, and, though considerably altered, an augite-andesite. This rock continues without essential change in character for the remaining 800 feet penetrated. The zoölogist is fascinated by the beautifully colored fishes, by the sea anemones, the holothurians, the

[1] *The Flora of Bermuda*, by Nathaniel Lord Britton. pp. xi, 585, New York, Charles Scribner's Sons, 1918.

coral polyps, the Amphioxus, and the phosphorescent insects and sea animals, which light their ghostly lamps as the short tropic twilight begins to blot out the distinctness of the landscape.

The botanist and the lover of plant life, to whom this volume will appeal most strongly, are interested in the scenery of Bermuda at once, as the steamer, after a voyage of two days and two nights from New York across the Gulf Stream, approaches the archipelago. The hill slopes are clothed with the deep verdure of the prevailing Bermuda cedar broken here and there by cultivated fields and clumps of the native palmetto. The blue sea penetrates the land here and there, and the promontories are characterized by the location of attractive villas and planted grounds. The white roofs of the cottages are seen above the tops of the ubiquitous red cedars. The student of plants finds that he can travel readily to all parts of the island group by the fine roads, which are kept in excellent repair by the liberal use of the crushed limestone rock.

By the use of the manual which Dr. Britton and several collaborators have given us, he can soon learn the more important native plants, which species have been introduced and escaped from cultivation, and which are grown in the fine gardens of the native Bermudians. The eleven species of indigenous flowering plants soon become old acquaintances; some of them are common, as the blue-eyed grass (*Sisyrinchium Bermudiana*), which appears in color as the frontispiece of the manual and the color of whose flower is attractively reproduced on the covers. The four endemic ferns, including the maidenhair (*Adiantum bellum*), as well as the mosses, lichens, and algæ, have no doubt been collected by him, if in search of a representative collection of the native plants. He soon learns by a study of the *Flora of Bermuda* that about 80 per cent of the native land plants inhabit the West Indies, or southern Florida, or both. About 8.7 per cent of the total native flora is endemic, there being 61 species in Bermuda or its waters not known to grow naturally anywhere else in the world. The number of introduced and completely or partly naturalized species is about 303. The number of species of cultivated plants which either grow now in Bermuda or are recorded as having grown there, is 864. The number of native species known, those that have reached Bermuda independently of human activities, including the flowering plants, ferns and fern allies, mosses and hepaties, lichens, algæ, and fungi, is at least 709.

Many of these forms are illustrated, so that with a description of them, and a fine bibliography and glossary, the visitor should not be at a loss to learn a great deal about the vegetation without undue expenditure of effort. The labor which the author has expended in the field, in the herbarium, and in the library, will render easier the labor of others, who may undertake to investigate other phases of the plant life of the archipelago. A more detailed study of the fungi and the diatoms is a desideratum, which, unless investigated by some person resident in Bermuda, must sooner or later be undertaken by some visiting mycologist or diatomist.

The species of the Bermuda flora are arranged under their respective families, and the handy keys under each family group, with the line drawings given in the text, will enable the tourist lover of plants to identify the greater number of those of the islands which will be met in excursions from place to place, from St. George at one end to Ireland Island at the other. The more interesting facts about the plants have been incorporated. The reader of the book will find, for example, interesting facts about various trees.

The endemic palmetto (*Sabal Blackburnianum*), for instance, is common in all but saline situations, and the plants differ greatly in size, depending on soil and situation. This palm, which shows hourglass constrictions of its stem, was first named botanically by Glazebrook in 1829 in the London *Gardener's Magazine*, 5:54 and there illustrated. The specific name was given in honor of a Mr. Blackburn, in whose collection in England it was then known, but all record of its origin had been lost, other than that it came into possession of his grandfather in 1737. It is now frequent in greenhouses in Europe and occasional in West Indian gardens. Its closest relative is probably *Sabal Palmetto* of Florida, the Bahamas, and Cuba, from the seeds of which, brought to Bermuda by floating, it may have sprung through isolation. Baskets of many kinds, hats, dish-mats, napkin-rings, fans and other small articles are made from the bleached leaves. An intoxicating beverage called "Bibey" was formerly distilled from its fruit.

The yellowwood, or satinwood (*Zanthoxylum flavum*), native of Florida and the West Indies, was widely distributed in Bermuda many years ago, but nearly exterminated by cutting for its valuable lumber, which was exported to England. This business was restricted by gubernatorial proclamation as early as 1632. Old records prove the occurrence of large trees in Cooper and Ireland islands prior to 1693. The large tree recorded by Governor Lefroy as 30½ inches in girth about 1872, was, in December, 1912, 33⅕ inches (83 cm.) in girth. It bears Lefroy's initials (RHL). This tree flowered and fruited abundantly in September, 1913.

The olive appears to have been introduced prior to 1612, being one of the first Old World trees brought to Bermuda. In 1661 the Bermuda Company ordered it widely planted, but it never became the basis of an industry. Lefroy states that some of the trees planted in 1661 were standing about 1875. This may very well apply to the ancient tree still in perfect condition at Norwood, and perhaps to one at Walsingham. The fruit produced in Bermuda is small and of inferior quality, averaging only about half an inch in length.

Critical studies, which Dr. Britton has made of all the plants described by him, will enable botanists to make the first careful comparison of the Bermuda plants with those of regions near by in order to determine the evolutionary processes involved in their differentiation as new forms. A question might be asked in this connection: Is the "age and area" hypothesis of Willis verified in an intensive study of Bermudian plants, such as has been presented in this volume on the flora?

The visitor from the Eastern United States will find such familiar plants as the narrow-leaved cat-tail, eelgrass, Spanish bayonet, weeping willow, bayberry, red mulberry, pigweed, four-o'clock, chickweed, life plant, red and white clovers, garden nasturtium, flax, poison ivy, Virginia creeper, tamarisk, sea lavender, persimmon, oleander, French mulberry, henbit, heal-all, spearmint, peppermint, Jamestown weed, mullein, rib grass, chicory, shrubby fleabane, seaside goldenrod, and many others. These and a number of the common weeds of Europe, which are cosmopolitan in their distribution, will give him a floral nucleus on which to begin a more detailed examination of the Bermudian vegetation.

Dr. Britton's book will be indispensable to all those persons, whether native Bermudians or otherwise, who wish to become acquainted with an interesting, near at hand, oceanic, insular flora.

The pink flowers of the bay bean (*Canavali lineata*) give color to the sand dunes and sea beaches through nine months of the year. The original seeds probably floated to Bermuda from the West Indies or Florida

"Personal Identification"[1]

By L. R. SULLIVAN

Most systems of identification are connected in our minds with criminals and are dismissed as being unimportant for honest men and women. The attitude of the public generally to the practice of finger printing was well illustrated by the reaction of the alien enemies, especially the women, whose finger prints and photographs were recorded at the time of registration. Some felt that they were eternally disgraced, and others, with relief, believed they had very narrowly escaped the electric chair itself.

Such a conception is very unfortunate. The criminal side is but a small part of the whole problem. To one case involving a criminal, there are a dozen in which the individual to be identified has committed no wrong.

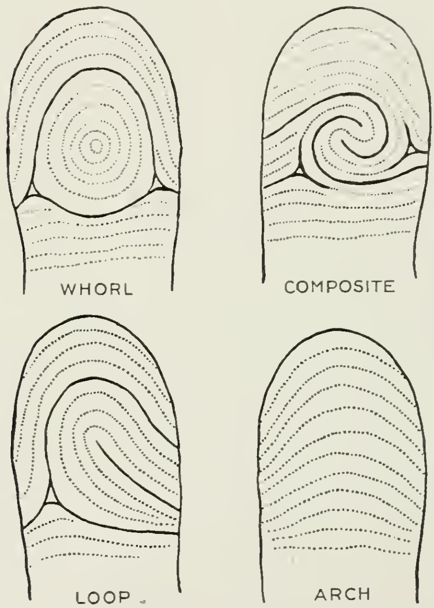
Personal Identification, by Professor Wilder and Mr. Wentworth, besides serving as a very complete handbook of the technique of the various systems of identification, aims to correct some of the fallacies in the minds of people and to prove the usefulness and even the necessity, to every individual, of a method which will furnish absolute identification.

The various systems so far adopted are discussed in turn and their merits weighed. It is pointed out that there are times when the name and the aspect of the face and figure are not sufficient for identification. There may be a duplication of features and expression. Photographs often fail to establish identity because features and expression may change in the course of time. Marks, scars, and tattoo, while valuable within certain limits, are cumbersome to record and classify.

How far anthropology has progressed is shown by the fact that even if only a skull or other part of the skeleton is found it is possible to give in some detail a description of the sex, size, and race to which the individual it represents belongs.

The Bertillon system of accurate measurements of the body and head, supplemented by descriptions of the hair and of eye color, is very valuable, and in the greater number of cases establishes identity. Several instances are noted, however, in which two individuals presented very nearly the same measurements and proportions throughout.

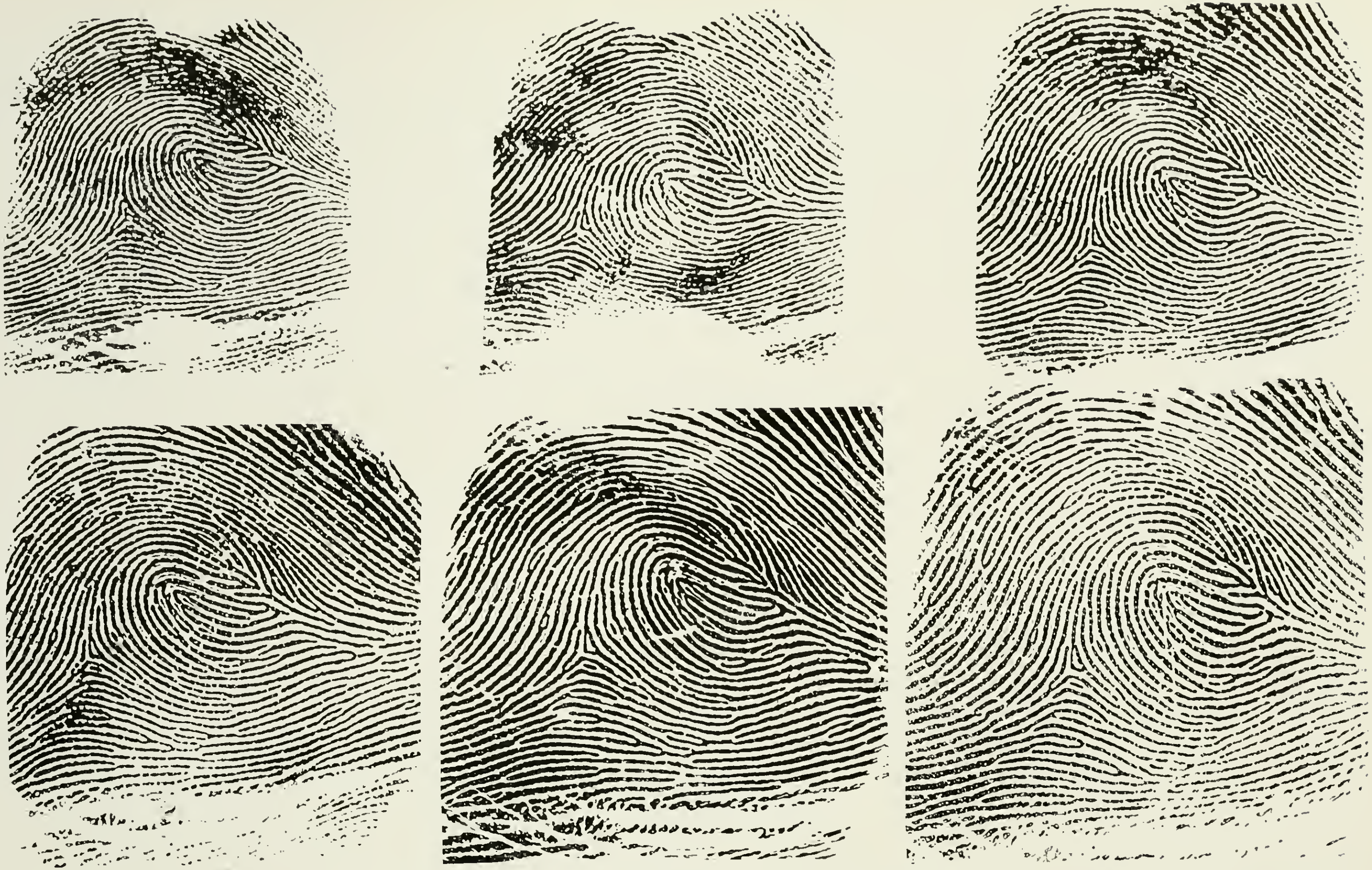
But for a final and conclusive means of



Courtesy of Richard G. Badger

All the designs formed by the ridges on the ends of the fingers can be classified under some one of these four general types. If it is desired to describe a design further than merely calling it a loop or a whorl, it can be done with reference to the "delta" or triangle, shown in the cut by the conjunction of the heavy black lines. The arch has no delta, while the whorl and composite both have two. In the case of the loop, for instance, a count is made of the number of ridges found between the delta and the central ridge of the loop or the "core" (which in this case is three). Consideration is also given to the direction in which the open end of the loop points, whether toward the little finger or toward the thumb side of the hand, known respectively as the ulnar and the radial sides. Then, assuming that the loop in the drawing is from the right hand, it is described as a radial loop with a count of three

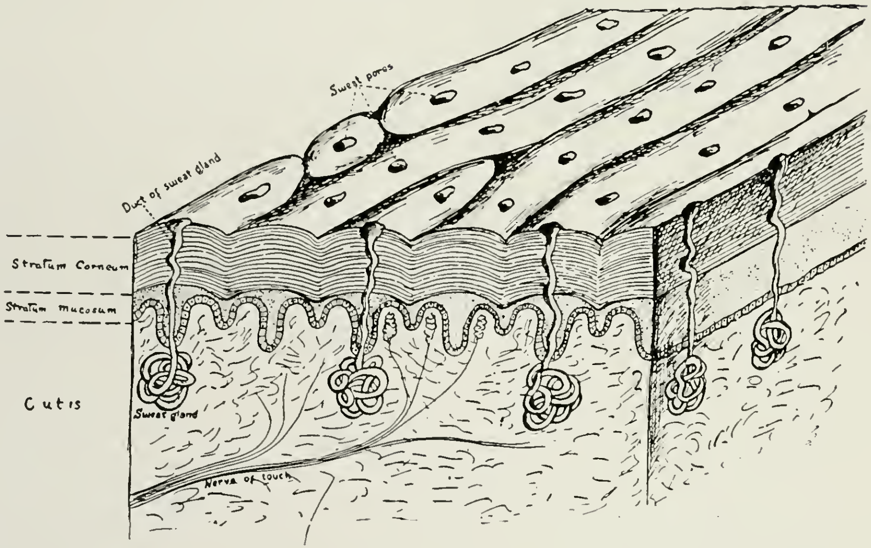
[1] *Personal Identification. Methods for the Identification of Individuals, Living or Dead.* By Harris H. Wilder, Ph.D., Professor of Zoölogy, Smith College, and Bert Wentworth, Former Police Commissioner, Dover, N. H. Published by Richard G. Badger, Boston, Mass. 1918. 374 pages, 150 figures.



Courtesy of Richard G. Badger

AN ILLUSTRATION OF THE PERMANENCE OF THE FINGER PRINT

These six prints are from the right thumb of a little girl and were taken at intervals of about two years from the ages of four to fourteen. They illustrate the absolute permanence of the design throughout ten years of rapid growth. For practical purposes in demonstrating the identity of, or difference between, two prints, use is made of the "Galton details," that is, "forks" formed by the branching of a ridge, "ends," "islands" which are very short ridges with only one sweat pore, and "enclosures" where a ridge branches and promptly unites again. If, in comparing a fragmentary chance impression (such as might be left by a person handling an object) with a known print, twelve points of identity can be made out, it is considered sufficient proof that both impressions were made by the same person



Courtesy of *Richard G. Badger*

FRICTION SKIN OF THE HAND AND FOOT

Diagram showing microscopic structure of the skin of the palms and soles, known as "friction skin." It is composed of two layers, an upper horny layer and a lower mucous layer, both of which are folded into ridges with reference to rows of sweat glands. On the left of the diagram can be seen a short oval ridge with a central sweat pore opening. It is by the fusion of such elementary structures that the ridges are formed. In mammals of orders lower than the apes these ridges are so arranged that they prevent slipping, after the manner of antiskid ridges on automobile tires.

Where identification of persons by means of the designs formed by the friction ridges (see illustration, page 721) is not possible because of the incomplete or fragmentary character of the print, it may sometimes be effected through microscopical comparison of the sweat pores. The impressions of the pores on two similar prints supposed to have been taken from the same person can be compared with reference to their size, form, number to the area, and position on the ridge.

The now famous system of finger printing was put on a scientific basis by Sir Francis Galton who received the first inspiration from Sir William Herschel. Galton's writings on the subject include *Finger Prints* (1892), *Decipherment of Blurred Finger Prints* (1893), and *Finger Print Directories* (1895). Herschel had used the prints in India as a semisuperstitious method of having the natives sign documents, a use which was even known in ceremonials of the ancient Chinese. After Galton had worked out a scientific scheme it was put into actual use by Sir E. R. Henry, of New Scotland Yard, London, at the beginning of the present century.

Courtesy of Richard G. Badger

Photographs from Scotland Yard of three men who so closely resemble one another that they might easily be mistaken for the same person. Their thumb prints, however, show such marked differences that no one would have trouble in identifying these at once as having been made by different individuals. One advantage in the use of finger prints for identification in criminal work is owing to the fact that the friction ridges are formed of sweat pores whose oily secretions keep the fingers sticky, so that whenever a man handles an object his fingers leave an impression, especially as he is likely to require a sufficient use of his sense of touch to preclude his wearing gloves. Sometimes faint imprints are developed by applying powder with a camel's hair brush, black or white according as the impression has been made on a white or dark surface. The powder is then blown off. There is always danger of damaging the impression, however, and efforts are being made to discover some method of staining it with chemical fumes. The certainty of the identification has recommended this method not only to the police for criminal investigation, but also in some instances to banks and to the Government for the army and navy. The authors of *Personal Identification* advocate that a national registration of finger prints be made with the birth or school registration of the entire population

identification the authors find that the use of the configuration of the friction skin (best known in the form of finger printing) alone fulfills all the necessary requirements. If the reader will glance at the palmar surface of the distal joint of the fingers, he will observe that the ridges which make up the skin texture form very definite patterns. In general these patterns may be distinguished as loops, whorls, arches, or composites. In detail there is no limit to the range of variation in these patterns. The loop opening toward the inner side of the hand (ulnar loop) is the most common pattern. It occurs on the right middle finger in 74 per cent of cases. Yet it is overwhelmingly improbable that this pattern, as found on the finger of any one individual, exists in all its details on any other finger at the present time, or has ever been duplicated in history.

The points in favor of this system of identification may be summed up as follows: it is individual and impossible to duplicate in another individual; it is permanent; it is marked in four important and convenient places (hands and feet); it is easy to record and classify; and objects which a man has touched often retain a legible record from which his identity can be established. This system has been in use in criminal courts since 1895, and not a single judicial error can be imputed to it.

Finally much stress is laid on the value of a national identification bureau in which the palm and sole prints of every individual would be recorded. Such records would be invaluable in establishing the identity of individuals having a lapse of memory, lost children, in granting passports, travelers' cards, travelers' checks, identifying pensioners and beneficiaries of various sorts. It would also be valuable in maternity hospitals in identifying babies. In banks it could supplement signatures and prevent forgeries. In the case of illiterates it would eliminate the "mark." Chinese coolies and other undesirable citizens could in this way be detected. The system is already in use by our Government in identifying soldiers and sailors. Famous paintings and other works of art could be so marked that they could not be counterfeited.

The whole subject, which in parts is fairly technical and complicated, is made very clear and decidedly interesting by the numerous incidents taken from the authors' experiences or from records of widely known police courts and police commissioners.

Report on the Work at Aztec

THE season's excavating at the ruined pueblo located at Aztec, New Mexico (continuing last summer's work described in the November JOURNAL by Mr. Earl H. Morris, in charge of the work), began June 16 and continued with but two days' interruption until October 17. Heavy storms twice stopped the work but otherwise the weather was conducive to the very best endeavor. Owing to lack of spring rains and practically no fruit crop, the farmers of the valley would have been obliged to look elsewhere for work had there been no excavating this season, so that an abundance of labor was available and of a quality unusual because of the intelligent personal interest taken by the men. The problem of clearing the rooms successively and restoring the walls as the digging progresses is one requiring the best of planning and execution. The large floor beams firmly imbedded in the walls, when broken by the weight of falling floors and walls from above, have been torn out and the walls twisted and shaken, so that the mason in charge must exercise considerable care that no harm comes to the workers and that the restoration is made as speedily as possible. It required three masons and two helpers each to keep up with the work. The number of men employed easily averaged twenty-five a day and most of the time three teams were kept busy hauling away the rock and earth.

About fifty rooms and three kivas were dug out (emptied) and the diameter of one other kiva determined which is the largest in the pueblo and more than forty-six feet across on the floor level. The last week's work brought to light rooms on the court facing south which were plastered in bands half white and half red, and in one room under the outer layers of white plaster were found incised figures in the harder gray plaster. They resemble the well-known pictographs of the cliff and caves. A satisfactory colored Lumière process picture was made of this wall.

Of the burials uncovered the most interesting is that of an infant on its papoose carrier. Pack rats had removed many of the bones. Over a layer of corn husks, cobs, and other refuse was placed a worn reed mat and upon it another perfect one, the cradle and child being then deposited on the mat near one side. With this were found in perfect condition a small basket, a tiny boot moccasin, the buckskin covering for the head piece, fringed and decorated with horizontal bands of colored porcupine quills, and a bird bone necklace strung on white buckskin. A ceremonial stick and parts of a wooden baby cradle were not far away.

The work at Aztec has progressed so far as to warrant some definite historical conclusions. Pueblo occupation of the vicinity, either continuous or intermittent, lasted through a number of centuries. The great community house came as the culminating architectural achievement of a long period of growth and development, and itself went into partial ruin at least once and perhaps twice, with subsequent repair and reoccupation. The first builders completed the intended size and form of the fortress village and dwelt in it for generations, if one may judge from the bulk of refuse which accumulated during their occupancy, and from the fact that, during this interval, silt and sand raised the country level along the north side three feet above the foundations of the walls. Then, either because of neglect or entire abandonment, many quarters of the structure partly collapsed, filling the lower rooms with débris.

Later, as a result, perhaps, of an increase in resident population, but more probably as a consequence of the migration of clans, the partly fallen walls were repaired, new floor levels were laid, and additions were made to the structure on the court side; that is, the dwelling was made to accommodate a greater number of people than had occupied it at any previous time.

Again, after a lapse of many years, the population dwindled to a mere handful. It seems evident that the few remaining families were conquered by a hostile band or tribe, which went from room to room of the community house, intentionally setting fire to the ceilings. The ensuing conflagration so damaged the stronghold that it was not again reoccupied.—CLARK WISSLER.

Notes

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

Life Members, MESSRS. C. M. GARRISON, MURRY GUGGENHEIM, N. B. HERSLOFF, EDWARD K. LINCOLN, W. A. MARSHALL, CHARLES V. MILLER, HENRY A. MURRAY, JR., and FREDERICK STURGES, JR.

Sustaining Members, MESSRS. WM. R. BEGG, W. A. GRAMER, HARRY L. MARSH, and E. L. MAYER.

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THE American Museum is a beneficiary under the will of the late Mrs. Russell Sage. The amount of this bequest is not as yet definitely known.

ON December 18 a gathering of members and friends of the American Museum in connection with the Red Cross Christmas Roll Call, presided over by Prof. Henry Fairfield Osborn, was addressed by Miss Kathleen Burke of the Scottish Women's Hospital, and Dr. Woods Hutchinson, of New York City. Colonel Burke, for she was recently made colonel of the 138th Field Artillery, in the United States Army, pictured scenes of the suffering in Belgium and France. She brought home to her audience the state of mind of the Allies in Europe, a state of mind that is still unknown to this country in its remoteness from German barbarities and the terrors of war.

Dr. Woods Hutchinson spoke of the work of the medical profession in the war. On account of his position as a sanitarian, the military authorities of the allied armies furnished him with facilities for viewing the medical work of the army in all its phases. The marvelous efficiency of modern surgery is demonstrated by the fact that 92 per cent of all wounded have been saved, while 80 per cent have been returned to the firing line. So skillfully has the surgeon accomplished his task that not more than 4 per cent of the wounded will be crippled. These figures, Dr. Hutchinson pointed out, were the basis of the Germans' conclusion that inasmuch as a doctor, by returning about a thousand men to the front every few weeks, was worth to the Allies a battalion of infantry, the Medical Corps and the Red Cross were a fair target for artillery and aëroplane. At least two thirds of the hospitals Dr. Hutchinson visited had been bombed. He spoke of the work of reconstruction and reëducation in France, a work which has been so marvelously accomplished that three fourths of the crippled soldiers who have been taught new trades are earning more than they did before the war.

THE American Museum will perpetuate the memory of Sergeant Charles Connolly who lost his life in the heavy fighting in France in July, by planting a grove of fruit trees on the Ourcq near Château-Thierry.

THE American Museum of Natural History through the department of public education has prepared eighteen lectures for use by the Young Men's Christian Association in encampments at home and abroad. These consist of stereopticon slides and manuscripts prepared by various explorers. The Museum has mainly borne the expense of the preparation of these lectures. The cost, however, has been materially reduced by the volunteer help of the young women of the department of public education, who have contributed their services in coloring, binding, and captioning the slides of the lecture sets, and also in arranging and captioning about four thousand slides that were presented to the Young Men's Christian Association for war work.

A HOSPITALITY room, or "canteen," for men in uniform has been established by the American Museum of Natural History on the first floor of the building near the main entrance.

THE American Museum War Relief Association has "adopted" two war orphans for the period of one year, through the Belgian Relief Commission for Babies and the Fund for the Fatherless Children of France.

CHRISTOPHER SCHROTH, of the registrar's office in the American Museum, greatly distinguished himself in the fighting of the last few months of the war, receiving eight citations. He has recently been awarded the Croix de Guerre for exceptional bravery in action.

THE annual meeting of the New York Academy of Sciences was held at the American Museum of Natural History on the evening of December 16. The annual address by Professor S. A. Mitchell, of the University of Virginia, was delivered in the auditorium under the auspices of the American Museum, the New York Academy of Sciences, the American Scenic and Historic Preservation Society, and the Institute of Arts and Sciences of Columbia University. Professor Mitchell spoke on the general subject of eclipses. He drew particular attention to the great uncertainty of observation, mentioning instances in which parties had been dispatched half around the world at great expenditure of time and money, only to fail in obtaining any results on account of weather conditions. A feature of the observations made at Baker, Oregon, was the attention paid to portraying the corona. Through the interest of Mr. Edward Dean Adams, the services of the accomplished artist, Mr. Howard Russell Butler, N.A., had been obtained, and a painting was made that portrays the corona better than has ever been done before. The finished painting was exhibited in Memorial Hall of the Museum, together with the sketches on which it was based.

THE American Museum will continue its Second Asiatic Zoölogical Expedition for another year. The first expedition sailed from the United States in March, 1916, and the second in June, 1918, both under the leadership of Mr. Roy C. Andrews, of the department of mammalogy. So far Mr. Andrews has canvassed especially the Chino-Tibetan border and western tropical China as far as Burma. He is at present in Peking and proposes, as soon as the spring weather arrives, to proceed to Urga in northern Mongolia. This town is situated near the junction of two life zones, the Siberian and the Mongolian and Central Asian, and will accordingly make an ideal base camp. In this region Mr. Andrews expects to take moose, elk, wild boar, and other large game. After a four months' stay in northern Mongolia, he hopes to hunt big-horn sheep along the Chino-Mongolian frontier. The species of mountain sheep found here is large, with horns measuring sixty inches. In following out the present program the expedition plans to be back in New York some time in February, 1920.

The Royal Society of London, at its anniversary meeting on November 30, reëlected as president Sir J. J. Thomson, of Trinity College, Cambridge, and professor of physics at the Royal Institution, London.

The British Museum is considering reopening exhibits which have been closed during the war, and placing again in their cases those objects which were of such value as to necessitate their storage in the basement for safe keeping from damage by Zeppelins. One wing of the building is still occupied by government offices.

Professor Henry Fairfield Osborn, president of the American Museum of Natural History, has been awarded the Darwin Medal by the Royal Society of London. The following is quoted from *Science*, December 27: "The Darwin Medal is awarded to Dr. Henry Fairfield Osborn. Dr. Osborn's chief work has been in palæontology, and, in connection with it, he has organized many collecting expeditions to the early Tertiary rocks of the west. One of the results of his work is the more precise determination of the relative ages of the extinct mammals in North America, and that has led to a correlation between the order of succession of the Mammalia in Europe and in America. A good deal of this work was summarized in his book *The Age of Mammals in Europe, Asia and North America*, published in 1910. In 1900 Osborn had come to the conclusion that the common ancestors of Proboscidia, Eirenia and Hyracoidea would be found in Africa; and the correctness of this view has since been confirmed by Dr. [C. W.] Andrews' discoveries in the Egyptian Fayum. Amongst the more important of Osborn's contributions to our knowledge of extinct vertebrata are his memoirs on the rhinoceroses, the horses, the titanotheres and the dinosaurs. In addition to all the work he has done personally, Dr. Osborn has had a wide and most beneficial influence upon biological research in North America, and he has produced a flourishing school of younger vertebrate palæontologists."

On exhibition in the Morgan gem hall of the American Museum is one of the world's finest known examples of gem carving, in the form of a chalcedony figurine eight inches high, "Pas de Danse," by the eminent French artist and stone engraver, M. Tonnelier. This graceful figure is carved out of an unusually perfect block of translucent blue sapphirine, of natural color (not stained), found in Uruguay, South America. It was a gift from the late J. Pierpont Morgan to his lifelong friend, Charles Lanier, who has generously deposited it in the Museum. The artist, M. Tonnelier, is a cripple, having the use of one leg only, and does all his work while seated on the corner of a high stool. He selects his material with the greatest care from the best that can be had anywhere, and never entrusts any part of his task to an assistant, or a pupil, not even the reduction of the rough block to approximate shape. The chalcedony figurine was exhibited in the Paris Salon in 1912.

The Brooklyn Museum has put on exhibition a collection of enlarged photographs of the cathedrals and churches of devastated northern France. The collection of cathedral photographs, from which this group was selected, constitutes one of the most notable works in architectural photography that have ever been attempted. Mr. Wm. H. Goodyear, the Brooklyn Museum's curator of fine arts, has been interested for many years in the architectural refinements, or deviations from rectilinear and strictly perpendicular construction, found in medieval structures. Where reconstruction of the damaged churches of France is to take place these views will be of material assistance, while in the case of those buildings irreparably destroyed, the pictures form a unique and valuable possession.

On the occasion of the twenty-fifth anniversary of the appointment of Dr. Frederick J. V. Skiff as director of the Field Museum of Natural History, Chicago, eighty-six of his colleagues presented him with an engrossed copy of resolutions congratulating him on the successful career which the Museum has enjoyed during his directorship.

There has come to hand a noteworthy volume on *Decorative Textiles* [1] by George Leland Hunter. As an example of good taste in book-making, it leaves little to be desired. Over its 458 pages are spread many wonderful plates of color and numerous remarkable half tones. The author takes up the leading modern textiles used in home decoration such as damasks, brocades, velvets, laces, embroideries, carpets, rugs, tapestries, wall papers, and tooled leathers. Under each will be found a brief statement of the historic evolution resulting in the present forms, a characterization of the techniques by which the textiles may be recognized, followed by a lengthy illustrated account of distinctive type textiles. Special attention is given to prehistoric and primitive textiles and their place in the history of the textile art as a whole. The material for these sections is taken from the American Museum's collection. The publisher is the J. B. Lippincott Company (Philadelphia and London) and the printing was done on the press of the *Good Furniture Magazine*, our one high-class household art publication.

In a recent book [2] from the press of the J. B. Lippincott Company is told the interesting story of the Virgin Islands from the time of their discovery by Columbus in 1493 to the present time. The volume is of particular interest to us since the United States acquired (on March 31, 1917, at a price paid to Denmark of $25,000,000) the important islands of St. Thomas, St. John, and St. Croix, together with a number of adjacent rocky islets, formerly constituting the Danish West Indies. The acquisition of these islands increases the territory of the United States by 138 square miles. Mr. de Booy spent the winter of 1916–1917 in the Virgin Islands engaged in archæological investigations in the interest of the Museum of the American Indian, Heye Foundation, New York City. This expedition and others to various parts of the West Indies which he has conducted in the interest of the same institution have brought him in intimate contact with the people and their home life. As the book owes its origin to the exploration of caves and the excavation of kitchen-middens of the West India Islands, we naturally find in it much information concerning the aborigines. The authors have not confined themselves to objects of interest in the larger towns, as is often the case, but take the reader the length and breadth of the islands. The tourist will find all requisite information; the business man will find something of the activities of the islands that may suggest investment; the spirit of romance that has always hovered over the islands has not been neglected; while accounts of the buccaneers, traditions of Black Beard, Blue Beard, and others are included. The book is profusely illustrated with photographs taken by Mr. de Booy.

In connection with the review in this issue of the Journal of Dr. Wissler's *The American Indian* we note a review of the book and an appreciation of the author's work in the *American Indian Magazine*. This magazine is the official organ of the Society of American Indians. The society is exactly what its name states—an organization of Indians to promote the education and general progress of the race and to assist in defense against incompetency and dilatory politics in the administration of Indian affairs.

The copy containing this review is a special Sioux number. Early in his anthropological work Dr. Wissler went out among the Sioux of South Dakota where he obtained much of the material which now forms in the American Museum the exhibition relating to the Indians of the Plains. A number of Sioux Indians (notably George Sword and Thomas Tyon) actively assisted him in the work, to whom both the Museum and Dr. Wissler are greatly indebted.

The recent fire that swept over several hundred square miles of Minnesota forests, destroying $100,000,000 worth of property and killing more than one thousand persons, is a matter to attract national attention even

[1] *Decorative Textiles.* An illustrated book on coverings for furniture, walls and floors, including damasks, brocades and velvets, tapestries, laces, embroideries, chintzes, cretonnes, drapery and furniture trimmings, wall papers, carpets and rugs, tooled and illuminated leathers. By George Leland Hunter. Published by the J. B. Lippincott Company, Philadelphia and London, and the Dean-Hicks Company, Grand Rapids; pp. 458, illustrations 580, and 27 plates in color. 1918.

[2] *The Virgin Islands, Our New Possessions, and the British Islands.* By Theodoor de Booy and John T. Faris. Published by the J. B. Lippincott Company, pp. 287, 5 maps, and 97 illustrations from photographs.

in these times when we have become accustomed to destruction of life and property on a huge scale. This holocaust was apparently the result of negligence on the part of the state legislature, which cut the forest protection appropriation nearly to the vanishing point. Although the state forester announced the presence of slow bog fires in the northern forests, he was unable to obtain labor for extinguishing them. It is to be hoped that Minnesota public opinion will now force the necessary legislative action to prevent a repetition of such catastrophes —of which the present fire is the third instance (Hinckley 1894, Bandette 1910, Duluth 1918).

A RECENT issue of the *Memoirs* of the American Museum [1] contains a notable series of illustrations of the North American species of the genus *Catocala* or "underwing moths," by Wm. Beutenmüller, with additional plates and explanatory text by Dr. Wm. Barnes, of Decatur, Illinois, and his entomological assistant, Dr. J. McDunnough. This memoir is the most elaborate and beautifully illustrated work of the kind that the Museum has issued, covering, as it does, the work of many years and the services of several entomologists. It contains more than 550 illustrations, of which 381 are colored drawings by Mrs. Beutenmüller. The whole series is for the most part the material for a monograph on these moths left unfinished by Mr. Beutenmüller when he withdrew from his curatorship in the American Museum in January, 1912.

THE war has centered attention on what can be gained by coöperation between the scientific men and the government of a country. A noteworthy instance of the willingness on the part of men in governmental positions to coöperate with men of science was illustrated in the summer of 1918 in the West Indies, when the nineteen instructors and graduate students composing the Barbados-Antigua Expedition of the State University of Iowa were entertained in government buildings and provided with laboratory and field facilities. The scientific results of the expedition will be reported upon by Mr. John B. Henderson, of Washington (Mollusca), Dr. Barton W. Evermann, California Academy of Sciences and Pacific Fisheries Society (reef fishes), Dr. W. K. Fisher, Hopkins Marine Station, Stanford University (Asteroidea and Holothuroidea), and Professor C. C. Nutting, State University of Iowa (Hydroidea and Alcyonaria).

[1] "Illustrations of the North American Species of the Genus *Catocala* by Wm. Beutenmüller, with Additional Plates and Text," by Wm. Barnes, M.D., and J. McDunnough, Ph.D., *Memoirs* of The American Museum of Natural History, New Series, Vol. III, Part 1.

THAT disease has not always been a scourge to animal and plant life, but arose some time during the great Coal Period of the earth's geological history is the opinion of Professor Roy L. Moodie, set forth in a recent number of the *Scientific Monthly*. The evidences for the antiquity of disease are limited to such forms as would leave their marks upon fossilized bones and among these Professor Moodie has found a number of pathological conditions closely resembling those resulting from known maladies. The giant reptilians (dinosaurs, etc.) show tuberculous and tumorous degeneration of the bones; among these monsters disease seems to have reached a climax, for after their extinction its evidences are less prominent until the appearance of mammals. Nothing new with regard to pathological structure has been learned nor was this to be expected, although, inasmuch as we know from the evidence of medieval history that diseases become extinct, further study may reveal infirmities hitherto unknown to science. Furthermore, no light is thrown on what part, if any, disease may have played in the blotting out of species, so that we are left in this important question to fall back entirely on historical analogy.

IN connection with the memorial by Professor Charles P. Berkey in the present number of the JOURNAL (page 705), the Editor wishes to call attention to a portrait of the late Charles R. Van Hise, geologist and president of the University of Wisconsin, in the February, 1918, issue (page 94). The reproduction is from a photograph of the bronze bust by the sculptor, the late C. S. Pietro, which was executed for the University of Wisconsin, and was on view in Memorial Hall of the American Museum for several weeks in the spring of 1918, before being sent to its destination. The bronze well portrays the fine intellectual strength of the man.

The American Forestry Association has inaugurated the plan of planting trees as memorials to our soldiers and sailors who lost their lives in the war. No better monuments to the memory of our fallen heroes could be devised than rows of living trees. The idea is receiving nation-wide commendation, and several specific methods have been suggested, among them the bordering of the great interstate highways. The fact that the now destroyed forests of France are recognized as having saved Paris makes this form of commemoration peculiarly appropriate.

Count Begouen, whose discoveries of prehistoric art objects in the caves of southern France are well known, is reported in *Le Figaro* (quoted by *Science*) as having made some additional explorations with his three sons during the latter's furloughs from the front. This time they discovered a series of painted figures. These paintings are among the most ancient records of human art (30,000 years old?) that have ever been found, and in this last instance include the unusual representations of a lion and the human figure. One particularly remarkable silhouette is that of a powerful, thick-necked man with perfectly human limbs but with a caudal appendage like that of the apes.

About twenty miles south of the great fossil quarry at Agate, Nebraska, there is a peculiar fossil deposit of somewhat later geological age, which has been called the Snake Creek beds. They consist of a series of small pockets in the sand and gravel beds near the surface, full of fossil teeth and bones, mostly fragments, but with many jaws and complete bones and occasional skulls among them. Three-toed horses are the most numerous; many thousands of teeth have been found, hundreds of jaws, and one fairly complete skeleton. A great number of other animals of the Lower Pliocene are represented in the American Museum collections from the pockets, obtained in 1908 and 1916. During this last summer Mr. Albert Thomson has obtained for the Museum an additional collection which includes a few interesting specimens, the best being fine skulls of the long-legged rhinoceros, *Aphelops*, and the rare rodent, *Mylagaulus*. The collection which he has brought back to the Museum will add materially to our knowledge of the mammalian life of the Lower Pliocene.

The American Museum Handbook Series presents to the public a new volume on *Fishes of the Vicinity of New York City*, by Mr. John T. Nichols. In addition to a key and illustrated descriptions of all the local fishes, the book contains an introduction by Dr. William K. Gregory on "The Structure and Mechanism of Fishes." This handbook will appeal not only to local collectors and anglers but also to everyone interested in the natural history of New York City as found both out-of-doors and in the New York Aquarium and the American Museum.

Mr. H. C. Raven, of the Smithsonian Institution, who returned to Washington from the island of Celebes on September 28, has gone to Cornell University to continue his studies. Mr. Raven has collected in the East Indies during the last six years more than four thousand mammals and five thousand birds for the National Museum.

Mr. Roy W. Miner, of the American Museum of Natural History, and his corps of assistants, Messrs. Show Shimotori, Chris E. Olsen, and Herman Mueller, spent six weeks of the summer of 1918 at the Marine Biological Laboratory, Woods Hole, Massachusetts. There, through the courtesy of that institution, they enjoyed facilities otherwise impossible for obtaining data and sketches for a new Museum group. The group will represent, magnified 625 times, an area of the sea bottom which could be covered by a 1⅝ inch magnifying glass. It is designed to show the natural history and methods of life of a number of minute sea animals, those known as the moss animals and their associates, and one of the ascidians (a "sea squirt"), the latter as a representative of forms closely related to the stock from which it is supposed the vertebrates have sprung.

Fish life at the very edge of rocky coasts, both in the tropical or subtropical Atlantic and the north Pacific, is represented in two new minute groups, each $22 \times 13\frac{1}{4}$ inches, lately placed in one of the cases of the fish hall of the American Museum. Small sculpins in the North superficially resemble blennies and gobies of the Tropics, whereas northern and southern blennies are quite unlike. The southern Atlantic group contains brightly colored coral reef fishes, the northern Pacific, viviparous surf fishes.

The Education Act passed by the closing, 1918, parliament of England is in a way an epochal piece of legislation for the United Kingdom. The selection of men for the army has revealed the need for greater attention to the physical well-being of the country's youth so this feature has received special attention. Special provision is also to be made for the physically inferior as it has previously been made for the feebleminded. All fees are abolished and school attendance is made compulsory between the ages of five and fourteen. Although secondary schools are not established by the Act, their growth is encouraged and the central schools are extended, providing for higher studies than those of the elementary schools. The bill is a recognition of the liberal aspects of education and the place that these have in the welfare of the people. A notable feature of the Act is that it places the control of child labor in the hands of the educational authorities so that there is hope that this evil is finally settled.

To quote from *Nature*, November 7, the measure provides "not only for a fairly adequate training in literature and in science, but also for effective, practical instruction for both eye and hand, as well as for the physical health and training of the child, and that at just the period of his life when he is most susceptible of treatment and of the permanent effect of such training. Few Acts have been subjected to so large a measure of public discussion as the Education Act of 1918, or have won so general an approval. Its chief purpose, whilst providing for the general well-being of the childhood of the nation, so vital a matter in present circumstances, is to give full opportunity for those who are naturally gifted to share in the highest educational advantages which the nation can offer. . . . And there is abundant testimony . . . to the wonderful initiative and intelligent grasp of the young men trained in the elementary schools who, in their scores of thousands, joined the national forces in 1914. The crux of the success . . . lies with the teachers, who must now, whatever the cost, alike in respect of payment, prospects, and pensions, be attracted to the most vital and worthy of the national services."

The annual report of the Secretary of Agriculture for 1918 reveals the fact that very satisfactory results have come from the farmers' response to the world's unusual demand for food. Although 1918 is not in every respect a record year for production, it is so far above the 1910–14 average that it stands favorable comparison with the four years that have witnessed intensive war cultivation. While the yield of crops is a result of climatic conditions as well as of industry and acreage, and these conditions were very adverse in 1917 and especially for corn in 1918, the production of cereals during these two years has been exceeded only by the record year of 1915. The acreage planted in cereals, tobacco, and cotton in 1918 exceeds by more than five and a half million the acreage of the record year.

With regard to monetary value, the Secretary estimates that the value of all crops for 1918, together with that of all live stock on farms, is somewhere around $24,700,000,000 as compared with $21,325,000,000 for 1917 and $11,700,000,000, the annual average for the five year period 1910–14. This does not mean that the country's wealth has increased to that extent, but rather that the financial returns to farmers have increased proportionally with those to other producers and their purchasing power has kept pace with the general rise of prices.

Owing to the retirement of Mr. Wallace Goold Levison from the *American Mineralogist*, Dr. Edgar T. Wherry, Bureau of Chemistry, Washington, D.C., will assume the duties of editor-in-chief, with the following associate editors: George F. Kunz, president of the New York Mineralogical Club; Herbert P. Whitlock, American Museum of Natural History; Alexander H. Phillips, Princeton University; Waldemar T. Schaller, U. S. Geological Survey; Edward H. Kraus, University of Michigan; Austin F. Rogers, Leland Stanford Junior University; Thomas L. Walker, University of Toronto, Canada; and Samuel G. Gordon, Academy of Natural Sciences, Philadelphia.

A collection of valuable archæological objects from Oncion, Santo Domingo, has been acquired by the department of anthropology in the American Museum through the gift of Mr. E. J. Valeur, of New York City.

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 1917:

Attendance in Exhibition Halls	786,151
Attendance at Lectures	115,802
Lantern Slides Sent out for Use in Schools	63,111
School Children Reached by Nature Study Collections	1,104,456

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 the JOURNAL. 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.

The various Classes of Membership are as follows:

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

They have the following privileges:

An Annual Pass admitting to the Members' Room
Complimentary tickets admitting to the Members' Room for distribution to their friends
Services of the Instructor for guidance through the Museum
Two course tickets to Spring Lectures
Two course tickets to Autumn Lectures
Current numbers of all Guide Leaflets on request
Current copies of the AMERICAN MUSEUM JOURNAL

Associate Membership

In order that those not living in New York City may associate with the Museum and its work, the class of Associate Members was established in 1916. These Members have the following privileges:

Current issues of the AMERICAN MUSEUM JOURNAL—a popular illustrated magazine of science, travel, exploration, and discovery, published monthly from October to May (eight numbers annually), the volume beginning in January

A complimentary copy of the President's Annual Report, giving a complete list of all Members

An Annual Pass admitting to the Members' Room. This large tower room on the third floor of the building, open every day in the year, is given over exclusively to Members, and is equipped with every comfort for rest, reading, and correspondence

Two complimentary tickets admitting to the Members' Room for distribution by Members to their friends

The services of an Instructor for guidance when visiting the Museum

All classes of Members receive the AMERICAN MUSEUM JOURNAL, which is a magazine issued primarily to keep members in touch with the activities of the Museum as depicted by pen and camera; also to furnish Members with reliable information of the most recent developments in the field of natural science. It takes the reader into every part of the world with great explorers; it contains authoritative and popular articles by men who are actually doing the work of exploration and research, and articles of current interest by men who are distinguished among scientists of the day. It takes the reader behind the scenes in the Museum to see sculptors and preparators modeling some jungle beast or creating a panorama of animal life. It shows how the results of these discoveries and labors are presented to the million public school children through the Museum Extension System. In brief it is a medium for the dissemination of the idea to

which the Museum itself is dedicated—namely, that without deepening appreciation of nature, no people can attain to the highest grades of knowledge and worth.

Publications of the Museum

The Scientific Publications of the Museum comprise the *Memoirs, Bulletin* and *Anthropological Papers,* the *Memoirs* and *Bulletin* edited by Frank E. Lutz, the *Anthropological Papers* by Clark Wissler. These publications cover the field and laboratory researches of the institution.

The Popular Scientific Publications of the Museum comprise the *Handbooks, Leaflets,* and *General Guide,* edited by Frederic A. Lucas, and the JOURNAL, edited by Mary Cynthia Dickerson.

POPULAR SCIENTIFIC PUBLICATIONS[1]

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By Clark Wissler, Ph.D. — Paper, 25 cents; cloth, 50 cents

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By W. D. Matthew, Ph.D. — Price, 25 cents

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VOLUMES II–VIII.—**Anthropology.**

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VOLUMES II, IV, V, VII, VIII, X–XIV, and an ETHNOGRAPHICAL ALBUM form the **Memoirs of the Jesup North Pacific Expedition,** Volumes I–X.

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MONOGRAPHS

A Review of the Primates. By D. G. ELLIOT. 3 volumes.

Hitherto Unpublished Plates of Tertiary Mammals and Permian Vertebrates. By COPE and MATTHEW.

A more detailed list, with prices, of these publications may be had upon application to the Librarian of the Museum.

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TO THE SOLDIER WHO DOES NOT SHRINK FROM DANGER, FROM HARDSHIP, OR FROM BITTER TOI
AND WHO OUT OF THESE WINS THE SPLENDID ULTIMATE TRIUMPH.—*Theodore Roosevelt*