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LETTERS

SIRS:

Your NATURAL HISTORY Magazine has always been of great interest to me.

I have been particularly interested in the articles of Roy L. Abbott. I judge he is a comparatively new contributor as I do not recall seeing his name in years past.

His observations of natural life are presented from the layman's viewpoint which should inspire every motorist of the highway or stroller of the byways with greater interest in our little friends of fur and feathers.

C. H. BUZZELL.

Battle Creek,
Michigan.

* * *

SIRS:

. . . The magazine seems to grow more interesting with each number. We enjoy it.

Mrs. JOHN F. GREGORY.

Millerton, Pa.

* * *

SIRS:

Avidly as I read each issue of the NATURAL HISTORY, may I this time express my especial appreciation for Mr. Barton's "Your Name, Please," in the April number? In point of information, wit and literary style I found it unusually satisfactory. . . .

May I say, too, how much I enjoy your pictures of microscopic life? As a layman I find my brief glimpses into this other world most fascinating.

HELEN A. ASKREN.

University of Michigan,
Ann Arbor.

* * *

SIRS:

Doubtless Dr. R. P. Wodehouse, author of "Weeds, Waste and Hayfever," in your March issue, would be interested to know the following correction to which I take the liberty to call his attention, in the range of the Giant Ragweed in Chart C.

I was engaged last summer by the Board of Health of Meriden, Conn., to stimulate a ragweed elimination campaign and in my investigations I found the Giant Ragweed exceedingly common over much of Connecticut where it was unknown to me prior to entering conservation work in Massachusetts in 1923. Chart C gives its eastern range as the Hudson River Valley, New York State; but it is now rapidly spreading up the Connecticut Valley, growing to great height on the more fertile soil.

In my opinion it is too coarse to be of great value as a humus producer, and effort should be made to control it, particularly along the highways where we cannot expect any transition back to forests in "1999 to 2300," as per illustration in above article, without the death of American civilization expected.

LESTER W. SMITH.

Sarasota, Fla.

DEAR MR. SMITH:

Thank you for your letter of May 8th. I am glad to have you tell me of your experience with the Giant Ragweed in Connecticut. Of course, it occurs much farther east than indicated on the map. In fact, Tall Ragweed is recorded botanically for all of the New England States and Maritime Provinces. But the boundary lines on the map are expected to show only the effective ranges of the plants concerned, as suggested by the title, "Hayfever Pollens." The New England States were entirely omitted from the range of Tall Ragweed, because after traveling over much of Massachusetts, Connecticut and Vermont I failed to find the Tall Ragweed growing in effective quantities in these states.

Of course, I agree with you that the Ragweed is a comparatively poor humus former, though it is much better than nothing. In fact, the main reason for writing the article was to emphasize the fact that soil must be covered and that there is always something better to cover it with than Ragweed.

I do not intend to advocate the withdrawal of soil from any useful purpose, upon which American civilization in the slightest degree depends; such soil does not produce Ragweed. Instead, I wished to point out that the Ragweed phase is transitory and, if left to Nature, will rather quickly pass, but that disturbances of the ground, even including digging, cutting and burning of the Ragweed, tends to perpetuate the Ragweed by maintaining the soil in the only condition in which the weed can long survive.

I wish to thank you for your interest in "Weeds, Waste and Hayfever."

R. P. WODEHOUSE,
Scientific Director
of Hay Fever Laboratory.

The Arlington Chemical Co.,
Yonkers, N. Y.

* * *

"SERPENT" OF CATERPILLARS

Sirs:

In my garden at Caracas, Venezuela, I had a curious encounter, which I think is of sufficient interest to relate:

Early one morning my maid, in great excitement, called me to look out of my window. From where I stood I saw what appeared to be a great, slow-moving gray snake, about fifteen to eighteen feet long, and about five inches wide. Observing that my gardener, an Indian, was standing very near and apparently unafraid and, not being timid myself, I rushed out to see this "serpent." He called it "Gusano" and it proved to be a most perfect formation of migrating caterpillars. At the head was the largest one, and from one end to the other the caterpillars were so closely packed together as to form a solid mass. Their upper bodies were covered with bristling gray hairs, while underneath they were pure vermilion, with round, red suction cups for feet. The mass moved slowly, spinning

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thick, viscous webs on which it crawled—not one worm straying out of the clean-cut line as they billowed along on their fine web carpet toward a great mango tree.

I was instantly disturbed, expecting them to scatter all over the place. But the Indian quietly took up his spade and, starting at one end, rolled them over and over into balls which were held together by the sticky web. He thus gathered a tubful of squirming caterpillars and dumped the lot into a trash fire. So ended the most unique and exciting migration I ever saw.

When I inquired further about them, all the Indians could say was "Gusano," which is the Spanish name for a worm; and that they passed in this way from one mango tree to another.

MARY MOTZ WILLS.

Atlanta, Ga.

This phenomenon, known as *processionary movement*, has been observed in caterpillars in both Europe and Australia, particularly in the family Lasi-

campidae. In the United States a somewhat similar habit is seen in the familiar Tent Caterpillar belonging to the same family: when the caterpillars leave the nest to feed they move along the trunk or branches on well defined trails formed by the silken threads they leave. But these caterpillars do not bunch together to form the spectacular "serpent" formation described above.—ED.

Sirs:

. . . I wish to tender to the editors of *NATURAL HISTORY* my appreciation of their excellent work. I have often wondered if it would not be possible to give to us laymen a wider aspect of animal life by presenting in forthcoming issues a series of articles dealing with the high spots in each of the phyla of the animal kingdom.

WILLIAM B. McILWAINE, III.
Alexandria, Va.



HERRING GULLS FROM LAKE SUPERIOR. These birds aid farmers by disposing of grasshoppers, but in this instance they extended their agricultural supervision to dine on five acres of herring distributed as fertilizer

SIRS:

Have just been enjoying my April number of your most interesting magazine and was particularly interested in the article "In the Life of a Herring Gull," by N. Tinbergen. Was rather surprised that the author did not mention that Herring Gulls were very plentiful on the Great Lakes, especially on Lake Superior, where these birds are, to us, most interesting and we spend a great deal of time observing them. Am enclosing a photograph published recently in our paper here, which I think may be of interest. This farmer has found by experience now that the Lake Superior herring is not very satisfactory as a fertilizer. But these birds, as you probably

know, fly far inland to eat the grasshoppers and are a great aid to farmers in disposing of dread pests. The monument in Salt Lake City to the Gull is fine tribute to their usefulness.*

Thinking you for another fine issue of, I think, the best magazine of its kind published.

J. W. WING.

Duluth Children's Museum,
Duluth, Minn.

*This monument commemorates the work of the gulls which saved the wheat fields of Utah from crickets in 1848. They were either Western Gulls or King-billed Gulls, both of which are closely related to the Herring Gull.

NOTICE—Readers are encouraged to submit their own photographs of natural history subjects. Those selected for publication on this page will be paid for at \$1.00 each, with full credit to the photographer. Return postage must be included.

FIJIAN WOMAN



ONE of a series of life sketches made by Edward Dair while in the South Pacific Islands with the Fahnstock Expedition. This particular subject lives in the village of Ndakunimba (Dakuniba), on Vanua Levu Island in the Fiji Group. She is about 30 years old, has the only straight hair in the village, and is undoubtedly a descendant of the early Tongan invaders.

THE TALL TRUTH

BEAVER UNDER THE ICE

When winter comes in the northern part of this continent, the world of water mammals, like the beaver, is greatly changed. A thick layer of ice seals the ponds, lakes and rivers, often leaving no air space.

Beaver can swim long distances under water; they can go without breathing for about six minutes. But at times this is not enough and the great need of exchanging the carbon dioxide for fresh oxygen must be met.

Sealed in, with no opening near, the beaver breathes out his all under the ice. A large bubble forms between ice and water; in a moment the oxygen is replenished, the carbon dioxide removed (both are essential), by free contact with ice and water. The beaver's nostrils are at the very end of his muzzle and project into the bubble; thus almost all the air can be drawn back into his lungs. He can do this many times and thereby is quite free under the ice.

Other water mammals use this method. In the early winter muskrats can be followed through the clear ice and watched at this trick. Sometimes beating on the ice above the bubble will shatter it, and the muskrat, unable to inhale the small bubbles may be drowned—surely a most undeserved fate for so resourceful an animal.

JOHN ERIC HILL.

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NATURAL HISTORY

The Magazine of the American Museum of Natural History

FREDERICK TRUBEE DAVISON, President

ROY CHAPMAN ANDREWS, Sc.D., Director

VOLUME XLIV—No. 1

★ ★ ★ ★ ★

JUNE, 1939

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HOLD IT:

A remarkably intimate and artistic photograph taken with only a normal six-inch lens, by William D. Campbell on his latest expedition for the AMERICAN MUSEUM OF NATURAL HISTORY



A "LOST" GERMAN COLONY—*Hidden away from the world in the Andean highlands of Venezuela, four generations of pure "Aryan" colonists have maintained their ancestral language and customs in defiance of the encroaching wilderness*

By THOMAS GILLIARD

ALITTLE less tired and we might have evaded those two inviting chairs. As it was we insulated their spotless surface with newspapers from far-off New York, ignoring even headlines, and settled our mud-besmirched bodies into their billowy softness.

For a while we were silent and utterly content with unfamiliar relaxation. I gazed idly at shimmering dots of light which sparkled through the rain-spattered window—the lights of Caracas, the capital of Venezuela, lying out there below us. Imaginatively, I pictured the sight as it would appear a few hours hence when daybreak would softly reveal the luxuriant valley, now but a chasm of blackness between my window in the Phelps mansion and the great Andean Cordillera beyond. I visualized the thousands of red-tiled roofs pricked here and there with an ancient Spanish church spire; the abundant Royal Palms with their teeming bird life and the narrow, one-way streets choked with dark Venezuelan Spaniards and modern automobiles, and quaintly enough with trams bucking the congested traffic. But now the city slumbered, and, as if in keeping with the mood, it seemed that even the beloved Simón Bolívar—the great emancipator of South America—perched high on his bronze stallion, was stealing his forty winks.

Hardly aware of the familiar snore which drifted from Billy Phelps' direction, I imagined the difficulties of Venezuelan exploration a hundred years ago—at a time when there were no trams or automobiles or even statues of the beloved Bolívar. Explorers of that day faced the trials which confronted the swaggering conquistadors and, later, the pioneer settlers in a land rugged and forbidding. Malaria, yellow fever and leprosy, coiled and ready to strike at brave, defenseless men. The ambitions shattered, the lives sacrificed.

Still in that half slumber of fantasy I imagined myself once again high in the Andes at the edge of a picturesque little lake called La Lagunilla. And as if in a dream I walked down the trail to the shambles of a cabin I had seen only that afternoon. There I came upon a big, square-shouldered man an inch or two under six feet. He entered the cabin. As I sat in the shaft of light which flickered out over the cool, green pathway, I watched Jean J. Linden, the pioneer botanist of a century ago, as he carefully examined the plant specimens he had collected. Lifting from the green mass an immense rose-colored orchid, still attached to its bulb, he examined it closely and his stern features were momentarily transformed. His penetrating "fixed from under" stare changed to one of wistful pleasure and keen satisfaction, as he adeptly pressed the gorgeous flower between two fibrous sheets. Sometimes it is hard to understand the values attached by some of us to seemingly immaterial successes. A single flower to that great botanist from half around the world was doubtless as gratifying and significant of achievement as was the first sight of the Pacific to Balboa.

Reflectively—for the moment aware of my place and time—I considered the significance of our own expedition to the summit of the Andes, a trip which had taken us over the same trail that Jean J. Linden had traversed 97 years ago. Like him, we, too, had been moved to select that spot in the cordillera because of a curiosity to inspect the quaint, isolated village high on its back—a village as different from the mass of surrounding country as an oasis is from a desert. And aside from that, we, too, had reaped from the fascinating territory a treasure. Not a chest crammed with jewels and gold but a scientific treasure, one we valued as Linden did his orchid, as a prospector would his new-found lode.

The strange events leading to our unexpected discovery of this unknown bird really began at

IMPORTANT NOTICE TO MEMBERS

NATURAL HISTORY is not published during July and August. Those members, however, who wish to have their September issue sent to a temporary summer address are requested to notify the Membership Secretary, giving the date at which they will return to their permanent address.

La Guaira, Venezuela, in mid-October, 1937. Some weeks previously the American Museum had given me the eagerly anticipated opportunity of acting as agent in Caracas for an expedition which they planned to send into southern Venezuela. Because the Venezuelan officials were so courteous and expedient, the work was accomplished in far less time than had been allotted to it, and I suddenly became aware of the always interesting predicament of "time on hand." My host and benefactor, Mr. William H. Phelps, and his son soon found a remedy, however. And in short order the abundance of time became a crucial scarcity of time.

Our hastily made plans called for a round-trip over the coastal Andes of Venezuela on burros. We would make a zonal collection of birds, mammals, and reptiles extending from the tropic to the subtemperate zone at 8000 feet. Our chief collecting ground would be in the vicinity of Codazzi Peak, among the highest in these mountains, and if a little of that "time on hand" remained, we would climb to the summit of Codazzi! (Perhaps the lure of those soft, billowy chairs in the Phelps' home can now be better appreciated.)

In the space of a few twilight hours the three of us assembled a fairly complete collecting outfit, and by the following dawn were on our way to La Victoria.

Venezuelan sky-way

I am convinced that traveling by car in the mountainous regions of Venezuela is comparable to flying in the states. Many people become sick from the atmospheric changes, the dizzy windings, and the feeling of height. Undulating over one of the most beautiful provinces in Venezuela, we followed Linden's route, but, while he had traveled for two days by burro to reach La Victoria, we covered the distance in a few hours by the fine concrete highway built by General Gomez. Much to my relief the rapidly driven Zephyr finally reached La Victoria at 10:30 a.m. At the time of Linden's visit in 1842 about 3000 persons lived in La Victoria; today the population has increased fivefold and is destined to continue growing, for this is a "hub" town. It lies on the banks of the Río Aragua and serves as a junction for roads which "ray" out to Valencia, San Fernando, and even to the Province of Casanare across the desolate llano lowlands.

After switching our westerly course to a northerly one and our streamlined car for a dependable old antique, slung so high that it appeared to be on stilts, we attacked the excuse for a road which leads to the foot of the Andes. Many fordings of the Río Tigre confronted us with forebodings as we ascended

the valley, leaving behind the plantations of oranges, lemons, mangoes, cocoa, coffee, corn, wheat and indigo, all clustered in the humid lowlands. Luckily, however, at the first impassable crossing of the temperamental little river, we were met by our peon and his three beasts of burden. There, six miles from La Victoria—despite all progress since Linden's time—we found ourselves compelled to drop back to his pace; a pace for which, it soon became evident, the trail had been groomed by a century of wear, and one which was to take us to a town as strange and unaffected by the moods of time as the trail itself.

On the burro trails

At Pie del Serro, a little village of a few adobe houses and one store, the valley ends in a steep canyon. The southern flanks of the Andes slope down to the hitching posts at this store, and plainly etched into their gigantic slopes are the aging switchback burro trails which, from time to time, Mother Nature has abruptly transformed into deep-gullied watercourses. High against the splendid landscape I saw two tiny pack animals picking their way toward us, but unfortunately the prospect of clinging to the top side of a burro for the long climb, coupled with my terrestrial nature, somewhat dimmed the magnificence of the view. There, splashed and contrasted in their rich metallic hues, the Andes rose up and up. They were all I had ever imagined them to be.

Astride our animals we took leave of the amazing congregation of black-brown Latins which had suddenly arrived to inspect us. My friendly little burro seemed to drop back into low gear at the first incline. From then on, no matter how steep the trail became, he just plugged methodically upward. And more important, he quickly and decisively relieved me of the delusion that I was showing him the way!

I soon began to think that mountain burros and ponies, bred and conditioned for this specialized work, were worthy of psychological observation. The necessity for frequent decisions on a narrow, dangerous path quickly instilled not only an absolute sense of confidence but an element of wonder, for the performance seemed indicative of a trifle more than even good horse sense. Jean J. Linden must have felt much as I did, for he wrote, "A European can hardly believe that mules and those that carry packs can traverse the terrible passes with such surefootedness. . . . My admiration and emotion for Colonel Codazzi's achievement was great at the sight of his trail winding over canyons of horrible depth and towering into the sky."

For about two hours and a half we climbed a mountain flank, stretching almost devoid of tropical

vegetation from 800 meters at Pie del Serro to 1960 meters at La Lagunilla. Barren as a grazing field, except for the infrequent canyon shelves crammed with trees and flowers and the impressive, staff-like Century Plants which, near and far, probed the sky, our progress was made in full view of the sharp-eyed forest denizens below; and as if in protest, howling monkeys roared in unison from the luxuriant forest crown which roofed the impenetrable gorges.

The flora changes abruptly just beyond La Lagunilla—"little lagoon"—where Linden procured many types of plants and where still stands the cabin in which he spent the night suffering from rancid smoke, vermin and a temperature of 5° C. above zero. For the remainder of the way to the "lost colony," the trail tunnels into a thick, sub-tropical rain forest, the crown of which averages about 100 feet high. This forest, as thick and as impervious to man as the densest Central American jungle, supports a wealth of indigenous treasures ranging from mountain palms to orchids. Previous to our remarkable find, perhaps the most unusual living thing to be discovered within its bounds was the unique orchid collected first by Linden and later named *Masdevallia tozarenensis* after the colony by Professor Reichenbach, the noted orchidologist and Director of the Hamburg Botanical Garden.

Deep in the forest, just before the 7500-foot height of land is reached, all the abandoned trails join in one old byway. There, in accordance with a strange history, it showed vividly the wear of almost a century. Pioneered by Colonel Codazzi even before the advent of the little colony he strove so hard to establish, it stands as a pathetic tribute to the ambitions of Aryan men, who, under the influence of promises abroad, deserted the Black Forest of Germany to take on a new life—a pathetic life, in that the treacherous Codazzi trail is still their only means of communication with the outside world.

Almost a century ago

The first mention of the colony appears in governmental records. On November 26, 1841, the politically prominent Count of Tovar and the engineer and patriot Colonel Codazzi, both keenly ambitious to see the natural resources of their country developed, obtained a grant from the Venezuelan government of from 40,000 to 60,000 pesos, contingent upon the establishment of a colony of 70 families. Count Martin Tovar acted as bondsman for the Colonel, who had just returned from Europe where he had interviewed a likely group of from 70 to 80 families, consisting of carpenters, weavers, cobblers, masons, tailors and lime-burners in addition to a doctor and a

priest. In the course of events the Colonel was further charged with and successfully executed the momentous tasks of picking a location, opening a permanent trail, and supervising the construction of the village.

He chose an unpopulated niche on the ridge of the coastal cordillera, accessible to both the humid valley of Caracas and the Caribbean Sea. This section, with an abundance of water, a vast supply of lumber and fertile lands capable of supporting a wide variety of plants in addition to the usual crops of an equinoctial agriculture, is said to have a climate analogous to the best in Europe.

Unfortunately, with the passing of the Count and the Colonel, the individuals who migrated were practically forgotten. They clung desperately to the new environment and in true pioneer fashion set up a rather rough but productive colony, named after Count Martin Tovar, "Colonia Tovar."

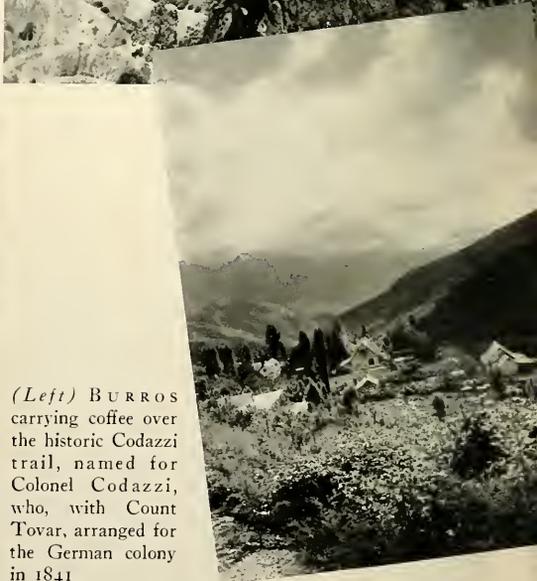
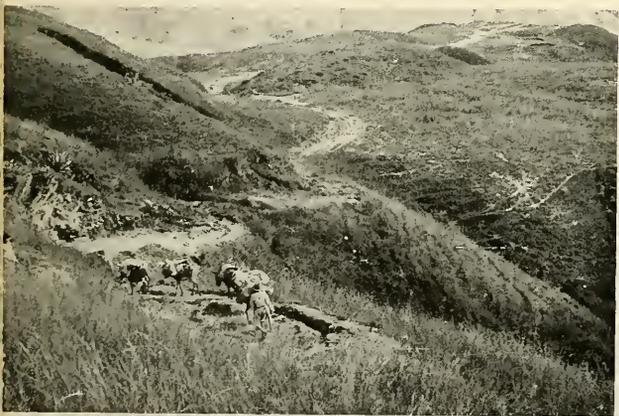
Race kept pure

Whatever hardships they suffered, they were governed by two laws. As our expedition approached the colony, the sight of two beautiful, blond-haired children astride burros gave living proof of the first law. This colony remains as pure as the day it landed, despite the association of transient peons for four generations.

Though probably not defined as such, the second law nevertheless is characterized by their isolation policy. The margins of their world seem limited by the actual boundaries of their land grant; for, while no longer completely self-sufficient, it appears that for a great part of their lives they have been so.

Perhaps the most vivid product of this isolation is to be seen in the general architecture of the village. Homes, both old and new, are totally different in design from the simple mud-floored, adobe huts so typical of Venezuela. Immediate requirements have presented problems, and building materials like those of southwestern Germany have been scarce, but the settlers have clung to the architectural style of their mother country. The half-timbered façades of the houses, reminiscent of old Germany, give the traveler the curious illusion of coming upon a postage-stamp principality of Middle Europe right here in the midst of the Andean forests. But instead of plaster being used between the timbers, adobe fills the spaces, a substitute made of mud and dried fibers. The roofs of the older homes, covered with split hardwood shingles, are sometimes surmounted with quaint German cupolas. It is regrettable, though an understandable reaction to the excessive rainfall, that of late these picturesque homes, otherwise so pleasingly

GOAL of the Phelps Venezuelan expedition was a collection of common birds living in the upper ranges of the coastal Andes, but it was the incidental "discovery" of two unique phenomena that made of the venture an unforgettable experience. The rarity of the first, a bird, was not established until months later when it was certified as the initial specimen of a new race. The second, a quaint German village flourishing amid the Andes, staggered the imagination at sight. Traveling by motor, the party swirled over the modern concrete Gomez highway (right) often gazing down into yawning 5000-foot gorges. Later, they mounted burros who plodded the lonely Codazzi trail (below) unchanged since its creation 100 years ago



(Left) BURROS carrying coffee over the historic Codazzi trail, named for Colonel Codazzi who, with Count Tovar, arranged for the German colony in 1841

(Above) THE "LOST" GERMAN COLONY, Colonia Tovar, as it first appeared to the expedition: a slice of southwestern Germany grafted on the Andes. Here the climate closely approximates that of Middle Europe and the colonists thrived. But with the passing of founder Tovar, they were almost forgotten and have lived in comparative isolation through four generations. (Left) William H. Phelps on a collecting foray near Colonia Tovar



THE REAL ARTICLE AND THE REPLICA. At left is an actual German village showing the startling similarity between the South American colony and its cultural source, in architecture, lay-out and even foliage. The typical building of Colonia Tovar (*left, below*) exhibits the half-timbered construction which makes the village appear so out of place in the midst of the Venezuelan Andes. Adobe plastering satisfactorily takes the place of the usual mortar and illustrates the craftsmen's persistence in adapting local materials to their traditional structural and artistic modes. The chalet-type porch, perhaps more reminiscent of Swiss architecture than German, is a conspicuous curiosity in this part of the world

Above, from Das Deutsche Dorf, by Heinrich Rebensburg



PERHAPS MOST ENGAGING of all the importations were the majestically towering poplars, (at right and also in German village at top of page). Curious is the fact that these trees are not native to Germany: Napoleon brought them from Lombardy. But the poplars found favor in their new home even though only males existed and propagation had to be performed with shoots from the adult trees



(*Below*) YESTERDAY AND TODAY: Colonia Tovar portrayed in an oil landscape painted in 1844 (*left*), and as author Gilliard photographed it from the same vantage point (*right*). The isolation of the Tovarians has been so complete and their racial pride so strong that the fourth generation remains as pure and blonde as its ancestors. Here the folkways of the Germany of happier times have been caught out of time and space

Painting by F. Bellerman from Bulletin Sociedad Venezolana



built exclusively from the meager materials at hand, are being roofed with galvanized iron.

To me, familiar with mass production and the endless variety of conveniences it offers, the culture and craftsmanship these people have been able to maintain in their limited surroundings was doubly impressive. In my room, for example, the beautifully morticed window frames seemed a product of mill work, but I knew that everything had been wrought by hand. And so it was with the church and its furnishings, the meeting house, and even the interesting cemetery.

Peaceful in the past

Aware of all the disturbing elements in our Europe of today, it seems to me that of the Tovarians' peaceful simplicity one might philosophize: Their thriving poplars and soft-spoken language are significant of a love for a country no longer existent. The outstanding feature of Colonia Tovar is the abundance of tall poplars which were lovingly conveyed by the immigrants over the brutal trails leading from their native Black Forest. So thoroughly do these trees complete the scene that one of my European friends, upon seeing a photograph of Colonia Tovar, mistook it for a German village. "That photograph," said he, "could have been taken in Hessen, Franconia or in Western Thuringia." And much more to my amazement he added, "Those poplars have an interesting history, even back in Germany. They are all males and can be propagated only by planting shoots. You see, they are not native to Germany. They are the descendants of a few sprigs which were brought from Italy by Napoleon between 1805 and 1812."

Today there is a little school at the colony, and the storekeeper has a radio and a home lighting plant of doubtful quality. Indeed some of the comforts of our civilization are encroaching on the simplicity of their existence, and Venezuela seems once again to be aware of these people. Shortly before our visit, a high government official, Señor Víctor López, inspected the colony; and earlier an adventuresome German baroness came, who, in contrast, was captivated by the simple beauty and peacefulness and has made it her permanent home. A telegraph system, put in at great cost to the leading merchant, is wrecked; hardly a single span of wire remains intact. The trail, a difficult and dangerous one at best and a furious water gully during much of the rainy season, remains the only means of communication. It compels an isolation more pronounced than that of many of our oceanic islands. There is fervent talk among the residents of a road the government may build, but, having seen the engineering difficulties involved, it does

not seem likely, at least from the direction of Pie del Serro.

Unfortunately, I had little chance to observe their homes and crafts; we had a prodigious task ahead of us and wasted no time getting started. Trap lines were set out and bird collecting began at once. That we were collecting mice, birds and insects was immediately responsible for our being placed in a class with aquarium penguins. The Tovarians could see no conceivable reason for our foolishness, but they were quick to take advantage of our insanity when a coin was seen to change hands over a bird which had been intended as a gift. From then on we knew no peace, and finally when taxidermic art had been swamped, an order was issued to concentrate on the "not-so-easily-obtained" ground birds.

It was our conviction when we gave this order that there were probably more undiscovered birds among this group than any other. Especially because they are of a type which are decisively governed in their wanderings by altitudinal limits and, therefore, cling to particular belts or regions almost as permanently as plants often do. This Andean coast range has been cut off from the main Andean range for eons of years by a hot valley; therefore we considered it within the bounds of possibility that we might find some distinctive birds in the Tovar woods—birds which might have developed along special lines in isolation subsequent to the intervention of the barrier valley.

An unknown bird

Even with twenty or more native collectors concentrating their unusual skill on these elusive birds, the volume decreased alarmingly. However, a number of fascinating specimens were obtained, and finally, on our last day, our method of attack seemed to bear fruit when a chap by the name of Florencio Ruthman, a happy-go-lucky fellow about sixteen years old who seemed to be the outstanding Huck Finn of Colonia Tovar, presented to Bill Phelps a long-legged ant-bird of strange proportions. Bill's observation of the outlandish feathered creature, like that of the majority of the Tovar residents and mine as well, was "I've never seen anything like it." A statement which, considered in the light of the 19,000 species of birds that have been discovered by man, was not altogether surprising.

Pondering over the matter I finally closed shop at 11 p.m. and before turning in recorded the following in my diary under heading of November 11, 1937. "Made 48 skins today, bringing the total to more than 330. This afternoon a bird was brought in for which I'd trade the whole lot. . . . It may be a *Gral-laria*, though Mrs. Sturgis' handbook on the Birds

of Panama says of the family Formicariidae to which this genus belongs, 'They range in size from that of a thrush down to that of a small wren or warbler.'—Our bird is as large as a quail!"

On the following day the strenuous return to Caracas was accomplished. Our seven-day collecting trip had been a success, Codazzi Peak had been climbed, and a brief two-day descent to El Limón in the tropical zone on the Caribbean side of the Andes had resulted in adding many new species to our collection.

In reflection, the rapid-fire occurrences of the past week, influenced by a haze of fatigue and relaxation, seemed ages past. It seemed questionable that my first



THE "MYSTERY BIRD"

A giant Ant Bird, found in the isolated mountains of Tovar, racially different from its nearest known relatives

South American expedition, one I'd looked forward to during half a dozen years of apprenticeship, could be over. Calculatively I considered the results: Had we done a good job? Would the specimens destined for the American Museum meet its high standards; and, for the hundredth time, what about that strange

bird? Should I rush it Air Mail to Doctor Chapman as Bill had suggested? The balancing and re-balancing of evidence, both pro and con, which had occupied my thoughts during most of the difficult descent from the colony eventually passed with me into a fitful dream—a dream in which I witnessed the withering expressions of disgust on the faces of the eminent scientists at the world's greatest ornithological center as they opened my Air Mail box and found a bird no rarer than a starling. If, instead of lapsing into that nightmare, I had wandered down into the backstreets of Caracas and employed the services of a capable crystal gazer, I might have saved myself a lot of grief. She might have told me to send the bird and to be patient. As it was, I sent the bird and remained decidedly impatient.

After twelve days with no answer I embarked on another venture destined to lead us beyond the last mail tributary. Isolated thus for two months beyond the reach of even a word of condolence from Dr. Frank M. Chapman, the fun my companions had with me is painful to recall—the insignificant remarks poked at my "Air Mail" bird, or, as some were wont to call it, "the dud." Indeed "*Grallaria gilliardi*," the scientific name applied by Bill Phelps, became camp folklore. However, their day of reckoning finally came when in mid-January, 1938, a mail plane arrived with the following long-to-be-treasured letter from our chief, Doctor Chapman.

After exactly fourteen days we have succeeded in getting your *Grallaria* through the Customs and, for the first time, I now see it here on my desk. It is apparently *Grallaria excelsa*, described by Berlepsch in 1893 from Mentaña Arica-gua on the south slope of the Mérida Andes. Elevation is not stated but probably in the sub-tropical zone. Your bird being from, I assume, the northern slope of the Caribbean Andes may have come from a more humid region, and only direct comparison of specimens would tell us whether the two are separate. But, in any event, I have your bird in my hands, at least the second known specimen of its species and the only one to exist in the American museums. I think that this is honor enough for practically the first shot.

In addition to the Berlepsch skin mentioned by Doctor Chapman, Doctor Todd of the Carnegie Museum has six skins of *G. excelsa* recently collected in the Mérida Andes. These from the Central Cordillera, when compared with our skin from the Coast or Caribbean range, show marked racial differences, all of which means that my bird is the first known specimen of a new race of birds. Mr. Phelps, present at the time this was determined—Doctor Chapman tells me—insisted that the new bird be given the name of the supposed "dud."

Doctor Chapman, however, has given me the greater privilege of describing the new bird and naming it *Grallaria excelsa phelpsi** after my friend.

*American Museum Novitates, No. 1016, February 20, 1939.

IN AN AFRICAN VOLCANO—*A thrilling climb through hail and storm to a monstrous cauldron of fire and molten rock just below the equator*

By MARTIN BIRNBAUM

KIVU, to a Belgian, means the most beautiful lake in Africa, if not in the world. Situated about two degrees south of the equator, between Lakes Edward and Tanganyika, its picturesque coastline and the loveliness of the many islands which stud its surface are sufficient reasons for such enthusiasm. Its waters are discharged into the River Ruzizi which feeds Tanganyika, and it lies on the boundary line between the Belgian Congo and the kingdom of Ruanda, now a Belgian protectorate, nominally ruled by Rudahigiwa, the hospitable young king of his race of giant Watussis.

We had to cross Kivu's placid waters, after leaving the attractive town of Costermansville, in order to reach the Mfumbiro volcanoes, made famous by the illustrious American explorer Carl Akeley, whose ashes rest on the lonely slopes of Mt. Mikeno. The whole region forms a divide for the great water systems of the Nile and Congo Rivers.

Scenic beauty

The little steamer which carried us north was clean and comfortable; and if black, half-clad Banyarunda longshoremen had not been handling the freight, we might have imagined ourselves on a lake in the Adirondacks. Before proceeding farther north, we made a stop of a few hours at the tiny port of Kibuyé on the Ruanda shore to pick up our huge motor car, the weight of which almost broke the runway constructed for the purpose of getting it on board. This gave us time to stretch our legs and wander up the low hills and along the lake, to enjoy the simple pastoral scenes around us. There were women and children bathing, boys tending their magnificent long-horned Ankole cattle, and small processions of Watussi chiefs and their entourages, proud in their gleaming togas of decorated white silk, their fantastic fashion of dressing their hair adding to their incredible stature and superb, regal bearing. They had come from afar to pay their tribute to the local Belgian tax collector, and when this business was concluded my friend Karl Wertz had an exciting time making pastel portraits of them, for which they obligingly posed.

On board, there was too much noise to allow anyone to sleep. The third class native passengers overran all the decks, and before seven in the morning we were on the road to Goma and its surprisingly good Hotel des Vulcans. It is built only a few minutes' walk from the lake front and within sight of the cones of volcanoes, soaring through the blue haze, one of which we hoped to climb. While negotiations for a safari and climbing equipment were in progress, I strolled through eucalyptus groves along the low, rocky shore, admiring the wonderful butterflies, the swift red darning-needles, and large azure lizards darting among the rocks. There were lovely mallows covered with yellowish blossoms whose cups were Madeira-colored, and above all shone the distant African skyline of billowy clouds, piled up in great clusters and allowing a glimpse now and then of the inviting peaks.

A native market

A short run across the boundary line of Ruanda brought us into the pretty town of Kisenyi, on the outskirts of which the natives were busy in a marketplace. Many of them belonged to the Wahutu (or Bahutu) tribes and had rowed across the mirror surface of Kivu in their long dugouts. The women, wearing bracelets of endless coils of copper wire around their ankles, arms and necks, bargained with Hindu merchants for cheap cotton goods and foodstuffs. The married mothers were distinguished by wearing a headdress of a band of beads. Some had a line of small metal or wooden plugs inserted into the lobes and rims of their ears. One child had its entire torso covered with incisions, but its mother would not permit me to make a drawing, nor could I find out the purpose of this strange scarification. Having found that the young serving boys at the Hotel des Vulcans (who came from Messisi) were not marked in any way, I was surprised to find this-child and other interesting examples of "tattooage," among the market people, and I busied myself making notes of the designs, while Wertz made studies of the Watussi noblemen to whom the kind and efficient administrator, Monsieur Schmidt, had introduced us.

At our hotel, we were told that twenty-odd men

would be needed to carry our equipment and supplies for the ascent of Nyamlagira*, the most rewarding of the flaming peaks in the region. Besides, we would have the cook and his assistants from the hotel. Five Europeans made up our party, and none of us had made any special preparations, for we were advised that there was no real danger attached to the expedition. No mountaineering skill was required. It was to be merely a question of endurance, and everybody seemed to forget that long, uninterrupted, daily motor rides were the worst possible training for our coming ordeal.

On Nyamlagira's slopes

The quiet of cool dawn still lay upon the mountain's slopes when a car took us to the heavily wooded base of the volcano, where the safari was already waiting. Soon the file of men, each one carrying a part of our bedding, food and other needs, disappeared into the jungle on the ascending trail, only wide enough for one person. They wore almost no clothing and many were barefooted. When we began the ascent, this seemed quite sensible, for cool grass covered the path, but very soon we began to slip over the moist pieces of sharp volcanic rocks and flounder in small, hidden, muddy pools, or trip over tough, protruding roots.

In spite, however, of these fatiguing exertions, the first part of our climb was pleasant and simple enough. The forest enclosing us was in no way menacing. None of the terrors of the Balinese palmetto jungle or the mystery of the great Cambodian woods, where the snake-like roots of the bastard banyan bar the intruder, were present. Nor was there the note of sadness and mourning which strikes the visitor to the Everglades, in which the suffocating trees are festooned with hanging mosses. Here, the sun's rays often pierced the verdant gloom of climbing plants and branches, and we heard the call of unseen birds. So many mountain climbers had penetrated these wilds on Nyamlagira's slopes, that gorillas had long since abandoned them for the remoter and more inaccessible heights and recesses. Moreover, had we by some strange chance been faced by this giant primate, the Belgian government had strictly and firmly warned us against making any attempt to hunt or photograph it.

When night began to fall, we had reached a rest house built near a pool of stagnant water, which was often visited by herds of wild elephants, to judge by their spoor. Whether this small sheet of water filled an extinct, minor crater, I was unable to determine. No remarkable incident had thus far broken the mo-

*Spelled Nyamuragira on a recent Belgian map.

notony of the climb, and our sole reward was a clear sky illumined and painted a fiery rose for a great distance by the flames in the crater, which was itself invisible, although we were well up on the slope. The prospect of seeing it now served to convert my joy into passion. A strange excitement came over me. I could hardly sleep and before retiring I kept admiring the streaks of more intense color which would flash like swift blushes through the glow. Then, too, there was a perfect crescent moon and a dark horizon sown with stars, all seen through the mystery of great towering branches. I had, however, no foretaste of the prodigious paroxysm of Nature which I was to witness on the morrow, although I had seen Vesuvius, Stromboli, Etna, Mount Batoe on Bali, and some of the Hawaiian and Javanese volcanoes.

Grottoes in the lava

We started the main climb before the hot shafts of the sun had penetrated the forest, and soon I began to wonder how the bare soles of our carriers' feet were faring. The sharp volcanic fragments were cutting our shoes to pieces, and we were shedding our clothes, handing them over to a solitary black boy who remained behind the rest of the safari to help us in case of need. In all, we had to reach a point about ten thousand feet above sea level, but as we had started from a plateau some four thousand feet high, our self-imposed task did not seem formidable. The occasional small clearings on our trail showed that all the rock was volcanic. Ancient eruptions, after rapidly cooling to form a crust on the surface, would now and then create long caverns, hollows and tunnels, where the liquid lava flow underneath had disappeared. These grottoes and passages would be filled by maiden-hair and other ferns, like those in the much larger and grander hollows on the sides of Hawaiian volcanoes, but we had come unprepared to explore caves and had no way of ascertaining their size. We had to content ourselves with admiring the exquisite vegetation near the entrance. There were vines of sweet-smelling jasmine, pink convulvulus, patches of ladies' slippers, orchids, monk's-hood, and especially a profusion of magnificent spikes of yellow and orange red-hot poker plant. The strange, prehistoric-looking flora common at this altitude on other African volcanoes and on the higher, non-volcanic "Mountains of the Moon," did not seem to flourish here.

Animals, if any, had, of course, been frightened away by the safari ahead of us, but when we reached a clearing near the tree line, affording a fine view of the jungle-covered plateau below us, we saw a slowly moving grey patch which proved to be a large herd



(Above) DAYBREAK ON KIVU, considered by Belgians the most beautiful lake in Africa. Here began the author's expedition to the Mfumbiro volcanoes



(Above) WAHUTU NATIVES beaching their dugout on the shores of Lake Kivu near the pretty town of Kisenyi, where the climbers recruited porters

(Below) THE COUNTRY Carl Akeley loved best: the Mfumbiro volcanoes. From foreground terrain the great naturalist collected his magnificent gorilla group for the American Museum. To the base of smoldering Nyamtagira (in background) the author's party proceeded by motor, whence only shank's mare could carry them to the top



From a painting by W. R. Leigh; AMNH Photo



(Above) WATUSSI CHIEFS and their servants arrived from distant regions to deliver tribute to the Belgian government. Paying "income" taxes appears to be quite an event in Africa. The chiefs are decked out for the occasion in gleaming togas of decorated silk, fantastic coiffures adding to their already gigantic height

PHOTOS BY
MARTIN BIRNBAUM.

(Below) STARTING UP THE TRAIL: most of the 20-odd carriers needed on the safari are already thrashing through the forest. Gorillas no longer inhabit these lower slopes, but by nightfall the party reached a water hole frequented by herds of wild elephants



(Below) BEYOND THE TREE-LINE, where the author and his companion, separated from the main safari, emerged from jungle heat to find the temperature dropping rapidly and a storm brewing. Torrential rain changed to pelting hail, which threatened attainment of the summit





(Left) REUNITED at the rest house on Nyamlagira's summit, the party set about visiting the rumbling craters, thrilled by the cauldrons of molten rock and whistling "safety valves" which hurled forth liquid lava

(Right) AT THE EDGE OF THE INNER CRATER, the author (second from left) faces the camera with friends. Overwhelmed by the satanic beauty of the scene, he writes: "These . . . regions . . . are the despair of the seeker after verity, for you lose your power of concentration and of focusing the mind. If only a single true fragment of the tumultuous whirling spectacle filters into the written description it is fortunate"



(Right and below) CLOSE UPS of the inner crater, wherein gases exploded with terrific detonations. The scene resembled some imaginary lunar crater come alive. Great inky waves of corded lava were swept pell-mell in every direction, filling every available part of the vast pit. When night fell the spectacle became infinitely grander, with dozens of blinding cauldrons visible for each one seen during the day. Huge flames plunged and reared and not only was the lava bed a sheet of dazzling crimson but the banks of clouds above the spectators reflected the field of glowing light. The author ventures a guess that a perfected color film may some day succeed in recording all this harmonious grandeur where words and brush have failed.

His hope, however, is that should this come about, men will not rely on vicarious experiences alone but "will still hazard their health and lives to follow such clues of science, adventure and romance"



of elephants, browsing in safety. In the meanwhile, Nyamlagira, while not absolutely conquering us, was slowly but surely exhausting our energies. The pieces of broken lava became sharper and large enough to endanger our ankles. A heavy dew had made every inch slippery, and rubber-soled shoes were ridiculous and dangerous footwear. We were following the treacherous bed of a narrow, partly hidden mountain stream, and I found myself over and over again in deep black mud. The grind had to be suffered hour after hour, and what sounded like the half-mocking piping of some bird was not exactly encouraging.

Equatorial hail storm

When we reached the tree line, Madame G— had hardly strength to continue. Here the course of the stream, made by the life-killing lava, was more and more difficult to follow, for it had cooled into grotesque pillows of stone over which we crawled on our hands and knees. Soused sweaters and even undershirts had long since been discarded in the hot, lower altitude; and now suddenly, without the slightest warning, we were almost overwhelmed by cold winds, followed by a hurricane and torrential rainstorm, which quickly turned to pelting hail. Visibility was for a few moments almost nil, for the driving gusts of water and ice pellets were as blinding and completely oblitative as a thick fog.

The safari, with the nimbler members of our party, had left us far behind. Only the black boy and I were there to help the intrepid lady who had insisted on accompanying us, and although I was in no serious difficulty, I almost despaired of reaching our goal without an accident. Drenched and shivering, we were obliged to leap, stagger, and scramble over troublesome clefts, formed by an ancient avalanche of immense volume, frozen and consolidated after its escape from the cone. Repeatedly we sat down on the hail-covered rocks to recover our forces. I went slowly on ahead, and at last my shout of triumph told my brave companion that I was on the rim of the summit, that the rest house and our safari were in sight below me, and that the fantastic spectacle which greeted my eyes more than repaid us for the struggle.

We were on the edge of a precipice which formed a high wall surrounding the crater. Into this we descended to a flat sulphurous plain, sparsely covered with vegetation, and here the wooden resthouse had been built. The immediate foreground was a scene of desolation and desert waste, with a few yellow composite flowering weeds struggling to live among the sulphurous fumes and burnt cinders or scoriae, reminding me of the Solfatara near Posilippo (south of

Naples) which I had often visited. A path across the level surface led to a much lower, second jagged wall enclosing the main active crater, filled to the very edge with hot lava streams and innumerable exploding zones.

Walking on the crater floor

When the relentless rain ceased and the drifting clouds lifted, we threaded our way with the help of a guide across this flat crust, avoiding the larger smoking fissures. The floor was so thin and hollow underneath that it seemed to quiver as we advanced with faltering steps, and secretly we prayed that no renewed outburst at some weak point would engulf us. Even this portion of the barren plain had an awe-inspiring, sinister, satanic beauty, the background of which was a bank of opaque threatening clouds. Proximity to these dangerous, disquieting forces had a sobering influence on our little party; and on arriving at the main pit, we were thrilled by the everlasting rumbling, the hissing and sizzling cauldrons in which liquid fire was seething and boiling.

It is difficult to be scientifically reticent while attempting to describe it. Even the most faithful picture drawn and the most carefully chosen phrases will seem exaggerated; and it was tantalizing to stand there spellbound, separated from extinction or eternity by only one false step, realizing that one could convey only the mildest suggestion of the truth. These are indeed the regions which are the despair of the seeker after verity, for you lose your power of concentration, and of focusing the mind. If only a single true fragment of the tumultuous, whirling spectacle filters into the written description it is fortunate. Countless details which make it all so startling are sure to be omitted, and the most laborious slave of truth might sit here futilely forever and strive in vain, with his most impassioned words, to make an accurate record. Only Divinity can weld such a weird mass—enormous in conception, perpetually in movement and aflame—into a fierce but harmonious grandeur. Perhaps a perfected color cinema camera will succeed where clumsy words or brush fail. Let us hope, however, that even when such inventions are commonplace, men, dissatisfied with trivialities and the monotony of civilized life, will still hazard their health and lives to follow such clues of science, adventure and romance.

Before us now were natural chimneys out of which gases escaped and exploded with terrific bombardments, cones or safety valves which whistled like huge blowpipes and from which molten lava was hurled. After projection, this formed smaller cones or ran back into steaming fissures. At some distance away

from us, near the corner, stood a high, motionless, black, rocky hill with stark glens and dales of its own, partly screening what was beyond it from our view; and the scene resembled some imaginary lunar crater but livid and active, instead of white and frozen. Great inky waves of corded lava had been swept pell-mell in every direction, filling every available part of the vast pit, and turned almost to hard stone at our very feet. Even at the margin this current of magma was too hot to walk upon, and quite near us its slow movement was almost visible.

Nature's fireworks

When night fell, it was all infinitely grander. The stupendous sublimity increased a thousand-fold, and was more menacing, more Dantesque and terrifying. A glimpse of it made you fairly reel with wonder. Now there were dozens of blinding cauldrons for each one visible by day, and the gigantic tongues of flame plunged and reared, danced and raced in mad confusion. Explosions of emanating gases succeeded one another with rapidity, and not only was the bed of lava a sheet of living, dazzling crimson, but the banks of clouds above us reflected the field of glowing light. The abyss was charged to the very brink with incredible, tameless forces. Rocks and melted minerals were thrown into the air, to fall in a rain of masses or drops of liquid flame, like the fireworks of demons. Even the finest crevices were transformed into filaments of flickering incandescent light.

I wondered whether the already snoring black carriers could have told me tales of superstition, similar to the Hawaiian legends, relating to the fiery spirits who ruled and haunted Nyamlagira's subterranean world. Although I had little difficulty in winning their confidence, I had no way of questioning them intelligently, and it would have been better to be quite alone, free from the verbose commonplaces of my European companions, while witnessing this unearthly splendor.

Here in this primal region where imagination could soar and nameless yearnings in life shaped themselves in concrete form, one could well believe oneself on the fiery periphery of the universe. It was a moment of cosmic consciousness such as Beethoven's grandest symphonies might arouse in us. Mother Earth was no longer a mere pagan myth but a living entity whose pulses one could feel. What was the meaning of this fugitive echo as of thunder, like the call of mysterious voices? Were the angry, hovering gods of the mountain threatening to tear Nyamlagira asunder? Thoughts were racing through my mind and the presence of my companions intruded on these hours of enchantment with a definitely unwelcome air. But

our dusky guide would not permit us to wander off by ourselves, and we had to be content merely to stand on the perilous edge, bewildered and uneasy, rooted to the spot, marveling at this ominous, one might say, cruel and monstrous beauty.

The following morning was cold, shrouded and misty. We postponed our descent in vain, hoping that it would clear and we might catch distant glimpses of other volcanoes. There is an eastern group which includes Karisimbi, the highest of these peaks (14,683 feet). Near it are Muhavura, the crater of which is now a lake, and Mount Mikeno, Akeley's last resting place. These are often covered with snow, and are all higher than Nyamlagira. This latter and Kirunga Cha-gongo* are the principal volcanoes in the western group. Whether any of them are more interesting, pictorially or scientifically, than the mountain we had climbed, I have no way of knowing. The whole region is studded with less important extinct peaks, and when we explored the deep lake in one of these craters, our raft was almost upset by a family of hippos which had made this particular pool their home.

The descent

The descent of Nyamlagira was almost more wearisome and trying than the climb, and now there was no reward for our aching senses except a well-earned rest after our peep into the blazing pandemonium of the primal world. Not having been really prepared for our venture, our muscles were stiff and swollen, and water blisters covered our toes. When we reached the jungle the sun was high, and again we removed almost every shred of clothing from our bodies. The natives, childlike and inoffensive, bore their heavy burdens more patiently than we did our light ones, lumbering uncomplainingly ahead of us with an atmosphere of power and at noon calmly drinking the water of the mountain pool in which they had just bathed and cooled their sweating bodies. All of them seemed good-natured and they took excellent care of us. Only once did I find them quarreling among themselves, and that was after some of them were assigned particularly heavy loads to carry.

When we reached the main road we found the cars and the rest of our party waiting. It took us only a short time to distribute *pourboires* among the black boys and soon we were gliding smoothly along on a fine road, past great coffee plantations, toward our next stopping place, the famous Albert National Park, which as everyone knows is the vast wild animal reservation which Akeley's enthusiasm and vision had helped to create.

*Otherwise called Nyiragongo.

ON THE THRESHOLD



PIPES OF PEACE



SEEING NATURE
through the
CAMERA'S EYE

By HENRY B. KANE

BEAUTY AND THE BEAST





GUEST
OF THE
BIRCHES



STUDY
IN
CONTRAST

DRAGON FLY



QUEEN OF FLOWERS—*The romantic history of the rose and the rôle it has played in the poetry, architecture and folklore of many nations.*

By HARRIET GEITHMANN

IN the literature of the world, both poetry and prose, as well as in religion and art, no flower has climbed to more dazzling heights than the rose. Ever since the "Father of History," Herodotus himself, in the fifth century B. C., chanted the praises of the fragrant Cabbage Rose, the (*Rosa centifolia*), and his Athenian countrymen crowned the rose the "Queen of Flowers," it has been beloved of men and women the world around. Horace, Ovid and Virgil and other Latin poets placed the rose upon a pedestal as an emblem of beauty. In fact all nations except China and Japan have paid tribute to the "Queen of Flowers" ever since the dawn of the Christian Era.

Rose festivals

In the early days of the glory that was Persia's, Persian rose gardens won great renown. Every year Persia celebrated with the "feast of the roses," an ancient ceremony that reminds one of the carnival of roses which is an annual festival observed by several of the modern cities in the United States such as Portland, Oregon, and Pasadena, California. In fact, festivals of roses are annual events among all the civilized nations of the world. Even today in Italy it is a national custom in the month of May to decorate both tables and orators with roses. The streets of ancient Rome were carpeted with rose petals for the duration of revelry in honor of Bacchus and for triumphant processions. Cleopatra had her dining salon covered with a carpet of living roses at least a foot thick, and even the tyrannical Nero spent fabulous sums on the roses with which he honored his banquet guests. In this connection it is highly interesting to note that both the Romans and Greeks employed the perfume of the rose as a cure which took the place of Byron's "sermons and soda water the day after." The people were taught by their poets to "refresh the brain with sweet roses and drive away vapours from thence."

In the village of Salency, France, the people have observed a festival of roses for ages, having begun the custom in the sixth century. Until the end of the sixteenth century, members of the French Parlia-

ment, noblemen and cardinals honored the "Queen of Flowers." In April, May and June every year, gentlemen of rank decorated both the spacious hall and crowned the members of Parliament with roses. Today, when France dedicates any of her lovely roses to individuals it is considered one of the highest of social tributes.

Attar of roses

Thanks to the favorite wife of one of India's richest rajahs, so tradition tells us, we are acquainted with the precious attar of roses. Seeking to please her august lord and master, this fair lady commanded her attendants to fill the palace bath to the brim with rose-water. Later when tiny drops of oil collected and glistened in the sunlight on the surface of the pool, they were carefully skimmed off by the attendants of the bath, who naturally concluded that the water was thus more or less impure. With the bursting of the drops of oil in this process of skimming, their delectable odor or attar of roses was thus discovered quite by accident. Persia, too, has handed down a legend relative to the discovery of the oil of roses. In this we learn that the Princess Nur-Djihan, who was almost as rich as Croesus, requested on her wedding day that all the fountains in the palace gardens should be filled with rose-water instead of ordinary water. At that time rose-water meant water in which roses had been boiled, a water of great value. While sauntering in the gardens with her young prince she was attracted to the opalescent globules of oil of roses which were floating on the water. Upon examination she found to her delight that they were concentrated perfume, which she promptly named in honor of her husband, Attah Djihan-Gir. This explains the origin of the English word attar or perfume of flowers, especially the perfume of the damask rose. Regarding rose-water, it is interesting to note that before rose oil was thus discovered the Persian Ibu Khaldun had to pay an annual tribute of 30,000 bottles of rose-water into the treasury of Bagdad during the reign of Caliph Mamoun in the 10th century.

In today's celebrated Valley of Roses, eighty miles long and from one to ten miles wide, which basks in the sun at the foot of the Balkan Mountains, the

precious attar of roses is produced by the peasant growers of roses, with an average annual output of 10,000 pounds. The fact that it requires 2000 pounds of red roses or over 3000 pounds of white roses to produce one pound of rose oil, tells the story of peasant labor in the rose gardens that stretch in all directions in this valley that lies between the Balkan Mountains and the Sredna Gora range. Here the air is fairly saturated with the fragrance of roses. The little Turkish town of Karlovo, nestling at the foot of the Balkan Mountains, the center of all this culture of roses, lives, moves and has its being in an atmosphere of perfume. Here the roses are harvested before sunrise because their perfume is sweeter just before they begin to open. Quite naturally the bulk of Karlovo's famous attar of roses travels to France and from thence to milady's boudoir the planet around.

From the shadow of the Pyramids of Egypt comes the phrase "a bed of roses," where indeed certain pampered people of rank and position were actually in the habit of sleeping on mattresses filled with petals of roses. This practice was also known among the Grecian citizens of the ancient Greek city of Sybaris in southern Italy. One of these luxury-loving mortals is reported to have complained of resting poorly because a rose petal had crumpled up into a hard ball, more the pity.

A forbidden crown

In Rome and certain Grecian cities where roses were used for chaplets and garlands of honor, woe to the sorry individual who dared to use such a chaplet without the august sanction of the law. One such was sentenced to sixteen years in prison and another was thrown into chains because he ventured to crown himself with roses which he had filched from a marble statue.

During England's War of the Roses, a thirty-year conflict between the House of Lancaster and the House of York in 1455-85, the men of the House of Lancaster wore red roses while the men of the House of York wore white ones as a badge of distinction. When Henry VII of Lancaster married Elizabeth of York the War of the Roses came to an amiable end.

Roses have figured in legends and in superstitions of mankind since the dawn of history. The red rose, we are told, originated when Venus pierced her foot with a thorn, and the white rose when she shed bitter tears over the thorny accident. Another fantastic

myth reports the origin of roses as simultaneous with that of the goddess of beauty. When the waves brought Venus into shore they also brought seeds of roses which soon rooted, budded, bloomed and perfumed the first air that ever Venus breathed. Still another legend tells us that all roses were primarily white and that they became red and fragrant when Cupid spilled a cup of nectar over them. When Venus was indiscreet in her affairs of the heart, Cupid presented the god of silence with a rose to bribe him into complete secrecy in order that the fair name of Venus might be protected. Doubtless from this legend came the phrase of secrecy, "sub rosa" or "under the rose." Carrying out this same thought in early times, men carved the rose in the ceilings of their dining-rooms to indicate that dinner conversations were "sub rosa" or strictly confidential. The Germans continued the custom and in 1526 the rose was placed over confessionals as a symbolic reminder of the secrecy inherent in this sacrament. In Egypt the rose was also considered the emblem of secrecy. Even shields, coats of arms and coins were thus decorated and the entire field of architecture was influenced by the "Queen of Flowers."

The name of the "Queen of Flowers" comes from the Latin word *rosa*. While its original name means red, the rose of today is represented by every color under the sun with the exception of blue and purple, and now and then one discovers an individual that almost captures those two colors.

As for thorns, we learn from the poetry of the East that the original rose had no thorns, but with the birth of Arimana, the god of evil, the rose developed what the world calls thorns. This same thought is carried out in religious articles which tell us that rose bushes became covered with thorns when the people became corrupted.

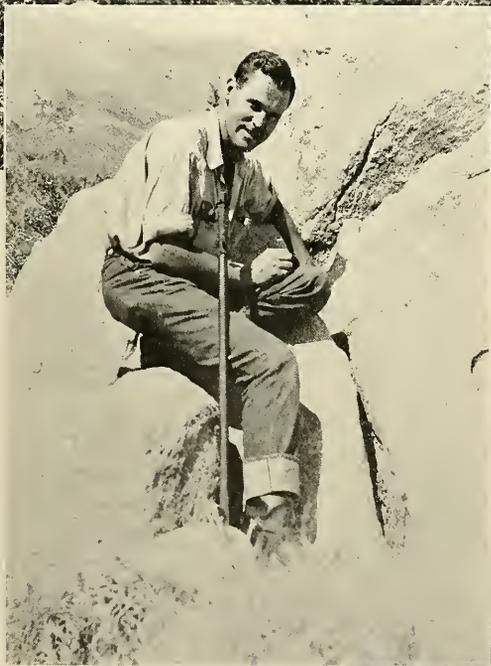
Favorite of nations

All of which is illuminating, relative to one of the most popular of flower families, information that throws many a true light and many a new light on the character of the rose, plebeian or patrician. With such a colorful history, centuries long, is it any wonder that England has adopted the rose as its national flower, and that men, women and children in over forty states in the Union at the last nation-wide contest conducted by the American Nature Association selected the simple rose wilding as the national floral emblem of these United States?



R. B. Cowles photo

(Above) EXHIBITING a climatic cross-section of North America from Mexico to Canada on its 10,805-foot slopes, Mount San Jacinto and the adjacent Colorado Desert provide biologists with an ideal field for the study of animal and plant distributions. Camping here with electrical equipment to measure changes in the bodily heat of reptiles, Raymond B. Cowles and C. M. Bogert gleaned new information about heat toleration in the class of animals popularly regarded as the world's champion sun-baskers



L. Little photo

(Right) WHERE REPTILES chose their own temperature in "burrows" as proved by electrical recordings. Lacking our mechanism for controlling blood heat, rattlesnakes chose with thermometer accuracy

R. B. Cowles photo

(Left) THE COLLECTOR needs a strong crowbar to extricate a Chuck-walla, a lizard that seeks safety in crevices, from heat as well as from enemies



REPTILES UNDER THE SUN — Popularly regarded as the world's most hardened sun-baskers, recent investigations show that most desert reptiles succumb in a matter of minutes to temperatures which man finds only moderately uncomfortable

By C. M. BOGERT

Assistant Curator, Herpetology,
American Museum

WHETHER man lives in the Arctic regions or in the tropics his normal temperature is 98.6 degrees Fahrenheit, and similar body temperatures between 95 and 111 degrees are characteristic of most mammals and birds. Nevertheless there undoubtedly was a time in the evolution of these animals when they could not maintain fairly constant temperatures. Possibly some 175 million years ago in the early Mesozoic Era when the brain case was becoming larger in the mammal-like reptiles, possibly much later, centers arose in the brain which control their mechanisms for maintaining heat in the body.

This evolutionary change probably came about gradually in the mammals and the birds, indeed the existing sloth and primitive duckbill are essentially "cold-blooded," and many hibernating mammals have temperatures far below 100. Be that as it may, temperature regulation in the higher mammals gave them an infinite advantage over the reptiles, which were and are today forced to rely upon solar heat for bodily warmth so essential to their activity.

Perhaps the presence of warm-blooded creatures was one factor contributing to the downfall of the great Triceratops, the Tyrannosaurus, and the other so-called Ruling Reptiles that preceded the mammals and at one time dominated the earth. At any rate, the birds and mammals with their mechanism for regulation of bodily heat found new vistas and new environments open to them. The reptiles, although having given rise to these higher groups, were left to struggle along and to evolve species with means of surviving in rigorous climates. Plainly they were at a disadvantage with mammals and birds as competitors in a changing world.

Yet reptiles have survived, becoming a diversified stock represented by approximately 6000 surviving species, still forced to maintain their principal stronghold in the tropics, but with at least one representative penetrating the Arctic Circle. It is highly interesting to see how the reptiles have overcome what is probably their greatest handicap, and to learn how they survive, even far away from the tropics.

Suppose we consider the saurians first. The lizards may sit in the sun, as most of us have observed, permitting the heat rays of sunlight to warm their bodies. Most of them are highly perfected sun-bathers pro-

HEAT MEANS DEATH TO THESE

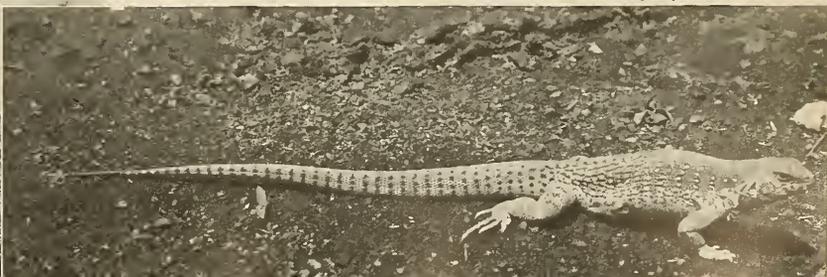
CONTRARY TO POPULAR IMPRESSION, most desert snakes and lizards cannot long endure intense heat. A man can easily survive a sun that will quickly kill a Desert Diamond-back Rattler (*below*), known to die in 9 minutes with the air at 96° and the sand 132°. More susceptible is the Granite Night Lizard (*right*), which dares not venture forth by day. Released in the shade, it scampered into the sun, stopped abruptly, opened its mouth, and succumbed almost immediately

AMNH Photo by Bierwert



REPRESENTATIVE of the hardier reptiles tested, the Desert Iguana (*below*) endured reasonably hot sun for 20 min.

C. M. Bogert photos



vided with a means of regulating their absorption of heat. Although color changes in lizards and chameleons sometimes serve the purpose of concealment, frequently the change from dark to light is merely a response to increased heat. Inversely, many lizards become much darker, some of them nearly black, when they are cold.

Like donning white linens

A Collared Lizard in the Coconino Plateau of northern Arizona may be light-colored during the heat of midday, the most conspicuous color on the body being light green with lighter spots and bars. A few hours later a hail storm may cause the temperature of the air to drop suddenly, and the entire body of the lizard will turn black as slate, with only faint traces of lighter pattern showing through. The minute pigment cells in the skin known as melanophores, which were nearly contracted when the lizard was in the sun before the hail storm, have expanded and obscured the green. If the lizard is now exposed again to the sun, it will absorb heat rapidly, gradually becoming lighter and greener as the heat penetrates. When its temperature has reached a point corresponding roughly to that in mammals and birds it becomes light-colored and reflects part of the heat. In other words, pigment cells accomplish nearly the same thing for the lizard that we achieve by putting on our white linens on warm days.

In popular accounts lizards and snakes are commonly described as "basking in the sun." Indeed, in wooded areas such as those of the Atlantic States and in the mountains, reptiles do bask. Competent writers make similar observations in deserts. Bertram Thomas in *Arabia Felix* tells of a lizard that scorns refuge from the heat of day in the Arabian Desert and "delights to sit on the most glaring prominences in the face of the tropical sun toward which it nods its head." In our Mojave and Colorado Deserts, Chuckwallas are seen on the rocks "too hot for the hands to touch."

However, the lizard cannot reflect all the heat of sunlight on a hot day. Even a mirror gradually becomes warm if left in direct sunrays, and obviously it is a more efficient reflector of heat than the whitest shade a lizard can assume. During the day, when temperatures may rise to 120 degrees, when even jack-rabbits seek the shade and man perspires so freely that he must drink more and more water to keep his cooling system functioning, how do the lizards manage to survive?

With the thought of gathering some information that might supply an answer to that question, I joined Dr. Raymond B. Cowles on the Colorado Desert in

California during the spring of 1938. Camp was established near Indian Wells on the western edge of the desert in the shade provided by a dense clump of mesquite. At this site we had both the San Jacinto Mountains and a vast expanse of sand dunes near at hand. From within the immediate region it was possible to secure reptiles of several kinds: rock-dwelling species living in the foothills and canyons, sand-loving forms in the dunes, as well as those which prefer to live in open country where the pungent creosote bush provides sparse shade.

Prior to my arrival Doctor Cowles had constructed several cages in a clearing alongside the camp. These cages were provided with artificial "burrows" consisting of sections of clay pipe buried in the ground where the captured reptiles could seek shelter at will. Since these pipes sloped downward, the air at the bottom was much cooler than the air at the surface. In addition to the ordinary laboratory thermometers, we had a device known as a thermocouple, which records temperatures almost instantly. In this instrument recordings result from electricity produced by the direct action of heat applied to two dissimilar metal wires joined at their extremities. The thermocouple gives more accurate readings than the thermometer, which requires several seconds to record any considerable change.

Competition from Roadrunners

With our desert "laboratory" established we had the problem of securing a sufficient number of live specimens with which to begin experiments. Unfortunately it proved to be a chilly spring with intermittent hot days, and reptiles were not exposing themselves in their usual numbers. To add to the difficulties we found ourselves competing with a family of lizard-eating birds, Roadrunners (*Geococcyx*), which not only reduced the local reptile population but found our cages to be one of the most fruitful places in which to do their hunting!

Doctor Cowles will gather many more data before his studies are completed. However, some rather astonishing observations were made that will give us some idea of the reptile's ability to exist in a desert where the temperature may fall well below the freezing point in the winter, whereas in the summer the ground surface temperature not uncommonly rises to 145 degrees. Let us see what happened in our desert laboratory, once we had assembled enough lizards and had discouraged that roadrunner family.

We chose a day when the shade temperature was nearly 100, and the sand temperature in the sun beyond the shelter was 135 degrees. First we selected

a Granite Night Lizard, a species that has a flattened body enabling it to seek shelter in narrow crevices from which it ventures only after dusk. The lizard was liberated in the shade. Instantly it fled from us, scampered into the sun where it stopped abruptly, opened its mouth and succumbed almost immediately. Such astounding susceptibility was undoubtedly due in part to the nature of its pigment cells, which are controlled by factors in addition to temperature in this species. Here was one readily understandable reason for its adherence to nocturnal habits.

Next we used some canyon-dwelling lizards, specimens we had taken the day before on the boulders and trees of the warm foothills. Exposing them to the sun with their bellies on the heated sand we watched the seconds go by. Within not quite two minutes a Rock Uta was breathing rapidly; it opened its mouth, attempted to move, but through impairment of its nervous system this already was impossible. In less than two minutes it was paralyzed. Hurriedly we removed it from the sun and found its temperature recorded by the thermocouple to be just over 100 degrees. A Granite Scaly Lizard seemed to absorb heat even more rapidly and showed extreme discomfort and finally paralysis in even less time.

117° fatal

With larger lizards, the Chuckwalla and the Desert Iguana, slightly different results were obtained. We found that these lizards could remain in the sun for periods up to fifteen or twenty minutes without obvious signs of discomfort. Whether this is due to greater bulk, thicker skin, or to better heat reflectors in their pigments, it is difficult to say at present. The rise in temperature was considerably slower in light-colored species, such as the Fringe-footed Sand Lizard and in the Desert Zebra-tailed Lizard. But in every case when the temperature reached 117 degrees the saurian succumbed.

Thus it became apparent that each species observed abroad in daytime was to some extent equipped to protect itself from the heat, but there was a very definite maximum heat that could be tolerated; beyond that death invariably ensued. By noon or a little later most lizards had vanished from the surface, seeking shelter in crevices or in burrows. On the desert during summer, the best time to look for lizards is the morning. Should the weather be "hot," no lizard remains exposed for long.

In the foothills I spent most of one forenoon watching a Chuckwalla on a rocky slope. Cautiously the lizard emerged from a crevice and paused for a few minutes, apparently to warm himself. Then he retired to a sanctum among the boulders. Soon he

emerged again, hurriedly bit off the heads of some yellow flowers and again sought shelter. For hours I watched, as back and forth across an exposed rock-surface this large lizard ambled, snatching a bit of food and retiring, but never remaining in the open for more than five minutes at a time. This was the solution to his cooling problem! When he became too warm, he was forced to seek the shade until he regained a comfortable temperature.

How they survive

Undoubtedly many other lizards are forced to adopt similar means of keeping their temperatures within a safe range. True, one sees them basking, but few observers ever pause long enough to determine just how long it is possible for them to remain in direct sunlight on a summer day in the desert. For the most part the habits of individual species are dependent upon the extent to which they can withstand heat. Lizards living in canyons go about their business of catching insects mostly in the shade. Consequently they need not be able to reflect as much heat as their relatives living on the open desert or among the dunes. The Gila Monster feeds voraciously upon birds' eggs during spring, and stores sufficient energy as fat in its tail so that it may be able to remain dormant in the cool depths of a burrow during the heat of summer. The little Banded Gecko and the Granite Night Lizard have evolved cat-like eyes for vision in dim light and have solved the problem in a different fashion. In addition to storing energy as fat they hide themselves in cool places during the day and come forth to seek food only at night. By similar means most desert snakes have avoided the excessive heat, for as we shall see many of them are burrowers that come to the surface after sundown.

With rare exceptions serpents, for some strange reason, have never evolved an adequate means of changing color. They have similar pigmentary cells in their skins, but unlike their saurian relatives, snakes are unable to undergo extensive changes from light to dark. Perhaps this is one reason why nearly all snakes in the desert forage chiefly at night.

There is one notable exception in the Southwest, where the slender, swift-moving Red Racer is frequently seen prowling at midday. Having learned this we liberated a freshly captured specimen in the middle of a large, dry lake-bed in order to determine how long the snake could remain in the open. On the caked surface of this old lake-bed there were no holes in which the snake might seek shelter. It was a moderately cool day for August on the desert. In the shade the temperature was only 104 degrees, but

HOW THEY BEAT THE HEAT

Unequipped to regulate their bodily heat as can the warm-blooded animals, these reptiles of the American Southwest show curious ways of avoiding death under the sun

Compiled for NATURAL HISTORY MAGAZINE

By C. M. BOGERT

*Assistant Curator, Herpetology,
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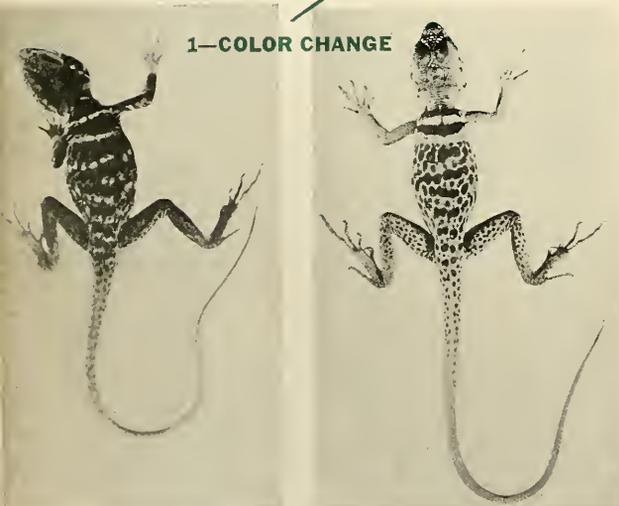
For man to live in a temperature hotter than his normal 98.6° may be unpleasant but it is not dangerous, for his automatic control mechanism holds his temperature almost exactly constant. Similarly most other warm-blooded animals (birds and mammals) have a characteristic temperature somewhere between 95° and 111°. Not so with the reptiles. Survivors of an evolutionary stage when this control mechanism had not been developed, these cold-blooded animals are as a rule far more susceptible to temperature extremes. Those shown here, inhabiting hot, arid regions, have solved their crucial heat problem in various startling ways

1 THE SAME LIZARD in cold and hot weather: a color change equivalent to the donning of white linen in summer. When cold, the body of the Collared Lizard of northern Arizona is as black as slate, with only faint traces of lighter pattern showing through. Under the hot sun, however, the dark cells (melanophores) which cause this, contract, leaving light green as the dominant color on the body, with lighter spots and bars. Since light colors better reflect the heat, the lizard thus tends to maintain a lower body temperature in direct sunlight

2 A THICK TAIL filled with fat accumulated during spring by the voracious eating of birds' eggs, enables the Gila Monster to survive the heat of summer without having to venture forth from his cool burrow in search of food. Ability to go long without eating is one advantage reptiles have in being cold-blooded, for they expend less nourishment in keeping the body warm. Warm-blooded animals which hibernate conserve stored fat in a fashion similar to that of the Gila Monster when he estivates—the summer equivalent

3 AN EXAMPLE of the survival of the swiftest: the Red Racer, which perhaps moves faster from one patch of shade to the next than any other Southwestern serpent. Its need for swift locomotion was demonstrated when a specimen liberated in the sun under test conditions raced only 86 yards in its effort to find shade before it was overcome by the heat. This 5-foot serpent is our only desert snake that dares venture out during the summer day, and in spite of its speed it must find the next shelter in about 3 minutes or turn back

1—COLOR CHANGE



*S. R. Atsatt photos, Courtesy
University of California Press*

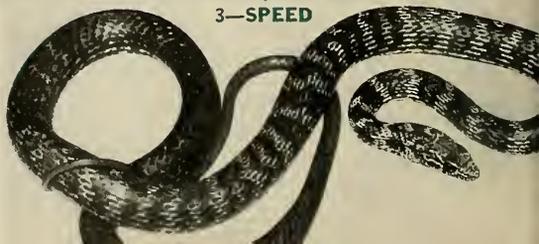
M. Zacuto photo

2—FOOD STORAGE



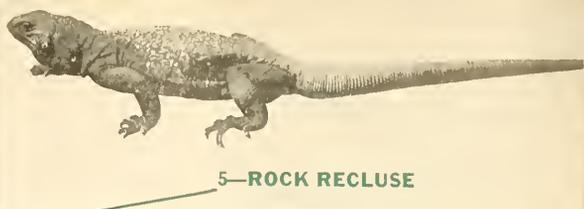
C. M. Bogert photo

3—SPEED





4—EARTH TUNNELER



5—ROCK RECLUSE

4 A REPTILE in spite of its worm-like appearance, the Silvery Footless Lizard perishes almost immediately if it is put in the sun. About a foot in length and as thick as a lead pencil, this saurian avoids the heat by burrowing in loose earth, where it feeds on small insect larvae. It no longer shows any external signs of limbs, which indeed would be only a handicap in the subterranean life it has chosen in its effort to escape the heat



6—NIGHT EYES

5 THE CHUCK-WALLA, second in size only to the Gila Monster, can stay in the sun for as long as 20 minutes, but must then seek shelter in rock crevices, which are an indispensable element in its desert habitat. It is a harmless lizard about 18 inches long, with vegetarian propensities.



7—SAND "DIVER"

6 THE LITTLE BANDED GECKO avoids the heat by hiding itself in cool places during the day and coming forth to seek food only at night. To aid it in the latter pursuits it has developed large, cat-like eyes

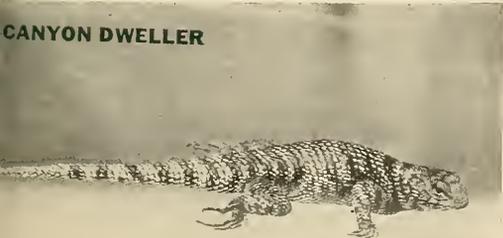
7 A LOWER JAW that fits into the upper enables the Fringe-footed Sand Lizard to "dive" into the sand and "swim" beneath it, thus escaping the rising heat of midday



8—TEMPERATURE "EYE"

8 RATTLESNAKES, if abroad at all during the day, spend most of their time coiled in the shade, away from the heat that is fatal to them. Hence they must do most of their hunting at night. To aid them in this, they possess a pair of pit-like heat receptors (indicated on Red Diamond Rattler). These are so sensitive as to enable the snake not only to detect the presence of a warm-blooded animal but to strike with precision in complete darkness, as has been shown by Dr. G. Kingsley Noble in the experimental laboratories of the American Museum

All photos this page by C. M. Bogert



CANYON DWELLER

9 THE GRANITE SCALY LIZARD avoids hot sun, which will paralyze it in less than two minutes, by inhabiting canyon bottoms where direct sunlight can be avoided. Less spectacular than color-changing, sand-diving, and blind-striking, this method is nevertheless effective also for the Rock Uta and other reptiles

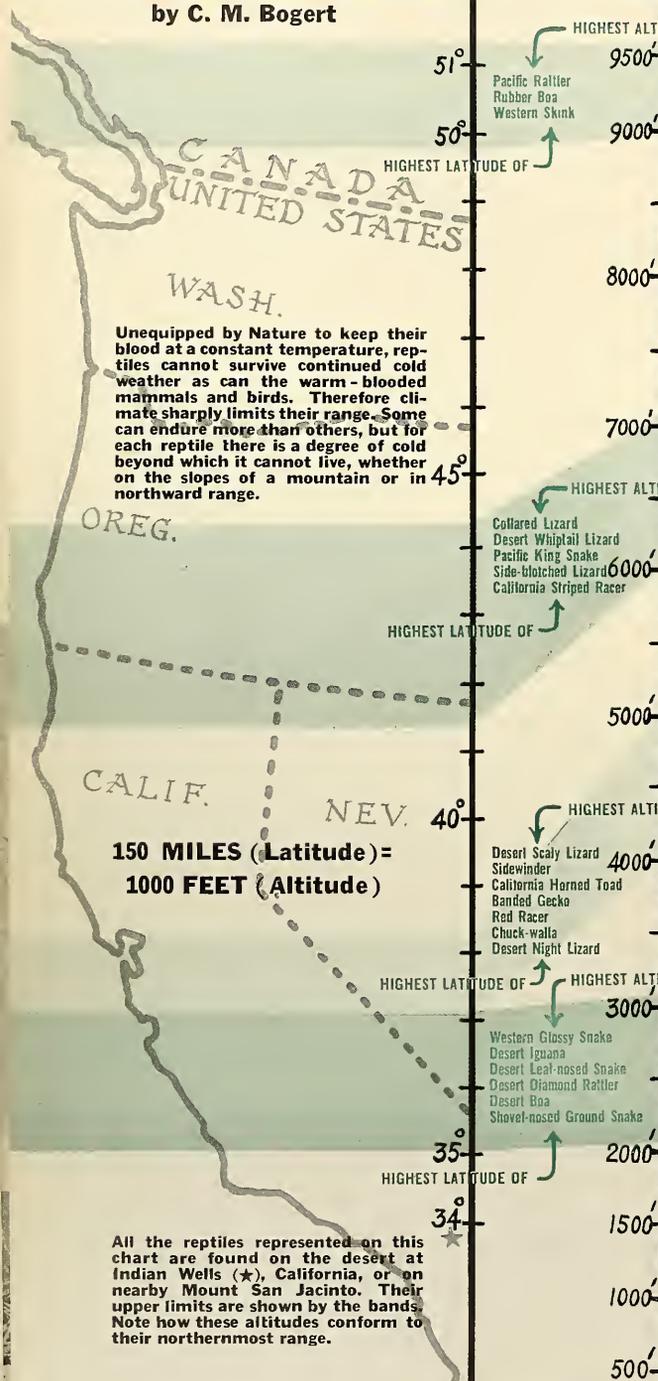
LATITUDE

ALTITUDE

Mount San Jacinto, which rises abruptly to 10,805 feet above Palm Springs, California.

Reptiles and Cold

Compiled for
NATURAL HISTORY MAGAZINE
by C. M. Bogert



Unequipped by Nature to keep their blood at a constant temperature, reptiles cannot survive continued cold weather as can the warm-blooded mammals and birds. Therefore climate sharply limits their range. Some can endure more than others, but for each reptile there is a degree of cold beyond which it cannot live, whether on the slopes of a mountain or in northward range.

All the reptiles represented on this chart are found on the desert at Indian Wells (★), California, or on nearby Mount San Jacinto. Their upper limits are shown by the bands. Note how these altitudes conform to their northernmost range.

The slopes of Mount San Jacinto were chosen by C. M. Bogert for this study because they exhibit a wide range of reptilian life from desert forms inhabiting the hot sands at the base to forms that can endure the cold climate near the summit. The tree zone near the summit is characterized by abundant rainfall and no severe heat. Fewer rep-

tiles are found in this zone than just below it in the zone of dense brush or chaparral. The most abrupt change in the character of the reptiles is where the chaparral gives way to almost true desert conditions at the base, where Palm Springs is located at an altitude of only 500 feet. The temperature is clearly the foremost factor.

The Pacific Rattlesnake ranges to timber line on the mountain and as far north as British Columbia



Photo by C. M. Bogert

Trees are found on the mountain's summit that grow in Canada; so is the heat-shunning Rubber Boa



Photo by R. B. Cowles

The Western Skink, a hardy lizard, ranges as high as 9500' on the mountain and to almost 50° N. Latitude



Photo by C. M. Bogert

The Collared Lizard, able to change color, is darker on cold days; ranges to 7000' and 44° N.



Photo by C. M. Bogert

The active Desert Whiptail Lizard manages to ascend to over 6000' and north to 44°



Photo by C. M. Bogert

With a preference for valleys and foothills, the Pacific King Snake still reaches 42° N.

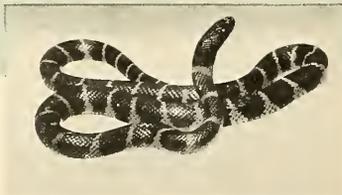


Photo by C. M. Bogert

Inhabiting rocks or trees, the Desert Scaly Lizard ascends as high as 5000' and 38° N.



Photo by C. M. Bogert

The Sidewinder reaches 4000' nearby; confined to sandy flats near Mount San Jacinto

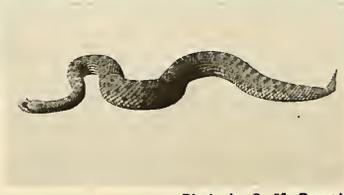
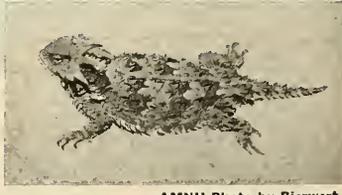


Photo by C. M. Bogert

The California Horned Toad is a coastal and foothill form that shuns the desert



AMNH Photo by Bierwert

Nowhere does the Glossy Snake ascend the mountains; accordingly it hardly reaches 38° N.



Photo by C. M. Bogert

The Desert Iguana is strictly confined to warm inland valleys; not north of 36°



Photo by C. M. Bogert

The temperature-sensitive Leaf-nosed Snake burrows to avoid heat, stays below 2000' to avoid cold



AMNH Photo by Bierwert

the ground was 122. At 2:30 in the afternoon the snake was placed on the ground, whereupon it began to crawl with moderate speed in a fairly direct line. At a distance of 40 yards it turned to the left, crawled about six yards and then turned again, crawling back nearly to where it had started. At the end of three minutes it slowed its pace, and in another minute it stopped short, moving its head about erratically. After six minutes had elapsed, all movement ceased and the creature seemed to be gasping. When turned on its back it remained in that position. Within six minutes and thirty seconds after being liberated, the snake was apparently dead with its temperature at 115 degrees, although the heart continued to beat until, in all, fifteen minutes had elapsed.

Here was the one snake seen abroad in daytime and yet it was able to traverse no more than 86 yards before it was overcome by the heat. This may be explained by the fact that in its normal habitat, scattered bushes and rodent burrows offer shelter so regularly that three minutes is always ample time for the Racer to save its life. Small wonder that one of the swiftest moving of all of our native snakes is the only species that dares venture out on the desert during the summer day—a case of the “survival of the fittest,” to paraphrase Darwin.

Temperature “eye”

The Red Racer seems to be incapable of feeding at night, probably because it relies largely, if not entirely, upon vision to detect and to capture its prey. Many other serpents use other senses to enable them to do their hunting at night. Dr. G. K. Noble, in the experimental laboratories of the American Museum, has shown recently that the facial “pits” on rattlesnakes and their close relatives are in reality heat receptors that not only enable the snakes to detect the presence of warm-blooded animals but make it possible for them to strike with precision in complete darkness. Through the combined use of their tongues and other organs many snakes have a fairly keen sense of smell that probably makes it possible for them to trail their prey. In addition many of them have eyes that are adapted for seeing in dim light.

Therefore, many snakes hunt at night, although they may be discovered during the day still on the surface but coiled in the shade of a rock or shrub. The little desert rattlesnake commonly called the “Sidewinder,” because of its unique locomotion so admirably adapted for travel in sand, may be seen early in the morning or on a cloudy day, resting at the base of a creosote bush. On warmer days one may find this pitviper in the entrances to kangaroo rat burrows

where it most frequently seeks shade. During hot weather it is rarely to be discovered in the daytime, but at night it prowls about extensively, sometimes covering a distance of nearly a mile, leaving its tell-tale separated tracks. Near our camp at Indian Wells we collected two or three Sidewinders during each warm evening.

“Preferred” temperatures measured

We kept many of these in our cages, where they were active every night, although each morning they were in resting coils at the entrance to the clay pipe “burrows” we had provided. Later in the morning they moved into the entrance to the pipes, and by noon they had descended still further down the incline where it was cooler. Observing this very striking behavior Doctor Cowles began taking the snakes’ temperatures at intervals during the day. The first temperatures taken in the morning were exactly 92° for every specimen in the cage. An hour later they were the same. By the hot part of the afternoon every Sidewinder had moved deeper in the pipe as the air grew warmer, and had to be drawn out with a hook. Again when temperatures were taken each Sidewinder was found to have maintained his body temperature at exactly 92°. On subsequent days a variation of no more than one degree was ever recorded. The sharp temperature discrimination in the Sidewinder is as remarkable as his method of locomotion. This small rattlesnake maintains a constant temperature as accurately as though he were equipped with an expensive thermostat. It can be assumed that 92° is the optimum, the temperature which this species of rattlesnake attempts to maintain because it is uncomfortable otherwise. Like the Sidewinder, probably every reptile has a “preferred” temperature. Seemingly this temperature differs somewhat in various species, but there is insufficient experimental evidence to say this with certainty.

Several experimenters have found similar lethal temperatures for different species of snakes, although the experiments were performed under different conditions of sunlight, or in the laboratory with heat but without light. It required from seven to twenty minutes for snakes to perish, but invariably the temperature at death was approximately the same.

On a day when the temperature in the shade on the desert was approximately 100 degrees a Sidewinder was liberated on the ground which had risen to 129. In twelve minutes the snake was dead, with its body temperature at 113. Since this agrees with our findings with regard to lizards, it is safe to conclude that no reptile, not even larger species, can long

endure a temperature that exceeds 120, which is probably the absolute maximum. Experienced collectors know that the simplest way to kill large crocodiles without apparent injury to the specimen is by exposing them for a time to the tropic sun.

Now let us see what is known regarding the reptiles' susceptibility to lower temperature. Despite the fact that one viper penetrates the Arctic Circle in Scandinavia, and others are known from chilly elevations, as high as 13,500 feet on Mount Orizaba in Mexico as well as in similar elevations in the Andes and in Asia, all reptiles are rendered inactive by cold, and it is extremely doubtful if any are capable of coordinated movement when the temperature is much below 60°. In the vicinity of our camp at Indian Wells we have collected as many as 24 snakes in the course of a warm evening between sun-down and midnight. However, we eventually learned that even though the ground was warmer than the air, once the air temperature fell below 60 degrees on cool evenings there was little use in searching for snakes.

An accidental discovery

In 1934 we unintentionally performed an experiment that provides some evidence for the belief that certain snakes are more susceptible than others to lower temperatures. From the edge of the desert that spring we had taken a number of snakes including a Worm Snake, a Long-nosed Snake, several Leaf-nosed Snakes and Shovel-nosed Ground Snakes, a Lyre Snake and a Mojave Rattlesnake. Shortly after these snakes were collected the weather turned so excessively warm that we feared our snakes might not survive, since many of them were burrowers that consistently avoided excessive heat in their natural habitats. Believing that we might prevent them from becoming too warm and, at the same time, bring about a forced suspension of activity that would conserve the energy stored in their fat, we placed them in a cold room where the temperature was maintained at approximately ten degrees above freezing.

At the conclusion of a week's time all the snakes were alive, but on the tenth day of their forced inactivity we discovered that many had succumbed. When we examined them all and determined which species had survived, one striking fact was apparent; *the live snakes were all species that ranged from the desert well up into the mountains.* Species confined to the desert or foothills—the Worm Snake, the Leaf-nosed Snake, the Shovel-nosed Ground Snake, the Lyre Snake, and the Long-nosed Snake—were all dead. Two little Spotted Night Snakes were alive, healthy and active when they became warm within

an hour, and a Mojave Rattlesnake, a larger species, more slowly but surely recovered from the stupor induced by the cold. In California the Mojave Rattler inhabits the higher deserts and in Arizona is known from elevations as high in the mountains as 6000 feet, while the Night Snake has been taken in the San Gabriel Mountains at 7000 feet above sea-level.

Lizard frozen stiff

On the other hand, some reptiles can withstand temperatures a little below freezing for a brief period. Early one spring as I was ascending Mount Pinos in southern California, a Horned Lizard was taken near the base of the mountain. That night I camped on the summit at an elevation over 8000 feet above sea-level. It was cold that night; the water in my canteen turned to ice. The Horned Lizard was apparently dead when removed from a container the following daybreak. It was frozen, stiff as a pine twig, so that it could be held upright by the end of its tail. Placed in the sun, it thawed and was active within an hour's time. The following night was probably colder still. A fine feathery snow drifted down upon camp, and the lizard was again frozen. Once more it was allowed to warm slowly, gradually regaining its flexibility, but this time the reptile was dead. This agrees well with accurate experimental results obtained by an investigator in Europe.

Had this Horned Lizard been free to do so, undoubtedly it would have buried itself in the ground and saved its life, but even then it is perhaps doubtful whether it could have gone down sufficiently deep to survive that second night. Lizards of another species occur on the summit of Mount Pinos, but that species of horned lizard does not exist in the mountains above 6000 feet. Many reptiles in the Southwest have fairly definite, preferred habitats, largely defined by their ability to withstand extremes of temperature, not merely for a day or so but through the course of the year. That is to say, the mean annual temperature is a most important factor in the distribution of reptiles.

Our American Southwest provides an ideal region for the study of distributions since the deserts lie adjacent to large mountain ranges, and diverse conditions obtain within limited areas. Mount San Jacinto in southern California is, biologically, one of the best known mountains in the world. It rises to an elevation of 10,805 feet above sea-level, with the eastern escarpment along a nearly vertical fault, so that this face rises abruptly from the desert below. At the desert base lies Palm Springs, less than 500 feet above sea-level. Nearly true desert conditions exist

there and in Coachella Valley as well, which extends southward from Palm Springs to regions below sea-level around Salton Sea. Yet on the summit of San Jacinto there is nearly the same type of vegetation that occurs in Canada at sea-level.

Biologists recognize what are known as "life zones," and in the San Jacinto region the stratification of life is particularly apparent. The floor of the Coachella Valley supports a type of vegetation characteristic of the state of Sonora, Mexico, with creosote bush, cactus, and other hardy perennials resistant to desiccation and drought. Along the base of the mountain, there are the less hardy plants, palo verde, cat's claw, and ironwood, with palm trees in the canyons where there is permanent water. Farther up the rocky slopes the vegetation gradually is denser, small scrub pines and oaks occur, and the plant life becomes recognizable as closely approximating that found along the coast of southern California, where the Pacific Ocean exerts a cooling effect on the contiguous land. Still higher on the mountain larger conifers appear; the ponderosa pine characteristic of mountains throughout the West becomes the dominant plant; and finally near the summit we find the weather-beaten, lodge-pole pines, the same trees that occur at sea-level in Canada with small but straight trunks.

In other words, within five miles by air-line one may encounter conditions similar to those that prevail in Mexico and in Canada. Driving over Mount San Jacinto one may pass, within an hour's time, vegetation not unlike that to be seen by driving from the southern border of the United States to Canada. Every thousand feet in elevation roughly corresponds to traveling 150 miles to the north. What has this to do with reptiles? It permits us to make one generalization; we may observe that their distribution has been influenced by the same factors that effect the distribution of plant life.

Range of types

Just as we find trees on the summit of Mount San Jacinto that occur in Canada, so also we find the Rubber Boa, a peculiar little serpent that is found in British Columbia at sea-level but in southern California is confined to the tree zone near the summits of mountains where there is abundant rainfall and no severe heat. Possibly a dozen other reptiles are found within this tree zone, but most of these are far commoner in the zone of dense brush or chaparral below the trees where the Rubber Boa is not found. The most abrupt change in the reptile population takes place at the foot of the mountain, where most of the chaparral dwellers are replaced by desert forms,

which in turn are unable to live in the mountains. The most important factor in these distributions is probably temperature, but many other factors are involved. Certain species such as the Granite Night Lizard, the Collared Lizard, the Rock Uta, and the Speckled Rattlesnake show such a decided preference for rocks that they are never found far away from them. In contrast to these reptiles, which are of necessity confined to the mountains or foothills, there are others like the Fringe-footed Sand Lizard which never strays far from dunes, or the Sidewinder, Shovel-nosed Ground Snake, and the Glossy Snake, which have a definite predilection for open, level country with sparse vegetation. The remaining reptiles exhibit varying degrees of catholicity in their habitat preference, although as the habits of individual species become known certain limitations become apparent. The Pacific Rattlesnake, for instance, ranges from the foothills to timber line, from Baja California to British Columbia, occurring in most of the coastal valleys, in open, in rocky, or in chaparral-covered areas, but it is apparently incapable of entering the desert. The garter snakes exist where there are streams and thus enter the desert only where there are natural creeks or where there are areas cultivated by man with irrigation ditches.

Adapted for sand

Of all the environments below timberline, none is more forbidding to most animals than sand dunes, and here only the highly specialized reptiles live. The great dune area near Yuma, Arizona, supports but three reptiles that can be considered inhabitants, and each of these is especially adapted for sand. The Fringe-footed Sand Lizard has elongated scales on its toes that seem to perform the function of providing more surface in the manner of snow shoes, so that the lizard attains great speed over the dunes. Furthermore this lizard has a lower jaw that closely fits into the upper, that it may "dive" into the sand when seeking refuge from an enemy and "swim" beneath it for a distance to ensure its escape. The Shovel-nosed Ground Snake is similarly equipped with a snout modification which is the origin of its name, and we have already mentioned the Sidewinder, with its method of locomotion so perfectly adapted for efficient progression over sand (see photograph). This rattler literally rolls along with its body making little more than two contacts with the sand. Oblique, disconnected, parallel tracks are formed as the weight of the snake is carried progressively from one contact to the next, each point on the body behind the head being carried through an

S-shaped path above the ground as the snake moves forward. This leaves on the sand an imprint of each scale on the body behind the neck, with the tail dragging to form a hooked-shaped imprint on the end of a straight track. From these imprints it would seem as though the snake had been lifted and replaced on the sand. The late Dr. Walter Mosauer, who carefully analyzed snake locomotions, has aptly compared the Sidewinder with a helix rolled on the sand. He has pointed out that this type of locomotion is the most efficient that could be achieved by a snake forced to crawl on flat surfaces.

We have here noted only a few of the means that have been evolved by the reptiles in their struggles to overcome the handicap forced upon them by their inability to supply their own body heat. However, there are compensations in being "cold-blooded." Whereas a high percentage of the food consumed by most mammals and birds is usurped in the oxidizing processes involved in keeping the body warm, this "waste" of energy is unnecessary in reptiles. Accord-

ingly they may go long periods without eating, and perhaps one meal each week during the warm part of the year suffices for most of them in temperate zones. Larger captive snakes have been known to survive as long as three years without food, although fat and other tissue reserves were, of course, gradually diminished.

Competition with the mammals and birds has been severe, but the reptiles have not passed out of the picture. The stupid sloth is still confined to the tropics, perhaps as a result of the inability of his stock to arrive at means of overcoming a temperature limitation. The snake, the lizard and the turtle will never penetrate the Arctic regions, but one or the other of them has succeeded in nearly every other habitat that may be entered, even the air. The Pterodactyl, a flying reptile of another era, suffered an evolutionary crack-up, but today the East Indian lizard, the Flying Dragon, is an efficient glider. The reptiles will never "rule the earth" again, but the old stock has stamina.

THESE TRACKS mean that a Sidewinder (or Horned Rattlesnake) has assumed the position of a flattened helix and literally "rolled" across a dune, traveling from lower right to upper left. The hook at the lower end of each track is left by the neck, the one at the upper end by the tail, while in between a perfect imprint of each ventral scale is left. The highly specialized locomotion of this sand-adapted rattler is paralleled by that of a true viper in the Sahara Desert. Curiously enough both the Saharan and the American snakes have the horn-like projection of scales over the eyes.

(Photo by
Walter Mosauer)



LIFE STORY OF THE

PRAYING

I. (IN THREE ACTS) CANNIBAL BRIDE

Or, Life Is Death for Mr. Mantis

1. HIS TERRORS exaggerated by the camera, this garden "dinosaur" is harmless to man but makes a curious sparring partner, returning each thrust and parry and following every movement with his great eyes. He twists his head like a human—a feat peculiar to mantids

2. THE CANNIBAL BRIDE attacking her husband: a frequent sequel to the mating act. She seizes him (3) in her saw-soothed forelegs (whose prayer-like posture gives this insect its name) and feeds on his decapitated, twitching body (4). A female mantis has been seen to snip off the male's head before mating, eat into the thorax, then allow fertilization by the half-dead male before finally finishing her feast. This sex-hunger link is also observed in some spiders; and the female tree cricket feeds from a gland on the male's back before and after mating. Similarly, the male *Cardiacephala* ant must continually feed the female with regurgitated food during mating. A piquant variation is the indispensable bridal gift from the male predatory fly *Hilara*—a flower petal or bit of grass, which the female handles throughout mating. Conubial cannibalism in insects is sometimes explained as an economy measure held over from some era of scarcity, wherein the male, having served his purpose, was utilized as sustenance for the development of the eggs



MANTIS

II. THE EGGS ARE LAID

5. EXUDING A WHITE, frothy substance, the mother mantis builds an egg case and lays her eggs in a single operation. Attached to briars and weeds a few feet above ground, these nests usually contain about 100 eggs. Her job completed (6), the female mantis departs without a backward glance, leaving her egg-mass to weather the elements from early Fall to late Spring. Then baby mantids will emerge from the egg chambers, and start a lifetime of feeding on almost any kind of insect they can catch with their predatory forelegs. But the frothy covering of the eggs is not always a complete protection. The female of a tiny European parasitic wasp, *Riella manticida*, after finding a mantis, alights on its back, discards her wings, and stays there until the mantis starts to lay its eggs, whereupon she moves to the rear and lays her own eggs in the froth. Her young then feed on the eggs of the mantis. Of course, if mother *Riella* alights on a male mantis she is out of luck unless she changes hosts when they are mating. Another foe is the common brown ant, which swarms over the egg case at hatching time and attacks the newly born mantids before their bodies have hardened. Insectivorous vertebrates—birds and monkeys—prove a further hazard to growing mantids

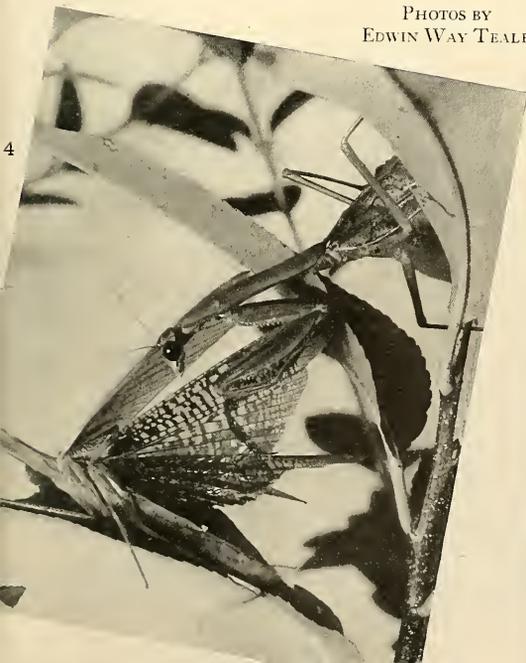


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6

PHOTOS BY
EDWIN WAY TEALE



4

III. A NEW GENERATION OF MANTIS

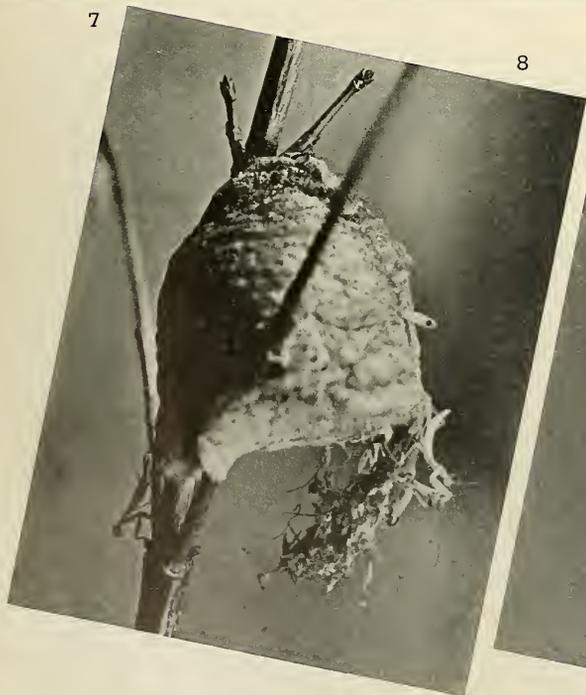
7. DOWN THE HALLS leading from egg cells and through "trap doors" formed by the overlapping flat walls of the egg case, come the baby mantids. They soon cast off the first skin which has left only legs and antennae free

8. "SMALL FRY," with great dark eyes staring and golden bodies wriggling, struggle to free themselves from the silken threads still holding them to the egg case. Like other "primitive" insects the baby praying mantis is at birth much like his parent—except for wings. If these mantids were born in China, they might eventually be captured, kept in bamboo cages and matched against one another like fighting cocks. The more practical Japanese sometimes tether them to bed posts to catch mosquitoes

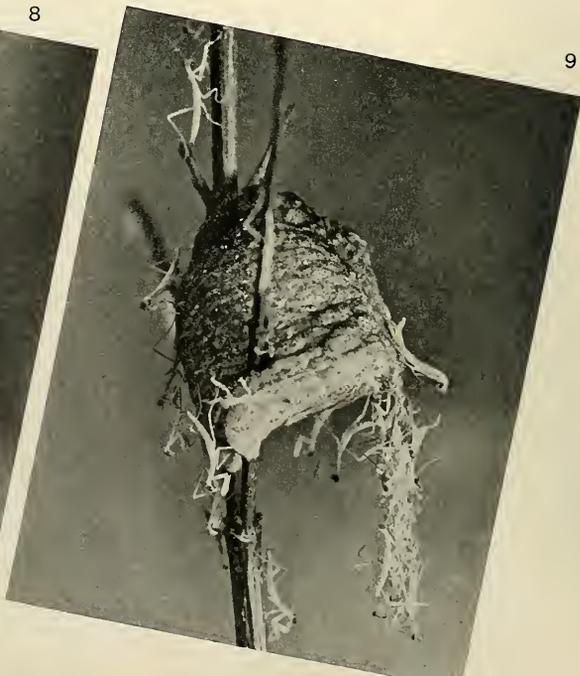
9. READY TO STAND ALONE. Soon their bodies will harden, darkening to greens and browns, and these young mantids will lurk in nearby leaves to prey upon their fellow insects. The notion that the praying mantis was imported to this country to combat the Japanese beetle is false. Southern United States boasts its own species, but in the North we have only foreign ones such as *Mantis religiosa* and *Tenodera sinensis*. Reasonably plentiful, the praying mantis presents an interesting subject of observation for almost any sharp-eyed gardener

Nichols photos from Lilo Maier

7



8



9

BIRTH COMES TO THE BITTERN NEST

As recorded by the camera naturalist

A. DAWES DU BOIS

THE American Bittern (*Botaurus lentiginosus*), that mysterious "thunder pumper" of the marshes, is distributed over the greater part of North America, but is not anywhere abundant. It is a confirmed recluse and a master of the art of self concealment, wherefore it is more often heard than seen. It builds its nests in the marsh, as a rule, though sometimes an adventurous individual resorts to the solid ground of an adjoining slope, as did the Minnesota bird whose domestic affairs are disclosed in the accompanying photographs.

This particular bird was remarkable, also, for her beligerent boldness. As I stooped to cut off a plant close to the ground on the 26th of May, a startling growl came from the grass just ahead. This was followed by a faint rustling sound; yet no animal was in sight. A search revealed an American Bittern, sitting on her clutch of eggs, amid grasses, weeds and alfalfa, at the edge of a patch of tall quack grass. Her nest was a compact platform of dried weed and grass stems, two and a half inches thick and twelve to thirteen inches in diameter.

When I pressed aside some weed heads in front of the nest, using a stick for the purpose, the bird stabbed the air on either side of the stick; but when I ventured to use my hand she struck it with marvelous quickness, with open bill, bringing blood on two alternate fingers. Two days' acquaintance made her even more bold; so that she crept off of the nest to strike. But when I held my foot toward her she refused to strike the sole of the shoe. A cardboard shield on the forearm proved inadequate, as the bird reached quickly around it.

We had our major encounter when the nestlings were four days of age. As I was stepping into the farther edge of the quack grass—instead of going around it in the usual way—the old bird came toward me with her wings spread, and without hesitation jumped and flew up at me. A cloth cap, held in one hand, was thrust out to shield my face, but the bird stabbed through the cap with sufficient penetration to bring blood in the palm of the hand. The next time I saw her starting forward in that manner, which was about a week later, I graciously retired; and as I walked around the clump of vegetation she went to the nest and took her stand there, although the young were out in the grass.

She was a little more tolerant at the front of the nest, where an observation blind had been erected. If I stood near, the sitting bird shook her head, turning it from side to side just perceptibly, with a slight lateral motion of her bill. She seemed to be saying, "No, no!"

In spite of the bird's aggressive vigilance, the blind made it possible to watch the course of routine nest life; and to record the following photographic story.

(Below) THE CAMERA HAS DISCLOSED, in this photograph, a remarkable feature of the bittern's power of vision: the ability to control each eye independently. The bird's right eye looks off to some distance to her right; the left, forward and downward to a point on the ground in front of her. She was unaware of the photographer's presence in the blind when the photograph was taken



THE NEST shown below was built in a marsh, according to the bittern tradition, but an adventurous bird will sometimes build her home on solid ground



(Above) THE BITTERN FAMILY in comparative repose, four days after hatching. The lusty appetites of the chicks have been temporarily satisfied, though the one in front has not quite finished swallowing. The long, fluffy down of the young almost matches the color of the stripes on the parent's breast



(Below left) THE YOUNG are fed by regurgitation of solid food. The old bird lowers her head, turning it at a convenient angle; a young bird grasps her bill; then the parent's bill begins slowly to open, allowing the food to slip gradually downward. The lump is often larger than a marble for youngsters four days old. Two chicks are grabbing simultaneously here

(Below) THOUGH THE MOTHER BIRD appears to have thrust her bill down the throat, this is not the case. With head tilted, she merely allows the chick to run its bill along hers at right angles to extract the solid food. On one occasion when the nestlings were given all the food they would take, the old bird was observed to give special attention to the smallest one



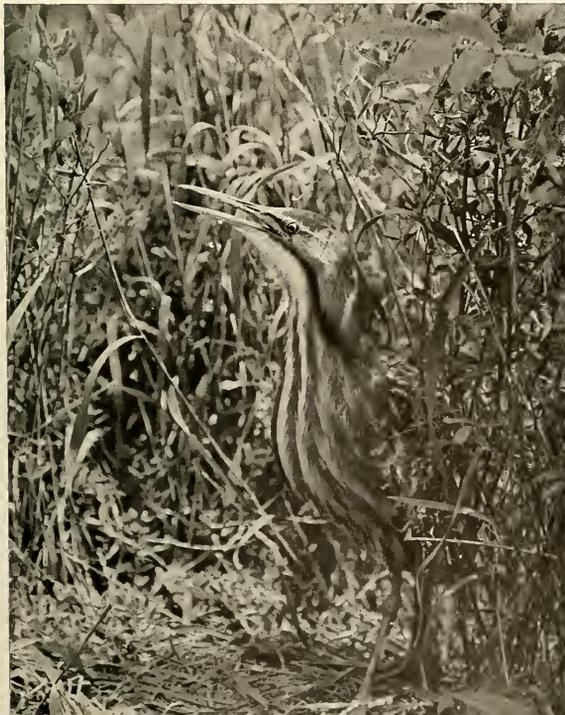
(Below) WARNING. At six days of age, the youngsters put forth their best efforts to intimidate the photographer. Even when only three days old they roused themselves from drowsiness in their mother's absence to growl and go through the motions of striking. At such times they were the fiercest looking, fuzzy, harmless little ceatures that could well be imagined



(Above) SOMETIMES after feeding her young, the mother bird would stand on the nest, stretched up to her full height, to look out through the tall grass tops

(Below) PANTING in the noonday sun, the old bird stood guard at the nest, though the young had found cooler quarters in the grass. Sanitary measures were so effective that the nest remained clean throughout the whole period of its use as a nursery. After a nestling had been fed, it retired into the grass beyond the edge of the nest

(Below) LIKE MOTHER LIKE SON. On one occasion when the parent was away, this youngster took the characteristic watchful posture, looking and listening with the utmost concentration. Two others were dozing on the nest floor



(Right) DEFENSE ATTITUDE. Guarding the gateway to her domain as the observer approached the bird closely, she partially spread her wings, lifted her stubby tail and erected her hood, exposing the white plumes at her shoulder which are used prominently in courtship display. The bird is not bluffing in this posture, as the trespasser would find to his discomfort if he were to venture closer



(Below) AN INTIMATE FAMILY PORTRAIT of the bitterns. The proud mother of nine-day-old chicks has been away food-hunting. The young were ready for her when she returned. A nestling has just received its food, and, while the parent is performing the swallowing motions which follow each regurgitation, another member of the family makes known its readiness to be served. The young one at right seems unaware that a mosquito on its "ankle" is getting down to work in earnest

When the young were two weeks old they rarely came

to the nest, but preferred nearby shady places amid tall weeds and grasses. It is doubtful that they ever used the nest after the eighteenth day. A considerable portion of the surrounding grass had been trampled down by the birds at that time; and two days later they had left the place entirely



THE HUMAN BOT FLY—*How did this extraordinary insect develop the habit of forcing a mosquito to deposit its eggs for it?*

By C. H. CURRAN

*Associate Curator, Insects,
American Museum*

THE HUMAN BOT FLY is one of the most remarkable animals in the world. Although it is only a lowly insect and is presumably incapable of reasoning, it does things that would do credit to human ingenuity. As you will see, the insect is well-named the "human" bot fly (*Dermatobia hominis*), for its larvae develop to maturity in human beings, but the strange thing is that the fly itself has no connection with man. All of the true bot flies lay their eggs directly upon their victims, but the human bot apparently never does this, though by an ingenious method it provides for the transportation of its eggs

to the animal body where they will develop. The human bot fly is probably unable to recognize its victims if it sees them. It has no direct interest in human beings, monkeys or the other animals which might serve as hosts for its offspring. Instead it concentrates upon mosquitoes and other biting flies. Since the bot fly has been observed capturing mosquitoes, we shall use these as an example of how it proceeds.

When the female bot fly is ready to lay her eggs she finds some stagnant pool or pond in which mosquitoes are breeding and settles herself upon some vantage point where she can observe the emerging mosquitoes. When the mosquitoes emerge from their pupal cases their bodies are soft and they are weak and incapable of long flights. As a result they fly laboriously to a blade of grass or to foliage where they can rest while their wings and body wall harden. The bot fly, ever on the alert, espies one of these soft and immature mosquitoes, dashes upon it during its short flight, wraps its legs around it and carries it to a place where it may rest in comfort.

Now begins the business of egg laying. Holding the mosquito carefully in order to prevent its escape or injury, the female bot proceeds to deposit from ten to fifty eggs on the under side of the mosquito's abdomen and on its legs. The bot shows rare judgment in placing its eggs, being always careful not to deposit them where they would hinder the mosquito in flight, and leaving more than the distal half of the legs free so that the carrier may settle without difficulty upon its



(Above) THE INSECT which employs a mosquito to lay its eggs on a warm-blooded animal: The human bot fly (*Dermatobia hominis*), enlarged 6 diameters

(Right) HEAD OF human bot fly (28 times actual size), showing its compound eyes, with which it almost seems to have studied the habits of the mosquito who deposits its eggs



AMNH Photos by Coles

mammalian victim. When it has deposited its eggs the bot fly liberates its victim and settles down to await the appearance of another emerging mosquito, no longer interested in the fate of the eggs it has already deposited. Altogether thirty or more mosquitoes may be captured and treated to the same indignity.

When released by the bot fly the mosquito loses no time in seeking a place of safety. Perhaps it is relieved to find that its burly captor has seen fit to release it, instead of devouring it as most captors would do. It is undoubtedly inconvenienced by the load of eggs that have been firmly attached to its body, but by the time evening arrives it is ready to join its mates in the search for blood.

If the mosquito should dine upon the sap of plants or upon some cold-blooded animal, the eggs remain inactive. It is only when they come in contact with a warm-blooded animal that sudden activity develops. The very thin shell bursts open immediately, and the tiny maggot crawls hurriedly out and onto the skin of the victim. It was formerly believed that the bot larva was unable to enter healthy skin and that if the mosquito did not bite, the young larva was doomed to death unless it could find some injury through which to enter the body of its victim.

But recently Major L. H. Dunn, who reared six larvae in his arms and leg at one time, observed that they were able to enter undamaged human skin. He observed that the young maggots set up an irritation within a day that had the appearance of a mosquito bite. It is, therefore, easy to understand how victims might have assumed that the bite of the mosquito was necessary. Two of the larvae which Major Dunn purposely placed upon his arm were observed under a glass while they laboriously rasped the skin and bored their way into the tissues. It seems probable that they are also able to enter uninjured skin of other mammals also.

Must breathe air

Once it has entered the skin the larva is relatively safe. While still young it stays close to the point where it entered, breathing through the spiracles in its moderately long tail. Since it must have air to breathe, it remains close to the opening, being entirely unable to obtain oxygen from the blood as some other parasites do. But as it grows older it penetrates more deeply into the muscle, coming to the surface only occasionally to breathe.

As a general rule human victims of the bot fly have the maggots removed as soon as they are discovered, but inasmuch as the young larva causes little or no inconvenience during the early part of its life under the skin it is not likely to attract attention, and it is

usually some time before its presence is detected. So long as it remains close to the surface and does not bore into the muscles there is usually only slight irritation, as a result of which there is a tendency on the part of the victim to scratch the infected area. As the larva grows and penetrates more deeply into the muscles, the itching sensation increases and the victim becomes aware of the movement of the larva from the surface into the muscle and back again, and there are times when he suffers severe pain.

Human guinea pigs

Our knowledge of the effects of the bot fly upon humans is gleaned from the experiences of a few daring scientists who have allowed the bots to develop to maturity within their bodies in order to determine both the effect upon themselves as well as the length of time that the larva requires to reach maturity. The larva becomes fully grown in six to eight weeks.

Aside from the small swelling, the first intimation that a larva is living within the muscles is likely to be a peculiar sensation of something crawling about within the muscles, although there is little outward evidence of infection to attract attention. If there is a twinge of pain as the larva attacks some particularly sensitive spot the sufferer is likely to pass it off with little more than a shrug, as possibly the result of a muscle being moved when not prepared for such action. As time passes, both the movement of the larva and the intensity of the periodic pains become more obvious.

The larva may bore as much as an inch into the muscle while feeding and the sensation caused as it travels back and forth is described as "extremely peculiar—as of something crawling or creeping within the body, a sensation that is quite unbelievable to anyone who has not experienced it." (I quote the words of one of the few men I know who has allowed the larva to develop to maturity within his body.)

The pains caused by the larva are often very irregular in their occurrence. At times they may occur every few hours, or there may be days when the only indication of its presence is the sensation of movement; at other times there may be prolonged pain. This may be so severe as to make it impossible to walk for some time, or to deprive the victim of the use of his arm, if that member is affected. Fortunately, such severe results are not frequent, and within a short time the victim feels entirely normal and is able to go about his duties without the slightest handicap. In due course the larva is full grown, makes its way to the surface, enlarges the hole through which it has been breathing and drops to the ground, where it pupates.

So long as the bot fly larva remains alive and healthy there is no danger to the host, but if it should be killed there is grave danger. While the maggot is alive it apparently secretes a substance that prevents bacterial infection, although a great deal of pus, accompanied often by fresh blood, is discharged from the nodule containing the larva. While there is no proof, it seems possible that the secretion preventing infection is urea, a substance secreted by blow-fly larvae which makes them useful in the treatment of ostiomyelitis.

Dead larva dangerous

Should the larva be killed within the body, either its putrefying body or the ingress of bacteria results in dangerous complications, and there are many records of serious illness and numerous deaths as a result of the intentional or accidental killing of the maggots. Even to cut open the muscle and remove the maggot may be dangerous because of the possibility of infection due to the slow healing of wounds in the tropics. Notwithstanding the danger, this extreme measure has often been undertaken, although it is not advisable unless the grub is dead and located well below the surface. Such an operation should be undertaken as soon as possible after the grub has died, and every care must be taken to keep the wound sanitary.

Dr. Robert Cushman Murphy, Curator of Oceanic Birds at the American Museum, returned from the American tropics last year in a crippled condition as the result of an infection caused by one of these bots. Although he had spent considerable time in the American tropics, Doctor Murphy had never before encountered the human bot fly, and only when his physician informed him did he realize that he had been attacked by one. The insect that caused him so much trouble was located in the calf of his leg. The larva undoubtedly irritated him and was evidently killed by iodine or unconscious pressure upon the itching spot. Fortunately for him the doctor who treated him was well acquainted with the human bot fly; for while no larva was found, the infected area had developed into a pus-filled abscess which rendered him lame for several months.

Those familiar with the larva take advantage of its natural weakness in order to remove it. Since it must come to the surface to breathe, it may be easily killed by the application of some substance to which it will adhere. Soft beeswax, chewing gum or some similar substance may be employed. This is placed over the opening maintained by the larva for breathing purposes. When the larva finds its breathing place cut off it attempts to force its breathing tube through the substance, with the result that it frequently finds

its tail embedded in the material. When its struggles cease, the covering is removed, and the maggot usually comes out with it. If the larva fails to come out with the wax, a sharply curved or hooked needle is inserted into the opening and the body removed. To attempt to squeeze the larva out after killing it is extremely dangerous and should never be done, since the crushing of its body results in the release of dangerous poisons into the muscles.

Although the human bot fly lays its eggs chiefly upon mosquitoes, it is not limited to these but also uses other biting flies, including flies belonging to the same family as the house fly. The eggs have also been found on relatives of the house fly that do not bite. At first sight this would seem to indicate that the bot fly might lay its eggs indiscriminately on a number of kinds of flies that more or less resemble each other, but this is apparently not the case. All the non-biting flies so far observed carrying eggs of the human bot have belonged to a group that are attracted to dung but which are much more strongly attracted to sores on mammals. The effect is, therefore, the same as when eggs are deposited upon a biting fly, access to the flesh being readily attained through the open wound.

Use of trees and shrubs

The story of the human bot might well end here were it not for another peculiar adaptation that enables it to attack range animals on the South American plains, where it takes an enormous toll of the leather industry as a result of the numerous holes it produces in the hides of cattle. The method by which the eggs reach their bovine victims is very different from that employed in reaching man, monkeys and other mammals in the forested regions. Instead of employing other insects to convey its eggs, it employs trees and shrubs.

The eggs are laid upon the leaves of trees overhanging the trails which the cattle traverse along the edge of the jungle, or on leaves in groves that spot the plains. As the cattle brush against the leaves, the eggs become attached to the hair, hatch, and find a foothold. Quickly the larva works its way to a place of security on the hide and eventually enters the muscles. It is possible that many of the larvae that reach an animal never gain an entrance through the tough hide, but a very large percentage must do so. The greatest mortality during the development of the bot fly from egg to adult takes place during the egg stage and this must be enormous. The laying of eggs upon foliage is an extremely wasteful method of propagation, but it nevertheless is successful, as may be realized by the fact that the fly exists in enormous numbers. Perhaps

it is fortunate for the human race that such a method is used, for if all the eggs were deposited directly instead of upon leaves this insect might be a much more serious pest than it is today.

Now the interesting question arises as to why this astonishing insect apparently refrains from laying its eggs in so many places where they would not successfully hatch in one or the other of these methods. Remember that sooner or later the larva must come in contact with an animal body. The bot fly is the only insect that achieves this end by laying its eggs upon biting flies. Yet, whether through the agency of biting flies or leaves which cattle will touch, the bot fly never sees the animal itself. How has it come to utilize these two curious methods?

It might be argued that the practice of laying the eggs on foliage was the original method, for this is rather common among parasitic flies, and was later perfected in the habit of utilizing flies that bite animals—which is exclusive to this insect. But the raising of great herds of cattle in Brazil is a relatively new development, coming within the past hundred years, whereas monkeys and other mammals have been pursuing their mosquito-bitten existence in the jungles for centuries. Therefore, it would seem that the habit of laying eggs on leaves must be relatively new to the bot fly, and that it previously ensured the perpetuation of its species through the medium of other insects. Even presuming that there may have been herds of other animals on the plains before this country was taken over for the purpose of producing beef for a considerable part of the world, how can we explain the transition from one method of egg laying to the other?

The truth is that there may be two distinct strains of the human bot fly: one that has always laid its eggs on leaves, and another that has developed the technique of using biting flies as carriers.

The mystery remains

But it is still interesting to speculate how an insect which develops in the body of an animal established the roundabout habit of laying its eggs on precisely the type of insect that will plant them there. If we presume that monkeys, being nearest related to human beings of any animals found in the American tropics, were the original host of the bot fly, we can find a very good reason why an insect carrier of the eggs should have been utilized. We must first realize that the human bot fly is active during the day but that as soon as the shadows of evening begin to deepen the fly seeks a safe place in which to spend the night. The same is true of monkeys. They (or at least the

vast majority of them) are diurnal and are quite inactive at night, unless disturbed by some recognized enemy. During the day they are extremely active, and a fly desiring to lay its eggs upon one of them would find it difficult to outwit the alert monkey. Monkeys, as we know, do not hesitate to eat any insects that come within their grasp, and a bot fly, which is fairly large as insects go would at once excite a monkey's attention as a possible morsel of food. As a result of this, the adult fly would have great difficulty in depositing eggs upon its host, whereas a mosquito, being smaller and perhaps more adept might do the job unnoticed.

It is still somewhat difficult to explain why mosquitoes should have been chosen as carriers of the eggs. It almost seems that the bot flies were anxious to lay their eggs upon the monkeys, but being denied this opportunity because of the activity of their intended victims, were able to observe that mosquitoes make a practice of biting monkeys. At the approach of nightfall the monkeys select a place to sleep, and the mosquitoes begin flying in search of food. We know definitely (from their habit of catching them) that the bot flies are able to see the mosquitoes. If one can accredit the bot fly with such an intellectual interest as to be able to reason from egg to mosquito to monkey, then the riddle is solved.

Accident or purpose?

But there are objections to such a theory, the chief being that insects are generally considered unable to reason. They are practically devoid of brains; at best their brain is extremely small and simple in structure. On the other hand, we know that adult insects, such as the honey bee, learn to associate certain colors with food, and that insects may develop a definite rhythmic reaction to certain periodic phenomena, such as light and darkness or periodic electric currents. Or it may be reasoned that the adult fly could easily have overcome its difficulty by staying up later at night and gradually becoming a nocturnal insect which could lay its eggs upon monkeys while they slept, as has apparently happened with other parasitic flies that attack night-flying insects. Again, it might be argued that the utilization of mosquitoes and other biting flies as a means of carrying eggs to the bot fly host was entirely accidental.

Regardless of all arguments pro and con, let us admit that we do not know definitely whether the leaf-laying habit developed first, or how the habit originated of laying eggs on mosquitoes and other flies that bite or visit wounds, but that in any case the human bot fly remains one of the most astonishing animals in the world today.

MODERN ESKIMO ART—*June sees the Bering Strait Eskimos again at their seasonal ivory carving. Rooted in the matchless artistry of their Stone Age ancestors, the carving of the present-day natives retains a spontaneity and purity of line which may long hold for it a place in the realm of real art*

By MARGARET E. MURIE

IN JUNE the Eskimos of King Island, fortress-sided rock in Bering Sea, will come sliding onto the long, smooth beach above historic Nome in their great walrus-skin boats and begin their seasonal activities as artists in ivory. As many as 40 people, with all the pots, kettles, rolls of skins, puppies and babies necessary for a summer's encampment, will spill out upon the shore, and summer for the King Islanders will have begun.

You look into an open 12 by 14 tent upon men and boys sitting on the sand who carve all day long, every day but Sunday. Nearby, an overflow group is working under one of the big boats placed upside down on posts several feet above ground and hung with walrus hides on the windward side.

His foot a workbench

Punayak is one of these artists. He sits flat on the sand with left foot on the opposite knee, sole upturned to serve as a workbench. Against it he holds his piece of ivory and works at it with an ordinary flat file. Between him and Angi there is a covered oval tool box made from scraps of driftwood. Angi is carving a pair of salt cellars in the shape of polar bears standing up, red tongues lolling. With old-time bow drill Angi is making the holes in the top of Nanook's skull for the salt. One of these bears is finished and stands on the tool chest. It has been carved with an eye so keen, so trained by constant hunting that every curve and shadow on the polar bear's back fairly ripples with natural action.

Centuries ago the first Eskimos to come to Bering Sea carved and decorated harpoon heads, knives, and darts that have commanded the admiration and wonder of all who saw them.* In winter when the storms raged too fiercely these Old Bering Sea people sat in snug driftwood and sod houses, and by the light of seal oil lamps they carved from walrus tusks the im-

plements they needed. Their drills and knives were of stone; yet while the icy north wind howled above their heads they fashioned articles which artistically surpassed the work of any of the descendants who came into possession of the white man's steel tools. Finally it seems that the time came when life was more difficult. Long days on the ice pack hunting walrus and in skin boats chasing whales left them less and less leisure, and harpoon heads and spear points had to go with little decoration.

Heritage

But they left an unusual artistic heritage to their modern descendants: the gift of a hand so steady, so skilled with knife and adz that it held within itself an unshakable sense of technique—a knowledge of ivory, its texture and cleavages, so old, so sure that it need not even be thought about.

Agnayak, on the other side of Angi, is making a set of butter spreaders. Their handle design is a fish, and with a tool which was once a dentist's drill, he is etching in the eyes, tail and fins. By evening he will have six spreaders lying in a row on top of his tool box, finished. Beside him, as the quiet murmur of Eskimo talk goes on, a fat little walrus takes shape in the serious fingers of his 10-year-old son. He is just beginning to carve but he does pretty well, as is natural. So all around the tent. Quiet talk, quiet jokes, low laughter, rugged, calm faces, the sure movement of brown fingers. Salt shakers, cribbage boards, butter spreaders, pickle forks, napkin rings, pen holders, paper knives, crochet hooks, bracelets, the things which white folks like to buy, take form; and little animals, the animals they know, bear and walrus and seal, take shape. Walrus and seal form the favorite motifs of the King Islanders.

In October the oomiaks will be loaded again and back they will go to the cliff-sided island which is their home.

I asked one of them: "Which do you like best, summer or winter?"

He answered quickly, "Winter!"

He was thinking of the time when he would be

*See "Old Eskimo Art" by Froelich G. Rainey, *NATURAL HISTORY*, October 1937.

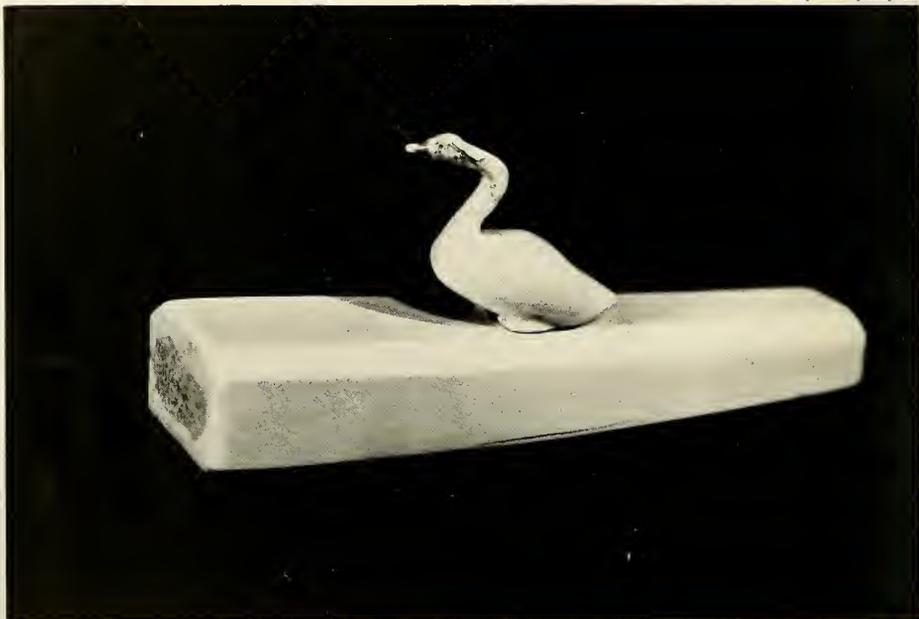


Photo by
O. J. Murie

(Above) A PAIR of walrus-ivory seal pups; striking examples of the renaissance in Eskimo art. Essentially an artistic person, the modern

Eskimo is producing carvings nearly as remarkable as those of his ancestors, following a sterile interim caused by hard times

Photo by Dudley Hayden



(Above) "THE SWAN," carved by a St. Lawrence Islander from a walrus tooth. The polished base is from

a walrus tusk. The Eskimos of long ago decorated useful tools; today they also practice pure art

(Below) AGHYOOK, THE WHALE: an animal of great economic importance, which is frequently represented in ivory

Photos by O. J. Murie



(Above) IVIEK (walrus) with eyes of inlaid whale-bone

(Below) NANOOK, THE POLAR BEAR. These figures find a ready market with summer tourists, a fact which often sets all males in the family to carving

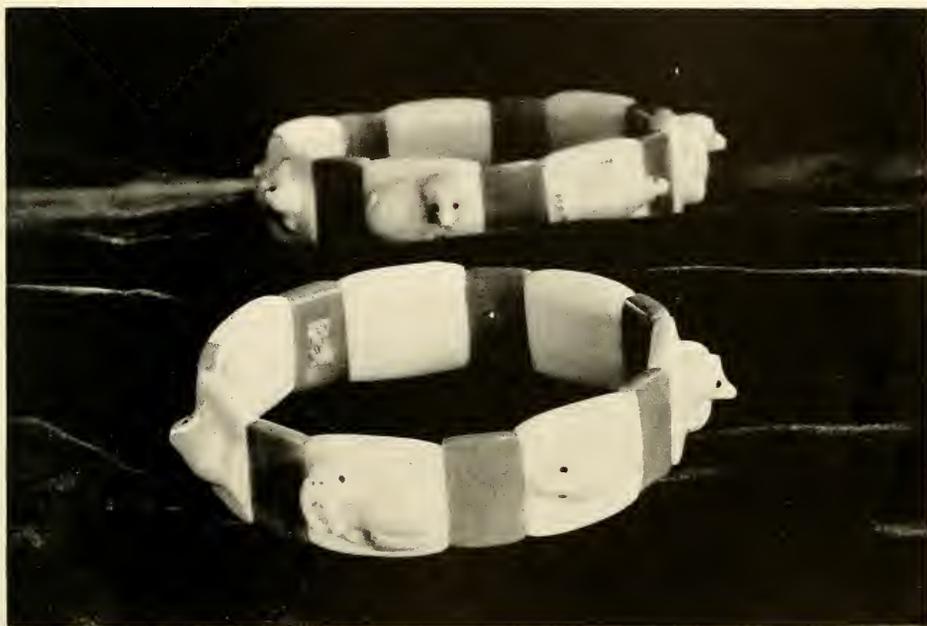


Photo by O. J. Murie



Photo by Dudley Hayden

(Above) THE BIRDS of St. Lawrence Island: Emperor Goose, Snowy Owl, Puffin, Ptarmigan and Snow Goose. The markings are engraved, then water color or pipe ashes mixed with water are rubbed in



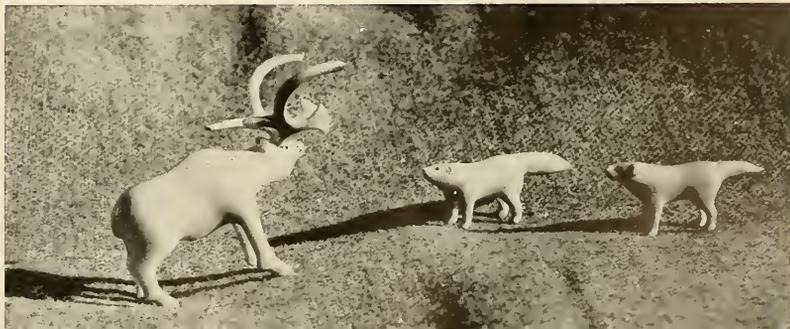
(Above) A BRACELET and its reflection showing both sides. The delicacy of the modern Eskimo's carving is

not impaired by such makeshift tools as discarded dentist's drills and hacksaw blades

Photos by O. J. Murie

ESKIMO CRAFTSMEN of this arctic renaissance are constantly gaining skill. Note the alert posturing of the fox and dog facing the beautifully contrived balky reindeer. From their "Old Masters" of many generations ago they have received a heritage of skill and knowledge of medium which promises to preserve for them a rare position in the realm of real art

MODERN ESKIMO ART



back in the life that was long ago, with some of the things that money can buy but also in possession once more of the primitive independence which is so dear to the Eskimo.

Away out over the gray foggy waters, much nearer to Siberia than Alaska, lies St. Lawrence, the big island of Bering Sea. Here we look in upon a similar scene, though few of its 500 people have ever seen Nome, and those few were dreadfully homesick before they got back to their own world.

Akeeya said, "I carve. Puffin, I carve. Reindeer, I carve."

An ivory carver at home

We go to Akeeya's house, one of the tiny white-man-style, ready-cut houses, of the modern Eskimo village of Sevoonga. In the entryway we step over pans of walrus meat and skinned auklets in seal oil, and go into the one room. There are two chairs; Akeeya's wife sweeps some clothing off them and we sit down. Two children are playing in a jumble of reindeer skins and blankets on the one big bed. Akeeya's wife stirs some meat in the iron pot on the stove, and Akeeya sits on the floor, a small piece of ivory in one hand, in the other a small curved knife made of a piece of hack-saw blade bound with thongs to a wooden handle.

That evening Akeeya came to the house where we were staying and handed me a reindeer. "What you call balky reindeer, in corral. He don't want to go, so I make him front legs this way." And what a perfect reindeer!

A group workshop

Out here on St. Lawrence ivory carving is not quite so communal an activity as among the King Islanders. But in the old village of Gambell in the northwest corner of the island the government has helped the men build a workshop. Here they repair their boats, their precious outboard motors, their sleds, tools and implements. And here in the quiet months of July and August, when hunting and trapping are slack, men who carve gather in small groups, each with his wooden kit of tools and ivory. They have not been carving for white folks as long as the

King Islanders and are not all so skilled, yet there are some among them who are artists.

In that medium so unmistakably their own, walrus ivory, we find them making the creatures of their far Arctic world; walrus, whale, bearded seal from the sea, the birds of the waters; and from the tundra, reindeer, white fox, snowy owl and ptarmigan. Excavation proves that these people from early times made small ivory birds and animal figures. They played and still play a game with small ivory ducks. So the suggestion of an interested Coast Guard captain and the encouragement of government teachers found ready response and the modern art gradually developed. Naturally clever fingers made these figures better and better, more and more real. The islanders soon found that many of the miniatures could be beautifully made from the teeth of walrus, thus saving the tusks for paper weights, ash trays, fountain pen holders, and other larger articles.

A present

Aghnelo said, "Tomorrow I carve, I make you present."

Two or three times the next day we passed through the entry way of the fine big house of Aghnelo's older brother. Each time we had to step past Aghnelo, squatted there above a tiny vise, with file and knife. In the evening Aghnelo brought me a jewel case, such a jewel case as perhaps never was before, hollowed-out of the small end of an exquisitely golden-brown old tusk and set into a base of fresh cream ivory. The fitted cover of fresh ivory bore a white ivory seal; the whole was polished and rubbed so that it shone like glass. This was the present Aghnelo had made.

Artists in ivory! On windblown beaches, in cluttered houses, in friendly workshops, in the tiny sleeping rooms of the walrus skin houses heated and lighted by seal oil lamps, in all these places fingers are busy, whenever the spirit moves.

For these are artists. They carve when they feel like carving. The roots of their art lie in the shadowy past of the primitive North. Their output cannot be computed nor regimented. And this is a cheering thing. Because here is hope that Eskimo carving may continue to belong to the precious realm of real art.

ARCHAEOLOGIST, SELF-MADE

That arrowhead Junius Bird picked up at the age of nine started him on a roving career re-blazing the trail of primitive man from the Arctic Circle to Cape Horn

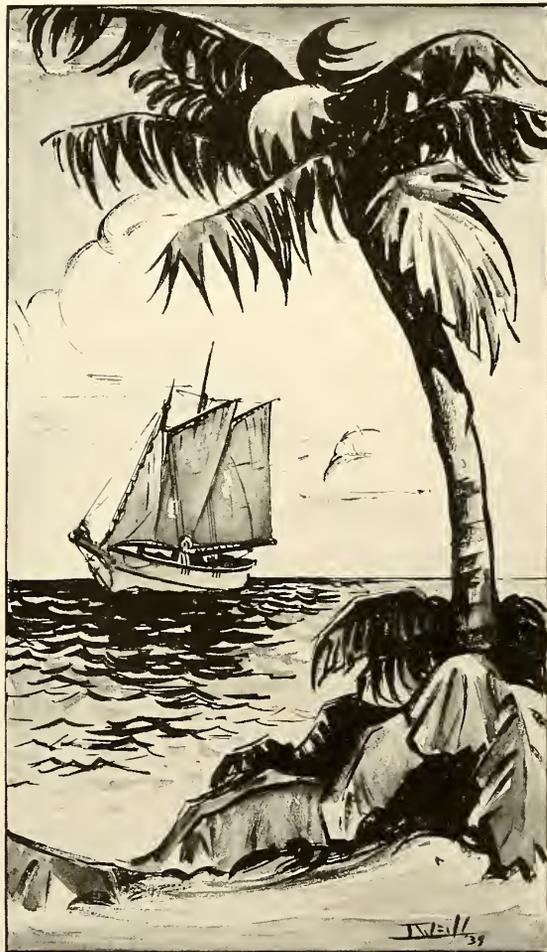
THE Bird's Nest is a rambling dwelling on Westchester County's shore line. The Birds inhabiting it consist, by an odd paradox, entirely of mammals and are, in turn, more or less accredited members of species *homo sapiens*. The chief mark of identification in the males of this family is the preoccupation of each with one of three branches of Natural Science, and once this essential feature has been grasped, classification may readily be accomplished upon the most cursory of observations. The paternal Bird (Henry Bird) is conspicuous for his collection of insects; his eldest son (Roland T. Bird*) for his dinosaur investigations, and his youngest (Junius Bird) for his absence. The latter characteristic is the result of wilful over-indulgence in the prerogative of archaeologists which is generally known as wanderlust and which has led Junius Bird from one tip of the Western Hemisphere to the other in the course of ten expeditions in as many years.

Wanderlust afflicted Junius at the tender age of nine. Poking about in the open country then surrounding the Bird's Nest, Junius stumbled on an Indian arrowhead (to date, the finest he's ever seen from that region), and this discovery obliterated any hope that he was destined to adopt a respectable, sedentary way of life. His collector-father fully understood the lure of ransacking the countryside for curios and actively encouraged the boy. Under this sponsorship, the more specimens Junius found the more he wanted, and in the next few years he amassed a prodigious collection of pre-Colonial bric-a-brac, scouring the township of Rye, New York, as Roy Chapman Andrews did Mongolia. Naturally the younger Bird's formal education suffered. The way to school took him through the same woods and fields that formed his principal collecting grounds, so that frequently he had to call upon the elder Bird to pen solemn notes concerning "an indisposition" of the previous day. In time his father's sym-

pathy was all that stood between the youthful collector and the truant officer.

Eventually, however, Junius managed to enter the freshman class at Columbia University, commuting thither

As Junius was in the act of skimming a biology text for his first morning recitation, Mr. Putnam coughed, lowered his paper and said: "Well, Junius, how would you like to



ILLUSTRATIONS BY IRWIN J. WEILL

by rail from the Bird's Nest. While thus engaged, he found himself one fine spring morning seated next to Publisher George Palmer Putnam, with whom he had struck up an acquaint-

ance. As Junius was in the act of skimming a biology text for his first morning recitation, Mr. Putnam coughed, lowered his paper and said: "Well, Junius, how would you like to go to Baffinland with Captain Bob Bartlett this Summer?" Had Mr. Putnam not been the father of the celebrated David Binney Putnam, boy explorer of the Arctic, Junius might well

*Author of *Thunder in His Footsteps*, published in May, 1939 NATURAL HISTORY.

have thought him an idle wag. But the publisher was unmistakably in earnest. "Since you've turned our Rye woods into a chain of pot-holes," he continued, "I think it would be in the community's interest to turn you loose in the frozen north."

The beautiful vision of actual professional collecting work floated like a dream of fair women across the closely printed page of the text-book. But Junius shook his head. "Gosh, I'd like to, Mr. Putnam," he said "only I've got to go to work this summer, and besides there's the college again first thing in the fall."

Later that morning Junius sat in a freshman English section, lending an inattentive ear to a harangue on the finer points of literature in centuries long past. When the bell ended this session, Junius made up his mind he had had enough. He cut his next class and turned up less than half an hour later in the offices of Putnam's Sons. Mr. Putnam had only to glance at the erstwhile freshman's face to guess his mission. "Changed your mind, eh?" he said. "Well, that's fine."

A few days thereafter, Junius set forth on the first of four Arctic voyages aboard the famous schooner *Morrissey*, captained by the irrepressible Bob Bartlett. Equipped with a working knowledge of marine engines gained during a youth spent on Long Island Sound, Junius was quickly apprenticed to the engine room while afloat and to running motor boats for landing parties once the *Morrissey* dropped anchor in Arctic waters. But his duties were not confined entirely to such grease-ridden chores. Much of the time he was on shore making systematic archaeological collections, and it was in pursuing this science that what he now calls "the Bird luck" came to the fore.

Slender hope of the expedition was to secure relics of the mysterious Cape Dorset Eskimos, a culture which had disappeared suddenly from the eastern Arctic without a trace. Only rarely had any tangible remains of their existence been brought to light, yet the redoubtable ex-freshman struck "pay dirt" almost immediately. In short order he unearthed a ruin yielding abundant tools and weapons which undoubtedly had once been fashioned by the Cape Dorset people, and bundled them for transport aboard ship. Today, Junius modestly ascribes this discovery to blind luck, contending that Fortuna willing, anybody can do archaeological work. Lest untested aspirants to the

life of a "digger" be lured by this into overconfidence, the writer feels constrained to add at once that subsequent events have proved the Bird luck to be a very special brand—almost a talisman assuring its possessor a charmed life.

The spell of the Arctic

With the best of intentions, Junius resumed his studies at Columbia when he returned in the fall. But whether the legendary call of the wild sounded from afar in his ears, or whether his fate had been sealed from the moment he appeared in G. P. Putnam's office the previous spring, the life of a sophomore was in some mysterious fashion forbidden him. The fact was, Captain Bartlett was then organizing another expedition to the Arctic and was anxious to avail himself of Junius's ser-



vices. A series of delays caused Captain Bob to repeat the offer from time to time, but like the mighty Cæsar, Junius thrice refused. Manfully he struggled through the first term culminating in the mid-year examinations. Still, the lure of the North was ever present and when the Skipper sent him an emergency plea during the inter-term vacation, Junius threw up his hands, accepted, and 36 hours later was northward bound on the *Morrissey*. By this act he lessened the ranks of potential Ph.D.'s or even mere B.A.'s by one. For thenceforward the education of this Bird was to take place in the field.

By the time Columbia's second term was in full swing, Junius was happily rummaging in refuse heaps on the Aleutian Islands. Contrary to usual notions of the Arctic, 100 cubic feet of refuse in this region is richer in artifacts than an equal amount in any other quarter of the globe. With the arrival of summer, Junius and his colleague built up an imposing stratigraphic record of the vicinity—a project as taxing on the sinews as on the intellect. But here was an idyllic existence. When sundown brought their digging to an end, Junius and his companion relaxed in a warm sulphur-

spring bath, whose temperature they could regulate by a primitive but effective system of sluices. Lolling in these healing waters, they gazed aloft at the glaring snow fields of the tundra, yet by reaching out a dripping arm, they could pluck sweet-smelling Arctic flowers that grew in profusion around their pool.

Refreshed by the soothing hot tub, Junius amused himself with such extra-curricular activities as introducing Eskimo girls to the dulcet tonal achievements of Rudy Vallee on wax, and the catching of a baby walrus bare-handed for a Museum Group.

Even at this early date in his long Arctic career, Junius's colleagues had learned to expect the Bird luck to bring up invariably some more or less astonishing find. They were not disappointed. Dream of many an archaeological investigator of this region is to discover mummies buried here long ago by an earlier cultural group. Smithsonian Institute has a small and valuable collection of them, but they are none the less considered great rarities and Museum anthropologists were anxious to have some represented in their assemblage of Eskimo cultural remains. For weeks Bird and his companion upturned nothing more than a few desiccated skeletons. Then one day, like some fabulous divining rod, Junius hit upon a burial area. Spades and picks were quickly plied and that evening he returned to the *Morrissey* with the several fine mummy specimens which are now ensconced in the American Museum.

From this time forth, Junius's fellow Birds became resigned to the fact that the Nest was for him no more than a depot where he might drop in for a meal or two between expeditions to the Arctic. It was, therefore, no occasion for surprise when, the following spring Junius again boarded the *Morrissey* as chief archaeologist of the Bartlett Expedition to Northeast Greenland. This was an important assignment. He had prepared for it by a winter of studying all available literature on the region, since it was advisable to have at his finger-tips every clue and hypothesis concerning this easternmost limit of Eskimo migration. On sledges constructed at the Bird's Nest, Junius made his way across the Shannon Islands where no serious work had ever been done, and brought back an extremely valuable collection, which might have been of even greater worth had he been able to excavate the

many sites which the pressure of time forced him to leave intact.

Southern interlude

Returning to civilization, Junius became restless. He was, therefore, an eager listener when Dr. Clark Wissler the Museum's Curator of Anthropology, outlined the proposition of a certain gentleman concerning a Caribbean voyage in search of shell mounds. A capable navigator, Junius was just the man for the job. Would he take it? Would he! A few minutes later he was interviewing the shell-minded gentleman in a downtown apartment, and once the necessary arrangements were made, he prepared to board a ship bound for Cuba.

The city of Havana, Pearl of the Antilles, is a diverting spot for the casual winter tourist who enjoys browsing about in the tropical sunshine by day and various street-side oases by night. It can, however, be something of a seventh hell to a coltish archaeologist brimfull of the brisk efficiency induced by the invigorating chill of the far North and itching to get into the field. But things seem geared to a slower tempo in southerly waters and Junius had to endure a languorous period of delay, brightened only by conversations with the expedition cook—a negro who had run away to Germany as a boy and now spoke a husky negroid Spanish with the accent of a Bavarian *Brau-meister*.

The shell-man happened to rent an oyster boat belonging to a bootlegger, and for the next several weeks Junius had the job of grooming the battered vessel for the relatively quiet coastal work contemplated on the expedition. When the oyster boat at last resembled a sea-going craft, the expedition was informed that the Cuban Port Authority would grant no clearance papers for a bootlegger's boat. No course remained but to buy the vessel, and finally one bright morning, the sails fluttered out to a billow and the ill-starred little expedition cruised past the gray walls of Morro Castle into the brilliant sapphire waters of the Caribbean.

Exhilarated by the tangy sea air, Junius banished all thought of the delay as he looked forward to weeks of profitable excavating in the shell mounds of lonely Central American beaches. Troubles began when an irate Guatemalan school teacher paid the explorers the compliment of arraigning them

for a wholesale rifling of her country's antiquities, although they were concerned only with such economically valueless trifles as broken dishes and stone implements. Their permit to collect was canceled promptly, and though it was later restored they were preparing to sail for home when Nature took it upon herself to hasten them on their way with one of the worst hurricanes the port of Belize had ever known. The first wild gust carried them halfway out of the harbor. Then Junius tenderly paid out the rope of the oversized anchor which plunged to the bottom with a resounding thud. For a little time the slender rope valiantly dragged its load through the boiling



waters. But inevitably, it snapped, and the oyster boat was sent scouting out to sea. Fortunately, one of the crew had sailed through a number of hurricanes and was able to direct operations with authority. By some providential benevolence and the indefatigable Bird luck, the oyster boat was one of the two craft that survived the tempest. In the afternoon a turn in the wind blew them back toward the concrete pier, now a Sargasso Sea of splintered wreckage. As they drew near, Junius feared a collision. But they swept past and as they did so, a noose was cast over a projection and the boat made fast to the dock. Previously, Junius had sealed all his films and packed them with his collection notes in a suitcase. Thus burdened, he was prepared to dash over the scrambled débris after the manner of Eliza on the ice floe, but, happily, he was spared an emulation of this historic feat.

The once prosperous little port of Belize now lay in a state of ruin comparable only to the moral and physical disintegration of the expedition. A rum-running center, its storm-cluttered streets literally flowed with the alcoholic contents of wrecked warehouses, and this was a windfall which many of the surviving civilians regarded as the silver lining to the dark cloud just passed. The result was that Junius did not breathe easily until lines of communication were re-established and he

was able to make his escape from what was left of Belize, the oyster boat and the expedition generally. For the first time in his life, Junius was heartily and unreservedly glad to return to civilization.

Of lice and men

After a summer of routine work in the quiet hills of Pennsylvania, Junius's spirits revived and he once more heard the North a-calling. By this time, he had made up his mind, as had other explorers before him, that the bleak simplicity of the Arctic was preferable in every respect to the turbulent vagaries of Nature in the tropics. And so, like a prodigal son, he returned to Captain Bob as archaeologist on the distinguished Peary Memorial Expedition.

It should not be supposed that the "friendly Arctic" had always allowed Junius to poke about her top-soil without even a hint of reprisal. For, although no hurricanes blow in this region, it boasts some sturdy, freedom-loving creatures from whose rebellious intentions he had made more than one spine-chilling escape.

Perhaps a bit cocky, because of his bare-handed capture of the baby walrus, Junius set out calmly enough to obtain photographs of musk-oxen for the Museum. After observing the grazing habits of these shaggy bovids, he decided that they were tame as cows and that his assignment was nothing short of child's play. Ignoring the lethal horns of an old bull, he edged up on the animal, his eyes fixed on the finder of his camera. At this point, the bull, startled by one of the expedition's dogs turned and charged. One glance convinced Junius that this Arctic assailant was far nimbler on his feet than the domestic bull. In fact, the craggy terrain has developed a shiftiness in these animals that would make an all-American half-back blush for shame. Needless to add, it was inadvisable to try an amateur's hand at the graceful *veronicas* of the bull-ring. Junius simply dropped his camera and ran.

Another time, Junius and his companions were attempting to hoist a wild, very much alive, and thoroughly peevish polar bear aboard the *Morrissey*. It was Junius's task to maneuver a rowboat around the white-furred giant until he could slip a loop of rope under its mid-section. Skulling as close as he dared to the threshing paws he skillfully carried out this precarious assignment only to have the bear re-

verse its course and, apparently deciding to bring the situation to a head, proceed to climb into Junius's frail boat. Horrified at the gnashing jaws and barely able to keep his feet on the heaving floorboards, Junius risked all on a wild sweep of his dripping oar. It was neck or nothing, for the none too fragrant fumes of bear-breath were already warming his cheeks. But he caught the black snout with a stinging thump, and the startled animal back-somersaulted into what must have seemed the safer medium.



It remained, however, for one of the Arctic's smallest creatures to provide Junius with his most harrowing experience. Dr. Frank E. Lutz, Curator of the Museum's Insect Department, had once expressed a desire to have specimens of Eskimo body lice brought back for his collection and, although he later regretted it, Junius volunteered to trap the creatures in their native haunts. After carefully selecting a potential hunting ground among his Eskimo friends, Junius handed them a pair of small bottles and requested as tactfully as one can in sign language that they might possibly be able to fill the order. The Eskimos thought it a great joke and went off with the bottles. How important a place the louse occupies in Eskimo life may be indicated by one of their folk-sayings: "That man is so old his lice don't taste good," which corresponds to our "old as Methuselah." The full significance of this aphorism becomes clear when one remembers that Eskimos, like most primitive people, habitually make between-meal snacks of the parasitic life on their bodies.

There was much other work to be done, and having handed over the bottles, Junius forgot all about his Eskimo friends until they suddenly appeared alongside the *Morrissey* as the expedition was about to weigh anchor. In the bustle of leave-taking, Junius hastily shoved the bottles into his pocket and

went about his chores. But later, during a respite, he went below to chat with the engineer, who cautioned him against sitting on a particular bunk because an Eskimo had been sleeping there and had probably left a few "remembrances."

"Oh, that doesn't bother me," said Junius. "Look what I've got." And, reaching in his pocket he pulled out—an empty bottle. The cork had worked loose, and although one bottle was safe for Doctor Lutz's insect collection, Junius was faced with a period of

sleepless exile on deck until he and his unwanted companions could manage to part company.

For any less intrepid personality, this would have evoked a heartfelt farewell to louse-hunting, but it was not long before our dauntless archaeologist was collecting essentially the same fauna in a remote village in Tierra del Fuego to which vicinity he had been sent on a one-man reconnoitering expedition by Doctor Wissler. Here the procedure was a more delicate matter. Junius had befriended a remarkably intelligent old native who could read, speak and write both English and Spanish. It is difficult to solicit lice from a person of such high intellectual attainments, but Junius played his hand carefully.

"Clemente, do you suppose there's anyone around here who could find me a few body lice?"

Clemente thought the matter over gravely and then replied, "Yes, I believe if you ask Juan down the path a way, he may be able to get some from his children."

Junius approached Juan and told him what Clemente had said. Juan grudgingly agreed to take the bottle and when Junius returned to find it filled Juan snorted, "You could have gotten all these and plenty more right in Clemente's house."

Junius could well believe it, but he

felt he had managed a ticklish situation with admirable diplomacy.

Man's farthest south

The spade work Junius was conducting in Tierra del Fuego was of singular importance to the science of archaeology. Farthest from any of the several areas which scientists have hypothetically established as Man's place of origin, this remote promontory at the southernmost tip of South America offers rich material on the extent of Man's distribution and the puzzle of his varied migrations. Alone, and living the harsh native life, Junius was able to disclose a sufficient number of artifacts in his six-month sojourn to make future collecting work on a better organized scale well-nigh obligatory. With this as a start, South America soon became his major field of endeavor. But an incident in his personal life forced him temporarily to suspend operations.

From a subsequent project in Bolivia, Junius returned to the environs of the Bird's Nest just long enough to become a husband. For a honeymoon, he—you've guessed it—took his bride on an expedition. Reliable old Bob Bartlett transported the couple as far north as Labrador where young Mrs. Bird took up a most bizarre variety of domestic duties. Her husband assigned her the dusty job of cleaning house in Eskimo dwellings that had been uninhabited for a century or more. But she seemed to thrive on it for, after their return to the Museum, Doctor Wissler looked at the archaeologist's bride for a moment and then said, "Well, how did you like it?"

She was loyally enthusiastic.

"Splendid." Doctor Wissler said, "How about three years in Tierra del Fuego?"

Mrs. Bird gulped. She would have rather liked assembling her wedding presents in a little home of their own, but the way of an archaeologist is the wind's way and she bravely resigned herself to two and one-half years spent, in part, on a 19-foot sailing boat. Together they cruised along the fog-bound coast at the very bottom of this hemisphere seeking clues to Man's wanderings in a prehistoric era, in order that the story of these migrations may be someday revealed in full detail through their trail-blazing efforts and the work of those to follow.

Today, Junius Bird is enjoying the unaccustomed task of sedentary office

Continued on page 64



Courtesy, American Museum of Natural History

The first vertebrate to display "OPPOSABLE THUMBS"

THE LITTLE FELLOW YOU SEE pictured above is a tree frog, *Hyla andersonii* (habitat, New Jersey to South Carolina).

In the long parade of vertebrates, beginning with fishes and ending with man, he is the first to display "opposable thumbs," or grasping organs.

As he leads the life of an acrobat, leaping from limb to limb in trees, Nature has wisely provided him with this protection.

He also has suction pads on each of his toes, which, like his opposable thumbs, keep him from slipping. These tiny pads are so powerful that he can stick to smooth, vertical surfaces, even glass, without difficulty.

He can also change his color to blend with his background. This protection helps conceal him from his enemies and makes him a difficult subject to photograph.

All in all, Nature has been generous to the tree frog. She has given him three forms of protection—and each

one makes life happier and more secure for him.

At the upper end of the animal kingdom is man, the most complex vertebrate of all. Being intelligent, he has provided himself with forms of protection beyond those with which Nature endowed him, forms which make life happier and more secure for him. Among them are the various kinds of insurance.

For example, life insurance is used by man to protect himself and his family against future want. He employs accident insurance to provide money at a time when bodily injury might prevent his earning it. And he carries automobile liability insurance to protect his home, his savings, and his good name, all of which might be taken from him as the result of a highway mishap.

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WHAT SNAKE IS THAT?

----- by Roger Conant and
William Bridges

D. Appleton-Century Company, \$2.00

THE primary purpose of this book is indicated by the title. In addition to identification, however, the distribution of each species and subspecies and a concise summary of habits is given. Eight pages are devoted to a general account of snakes, as many more to snake bite and its treatment.

Identification of the snakes of the United States is certainly made as simple as possible without sacrifice to scientific accuracy. In order to determine the name of any snake one need only to know its place of origin, the type of scale and anal plate that it has, and its color pattern. A special plate describes the two types of scales and anal plates; and color patterns of the great majority of kinds are clearly illustrated.

Both of the authors are well qualified by extensive zoo experience to write for the layman, the senior author being a professional herpetologist of high standing. The book is not only scientifically accurate but reflects the latest professional opinions on the classification and distribution of our snakes.

CLIFFORD H. POPE.

PENTHOUSE OF THE GODS

----- by Theos Bernard

Charles Scribner's Sons, \$3.50

THEOS BERNARD went to Lhasa to learn all he could about the religion of the Tibetans. He left knowing more about that fabulous city than any other white man—or indeed, than most Tibetans.

Lhasa is the most difficult city in the world to enter, and therefore, there are nearly as many people claiming residence there as we have descendants of Mayflower passengers. Strangers are not welcomed within its gates because it is the Holy of Holies; there is no large scale commerce carried on, only religion. His religion is the most serious and important thing to a Tibetan and he sees no reason for letting outsiders in to merely look on and, mayhap, defile his temples. Of the few who have really reached Lhasa, most of them had to be content to remain in the city itself and were not given free access to all the shrines and chambers of the Potala.

But Doctor Bernard went to Tibet as a

student of Buddhism and not as a tourist. He was more than accepted—he was thought to be the reincarnation of one of their saints and welcomed with open arms. He was initiated into all their rites and secrets and stands today as the only American Lama. He tells of his experiences in the Penthouse of the Gods, which is his Americanization of that gigantic edifice—the Potala. He gives an accurate reporting and does not attempt to make his trip seem a perilous adventure and himself a super hero. Instead we learn the everyday facts that are so homely and appealing—sanitation, weather, food and customs. We are also given fascinating descriptions of the religious and political phases and personages. But best of all Doctor Bernard explains the eternal "Om mani padme hum!", the theory of reincarnation, what religion means to the Tibetans and what they can look forward to.

The photographic illustrations are masterpieces. It is too bad that a glossary and

map are not included, they are so necessary.

SEWARD S. CRAMER.

WHAT SHELL IS THAT?

----- by Percy A. Morris

D. Appleton-Century Company, \$2.25

THIS compact little hand book was compiled by Percy A. Morris, a member of the technical staff of the Peabody Museum at Yale, and is especially adapted for the use of amateur naturalists and shell collectors. It is purely conchological in scope and limited to the species indigenous to the coastal region from Labrador to Cape Hatteras.

The subject matter is conveniently treated under five headings: marine pelecypods, marine gastropods, fluviatile pelecypods, fluviatile gastropods, and terrestrial gastropods. Also the technical terms are clearly defined and the species carefully described, but the photographs accompanying every description are, in many cases, too weak and blurred to be of much diagnostic value. Had the latter been retouched and their salient features more sharply brought out, the value of this otherwise very useful little book would have been greatly increased.

GEORGE H. CHILDS.

WHAT TO SEE AND DO IN MEXICO

----- by George W. Seaton

Prentice-Hall, Inc., \$3.50

MR. SEATON has prepared a very pleasant compendium in *What to See and Do in Mexico*. His years of experience in the tourist business put him in a position justly to distinguish between what the traveler wants to know and what available information is superfluous to him. The history of our Latin American neighbors sounds no chord of recollection in the average American nor do the peculiar social problems awake even a dim hint of comprehension. Most of us travel for pleasure and do not see fit to undertake a course of reading in advance. Therefore, a little volume like this which sets the scene for comprehension and recognition, should prove extraordinarily useful, even if it lacks the fullness of Terry's standard guide which has the Baedeker approach. Mr. Seaton has done a highly useful job in trying to dispel that glaze of un-understanding which so distinguishes the eye of the American tourist in Mexico.

G. C. VAILLANT.

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H. E. VOKES.

HARDY CHRYSANTHEMUMS

----- by Alex Cummings, Jr.

McGraw-Hill, \$2.50

THE chrysanthemum, with its history of cultivation dating back to the Confucian Era, has in the past few years been brought into renewed fame and favor by the well-known horticulturist, Alex Cummings, who has developed many new hybrids from the hardy Korean type.

Chrysanthemum, from the Greek "chry-sos" (gold) and "anthos" (flower), has long since lost that limiting "yellow" factor under the hands of expert geneticists, for we find listed such color variations as bronzy-red, soft pink, white, salmon red, port wine or silvery-lilac in his "recommended varieties."

Out of vast experience he gives very concisely much valuable information here on propagation, culture, diseases and breeding of hardy chrysanthemums which are suitable for various types of gardens.

FARIDA A. WILEY.

CAPTAIN BERNAL DIAZ DEL CASTILLO. A TRUE HISTORY OF MEXICO

-- translated by Maurice Keatinge

Robert M. McBride and Co., \$3.75

BERNAL DIAZ DEL CASTILLO was a soldier in the army of Cortes, during the entire campaign of the Conquest of Mexico which began in 1519. He has the great gift of describing what he saw as he saw it without the invocation of literary tricks. His memoir, *A True History of the Conquest of Mexico*, or *New Spain* as it is called in most editions of this unique work, is one of the great foundations for any history of Mexico, Indian or Spanish. Bernal Diaz gives us the viewpoint of the ordinary man, witnessing great events and fantastic scenes; it was through his eyes that Prescott saw the pageant he described in his important work.

Bernal Diaz radiates a bluff, burly charm. He makes historical figures become living characters. A rousing good fight is all in the day's work and on looking back (he wrote his account some decades after the events took place) he is amazed at what Cortes' hard-bitten hand-fol actually accomplished. The greed of

high officers, the generosity of Montezuma, the virtues of the war horses denied to a humble soldier, the merits of the ordinary fighting men, are all set forth with a homespun acuteness that flavors the whole volume.

Five books are essential to a reading background of Mexico, Flandran's *Five Mexico* for the ordinary modern scene, Anita Brenner's *Idols Behind Altars* for the artistic renaissance of recent years, Spinden's *Ancient Civilizations of Mexico and Central America*, for the Indian past, Prescott's *Conquest of Mexico* for the Conquest, and finally, Bernal Diaz del Castillo for the effect of the impact between Spaniard and Indian. It is a boon to all visitors to Mexico that McBride and Co. have re-issued this important source. The fact that this is a somewhat inferior translation, by no means detracts from the value of making this great book accessible to all at a low price.

G. C. VAILLANT.

INDIAN OASIS

--- by Janette Woodruff, as told to Cecil Dryden.

Caxton Printers, Caldwell, Idaho, \$3.00

SQUAWTOWN: My Boyhood Among the Last Miami Indians

----- by Will M. Hundley

Caxton Printers, Caldwell, Idaho, \$2.50

MRS. WOODRUFF, the heroine of *Indian Oasis*, spent the best of her life, the years 1900-1929, in the United States Indian Service, first as teacher then as matron. Her time was divided between the Crow of the plains, the Paiute of the Great Basin and finally the Papago of the Arizona desert. The aim in her book is to recount experiences with these Indians, chiefly with young people, in nursing the sick, assisting at confinements and fighting to keep out liquor. It was a busy, hard life, but far from an unhappy one. There are adventures now and then, but through many pages of the book stalks the stern realism of reservation Indian life.

Squawtown is a charming autobiography of a white boy whose father moved to the Miami Indian reservation in Indiana about the year 1875, to teach the Indians to farm. Though most of the Indians left Ohio and Indiana after the War of 1812, a remnant of Little Turtle's tribe chose to remain on the Mississinewa River, a tributary of the Wabash, where some of their descendants still reside.

It is an entertaining book, though telling more about rural white life in the wooded country of Indiana than about the ways of the Miami Indians. The two best historical chapters are those describing a "Turkey Shoot," and an old-fashioned dance at which the white "bad boys" changed the wagon wheels, tangled the harness and played all the other rough pranks in vogue in the 70's.

Both books are from the Caxton Printers of Caldwell, Idaho, who have already established a reputation for good popular books revealing the feel of the West and its history.

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by Victor T. Allen

Bruce Publishing Company, \$3.50

GEOLOGY, dealing with the earth upon which we live, is one of the most fundamental of the sciences, nevertheless, there is as yet a lack of adequate non-technical works telling the story of the science in a sufficiently popular vein to hold the interest of the average reader. *This Earth of Ours* comes close to filling this need, particularly in the early chapters devoted to the principles of Dynamic Geology. The later chapters on Historical Geology, in my opinion, attempt to include too much detail in the space allotted and as a result are not up to the earlier standard.

Perhaps the most notable feature of the work is the great number of illustrations, exceptionally well chosen, and most of them new. There has been a tendency among writers on geological subjects to use certain illustrations which have appeared so many times in textbooks that one who makes a practice of examining nearly all new publications on the science often feels that he can foretell just which scenes will be used to illustrate each topic discussed. Many geologists will find much of value here.

This is a volume in the "Science and Culture Series" edited by Joseph Huxslein S.J., Ph.D. However, only in the chapter entitled "The Origin of Life" does the story bear the imprint of the dogma of the Roman Catholic Church.

It is a book to be recommended.

H. E. VOKES.

GUATEMALA PROFILE

Addison Burbank

Coward-McCann, \$3.50

MODERN PRIMITIVE ARTS

Catharine Oglesby

Whittlesey House, \$3.00

THE steady stream of books on Middle America and on Indian North America is indicative of a gradual shift of our national interest from being a cultural dependency of Europe to becoming a part of new continental American tradition. The majority of the volumes take the form of various personal experiences of individuals subjected to these new stimuli. These books make delightful reading, often, but they hardly are bibliographical references for the purblind eyes of this bearded Americanist.

Addison Burbank's *Guatemala Profile* is a sensitive and charming account of an artist's personal experiences in Guatemala, which is fortified by considerable reading. The volume conveys in words what the author expressed in his drawings and paintings. Observation, keen and clear, is never dulled by conventional phrases. I suppose the most sincere compliment I can pay is to express my envy of Mr. Burbank for seeing so much of Guatemala with such a keen sense of personal enjoyment and fulfillment.

Catharine Oglesby's *Modern Primitive Arts*, strives to inculcate in the reader that satisfaction, which some people, including the reviewer, feel in the anonymous arts of those socially and economically unspecialized people, whom we are wont to call primitive. Her book is a technical and emotional introduction to the Indian arts of the southwestern United States, Mexico and Guatemala. *Modern Primitive Arts*, however, suffers immeasurably from careless composition, occasional errors of fact, and an indifference to the proper spelling of place names that reflect credit neither on the author nor the publisher.

The enthusiasm, the sense of personal experience, which is radiated by these two volumes should induce many readers to follow their example. To travel south, to watch and absorb the honesty of native life, offers every potential tourist the chance to be a traveler, freed from the dogma of guidebook writers. Yet let it not be forgotten that the description literature on Indian culture began with the Spanish Conquest and has continued for four long centuries. Discovery of the Indian is a personal matter, not an intellectual one.

G. C. VAILLANT.

GARDEN PLANNING AND BUILDING

H. Stuart Ortloff and
Henry B. Raymore

McGraw-Hill Book Co., Inc., \$3.00

GARDENS and spring are almost synonymous. As formerly at the spring season, new books on the how, when, where and what of gardening techniques begin to appear. In *Garden Planning and Building* the emphasis is placed on design as the prime factor in making the "Home Beautiful." These two Landscape Architects tell us there must be "balance, coherence, unity and symmetry" in garden planning. They try to convey to their readers these factors through the medium of 51 sketches and by means of discussions on such chapter headings as Basic Landscape Design; Gardening and Lawn Making; the Circulatory System; Water Features in Landscape Design and other underlying principles which govern the creation of pleasing effects in landscape gardening.

There are numerous practical suggestions here such as: how to build paths, brick walls, rock gardens, dams, pools, fences, and what type sculpture is permissible or what constitutes good taste in garden etiquette; but no doubt many home owners will still need the aid of the landscape architect to interpret their particular situation in terms of the "stage," "occult balance" and "vistas."

FARIDA A. WILEY.

THE RECENT MAMMALS OF IDAHO

by William B. Davis

Caxton Printers, Caldwell, Idaho, \$5.00

THIS contribution from the Museum of Vertebrate Zoology at the University of California, is a substantial volume, well printed and conveniently planned.

There is a description of the 141 living mammals in Idaho, with 23 maps showing the range of species within the state.

For each species and subspecies there is given the most acceptable common as well as the correct scientific name. The volume contains a separate list of the 43 specific and subspecific names based on Idaho taken mammals, valuable data on type specimens, and a gazetteer of all the localities from which specimens have been recorded.

The book contains a wealth of information well worth the perusal of the student and professional mammalogist.

G.G.G.

MAN THE WORLD OVER

----- by C. C. Carter and
H. C. Brentnall

Appleton Century Co., \$3.00

THE difficulties of writing a geography book in this year of grace are epitomized by the publisher's footnote to the chapter called "East of the Rhine." It reads, guardedly enough, "At the time of going to press, the boundaries of Czechoslovakia and its adjacent countries are in the process of change." It does give one pause to think that a book becomes dated these days before it rolls off the press.

Yet, despite this superficial handicap, *Man the World Over* presents in a laconic, easily assimilated manner, a reasonably up-to-date assembly of the materials, natural resources, man-power—in short the wealth—that motivates the kind of "process of change" to which its publishers refer. The book is written, as every book should be, with one eye on the post-Munich world. It tries and seems broadly to fulfill, the role of purveyor of cold facts to John Public. That Germany has a population of 72 million and France 42 million for approximately the same area is one of the cold facts and a very significant one. There are many others of vast significance; especially those dealing with the colonial countries.

MEDICAL ENTOMOLOGY:

Third Edition of *Medical and Veterinary Entomology*

--- by William B. Herms, Sc.D.

The Macmillan Company, \$5.50

THIS is an almost entirely rewritten and enlarged edition of the previous books on the subject by Doctor Herms, and, as it should do, it reflects the enormous gain in knowledge on the subject during the past decade. Before the beginning of the present century, travelers to tropical regions and residents adjacent to swampy areas of temperate climes attributed malaria (and yellow fever in the tropics) to some scourge carried in the mists that often arose from the swamps. Today almost everybody knows that these diseases are carried by mosquitoes and that they can be transmitted in no other way. Forty years ago less than a dozen diseases of mammals were known to be carried by insects; today there are scores of them and the number is being in-

INFORMATION TEST

A few informational high spots that may be gleaned from this month's NATURAL HISTORY

Score 5 points for each correct answer. Correct answers on page 62

1. The peaks called the Mountains of the Moon are entirely mythical. True..... False.....	11. Although 98.6° is normal human temperature in the temperate zone, the figure is substantially lower among tropical people and higher in arctic dwellers. True..... False.....
2. The bittern can move each eye independently. True..... False.....	12. Among the artist's tools which modern Eskimo ivory carvers have derived from the white man are (a) Cast-off dental drills (b) Mechanical stamps to reproduce their designs in larger lots (c) Sculptor's mallets and chisels
3. When a beaver is caught under continuous ice without any breathing hole, he (a) Holds his breath until he dies (b) Gnaws through the ice with his sharp teeth (c) Expels the air from his lungs and allows it to freshen in contact with ice and water	13. Both Greeks and Romans used rose perfume to (a) Cure "hang-overs" (b) Extinguish fires (c) Place a magic curse on their enemies
4. The Praying Mantis will attack man whenever possible, its sting resulting in death. True..... False.....	14. If the mosquito-carrier lands on a man's arm but does not bite, but fly larvae will be unable to enter the human tissue. True..... False.....
5. The color of a lizard may be affected by the day's temperature. True..... False.....	15. The Praying Mantis resembles man in that (a) It bears live young (b) It can turn its head (c) It shows close parental cooperation in raising the young
6. A Thermocouple is (a) An electrical instrument used to measure temperature (b) A tool used by Eskimo artists (c) A device used by Martin Birnbaum to photograph volcanoes	16. Our term "Attar of Roses" is (a) A commercial trade mark (b) A corruption of "Adder of roses" referring to a legendary serpent (c) Derived from the name of a Persian prince
7. The human bot fly is so called because (a) It can turn its head like a human (b) Its larvae develop in the skin and muscle tissue of man (c) It feeds on human blood like a mosquito	17. The facial pits of rattlesnakes are (a) Their ears (b) Storage places for their venom (c) Heat receptors
8. Bittern chicks keep their nest clean by retiring to relieve themselves after eating. True..... False.....	18. The rose occurs in only three colors: red, white, and yellow. True..... False.....
9. Was the Praying Mantis imported to this country to combat the Japanese beetle? Yes..... No.....	19. Should bot fly larvae enter your body, it is advisable to kill them at once by pressure, iodine, or other violent means. True..... False.....
10. The safest time to explore the desert unmolested is at night when most of the snakes are asleep. True..... False.....	20. "Sub rosa," the phrase of secrecy, springs from (a) The mythological gift of a rose to ensure secrecy in Venus's love affair (b) The habit of Spanish beauties of holding roses clenched in their teeth (c) The plating of roses on graves

creased each year due to the diligent research of entomologists and medical men. Doctor Herms discusses all the diseases known to be carried by insects and their relatives—spiders, scorpions, crustacea, etc., both from the standpoint of diseases carried, methods of transmission and means of control.

It is seldom that a book that is intended as a text in colleges, and as a reference for those engaged in public health work, contains such a mass of information of interest to the general public. The layman who might be interested in the subject will find that the larger portion of the five hundred pages is pleasant reading and he is certain to be surprised to learn that a few of our common insects may play an important part in his physical welfare.

C. H. C.

A FIELD GUIDE TO THE BIRDS

by Roger Tory Peterson

Houghton Mifflin Company, \$2.75

THIS is a completely revised and enlarged edition of the book of the same title published in 1934. For those who are familiar with the original work it may be said that the present edition will be found even more satisfactory and useful than the first.

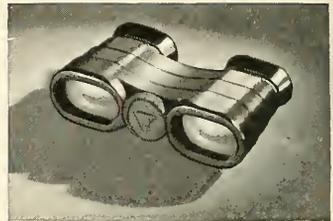
For those unfamiliar with the first edition, it may be said that Mr. Peterson's book emphasizes the outstanding characteristics of the different birds, showing the various differences that are likely to prove useful in distinguishing them in the field. Thus, a particular pattern or marking will frequently identify a species at a glance in a wide range of outdoor lighting and at a considerable distance when colors are indistinguishable and if the observer can be sure of these particular markings he need not worry himself about the minor details that only confuse the issue. Hence both description and illustration are here concentrated on the important features.

The warblers and the brighter-hued finches are illustrated in color since this is important in their case, but the remainder of the plates are in black and white, with color notes where these are particularly significant. The result is a condensed summary of the distinguishing features of the species of birds of eastern North America with non-essentials omitted. The book is thoroughly recommended as a pocket companion for all who wish to become better acquainted with birds in their native haunts.

J. T. Z.

Answers to Questions on Page 61

1. False. See page 15. They are in Central Africa, and otherwise called the Ruwenzori Mountains
2. True. See page 41
3. (c) Expels the air from his lungs and allows it to freshen in contact with ice and water. See page 3
4. False. See page 38
5. True. See page 30
6. (a) An electrical instrument used to measure temperature. See page 28
7. (b) Its larvae develop in the skin and muscle tissue of man. See page 45
8. True. See page 43
9. No. See page 40
10. False. See page 29. Many reptiles do their hunting at night, lying dormant in the day
11. False. See page 27
12. (a) Cast-off dental drills. See page 49
13. (a) Cure "hang-overs." See page 24
14. False. See page 46
15. (b) It can turn its head. See page 38
16. (c) Derived from the name of a Persian prince. See page 24
17. (c) Heat receptors. See page 34
18. False. See page 25
19. False. See page 47
20. (a) The mythological gift of a rose to ensure secrecy in Venus's love affair. See page 25



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*SIRS:

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Philadelphia, Pa.

SIGNED.

Bring 'Em Back Alive — with Movies

By CHARLES H. COLES

Chief Photographer of the
American Museum of Natural History

YOU have probably felt that keen disappointment, when you reviewed the snapshots you took on your last vacation, of having so little left to recall the exciting times or beautiful scenery that you experienced on your trip. The movie maker never has this feeling. He has brought back his memories alive. At his bidding they move on the screen and reconstruct the glorious vistas and pulse-quicken activity that he has seen.

Did you ever take movies? You'd be surprised how easy it is. It is actually easier to get a good movie than it is to get a good snapshot. Movies are not only easier to make, but they are far more fascinating to see than mere lifeless prints. Ask any of your friends to come up to the house to see your album of snapshots that you made on your last trip. Unless you are a past master at artistic photography, your invitation will probably be accepted with a polite but resigned air. But ask someone to come up to see some movies—well, they'd be delighted!

Motion pictures have a great deal more of life in them than still photographs. How often you have taken a snapshot of a person to have it turn out to look like the original subject only by the wildest stretch of the imagination. We do not see people frozen into rigid immobility. They move, gesture, smile. These are attributes of being alive. We recognize friends not only by their appearance, but by little mannerisms and characteristic motions. How can your snapshot reproduce these things? It cannot. But the motion picture can and does. That is why it is such a satisfying sport.

Especially in animal photography is the motion picture camera supreme. Animals whose behavior is unfamiliar to you—creatures of the wilderness, birds, and even insects pursuing their curious existence—make fascinating motion picture studies, which are often of permanent scientific value. With telephoto lenses, animals can be brought closer to the screen than they can to the eye, and the motion picture camera enables you to know them more intimately than you can in any other way.

Besides the realism that motion produces, another factor adds greatly to the enjoyment of motion pictures. In a darkened room, you lose sight of the furniture and surroundings in your home and the motion picture screen becomes a window out of which you see another world. Without a suitable basis of comparison, your eye is tricked into believing that the images are not as tiny as they really are, but are full-sized pictures of the original subjects. It requires only the slightest imagination to project yourself into the scene on the screen, so the first thing that you realize is that you are reliving the action that is being projected. You cannot possibly tell how much movies can mean to you until you have made and projected your own.

What size film

If you really want to get into the fun of

making your own movies, you'll want to decide whether to use 16-millimeter or 8-millimeter films. Unless you want to show your pictures to large audiences of several hundred persons, the 8-millimeter width is the size of movie that you will choose. These cameras are much smaller and lighter than the equivalent 16-millimeter models, and cost much less to operate. The pictures may be made in black and white or in full color, and projected sharply and full of detail in your own living room.

The most widely used type of 8-millimeter motion picture cameras operate in a way that will seem unusual to those acquainted with larger film cameras. It was found that loading and developing such a narrow film was too difficult to accomplish in the usual ways, so it was decided to manufacture the film as a 16-millimeter film and send it through the camera as such. Only half the film, however, is exposed to the light on the first trip through the camera, the other half of the 16-millimeter width being reserved for the second trip. This means that when two minutes of action have been filmed, it is necessary to change the spools around in the camera and send the film through the camera again for the third and fourth minutes of action. After the film is processed, it is split lengthwise into two 8-millimeter lengths, cemented end to end, and returned in one 8-millimeter piece. An advantage of changing the spools at the end of two minutes is that you may substitute another kind of film, for example color film, and finish the first film some other time.

Cameras

Eight-millimeter movie cameras may be obtained in simple or complex models. The simplest has only one lens, which does not require focusing, one film speed, and only one adjustment—for variations in light intensity. This adjustment is extremely simple and easy to make, requiring no previous knowledge of exposure or photography. It is only necessary to load a film into one of these pocket-sized cameras and look through the spy-glass finder. Upon pushing the operating button "what you see, you get."

The most complete of the 8-millimeter motion picture cameras is the new Bell and Howell Turret 8. Here is the latest and most versatile camera that is available for the narrow width film. When fully equipped, six lenses are mounted on its movable turret-plate. Three of the lenses are used for photography, each magnifying to a different degree the object toward which you point the camera. The other three lenses automatically change the viewing angle of the spy-glass finder to correspond to the view of the "taking" lens. With all this startling array of photographic equipment, the camera is still surprisingly small and light. It is, perhaps, the finest and most versatile 8-millimeter camera now available.

Projectors

It is a curious fact that a great many movie makers spend more for their camera than for their projector, when it is really the latter that is more responsible for the re-creation of the original scenes that were

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filmed. The camera merely condenses the scenes onto a small film, while the projector must not only illuminate the film to a high intensity but must also play the part of a projection microscope of marvelous precision, magnifying the image from 200 to 500 diameters—a magnification of no mean degree under any circumstances. Besides this task is the one undertaken by the precise mechanism which changes the pictures on the screen so swiftly and accurately that

the individual pictures blend into an illusion of continuous motion.

It is plain to see, therefore, that a good projector is even more important than a good camera, although the best of each will never cause regret to the owner. The Bell and Howell projectors lead the field with their precision mechanism for 8-millimeter film. These projectors have the accuracy of movement and brilliancy of illumination so essential to the presentation of a bright and realistic motion picture show.

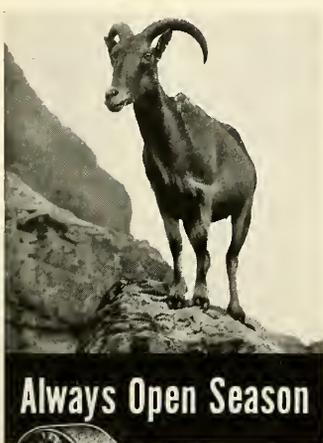
So let's take movies. They'll delight you and your friends, but what's more important is the satisfaction and pleasure your motion pictures will bring you when they capture forever your fondest memories and your most fascinating trips and "bring 'em back alive."

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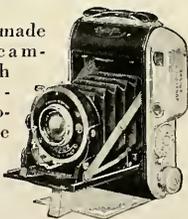
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ARCHAEOLOGIST, SELF-MADE

Continued from page 56

work in the Museum. On a series of tables laterally barred with strings tautly drawn to represent stratigraphic levels, he has arranged the wealth of artifacts which he and his wife dug from the reluctant earth on their memorable voyage. But the ordeal of this exacting epilogue will be over soon and the Birds will return to ocean and field, pit and cave, which, from all appearances will forever be their natural habitat.

Looking back on the crowded years of his odyssey apprenticeship, Junius pronounces them typical of what might be called a normal archaeological experience. If one goes out to dig in the unfamiliar soils of those wildernesses still extant upon the globe, the intrusion will inevitably be resented, hazardous escapes and sometimes strife will surely follow. It is not a way of life for lovers of comfort and security, but it provides compensations in the form of great moments of adventure and discovery for those inspired to write the unwritten history of early man.

—D. R. BARTON.

Recent Museum Publications NOVITATES

- No. 1018. New Genera and Species of Neotropical Physogastric Termitophiles. (Staphylinidae: Aleocharinae). By Charles H. SeEVERS.
1019. A New Anchitheriine Horse from the Tung Gur Formation of Mongolia. By Edwin H. COLBERT.
1020. The Species of *Macromya* Desvoidy (Tachinidae, Diptera). By C. H. CURRAN.
1021. The Dipterous Genus *Chrysotachina* Brauer and Bergensstamm (Tachinidae).
1022. African Tachinidae-II. By C. H. CURRAN.
1023. New Polychaetous Annelids from New England, Texas and Puerto Rico. By Aaron L. Treadwell.
1024. *Tridentopsis tocentinsi*, a New Pygmid Fish from Brazil. By Francesca LaMonte.
1025. Records and Descriptions of African Syrphidae-III. (Diptera). By C. H. CURRAN.
1026. Records and Descriptions of African Syrphidae-IV. (Diptera). By C. H. CURRAN.

BULLETIN

Volume LXXVI Art. 2—Carnivora of the Tung Gur Formation of Mongolia. By Edwin H. COLBERT.

LETTERS

SIRS:

This picture was taken on San Miguel Island about 30 miles off the coast of California, where some friends and I recently visited. These lonely sand dunes constitute a rich collecting field for the archaeologist, amateur or professional. Although we found many interesting and valuable artifacts which betokened the peaceful accomplishments of the now extinct Indian dwellers on this island, perhaps the most striking sight of all was an ancient battleground scattered with hundreds of human bones.

That the wholesale death was not the result of disease was clearly shown when



Photo by P. H. Dowling

one of our party, Mr. Arthur Sanger, discovered the skull shown above. An arrow tightly imbedded in the bone provided grim and unmistakable evidence that the man had come to his end at the hand of an enemy.

P. H. DOWLING.

Beverly Hills, Calif.

* * *

SIRS:

Your magazine has been most beneficial to our art department. I should like to see more photographs especially of American birds, animals, and insects that destroy our crops. Furthermore, an art department in the magazine would be of great interest to our young artists; it would, no doubt, be an incentive to build animation strips, etc. Just a suggestion.

DELLA M. HACKETT.

East Orange, N. J.

* * *

SIRS:

... I should like to say that while I maintain membership in various organizations there is none which has given more pleasure to me and the members of my family than membership in the American Museum, and one of the best features is the magazine NATURAL HISTORY.

JOSEPHINE CORDUA.

Bronx, N. Y.

Sirs:

Does the quotation below cause you any doubts concerning the origin of the phrase "sub rosa"? It does me. You remember that in your June issue you explained the phrase as springing from the mythological gift of a rose to ensure secrecy in Venus' love affair. The book from which I quote is a gold mine of information and I have always found it correct.

JOHN HEARD.

Boston, Mass.

"The origin of the phrase 'under the rose' implies secrecy, and has its origin during the year B. C. 477, at which time Pausanias, the commander of the confederate fleet of the Spartans and Athenians, was engaged in an intrigue with Xerxes for the subjugation of Greece to the Persian rule, and for the hand of the monarch's daughter in marriage. Their negotiations were carried on in a building attached to the temple of Minerva, called the Brazen House, the roof of which was a garden forming a bower of roses; so that the plot, which was conducted with the utmost secrecy, was literally matured *under the rose*. Pausanias, however, was betrayed by one of his emissaries, who, by a preconcerted plan with the Ephosi (the overseers and counsellors of state, five in number) gave them a secret opportunity to hear from the lips of Pausanias himself the acknowledgment of his treason. To escape arrest, he fled to the temple of Minerva, and, as the sanctity of the place forbade intrusion for violence or harm of any kind, the people walled up the edifice and left him to die of starvation. His own Mother laid the first stone.

"It afterward became a custom among the Athenians to wear roses in their hair, whenever they wished to communicate to another a secret which they wished to be kept inviolate. Hence the saying *sub rosa* among them, and, since, among Christian nations."

(*Gleanings from the Curious*, p. 211, collated by C. C. Bombaugh, Baltimore, 1870.)

* * *

SIRS:

This is to express to you how much a Museum man gets out of your topnotch periodical. . . . A magazine must be pretty good that reaches first place in one's estimation. For instance, your recent issue on the dogs of the world went with several other copies to one of our leading livestock men, a Senator in the Legislature, when he was ill with flu at the local hospital. The ex-Secretary of this Commission insists on going over every issue, including all back numbers. The number with the hay fever was so good an epitome of weed and erosion control efforts in this state that the pages and maps were taken out and arranged on a large 4' x 6' screen, under glass, together with the chief herbarium grasses and weeds indicated as from this state, in the mid-entry of the Capitol for all to see. Our first hay fever cases seem to begin the middle of May.

Many of the excavation articles, espe-

IN MEMORY OF A DEPARTED LOVED ONE



Practical Thoughts on One of Life's Most Solemn Duties

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cially on ancient man, have been studied by the WPA Research Division and will be cited when we get around to a printed revision of our old mimeographed Bulletin IV. As a biologist I take great interest in all the articles on these subjects.

A. C. BURRILL.

Missouri Resources Museum,
Jefferson City, Mo.

* * *

SIRS:

On May 25th last my cousin, Ingals Fisher, discovered near Lyons Falls, New York, a tiny fawn a little bigger than a snowshoe rabbit and apparently dead. Although hunting season was six months away, its mother had probably been killed by some lawless woodsmen. The fawn proved to be alive however and was brought back to our home where warm milk, water and a nip of brandy were administered by means of a medicine dropper. This soon revived the fawn, who, despite the fact that it was not more than ten days old, began to wobble around on its spindly legs. Not long afterwards "Bucky," as we called the fawn, took to bottle feeding and consumed a daily quota of four or five eight-ounce bottles, thus running up a sizable milk bill. The fawn was enclosed within a pen formerly used for the family dog. Although a kennel was provided, it seemed to prefer lying out of doors in all weather, fluffing out its coat on cold days just as a bird fluffs out its feathers.



Photo by Clarence Fisher

Like our friend's cat George whose name was changed to George Eliot when it had kittens, "Bucky's" name was eventually transformed to "Becky." Answering most amiably to either name, she was friendly to all visitors and would throw herself against the wire of her pen in great joy whenever her "master" appeared.

Though it would have been easier to handle quicksilver, we managed to record the following data regarding Becky's growth:

	June 15th	July 8th
Total length	29 inches	36 inches
Height at shoulder	18 inches	21 inches
Weight	12 pounds	20 pounds

The figures showed that she grew more horizontally than along the vertical axis. This was a new discovery for us and we can offer no satisfactory explanation.

As Becky grew and summer passed, what to do with her constituted a real problem. Feeding her had become expensive and yet it was not safe to allow her to forage for herself since she had become so dependent on humans that it would have meant sure death to turn her loose. Animals in the usual public zoo appear to have so little peace and privacy that a



Photo by E. B. Hone

BIG TUSKS

Mr. J. A. Hunter, who accompanied the Harry Snyder East African Expedition last year, in a letter to Mr. Goodwin states, "I have been out on safari most of the time since you left, first with an Indian Rajah for three months and later with Mr. Zietz, a Zurich sportsman. George, I have found a wonderful stretch of new elephant country in Kenya, and why no one made the discovery previously I do not know. In this area Mr. Zietz got



a couple of real big ones: the first carrying ivory weighing 152 and 142 pounds, and the second bull 127 and 125 pounds. In the meantime, I have to do some buffalo and elephant killing for the Government of Kenya."

Ivory weighing 152 and 142 pounds is not the heaviest known but ranks high in the list for all-time records. Today, when most of the big tuskers have been killed, it is not often that ivory weighing much over 100 pounds is secured. Mr. Hunter is the Kenya Government representative who is commissioned to kill bad elephants when they become destructive to native villages and crops.

NOTICE TO READERS

Readers are encouraged to submit their own photographs of natural history subjects. Those selected for publication on this page will be paid for at \$1.00 each, with full credit to the photographer. Return postage must be included.

For items published under the title THE FALL TRUTH (opposite), NATURAL HISTORY Magazine pays \$3.00.

private park near Westchester County, N. Y., seemed preferable. Soon Becky was safely transported to her new home by park officials and is now enjoying the company of some "young bucks."

There is no greater pleasure than gaining the confidence of a wild creature, but one should always be willing to assume the consequent responsibilities. Once we have removed their protective fear of man, it is hardly sporting to betray their trust by letting our guardianship lapse unless they can be turned over to conservation authorities who can attend to their needs.

New York City

BETTY HONE.

Sirs:

I should like to take this opportunity to express my appreciation of the work of the Museum in putting out this excellent magazine. The articles carry weight, are interesting, and entertainingly written and merit the attention not only of the layman but of the scientist. The format, type, paper, and reproduction are superb. . . .

JACK W. DUNLAP.



Photos by Paul Hadley



Photo by Anthony V. Ragusin

STONE WOOD

SIRS:—It occurs to me that some of your readers might be interested in these photos of our local petrified "forest" which is found under the hills of N. E. Arkansas. This was little known until a few years ago when two local men, H. H. Harlan and his brother Ira W. Harlan, began to excavate the trees as a hobby.

One of the trees, a twelve-foot specimen, is mounted locally in a concrete base and has attracted attention of thousands of tourists, and the attendant publicity has brought many people to see this natural wonder. But the "forest" cannot be recommended for sightseeing, as with few exceptions the trees are buried underground, and are only brought to light by erosion or excavations.

Piggott, Ark.

PAUL HADLEY.

[These fossil logs probably represent a large quantity of driftwood that accumulated along an old coast line and were petrified in the sands. Similar occurrences are common from north-eastern Arkansas through Louisiana into Texas.—Ed.]

THE TALL TRUTH

RODENT IN REVERSE

Most mammals have little need to run backwards; they usually have longer hind legs than front ones, which arrangement is helpful going forwards but would be a hindrance in retreating rapidly. The terrain is rarely devoid of obstacles that require vision, and eyes are on the front end.

But the pocket gopher, a small burrowing rodent of the west and south lives most of his life in a series of underground tunnels excavated by himself and only slightly larger in bore than the greatest diameter of his body. Turning in this burrow is a gymnastic feat, and to turn in the face of an enemy would be bad tactics for an animal whose sole protection is a pair of chisel-like incisors.

The pocket gopher, with hind legs about the same length as the front ones, has the faculty of running as rapidly backwards as forwards. For "eyes in the back of his head" he has a very sensitive tail that is bent downwards to warn of obstructions to the rear. Tracks and observations show that on the rare occasions when pocket gophers come out of their burrows they enter them again running backwards, someone remarked "as if drawn back by a string." No time is lost turning, and defenses are thus where they can be used to best advantage.

JOHN ERIC HILL.

DO PLANTS THINK?

Charles Darwin wrote, "We must believe in the existence, in plants, of a pale copy of what we call the consciousness of ourselves."

The leaves of the scarlet runner (a kidney bean plant with brilliant red flowers) droop with the coming of darkness and rise only with the morning sun—motions apparently due to the reaction of the sensitive tissue of the leaves to the varying strength of light rays.

We would suppose that absence of light would reduce the plant to a static drooping posture. But if we place the plant in a dark room *the same movements continue to occur for some time.* Habit? But what is habit even in this rudimentary form, unless "a pale copy" of memory?

LEONARD MEETER.

HAVE A DRINK OF FRESH WATER AT SEA

This artesian well, which emits cool and crystal clear drinking water, is located in the Gulf of Mexico, fourteen miles off Biloxi, Miss. The unusual situation is easily explained. Some years ago, at the spot where this fisherman stops for a drink, there was a solid sand island known as the "Isle of Caprice," which the French explorers, arriving at Biloxi in 1699, called "Dog Keys." Erosion from the Gulf finally washed away this island, and all that remains is this well. Here, boats bearing anglers or professional fishermen may pause for fresh drinking water.

ANTHONY V. RAGUSIN.

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ROY CHAPMAN ANDREWS, SC.D., Director

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"WITH HIS GREAT
BLACK LUSTROUS EYES"

William Beebe

Photo by HENRY B. KANE



NATURE'S BIRTHS AND BABIES

By **RAYMOND L. DITMARS**

Curator, Mammals and Reptiles, New York Zoological Park

ANIMAL PARENTS produce their children and care for them in such diverse ways that the natural order seems at times completely banished and Nature merely acting whimsically. How comes it that baby buffalo and deer walk immediately after birth, while bear and lion are born blind and utterly helpless? Is it by whim or by planning that 21 months are necessary for development of an elephant's embryo and only 21 days for that of a mouse, that a 100-pound seal may give birth to a 20-pound youngster while the larger kangaroo's baby is dwarfed by your little finger? My 30 years of observation among animals, large and small, in the field and among captives, tend to increase, rather than diminish, my wonder at Nature's amazing variety in her ways of raising babies.

At the Zoological Park one day, a keeper called my attention to a baby hyrax, less than a week old. The hyrax is an African animal resembling a guinea pig, and this infant, already a quarter the size of its mother, was darting about her and burrowing under her. A door slammed and the frightened parent leaped to a shelf a yard high. The infant also made the leap.

Nearby was a large kangaroo, reared upon powerful hind legs, standing as high as a man. The head of a bright-eyed, interested youngster protruded from her abdominal pouch. It was four months old. When born, it had not been much over an inch long, an almost shapeless, fleshy mite, about one three-thousandths of its mother's weight, writhing into the mother's pouch to attach itself to a pointed nipple which expanded and thus held the baby securely. Even now it was still helpless. What a contrast with the younger, scampering hyrax!

In the Reptile House a fer-de-lance, deadly six-foot tropical snake, had given birth to 62 babies, each close to a foot long and from the moment of birth independent of parental care.

These were high spots in a single morning's casual walk in our Zoo. To be more systematic, let us look at the various backboneed animals classified in order—mammals, birds, reptiles, amphibians, and fishes.

Most man-like of wild creatures are the gorilla, chimpanzee and orang-utan. The ape mother produces a single infant which is nursed and cuddled as is a human child. The period before birth, however, is shorter than with the human and growth faster.

A 150-pound orang mother may give birth to a five-pound infant which will reach sexual maturity in eight or nine years.

Hoofed animals have no nestlings, no babies born blind. Deer fawns and buffalo calves, for instance, walk immediately after birth. On the other hand, among flesh-eating animals—lions, tigers, leopards, bears, wolves, foxes, weasels—utter helplessness of the young is the rule. A 300-pound bear, after an eight-to-nine-month gestation period, produces one to four blind, hairless mites no bigger than kittens.

One might expect that the larger the animal the longer the development of its young, and the elephant seems to demonstrate the principle. The baby elephant, born after nearly two years' gestation—the longest among mammals—weighs 150 to 200 pounds as compared to 8000 pounds of mother. It is not weaned until three or four years old, and takes 15 to 18 years to reach maturity. But the world's most gigantic mammal, the whale which weighs 40 tons or more, has a gestation period lasting only about a year. However, the single young weighs in excess of seven tons and attains full size in about five years.

Bats, the only mammals capable of true flight, are careful mothers, wrapping membranous wings about their progeny and as frequently taking them on nocturnal flights as leaving them in the nursery, which may be in a cave or the cavity of a tree. From my adventures with the tropical vampire and giant South American bat I have never noted more than one young at a birth, the baby clinging to its mother's breast when small and later hanging beside her, to be enveloped by protective wings at the slightest disturbance. The young of my giant bats attained full size in less than five months, with wing spread of two feet, but mother and young stayed close together. Other bats have two, three and four young. One quite tame northern brown bat gave me every chance to watch her four babies grow, and it was astonishing to see her soar off on twilight flight with the family clinging to her, their combined weight appearing to be as much as that of the mother.

Rodents, or gnawing animals, vary widely in period of development. Here we have the shortest gestation among mammals—about 21 days with mice and rats. Anyone who has seen newly born, blind and hairless mice will realize the deficiencies that result

from this short period. Contrariwise, another type, the guinea "pig" or cavy, carrying progeny up to 70 days, produces lustrous-coated, bright-eyed babies which within a day or so scamper after the mother.

Porcupines have open-eyed babies which in a few days erect their own protective covering of needle-sharp spines. The Canadian porcupine produces youngsters larger than those of a bear, which is 30 to 40 times its weight.

Among pouched animals or marsupials—kangaroos, opossums, phalangers—there are no obstetrical troubles. Periods of gestation may be 40 days or less, with a shift of the undeveloped young to the incubator pouch. A brood of 12 opossums, writhing pink mites, could snuggle in a soup spoon.

Topping all others in eccentricity is the echidna of Australia, a four-legged animal with the bristling spines of a porcupine and the long darting tongue of an ant-eater, but with a beak like a duck. The female lays one or two leathery-shelled eggs which she tucks into her abdominal pouch. When the nearly shapeless, hairless infants are hatched she rears them with milk!

The parental life of birds has many vagaries. Thus the female tinamou of the Guianas, after laying an egg, indifferently flies away, leaving the male to incubate it—a long 56-day process. The male also cares for the young. Often while he is still attending a half-grown chick the mother comes back and lays another egg, delegating to the father the dual duty of incubation and infant responsibility. She may return even a third time.

Quite opposite is the behavior of the Old World hornbill. Before laying one or two eggs the female selects a hollow in a tree, inside which the male plasters her with cement-like mud. Only a small peek-hole is left through which the imprisoned spouse receives food from the male.

The female Emperor penguin of the Antarctic lays a single egg but, as there are no nesting materials to protect it from freezing, she rolls it onto her feet, where a body flap protects it. If, in moving about for food, she loses her grip of the egg, penguin courtesy demands that another penguin pick up and care for the egg until it too must move about. Eggs are thus so shifted back and forth among male as well as female adults that it's a wise penguin that knows its own parents.

Among birds of lesser size the 14-day incubation period of robins is fairly average. This speed of development is matched by subsequent growth, surpassing that of the fastest growing mammals such as rats and mice. Within half a month the bird leaves its nest, and in a few days more attains full size.

Birds have descended, or ascended, according to

point of view, from reptilian ancestry. It is probable that the greater number of the very early reptiles laid eggs. Today, a number of what science terms specialized types produce living young. These are mostly snakes, although there are a few lizards. But among reptiles, the crocodylians, so far as I know, are the only ones that build nests. Some are little more than a hole scooped in sand or mud, in which eggs are deposited and covered. But the alligator makes an actual nest, imbedding its eggs in a mound of debris and leaving them to be hatched about two months later by the heat of decomposition. I have seen mother alligators lurking near the nest, and have heard grunts and answering barks from the youngsters, though there is no attempt to feed the young. Turtles, lizards, and snakes all shift for themselves as soon as they hatch or are born.

Egg-laying snakes carefully select incubating hollows, some hiding them under flat stones or in hollow logs, where there is moisture and heat. With snakes that give birth to living young, the gestation period is four to five months and the number in the litter varies greatly. Fortunately the poisonous snakes of North America, rattlesnakes, the water moccasin and copperhead, seldom have over a dozen young ones. Harmless snakes such as garter snakes and water snakes may have as many as six dozen.

A water boa or anaconda from Trinidad gave me my most impressive picture of a litter of infant snakes. The mother was 18 feet long, 10 inches in diameter, and weighed about 175 pounds. One morning I found her cage crawling with infant anacondas, 72 of them, the biggest baby snakes I have ever seen, each a yard long and close to two inches in thickness.

The eggs of amphibians—frogs, toads, salamanders—though laid in large numbers, are generally abandoned so that comparatively few survive. With the aquatic Surinam toad, however, the male presses a hundred or more eggs into cavities of the female's back, within which minute tadpoles develop and hatch. Caplike covers that have grown over the cavities then pop open as if hinged. Dendrobates, a toad of the American tropics, carries its young following hatching to pools where they complete their tadpole life.

Descending the scale of vertebrate life to the fishes, we find again wide diversity. The adult pointed-tail ocean sunfish attains a length of 10 feet and a weight of 1200 pounds. A baby sunfish found for the first time recently during a dredging expedition in the Sargasso Sea, was one-tenth of an inch long. To attain the bulk of the parent it would need to increase its weight 60,000,000 times!

In number of eggs the ling is a star performer—as many as 28,000,000. The cod produces 6,000,000 to 10,000,000, the salmon—its eggs relatively large

—about 15,000. A platter of shad roe may contain from 25,000 to 150,000 eggs. But some fish produce not more than 100 eggs, building for them nests of grass, or bubbles, and guarding them from intruders. Others incubate their eggs within the parental mouth. With the little sea horse the eggs are transferred to a pouch on the abdomen of the male. Some fish produce their young alive.

Among invertebrates, spiders stand out in solicitude for their young. Our common water spider encases her eggs in a bag of silk which, gripped by her fangs, she carries with her wherever she goes. When the infants are about to hatch, the mother tears the bag open, spins a nursery web or exercising lattice for them, and guards them with such savagery that she may be torn limb from limb without deserting it. This is almost the only time that this free-hunting spider spins a web. Another, the common wolf spider, carries her several hundred babies around on her back until they are strong enough to shift for themselves.

The young of some spiders have an ingenious way of pioneering from home territory. They climb to the tops of grasses, shrubs, or trees, throw out a long strand of silk and, as the breeze catches this as a streamer, they release their hold and soar off. If the air current is upward they may travel a hundred miles or more.

The most precocious insect youngster is the common European oil beetle. The larvae develop from eggs laid in leafy debris, but are not at all interested in their abode. Each one gets the idea—how, is one of Nature's mysteries—that it must have a diet of bees' eggs. The problem is to get inside a bee's nest.

The tiny thing climbs to a flower, waits for a bee, climbs on its back and so reaches the coveted destination. There it feeds on bees' eggs until it bursts its first larval skin, and then on honey until, again bursting a larval shell, it emerges from its sticky domicile in adult form.

As examples of widely different life cycles among insects, take the katydid and the 17-year "locust" or cicada. Katydid eggs, imbedded in the autumn under scales of bark just before the female dies, hatch with the spring. The tiny green creatures, at first not bigger than a flea, shed successive skins and by August are handsome green insects with stridulating organs at the base of the male's wings which, when rubbed together, produce the rasping "katydid" and "katy-didn't." This is the mating call, which continues only several weeks. Then eggs are laid, and the katydid dies.

With the 17-year locust, the female imbeds her eggs in a twig; tiny hatchlings later drop to the ground and burrow, obtaining juices from tender roots—a 17-year babyhood, alone and in darkness. Coming from the soil, the back splits open and a creature with glittering wings writhes forth, fitted to fly in air and sunshine. Mating time is short—a few weeks devoted to egg-laying for the next generation's 17 years of subterranean youth.

Thus, Nature relentlessly experiments all along the line of evolutionary development, sometimes with strange and bizarre results, sometimes producing examples of devotion and sacrifice involving instincts which we like to think of as peculiarly human.



Photo by
HEIN GORNY
from BLACK STAR



Courtesy Stacy Woodard and Horac

THE ROADRUNNER IN FACT AND FOLKLORE—*If you meet a rattlesnake and a chaparral bird in your trail you will witness a most amazing encounter, in which "America's mongoose" will win your unqualified admiration with his picturesque personality*

By J. FRANK DOBIE

BORN and reared in southwest Texas, I was grown before I knew that the bird had any other name than *paisano* (pronounced pie-sah'no), by which Mexicans of Texas and northern Mexico know it. The word means *fellow-countryman, compatriot, native*. It is sometimes said to be a corruption of *faisán* (pheasant), a word corrupted in some Mexican localities to *faisano*. Yet the bird belongs to the cuckoo, and not to the pheasant, family. Its scientific name, *Geococcyx californianus*, signifies "ground cuckoo," the type specimen having been collected in California. It is known to Mexicans also as *corre camino* ("runs the road"), *churrella*, *churrea*, and other names.

The names in English are just as numerous, varying according to locality. Roadrunner, chaparral

cock, chaparral bird, and chaparral are the more common names, exclusive of *paisano*—which name I intend to keep on using, because it expresses a quality that is to me fundamental. The bird and I are fellow natives of the country. Lizard bird, war bird, snake-eater, medicine bird, cock of the desert, and ground cuckoo are names met with in print, though not used to any extent, I think, by people belonging to the land. I have never met "bird-of-paradise" as a name except in the well-worn anecdote of the west Texas real estate agent who in answer to his prospective client's question, "What's that bird?" replied, "Bird-of-paradise, some folks call it," whereupon the stranger commented, "He's a hell of a long ways from home, ain't he?"

The Texas Folk-Lore Society has adopted the *paisano* as its emblem, and in 1936 the Texas Centennial propagandists at Dallas, where the Centennial

Exposition was held, did much to popularize the bird as being characteristic of Texas. New Mexico has adopted it as the state bird. It is doubtful if any other native bird of North America, excepting the eagle and the turkey, which the Aztecs had domesticated long before Columbus sailed, has been so closely associated with the native races of this continent. It appears in the mythology, songs and legends of more than one tribe of Indians. English-speaking men living over the range of the bird—Texas, New Mexico, Arizona, California, most of Mexico and into Colorado, Oklahoma and Kansas—have generated an interest in it that not even unjust persecution has diminished. A full description of the bird, with emphasis always on its long legs, a tail that serves as a brake, running ability, brilliantly colored head, comical antics and insectivorous appetite, is to be found in many books. I will give here what is to be found in Eve Ganson's delightful and doubly delightfully illustrated *Desert Mavericks*.

The Road-Runner runs in the road,
His coat is speckled, à la mode.
His wings are short, his tail is long,
He jerks it as he runs along.
His bill is sharp, his eyes are keen,
He has a brain tucked in his bean.
But in his gizzard—if you please—
Are lizards, rats, and bumble bees;
Also horned toads—on them he feeds—
And rattlesnakes! and centipedes!

The roadrunner is the most interesting bird of the Southwest.

"On them he feeds"

Now that the urban hunter is envious of every quail that makes the morning cheerful and the evening tranquil with his call, the roadrunner has been charged with eating quail eggs and killing and eating young quail, and is even being killed out in many places on the assumption that this charge is true. It is a pity that authentic evidence is not as easy for the public to digest as superstition and rumor.

During the summer of 1938 Roy Bedichek, a good ornithologist, was on a United States Wild Life Refuge in southern Texas in company with a man employed by the government to help "balance nature." This man carried a gun and had, he said, "orders from Washington" to kill roadrunners off the refuge. "Why?" Bedichek asked. "Oh, because they eat other birds." Bedichek proposed to examine the crops of two roadrunners killed. The contents, spread out on white paper, consisted of nothing but legs and wings of grasshoppers—nothing else at all.

In the early spring of 1932 two paisanos killed in the country near San Antonio were brought to the Witte Museum, where Mrs. Ellen Schulz Quillin examined the crops. In the crop of one killed on a cool day were found 21 snails, 1 cutworm, 1 bee, 1 spider, 3 daddylonglegs, 2 pods of a nettle, 2 crickets, 7 small beetles, 2 June bugs. In the crop of the other, killed on a warm day, were found 31 cutworms, 12 snails, 9 beetles, 1 cricket, and many moths.

In *Arizona Wild Life*, October, 1932, D. M. Gorsuch of the U. S. Biological Survey printed a

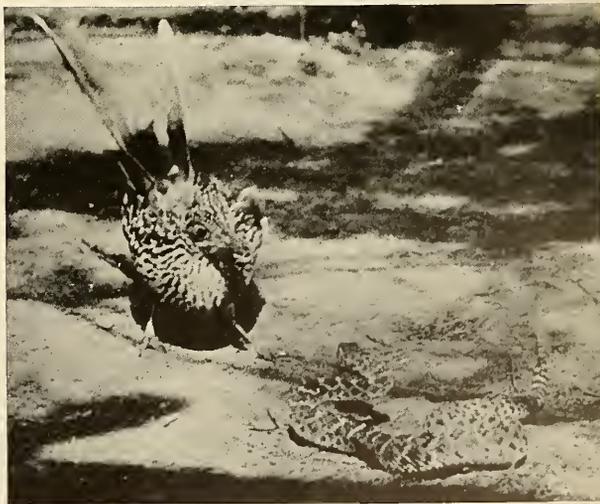
very interesting report on the food habits of roadrunners as determined by field observation and the official examination of 100 roadrunners taken in proximity to quail at a time when the quail were nesting or were leading their broods afield. Grasshoppers constituted 62 per cent of the stomach contents of the hundred roadrunners examined. In another large per cent of miscellaneous insects found, centipedes, scorpions and tarantulas were included. The reptilian contents were mostly lizards, but part of a rattlesnake was found. "No evidence of quail or their eggs was found," although two cactus wrens, an unidentified sparrow and a nestling meadow lark were found.

"About two years ago," Mr. Gorsuch continues, "I saw a roadrunner following a family of twelve newly hatched Gambel quail and their parents, as they fed through the grass. This appeared to be a splendid opportunity for the roadrunner to secure one of the chicks, for although the adult quail knew of its presence, they gave it little attention. The roadrunner's interest centered upon those grasshoppers that the quail started up and that flew beyond their reach. This continued until the roadrunner darted immediately in front of the cock quail to get a grasshopper, whereupon the cock turned and savagely attacked the roadrunner, who escaped by jumping into a mesquite, from which it sailed into an adjoining wash. On many other occasions a like proceeding has been observed, and it is my conviction that the roadrunner follows such feeding quail for the grasshoppers thus started up."

Just so, roadrunners—like robins and blackbirds—sometimes follow a plow to get the worms ex-

ONE OF NATURE'S CLASSIC CONFLICTS. *The agile roadrunner tires the rattlesnake, then pierces the brain with rapier-like thrusts. Digesting it by degrees, the bird may go around for hours with part of a snake protruding from its mouth*

Courtesy Stacy Woodard and Horace Woodard



posed. The procedure is common in wild life. I have seen cowbirds hanging around the heads of grazing cattle to catch the insects routed out by the grazers. Gulls, terns and other shore birds follow boats to catch the mullet dispersed. Coyotes hang around badgers to catch the rats that the badgers chase out of nests they are digging into. During the drouth of 1935 in southwest Texas, while ranchers around Brady were singeing off spines from prickly pear so that their stock could eat it, two men reported that roadrunners followed the pear-burner every day searching the singed pear for roasted worms and bugs.

In 1916 the University of California issued a 50-page pamphlet on *Habits and Food of the Roadrunner in California*, by Harold C. Bryant. Insects comprised 74.93 per cent of the contents of the stomachs of 84 roadrunners examined. No quail were found, but two small birds were found, also lizards, mice and a tiny cottontail rabbit. The small amount of vegetable matter consumed by the roadrunners appeared to consist of sour berries.

Useful citizens

It must be admitted, however, that a few roadrunners do at times destroy a few young quail. Yet there is no evidence to support the common belief that roadrunners in general are persistent and customary predators on young quail; and in all the evidence both oral and written I have examined, I have not found one single authentic instance of a roadrunner's having destroyed quail eggs. It may be that occasionally a roadrunner does eat quail eggs. But there are numerous instances of the destruction of mice, large wood rats, and various kinds of snakes by the bird—and snakes and rats are undoubtedly much more destructive of quail eggs and young quail than the roadrunners are themselves.

An old-time Mexican ranchero whom I met at Parral, in the state of Chihuahua, told me that country people in that region sometimes catch the paisano young, tame it, and utilize it to catch mice and rats.

Nature balances itself far better than man can ever balance it. The most roadrunners I have ever seen are in that part of Texas where the blue, or scaled, quail are admittedly more plentiful than anywhere else in the United States. I refer to the brush country between the Nueces River and the Rio Grande. By riding a day in some of the big pastures of this region in late summer of seasonable years a man might count a thousand blue quail, many bob whites, and easily a hundred paisanos. In the sand hills of the same area bob whites used to abound by the thousands—are yet plentiful on some protected land—along with many, many paisanos.

You will not find the most colts and the most panthers in the same pasture, or the most lions and the most lambs. You will not find the most shotgun hunters and the most quail in the same pasture.

And what if the paisano is now and then directly responsible for one less quail to shoot at? He is a poor sportsman whose only interest in wild life is something to kill. How much more interesting and delightful is a country where a variety of wild life abounds! If it were necessary to choose between ten quail and no paisanos, or nine quail and one paisano, not many people who have any response toward nature or capacity for being delighted by the countryside would hesitate to choose the latter. The value of the roadrunner to the farmer as an insect destroyer need not be dwelt upon.

A few years ago a rancher named John Henderson who was trying to raise young turkeys on Honey Creek in Kerr County, Texas, began missing several from his bunch. Taking his shotgun, he one day followed a flock to the creek. He saw a huge bullfrog leap out of the water, snap a little turkey up, and dive back into the water. He waited and before long the bullfrog reappeared. He shot him, dissected him, and found the freshly swallowed turkey inside the frog. One swallow does not make a summer. Bullfrogs in general cannot be considered as destroyers of young turkeys.

Once while watching at a dirt tank, I saw a paisano that came up to drink, peck at a frog, which escaped. A Mexican told me that the day before he had seen a paisano catch a small frog, beat it to death on the ground, and swallow it. Yet paisanos are characteristic of a country generally devoid of frogs, and certainly they are not generally frog-catchers.

Water-shy

Not ten miles from the site just mentioned I once observed half a dozen paisanos running around and around on the rim of a circular cement water trough, trying to reach down for a drink. The water was too low. Out in the middle of the trough, which was about eight feet in diameter, floated a good-sized board attached to the valve-float; this board was half covered with frogs. Not a paisano had sense enough to jump to the board and drink from it, and no paisano had the least intention of catching a frog. I placed a dead mesquite limb in the trough so that one end of it went down into the water while the other rested on the rim. Not a bird would walk down the limb to water. Two or three paisanos were at the same time running around on the tin roof of the cistern which fed the trough, trying to get at water. The saying in southwest Texas, "as crazy as

a paisano," seemed here well founded, although in some ways the bird certainly is not "crazy." Paisanos cannot swim at all and they frequently drown in cement troughs and cisterns.

I estimated there were probably a hundred paisanos within a radius of half a mile of the cement trough. On August 9th I discovered near it a paisano nest up about ten feet in a mesquite tree. On my horse I could watch the old bird feeding her young. There were three nestlings, two about ready to leave and a third less mature. The parent bird fed them exactly in rotation, exclusively on grasshoppers, as long as I watched, which was about an hour. A youngster would open its mouth wide; the old one would poke a grasshopper-laden bill down the orifice and hold it there until the morsel was swallowed. Then she would fly to another mesquite and cock her head this way and that until she located an insect. Then she would fly softly to a spot, whence she made a swift dart. Usually she caught, but sometimes the grasshopper escaped. From her position up in a tree she could see grasshoppers flying and lighting. If she located one lighting on the ground, the way she volplaned and nabbed it was a pretty sight. She never missed a grasshopper on the ground.

Within a few rods of this paisano nest I saw five or six dove nests on which the doves were peacefully brooding, and I saw a little mocking bird just out of its nest. The doves and mocking birds did not seem to regard the paisanos as enemies. I saw a paisano make a pass at a rusty lizard on a tree trunk and miss it; the paisano seemed to expect this. I have seen dozens of green lizards in the bills of paisanos but never a rusty lizard. There is a very tall tale about a roadrunner in California that kept a hill full of lizards growing tails for him to eat. This paisano discovered that a lizard would, unlike Mary's little lamb, leave its tail behind it if the tail was snapped up, and would then grow a new tail just as good to swallow as the original.

Greedy

An astounding revelation of the voracity of the bird is given by G. M. Sutton in an account of two pet roadrunners, "Titania and Oberon," in his book *Birds in the Wilderness*. He tells how they manage to swallow horned frogs. The paisano digests rapidly. He will begin swallowing a snake 30 inches long and after he has got a certain portion of it down must wait for the digestive juices to act before he can swallow further. Thus he may have to go about for hours with part of a snake dangling out of his mouth before he can get it all down. He is truly, to use the phrase out of an old folk rhyme, a "greedy gut."

When Dr. H. A. Pilsbury of Philadelphia came to Texas and Mexico a few years ago hunting snails, I told him he should throw in with the paisanos. He didn't understand what I meant. I explained how the paisano picks up a snail, breaks the shell on a rock, and then eats the meat; how he will bring snail after snail to the rock he has selected as a meat-block, or table, to break it, passing scores of other rocks on his way; how sometimes at one of these rocks, or maybe a hard bit of bare ground, more than a cupful of broken snail shells may be picked up. Doctor Pilsbury replied that, so far as he knew, there was but one other bird in the world that eats snails in this way. That is an English thrush, and the places where the thrushes collect the snails are called "thrush altars."

At home in desert

The paisano is found far from water and in waterless deserts. Some observers have thought water not essential to them. This may well be in places where they have adapted themselves to desert conditions, especially since they eat animal food containing a high percentage of fluid. In Sonora there are deer that almost never drink water, although the same deer in other parts of the world drink more or less regularly. Where water is available, however, roadrunners are thirsty drinkers in the hot summer. In southwest Texas they are exceedingly methodical and regular in coming to water. One time while I was watching a gasoline engine pumping water for cattle during the dog days of August, a period when the wind habitually fails to blow enough to turn windmills, I noticed how a particular paisano came every day about a quarter of twelve o'clock to drink. He was as regular as the sun.

How the idea that the paisano cannot fly at all got started, I cannot imagine. Down a hill or a mountain he can volplane for long distances. Frequently one will fly up into a tree to get a wide view. Of course, however, he is essentially a ground bird. His speed, like nearly everything else connected with him, has been greatly exaggerated. Any good horse can outrun one on a considerable stretch. Walter Fry of the Sequoia National Park, California, is quoted as saying that a roadrunner he was chasing in an automobile attained the speed of 26 miles an hour. Bailey's *Birds of New Mexico* gives his top speed, tested by automobile, as fifteen miles an hour. Running down a path ahead of a buggy or a horseman, the roadrunner often seems to enjoy the exercise as much as a pup enjoys chasing a chicken. While speeding, he stretches out almost flat. Sometimes he falls in behind a traveler and follows down a trail. He enjoys a dust bath. He can stand



Courtesy Stacy Woodard and Horace Woodard

BABY ROADRUNNERS. *Though helpless now, these chicks will grow up to help keep down the rattlesnake population. Grown roadrunners eat many insects, and use special rocks as chopping blocks for breaking open snails*

terrific heat, but on hot days he likes to pause in the shade, even though it be nothing but the shadow of a three-inch mesquite fence post.

That paisanos, single and in pairs, kill rattlesnakes is a fact established beyond all doubt, although folklore amassed around the subject has made ornithologists slow to admit it. In the fall of 1928 near Robstown, Texas, some dogs overtook a roadrunner which could not get out of the way because of a rattlesnake in its mouth. They killed the bird before men could stop them, and after a photograph was taken, the snake was extracted and measured. It was eighteen inches long and had four or five rattles.

I have hoped for many years to come upon a paisano-rattlesnake combat—just as I have hoped to come upon two buck deer with their antlers locked in mortal combat. Encountering either phenomenon depends so much upon chance, that only individuals who spend their lives out of doors are likely to be witnesses. I have questioned scores of *hombres del campo*—men of the range and countryside—about paisano-rattlesnake fights, and I have the testimony of several whose word cannot be doubted.

In October, 1932, Bob Dove, of Eagle Pass, a strong-bodied and strong-minded man who had had a great deal of experience on ranches on both sides of the Rio Grande, told me that he once saw a paisano kill a rattlesnake about 3½ feet long. The fight was in a cow pen. The bird in its maneuvers raised a great amount of dust. With wings extended and dragging in the dust, it would run at the snake, aiming at its head. The snake struck blindly, several times hitting the paisano's wings, without effect, of course. Finally the bird pecked a hole in the snake's head and punctured the brain. It ate the brain but nothing else. I have further evidence on brain-eating.

I have heard of the paisano's killing little chickens and eating only the brain. I do not know this to be a fact, however. I know that on the ranch of my boyhood and youth in Live Oak County we had many chickens and many paisanos, which often came

among the chickens, big and little; the chickens never seemed to pay the paisanos any more attention than they paid the blackbirds, doves and quail. Between the pens at the stables and the branding pens was about a hundred yards of old log fence, and in this old fence there were paisano nests every year. Snakes—particularly chicken snakes, but also sometimes coachwhips and bull snakes—ate eggs and little chickens; coyotes were a constant menace; but we never thought of the paisanos as being destructive to the chickens.

Mrs. Bruce Reid, of Port Arthur, who has raised several roadrunners as well as many other birds and who has supplied much information to the Biological Survey, claims to have witnessed two paisano-rattlesnake combats. In each instance, the snake's head was bruised and bloody. One rattler, about three feet long, sought refuge in some cactus, but the paisano, as hot after it as a hound after a wild cat, got to it. In its writhings, the rattler brushed an irregular line of dead cactus leaves about its body—a circumstance that might account for the tradition of a cactus corral.

Sometimes the paisano is described as giving a "war dance" about the rattler to confuse and infuriate him. Wild turkeys are said to make attacks, occasionally, on rattlesnakes in much the same manner.

In the spring of 1932, Ellen Schulz Quillin, botanist and naturalist, was quoted in the *San Antonio Express* as saying that while the paisano is an avid destroyer of field pests, there is little foundation



Courtesy Stacy Woodard and Horace Woodard

(Above) A SCENE from the film *Chico* showing the roadrunner's friendliness. Called paisano (countryman) on both sides of the Rio Grande, the bird responds readily to human companionship and occupies a picturesque position in the folklore of the country. One widespread legend accuses the roadrunner of depleting the quail supply, but evidence does not bear this out. Science looks askance also at tales of cactus fences built around rattlesnakes by roadrunners

for the belief that it kills rattlesnakes. Within a few days she received a letter from Alfred Toepferwein, rancher, telling how a recent experience had put a stop to his habit of shooting paisanos wherever he found them on his ranch. He wrote:

"One day I saw one of the birds, feathers turned forward like an angry deer turns its hair, jumping up and down, back and forth. I paid no attention, but pulled my .45 and fired, missing the bird barely by an inch. The bird, not a bit frightened, kept its feathers up and kept jumping toward the same place. Then the rattlesnake story I had heard of several times came to my memory. I went to the place and found a rattlesnake almost dead. I have killed no more chaparral birds since then."

I might adduce further evidence, considered by me unimpeachable, but I will conclude the testimony by a quotation from *Time* magazine, March 7, 1938, which reproduced also a picture, not fabricated, showing a roadrunner about to leap at a rattler, more than twice as long as the bird, with head and forepart raised to strike. "Last week," the article runs, "a full-length documentary film on Mexican animals, produced by Brothers Stacy & Horace Woodard, made the roadrunner-rattlesnake story a little less tall but no less telling. *The Adventures of Chico* shows 10-year-old Goatherd Chico taking his siesta, guarded by his roadrunner pet. A rattlesnake

approaches. Without hesitation the bird attacks, head feathers fanned and wings tensely spread. Like a matador, it lures the snake into striking, easily swings out of reach. Like a matador, it waits and feints till the enemy tires, then kills with swift skill."

The filmers of this scene spent a year in Mexico taking animal pictures. The relation of the boy Chico to the bird may easily have been arranged, but the fight between snake and bird admits of no faking. The story of how a sleeping shepherd awakes to find a rattlesnake threatening him and is saved by the timely intervention of the snake's inveterate enemy is common. Jack H. Lee in his book of verse, *West of Powder River* (New York, 1933), has a ballad relating the incident.

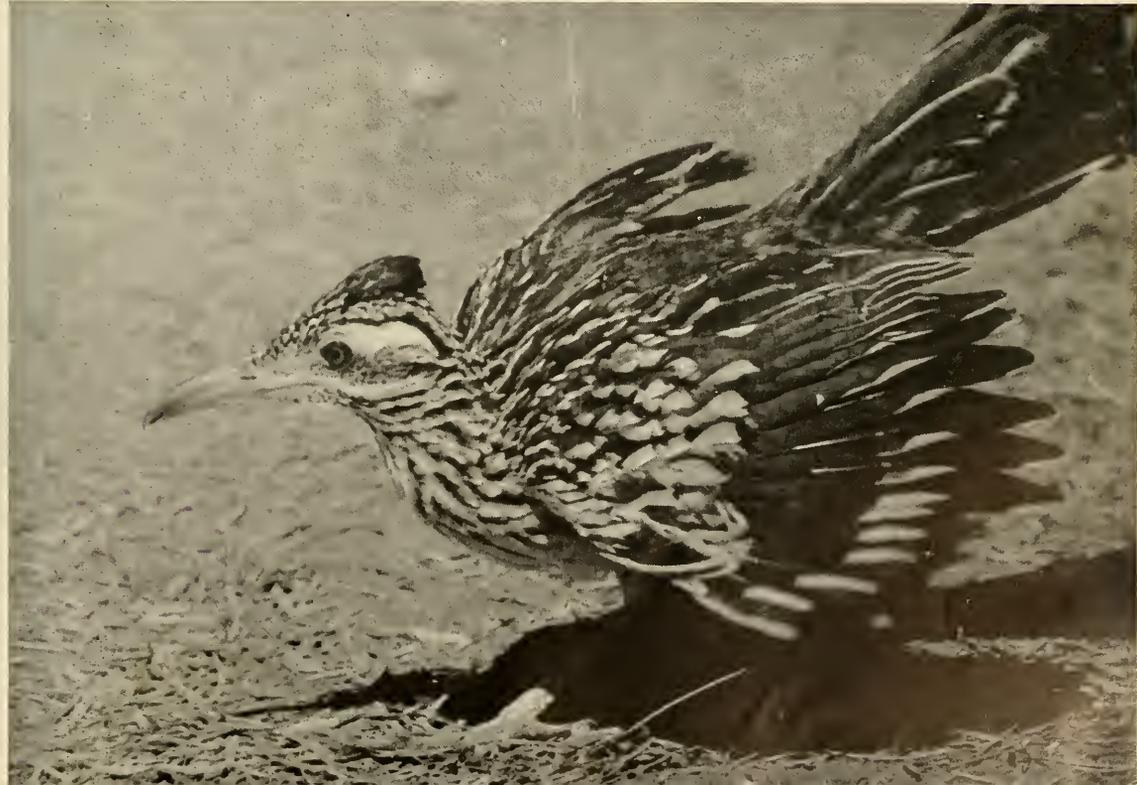
Leaving man out of the picture entirely, the truth is being proven, and there is no reason why ornithologists should henceforth use the words "seems," "perhaps," or "it is generally said," in modifying remarks about lethal combats between paisanos and rattlesnakes.

The Corral of Thorns

If I were writing an article strictly scientific, I should at this point drop the rattlesnake; but any animal is interesting to man not only for the facts about him but for what human beings associated with the animal have taken to be the facts. Hardly any established fact about the paisano is as familiar to the public as some form of the story about the bird's corralling a rattlesnake with cactus joints and then either killing it or making it kill itself.

"WAR DANCE." *With wings spread, the roadrunner lures the snake into striking, plays it like a matador until it tires, then delivers the fatal stroke*

Courtesy Stacy Woodard and Horace Woodard



The bird is certainly the more interesting for this commonly believed and more commonly told story. It has appeared various times in print, nowhere so divertingly told as by The Old Cattleman in Alfred Henry Lewis' *Wolfville*. Other forms of the story appear in other books for children: to cite two recent ones, *Indians of the Pueblos*, by Therese O. Deming, and *Thinking, Speaking, and Writing* (Book Two), by Jameson, Clark and Veit.

Nor am I prepared to deny that paisanos never corral rattlesnakes. They may. Perhaps they could. It is claimed that snakes hear through the ground and that a sleeping rattlesnake could not be corralled without his becoming aroused. I do not know. The roadrunner runs lightly. But I make no argument, no denial. The stories are interesting. They are part of the history of the most interesting bird of the Southwest. Some of the narratives are very circumstantial—as all good narratives must be.

Believe it or not

In May, 1933, I was introduced to E. V. Anaya, a practitioner in international law of Mexico City. He was reared on a hacienda in Sonora, where he was associated with Opatá Indians. He is as swart as a desert Indian himself and as decisive as Mussolini. The Indians and Mexicans of Sonora call the paisano *churella*, he said.

"Have you ever seen one kill a rattlesnake?" he asked me. "... No? Well, I have—once. I was out gathering pitayas. [The pitaya, or pitalla, is a cactus fruit.] It was in the month of May—the month of pitayas. I was just a boy, about 1908. I was with an Opatá Indian.

"Just as we got to the top of a mesa, the Indian very cautiously beckoned to me to come nearer. Then when I was close to him, he whispered, 'See the *churella*.'

"'Churella,' I replied. 'What of it?' The bird is so common in that country that little attention is usually paid to it.

"'This one is killing a rattlesnake,' the Indian spoke softly. 'Let us watch.'

"We crept up silently until we were within twelve or fifteen yards of the *churella*. A rattlesnake lay coiled on the ground, apparently asleep. The *churella* had already gathered a great many joints of the cholla cactus and had outlined a corral around the snake. The corral was maybe three feet in diameter.

"The *churella* was working swiftly. Cholla was growing all around us, and the joints were lying everywhere on the ground. The bird would carry a joint in its long beak without getting pricked. He

built the little corral up, laying one joint on top of another, until it was maybe four inches high. Then he dropped a joint right on top of the sleeping snake. The snake moved, and when he did, the spines found the openings under his scales. The snake became frantic and went to slashing against the corral. That made it more frantic. Then the *churella* attacked it on the head and had little trouble in killing it. The spines made it practically defenseless."

Rats use cactus

If a roadrunner were going to use any kind of cactus to corral or torment a rattlesnake with, cholla joints would surely be best suited to the purpose. Each joint is so spined that if one single thorn takes hold of an object and the object moves the least bit, another and then several other thorns will dig in. Instead of throwing off the cholla joint, movement causes the one thorn in the flesh to act as a lever for giving more thorns entrance. In bad cholla country of Sonora I have ridden a native horse, wary of the thorns, that, nevertheless, caught several in his pastern. Then the only thing to do was to dismount, get a stick, and with it jerk the cholla joint directly out. I have seen a cave in that same country with enough cholla joints heaped in it to fill a freight car. They had been placed there by rats. The Papago Indians used to dispose of their dead by laying the body on open ground and then heaping cholla over it—a thorough protection against all beasts of prey.

Snakes, rattlesnakes included, eat rats. The desert wood rats or pack rats in the Southwest build about their nests a defense of thorns against coyotes and foxes. But on the other side of the case, one of the best places to find red diamond rattlers and Mojave rattlers is in these nests, where they crawl about the cactus with impunity. A large percentage of snakes caught in these sections have one or more cactus spines sticking in their bodies and seem not to be inconvenienced by them.

An old German mining engineer named Engelbert Brokhurst, widely traveled, learned, observant and cranky, whom I met in Mazatlan, told me that Indians of the West Coast of Mexico regard the paisano as a sacred bird and will not kill it. They all say that the bird corrals sleeping rattlesnakes and then torments them to death with thorns.

The evidence, however, is by no means all from Indians and Mexicans. *Black Range Tales* (New York, 1936) is a book of reminiscences by an old-time prospector and miner named James A. McKenna from New Mexico. "One spring in Lake Valley," he relates, "my partner and I watched a

pair of roadrunners. Morning after morning we met them outside the tunnel where we worked. Not far from the mouth of the tunnel a rattlesnake used to climb on a rock to take a sleep in the early morning sun." [They were out-of-the-ordinary outdoors men not to kill it, but it must be remarked that a rattlesnake sleeping in the sun is an occurrence almost worth talking about in itself, because of its rarity.] "It soon became plain to us that the roadrunners had spotted the rattlesnake. One morning we saw them making a corral of cholla joints and thorns around the snake. How quietly they worked until the crude circle was nearly three inches high! Then both birds ran with a strange cry toward the cholla corral, waking up the rattlesnake, which struck instantly. Hundreds of fine sharp thorns were buried in the tender underside of the snake's throat. The more he twisted and turned, the deeper the spines of the cholla worked into his neck. After a half-hour of writhing, he lay still. The roadrunners hung around long enough to make sure he was dead; then they hacked him to pieces, which they carried off to feed their young. Prospectors always keep on the lookout for rattlesnakes if they take note of a pair of roadrunners in the vicinity of the camp."

Yet some critic has spoiled this story by pointing out that a paisano does not have enough force in his beak to tear the flesh from a rattlesnake carcass.

Life and death struggle

Something of a variation in the use of cactus comes in an account written by Hampton McNeill of the Texas Panhandle. Hunting quail one day, McNeill heard "some kind of unfamiliar chuckling" going on just over a small mound. He stepped up on top of the mound, and there "a chaparral and a rattlesnake were fighting for life and death. The snake was completely encircled by cactus leaves. Its head had been pierced so many times by the cactus thorns that a match-head could hardly have been placed anywhere on it without covering a thorn hole." The narrator probably had no magnifying glass to look at the holes. Remember, however, that the prickly pear in the Panhandle grows low and scrawny, the leaves (known to botany as pads) not strongly jointed.

"The chaparral would run up to a cactus bush, take a good hold on a leaf with its bill, shake the leaf loose, and then return to the scene of battle. Using this thorny leaf as a shield, the chaparral would rile the rattler into striking at him. After the snake had struck several times, the bird would lay the leaf down near the snake.

"The chaparral repeated this action several times.

In the course of time, the rattler seemed to become completely exhausted, for he would no longer offer resistance when the chaparral returned with more cactus leaves. Having brought up two or three leaves without arousing the snake to action, he then disappeared in the sage brush. The snake was not dead, but I put him out of his misery."

Philip Ashton Rollins in his generally excellent treatise *The Cowboy* describes still another mode of attack whereby the bird uses thorns but does not bother with a pen. "The chaparral-cock," he says, "might stop its hunt for bugs, seize in its bill a group of cactus thorns, spread its wings wide and low, and, running more speedily than could any race horse, dodging as elusively as does heat-lightning, drive those thorns squarely into the snake's open mouth, peck out both the beady eyes, and then resume the hunt for bugs." According to the folk, a paisano upon finding a rattlesnake "charming" a rabbit, slips up and jabs a cactus joint into the waiting jaws of the would-be killer.

A resourceful creature

The roadrunner's alleged use of cactus as shield and rapier has become almost as much a part of him as those of his habits which are thoroughly authenticated. The rattlesnake's apparent unconcern for a few cactus spines more or less, makes this trick seem less plausible; but we must remember, before condemning the legend as utter fabrication, that the roadrunner proves itself a resourceful creature when, for instance, it carries snail shells to a certain rock and dashes them apart on it with a swift stroke of his head in order to eat the contents. This has been verified, even photographed, and fragments of snail-shell around rocks in places where snails occur attest the prevalence of the habit. On the other hand, no scientific observer has seen the building of the cactus corral around a "sleeping" rattlesnake, nor does one find circular piles of cholla that might have been used by a roadrunner. Since the bird is capable of killing medium-sized rattlesnakes by means of simple combat there would seem to be no advantage in the elaborate cactus corral, and the disadvantages are obvious.

What would happen if a rattlesnake bit the paisano in a vital spot may be deduced from an account in a book first published in Cincinnati in 1847, by C. Donovan, *Adventures in Mexico*. During his captivity in the Mexican War, Donovan visited an extensive botanical garden near San Luis Potosí, and there became acquainted with *huaco*—the most celebrated herbal cure for snakebite in Mexico and the southern tip of Texas. The discovery of the

medicinal qualities of *huaco*, Donovan learned from the natives, was attributed to a bird that "feeds upon snakes and reptiles." Indians in the far past noticed that after a combat with a snake the bird would "search for the herb to eat it." Thus they learned from the bird the "sure remedy" for snakebite. Actually there is no known herb which, taken internally, is a sure cure for snakebite. And whether the one referred to would act on a bird in the same way it would on a man—or whether the bird could conceivably discover its benefits—is something else again.

Be this as it may, the paisano merits our attention on many accounts. The bird has a great deal of curiosity and is easily domesticated if taken young. One will hop into the open door of a house and stand there a long time looking this way and that. Perhaps he has an idea that some shade-loving creature suited to his diet is in the house. He will come up to a

camp to investigate in the same way. The way he raises and lowers the plumage on his lustrous-feathered head while he goes *crut, crut, crut* with his vocal organs is an endless fascination. He must surely be the most comical bird of America. He will go through more antics and cut up more didos in an hour than a parrot can learn in a lifetime.

People like the paisano. He is thoroughly a part of the country he inhabits. Some day you will meet him—if you have not already—an agile streak, darting down the trail or road. Suddenly he will throw on the brakes by hoisting his tail, stand for a minute dead still except for panting and cocking his head at you on one side and the other, and then suddenly streak out again. And when you do, remember that you have met a citizen, a "country-man," who has some rights and deserves not only respect but observation.

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By JAMES L. CLARK*

*Director, Arts, Preparation and Installation,
American Museum*

OF all the animals to be shown in the American Museum's new North American Hall, the collecting of suitable specimens for the Mountain Lion Group presented perhaps the greatest uncertainties.

Known under a dozen different names—Mountain Lion, Cougar, Panther, Puma, Painter, Catamount, King Cat, etc.—this animal was originally distributed right across the United States from coast to coast, and even as late as 1900 was found in New England and along the Canadian border. Early settlers soon recognized it as one of the two or three foremost enemies of man, perhaps second only to the plains wolf, which also was most destructive of stock; and its numbers have been greatly reduced. Now the mountain lion is chiefly confined to the Rockies, with a few in the Everglades of Florida.

Deer constitute the favorite food of this animal, but it also attacks cattle, sheep and horses. Jumping on its victim's back and biting at the base of the skull, it holds on and rides the creature down, as it does when killing deer.

Unlike the wolf, the lion never shows itself in the daytime. It is a stealthy, clever, nocturnal hunter which kills one or two deer a week, dragging the kill into dense thickets or other secluded spots and covering it with leaves when it has had its fill. If the weather is cool, the lion may lay up near by, feeding from time to time until the body is consumed, but leaving it if the meat becomes tainted, to kill again.

Old lion hunters who have killed hundreds of lions may never have laid eyes on a lion unless the hounds have first put him out of his daytime lair. Furthermore the lion covers a large territory. There are no mountain lion trails, as the animal does not frequently retrace his steps. It is extremely difficult and in some cases impossible to catch him in a trap.

If the lion cannot be shot with a rifle and cannot be trapped, there remains only one way in which man can hunt this largest of the vermin—by turning to his best animal friend, the hound. The great partnership of man and the hound, assisted by the horse, provides an effective method of coping with the mountain lion.

Attaining its greatest size in the West, it has held to its last stronghold among the little-settled and rugged country of southern Utah and northern Arizona. The Grand Canyon was therefore chosen as the setting for our museum Group, not only because this is where possibly the best specimens could now be obtained but because of the spectacular background it offered, which would thus bring another National Park setting into our Hall. This labyrinth of protected canyons and forbidding plateaus, unbelievably vast in area, is perhaps the best known mountain lion country of today.

Spring was the best time for their coats. Then they would have the fullest hair, and cool weather would better the conditions for long tracking by the dogs and horses. Through the generosity of a Patron of the Museum, Mr. Beverley R. Robinson, who also subscribed the Grizzly Bear Group, plans were made to send an expedition into the field in early April and provision was made for the building of the Lion

*JAMES LIPPITT CLARK, who has hunted for the American Museum in Central Asia, Indo-China, and various parts of Africa, now turns his attention to our own continent toward the creation of a North American Hall. As director of the Museum's Preparation Department, his talents as animal sculptor, taxidermist and field naturalist have made

him preëminent in the modern school of animal representation ever since the days of Carl Akeley. In 1930 the National Academy of Design awarded him the Speyer Memorial prize in sculpture. He is well known as a lecturer and as the author of many popu-

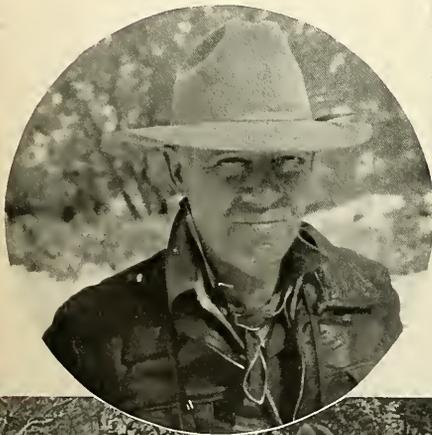
lar accounts of his travels. His latest expedition, described in this article, was made possible through the deep interest and generosity of a friend and Patron of the Museum, Mr. Beverley R. Robinson, as is also the eventual building of the beautiful Lion Group.

[THE EDITOR]



(Above) THOUGH WATER FROZE and snow fell at night, the days were mild and sunny. The hunt began each day at dawn and continued till the dogs became too fatigued to trail

All field photos taken by expedition members



(Above) VETERAN of many Museum expeditions, Dr. James L. Clark, Director of the Department of Arts, Preparation and Installation, surveys the rough going ahead. Dr. Clark urged a springtime hunt to insure the best fur

(Left) LEADING FIGURE in the new North American Hall project, Chairman Robert E. McConnell. Mr. McConnell, a Trustee of the Museum, headed the expedition and shot the first lion



(Left) THE HOUNDS, indispensable equipment for any lion hunter. Mountain lions are stealthy, nocturnal and extremely wary. Almost never successfully trapped, they keep in hiding throughout the day and can only be located and dislodged by the use of trained hounds. Hounds must be lean to work well. They are fed dried, wild horse meat and whenever available, dried lion meat

SCENES from a lion hunt which provided specimens and background for the American Museum's new North American Hall. Pursued necessarily with hounds and horses, lion hunting in America takes the hunter pell-mell over harrowing terrain and is a sport for frontiersmen, not gentry. Indeed, gunning frontiersmen reduced these animals, once nation-wide, almost entirely to the Rockies, Utah and Arizona being their stronghold. Thither went the McConnell expedition to secure specimens of this "vanishing American"



(Above) LION NEMESIS: Jack Butler, expedition guide and master of the hounds—one of the country's best lion men. At right, Dexter, whom he trained exclusively to hunt mountain lions. One quarter bloodhound, three quarters English foxhound, this dog is ideally adapted to his work. Endurance, keenest of noses and unflinching courage characterized the pack's performance throughout the expedition



(Below) BROKEN ROCK, often covered by only the thinnest veneer of soil, made the going excessively rough. Riders were frequently forced to dismount and lead the horses over dangerous stretches or take wide detours. Many fruitless hours were spent in the saddle while the quarry lurked somewhere at the end of the labyrinthian trail



Group. The party consisted of Mr. Robert E. McConnell, Chairman of the Committee on the Hall of North American Mammals, as leader of the expedition; Mr. Waddy McFall, assistant in the Department of Arts, Preparation and Installation; and the writer.

The evening of April 9th found us in Cedar City, Utah, a delightful little spot some 5000 feet up in the cedar-covered mountains, where we met our guide, Jack Butler, acknowledged the best of lion hunters along the North Rim.

Early in the morning, with bag and baggage, we were whizzed by truck some 90 miles through colorful country into the very southwest corner of Utah. Here camp had been set up some days before and we were greeted by Mrs. Butler, our hostess and cook, and Jim Adams, our able second guide. Our tents were clustered on a little flat near a stream of clear water, over a mile above sea-level. Sage and scattered cedar covered the steeply rounded hills, and the little peep frogs sang their merry song of spring as twilight waned. Beyond the hills to the north and west rose some granite outcrops, ideal day-retreats for the lion.

The clear western air cut far distant hills in sharp outlines, as if they were but a few miles away, and brought them even closer in the mellow evening light. Ice formed in our buckets during the night, but the days were sunny and warm.

Off at dawn

Each morning we were up well before daybreak for an early start, and in the dim light of the coming day, as we saddle our horses to begin our hunt, two planets, Jupiter and Venus, the morning stars, hung like pendant balls of molten gold against a pale-green eastern sky. Each morning they came closer together and seemed so near as to almost rest on the distant ridges. By sunrise we would be on our horses and away with the dogs, scouring the country for signs of lion. Seldom did we have even a game trail to make our way an easy one. For the most part it was cross-country, through cedar or stubborn scrub oak that tore our clothes and scratched our faces.

At the end of our first week we had had no success. Day after day we rode out of camp, covering new ground but finding only old tracks. Stone mountains still cracking up, surfaced with merely a veneer of soil and a covering of sage and short, stiff bush, made the footing invariably bad. The patches of scrub oak, growing closely set and from six to eight feet high, were as tough as hickory, with ragged, knurled terminal branches that were persistent and tenacious. To go through a patch of this was like going through steel springs, and one was always glad to be out of it.

Leather chaps were a necessity, not only to save our clothing but to protect our legs.

There were noticeably few birds. The red-headed western vultures were occasionally seen, soaring the blue heavens or perched high on granite boulders. Several red-tailed hawks soared and darted for rabbits. The western tufted bluejay, the night-jar and a few smaller birds, including the sparrow, occasionally crossed our trail.

Our hunting averaged from fifteen to twenty miles a day, for by early afternoon in the heat of the warm spring sun the dogs, after going hard from six to eight hours, would become played out. So we would all return to camp, to rest for the morrow.

Two hand-picked specimens

For our Group we only needed two specimens—a big male and a female. It would not be good natural history to put cubs in the Group with a big male, for that would not be true to their habits. A female with cubs would never allow a male to come near, because the male parent by some fiendish twist of its nature would invariably kill the cubs at once.

These two specimens could not be just any two; they must be a selected or "hand-picked" two. And our problem of how to get them did not seem to be getting any easier.

On the trail the tough bush had ripped open a bag tied on the back of my saddle, and I had lost my telephoto lens, not to discover it until the next day. While Jim and I back-tracked on our path of the day before, Mr. McConnell and McFall went with Jack and the dogs down the valley where we had hunted without success the first few days.

It was Monday morning and the scenting advantages that may have obtained the last few days were practically gone. Thursday's snow had melted quickly and the warm midday sun dried the ground and vegetation. Scent does not cling long to smooth, dry rocks, where sun and wind soon force it away, though in protected gulches covered with grass and brush it will hold for a longer time.

No one was over-optimistic this morning. The men and also the hounds were feeling the effect of the hard days of fruitless hunting. The dogs were not wasting any energy, yet one sensed grim determination in their work, as they became more attentive to the suggestions of their master. The pack consisted of eight hounds—the foremost, old "Spuds," the hero of 115 lion kills, a black and tan bloodhound, with a deep, far-reaching voice and keen sense of lion hunting. Next perhaps came "Speckles," daughter of Spuds, herself the mother of a very promising young hound of the pack who, however, was still young

enough to scent wistfully along fresh deer trail. The mother of Speckles was a foxhound. The third hound to stand out was named "Pilot," a little dark tan coonhound seven years old—energetic, intelligent, aggressive, with a keen nose and a good voice. These three hounds alone could probably have trailed and treed a mountain lion, though the rest gave valuable assistance.

Lion tracks

Not more than fifteen minutes after leaving camp, Jack Butler spotted the imprint of a lion track. The moment he leaned in his saddle to examine it, all the hounds came to him. Spuds spoke, and the hounds worked slowly toward the north, up a small gully, into dense oak brush and low cliffs. Jack was not hopeful; too much dust had been blown into the track for it to have been made last night. Probably it was at least 36 hours old. The lion might well be 25 or 30 miles away, at the end of which trail the hounds would have been too sore and weary to have pushed the lion fast enough. However, it was our best bet, and the hounds seemed more optimistic than Jack.

They went away for perhaps a half a mile with considerable volume of voice and at a fair rate through that rough country. We, on the horses, had to make a short detour but caught up quickly at a short fault below the top of the ridge. At the top, after about a mile of satisfactory trailing through brush and cedar, we came to a stretch where the breeze had a better chance and the hounds were at fault.* Twice Jack dismounted and worked out the trail. Within two or three miles from the start we came into granite country where bare ribs of rock protruded at intervals. The lion track lead directly toward one of these granite ribs, where the hounds worked very slowly and uncertainly. They had come definitely to fault and the situation appeared hopeless. Spuds even came back to his master to lie down in the shade. Jack dismounted and made a cast of about 200 yards in diameter.

We found in the rocky soil beyond the granite outcropping a slight evidence of track. Spuds came to in a clear voice, and all the other hounds immediately came on. Away we went again. It was a cold trail but we followed it until about 11:30 that morning, over a distance of perhaps seven or eight miles, up and down, through knobby oak and manzanita brush.

Then we reached the base of a very large cliff. The rock was broken up by erosion, and several gulches afforded means of ascent, but the horses definitely had to be left behind. The hounds were working well, but they had to be lifted in places over steep parts in the

cliffs. Old Spuds was too heavy to carry, and philosophically returned to the horses at the base of the cliff. Near the top it was clear the scent became stronger. The hounds grew more excited, more eager. Then suddenly above us they gave a great burst of voice. All of them shot forward as fast as they could go over the top of the ridge, out of sight and soon out of hearing. Jack yelled like an Indian and turned back to reach the horses. What had taken us a half an hour to climb took us nothing flat to descend. Mounted and pushing the horses as fast as they could go, it nevertheless was fully twenty minutes before we could get around to where the hounds had last been heard. The cat had doubled back on her track down the gulch. Here Spuds came into his own, giving voice immediately and causing us to thank our lucky stars that we had him to take us on the trail of the cat and the hounds. They were far ahead for we could hear nothing though every hound must have been giving tongue as they pushed the lion across the country. After half a mile, Mr. McConnell branched off at the top of a low ridge out of hearing of Spuds and stepped ahead of his horse a few yards into the quiet air. Far off in the distance he could just hear the full cry of the pack. He yelled to Jack that they were ahead, down a branch gulch. Jack immediately suggested that Mr. McConnell go on and see if he could catch them, while he stayed with Spuds, a surer but slower procedure.

After about one and a half to two miles of wild riding down hill, through brush and over rock, Mr. McConnell hit the bottom of the gulch just as the whole pack at full cry, with the lion in front of them, came off the side of a hill. Except for the thick brush the hounds could have run by sight. As it was, their heads were up, and each one concentrated on greater speed and greater volume of voice.

Treed

The mountain lion is a sprinter but has little endurance. The females can make a good run of one and a half to two miles. The cat's last splurge was down a hill and up a tree, where she was entirely safe from the hounds, for even if the hounds could climb it, she could effectively deal with them one at a time. Unfortunately the lion was screened by thick branches in the pinon, and showed only spots of tawny color. Mr. McConnell made several attempts to get good pictures but the tree was entirely too thick for satisfactory photographs. All the hounds except Spuds were at the base of the tree making a great racket.

The cat was rapidly regaining her wind, apparently looking for a way out for a jump to the ground and another run. She was striking viciously at Speckles under the tree. Already fifteen or twenty minutes

*Lost the scent.

(Right) POISED on a rocky rise of ground, the huntsmen listen while the hounds give tongue. Hot sun and wind in open country weakened the scent and distracted one or two younger dogs who started wistfully following deer or bob cat trails. The chaps worn by both riders were no mere picturesque stage properties—limbs as well as clothing had to be protected from the lashing brush



(Left) PILOT, ace dog of the pack. When the trail was finally untangled, Pilot, like Abou Ben Adhem, led all the rest



(Above) "TRAPPED" in one of the canyons where the wily lion leaves his trail. Mr. McConnell leads the way out, with Doctor Clark following astride his white horse

(Below) ATOP THE HIGHEST HILLS, the party rests while the dogs nose about hopefully. Disappointments in lion hunting are as plentiful as the quarry is rare. Sportsmen who have an eye for the gorgeous geological scenery of our Southwest are apt to be more patient





(Above) LION SPOOR and the paw that made them. When these tracks were first discovered the hounds became excited and set off in hot pursuit. However, experienced hunters on the expedition feared the imprints were "cold" (more than 24 hours old) and that the long trail

would exhaust the dogs before they could tree their quarry.

The lion customarily kills one or two deer a week, eating his fill and invariably covering the kill until returning to feed again. Other names for the same animal are Cougar, Panther, Puma, King Cat, Catamount, Painter



(Left) HIGH UP on a wind-swept granite ridge the dogs wander, trying to untangle a weak and confused trail. Absence of damp, scent-retaining soil made trailing difficult

HUNTING SIX TO EIGHT HOURS a day over twenty miles of country varying between barren rock like that at left and the dense, scrub vegetation of the slopes shown below, wearied man, dog and horse. Meanwhile the lion seemingly laughed at their futile efforts and appeared at times to be deliberately doubling back on his tracks



had elapsed, and Jack Butler, following Spuds, had not yet arrived with the rifle. The Museum wanted mountain lion specimens, not pictures or stories. Here was a good specimen—almost “in the bag,” but still not quite. Spuds could not even be heard now—he might have hit another lion trail. To chance a shot with his pistol was risky, for a wounded lion will kill hounds; but Mr. McConnell finally decided to make the shot with a .45 Colt. At the report the cat came out of the tree in a lump, hitting the limb immediately below her. When she hit the ground she managed to run but a few yards—a lucky shot, indeed, for a lion hunter's best friends are his hounds.

It was a joyful camp that evening, with our first lion and the missing telephoto lens in camp, for I had luckily found it six miles back on the trail. Mr. McConnell had to leave for home the following day, and we split into two parties with the dogs, to increase our chances before his departure.

But even after two days we had had no success, and we moved camp to another range of mountains to the southwest. Jim, Waddy and I took the horses and dogs some 25 miles directly across country, while Jack and Mrs. Butler moved the duffle by truck, traveling three times as far to get to the same place. Here we made camp on the flats of a stream called the “Beaver Dam Wash,” under the shade of some big, spreading cottonwoods. It was a pretty spot, deep in this canyon, with the steep hills rising abruptly from the water's edge.

With camp made snug by nightfall, I planned to leave the next morning with Jack for a two-day trip to the Canyon to look over a background location, while Waddy and Jim were to hunt this new country for promising signs.

Storm

Just as we parted at daybreak ominous clouds broke into a light rain, and we carried on toward the Canyon in an ever-increasing storm. By six o'clock that evening, after grinding through muddy roads in our slow, winding ascent to the Kaibab Plateau, we came to an old deer-hunting camp near the Rim and spent the night in a little shack. Snow and hail started to fall again at dusk, and it looked as though we might be snowbound for a few days, but luckily the morning broke clear and we were out on the Canyon Rim just after sun-up.

Looking off from Crazy Jug Point, we could see the Canyon sweeping miles to the west, bathed in all the glory of the soft morning sunlight. Below us it dropped sheer for over a thousand feet and then stepped down in a series of sage-covered shelves to its greater depths by the river, which we could see only as a silver thread, deep down in a distant purple

shadow, some 5000 feet below us. It was a perfect background setting for our Group. Hardly had I hoped to find such an ideal spot without a great deal of searching.

Blocked by snow

We had hoped to reach Point Sublime, which we were told offered perhaps the best view of the Canyon, but winter snows still blocked the roads, barring access for another month. Upon my return, my associate, Mr. Albert Butler, would come out with an artist to collect the foreground and background material and to pick the most suitable setting of the two.

Having accomplished our mission of looking over background scenes, we turned back through the lovely forest of big western yellow pines that form the Kaibab Forest Reserve along this North Rim. Estimated to be some 400 years old, this forest is comparatively recent, probably having come into being with a change in climatic conditions.

In the morning sun the reddish-tan bark stood out in sharp contrast to the rich green of the long needles. With no undergrowth whatever, it was a lovely park land, which appeared all the more striking as we left the Rim to find the ground a solid blanket of snow—a fall of the night before which had melted back along the Canyon edge in the warm currents of air.

Here, too, we were fortunate to see those rare and beautiful white-tailed squirrels known to the Kaibab Forest. With their black bodies and dark-brown stripe running down their backs, their long, tufted ears and big, white, bushy tails, they fitted well into our colorful setting.

Reluctant to leave this fairyland forest, with warm morning sunbeams streaming through in parallel golden beams, we wound our way among the big trees, descending all the while to lower levels. Back to our hunting camp we hastened, passing over sage-green deserts enriched by the Spring showers and through canyons of colored rocks, like miniatures of their greater brother. It was Arizona in Spring, Arizona in all its colors. On the lower levels flowers were beginning to bloom. The cottonwoods and aspens along the streams were taking on their vivid tender greens, intensified all the more by the rich reds of the native soil. What a riot of color it was, all blended harmoniously by that film of atmosphere which seems to keep every vivid color in its proper balance of tone.

Our way down and back passed directly through the canyons of the Zion National Park, all of which are really distant tributaries of the Grand. Somewhat different in formation and erosions, this fantastic region is nevertheless as colorful as the Grand

Canyon except for the lack of blue and purple hues produced by distance.

Ten o'clock that evening found us back again in camp. The boys were up awaiting us, which seemed strange, for our early and long hours of hunting put us to bed sometimes at eight, seldom after nine. But they had good news. They had got a male lion that very day.

Now our Group was assured. The only two lions we had secured were a male and a female—just what we wanted. One might get a dozen lions and still not be lucky enough to get a male. Jack Butler had taken twenty-three lions last year, and of these, eighteen were females, while of the other five males, only two were "Big Toms."

At the eleventh hour

Two weeks had now passed, and the following evening I was to return to New York, yet I had not even seen a lion. Both the other members of the party had been successful, and truly so. Two lions in camp and both about what we wanted—one could not have dared to hope for such luck in lion hunting. But we would go out hunting again in the morning, and I would return around noon with Jack to pack up and head for Cedar City and home.

Hardly could we expect to get another lion, surely not on the second day straight. This was just too much to hope for, and especially a Big Tom—but here I quote from my diary.

"Tuesday, April 28th. Clear and mild.

"We were up at 3:30. It was my last chance for a hunt. . . . At the first sign of daylight (about 4:30 o'clock) we left camp. There was little hope of seeing a lion; in fact, with the long hunts from the other camp I had hardly expected this camp to produce anything. . . .

"We climbed from our river camp up the high, steep hills over the tops into a very large, hilly basin. After an hour or so we crossed some old tracks, one of which was very large. We followed these for some distance by sight, for they were too 'cold' for the dogs to get the scent—about two and a half days old. Several signs were noticed where an animal had stopped under trees and scratched the ground. In one place a comparatively fresh sign was beside that of an old one, indicating that this lion was perhaps a regular inhabitant of this big valley. Jack immediately became interested and followed it with renewed enthusiasm. . . .

"The spoor took us on for hours, and once we thought it hot when the dogs fussed a lot over what proved to be a fresh bobcat track. The dogs were able at times to pick up a weak scent and follow the lion track through the bush, but not over open ground,

where wind and sun had eliminated it completely. Jack would faithfully follow the footprints, which he could do with remarkable accuracy. But still it seemed hopeless to me, in spite of the dogs being able to pick it up at times. It was, however, an ideal day. There was still dampness in the ground from the recent rain, and a thin haze softened the harsh, hot sun and kept it cool for dogs and horses.

"About noon, after going steadily since daylight, the dogs took more interest. Jack said that although the track was old, we might come to the spot where the lion had lain up the day before.

"Suddenly the dogs gave tongue and started on the run. Jack thought they had hit a fresh track and suspected they might jump the lion somewhere in that section. I still thought he was only encouraging us, yet it was exciting to get some action. We had to urge our horses to keep up with the hounds, while the excitement of all continued to build up. It seemed likely that something was about to happen, for all this sudden interest in the dogs could hardly be a false alarm.

"Then the dogs went into action, and Jack shouted to us to be on the lookout, as they might jump the quarry near a recent deer kill. Jack sprang into action to watch his dogs, and we all followed, galloping as fast as we could, dodging cedars and bush, trying to find the center of the rapidly shifting dogs. Things were happening fast. Jack was shouting, and the dogs barking and baying their loudest. Our blood boiled as we pressed on with loose rein at dangerous speed, hoping our horses would not stumble and hurl us headlong into a patch of cactus.

A flash of yellow

"As I topped a rounded ridge, to look down into a little draw, bedlam broke loose. Flashes of dogs were darting in all directions. I saw Jack going on the dead run through the trees, then a flash of yellow hide. We were on the lion at last! Spurring my horse, I galloped to get to the other side of this steep little draw. I had lost Jim and Waddy. Everybody was now on his own, trying to close in on the shifting position of the lion. Sounds of shouts and barks filled the air and echoed throughout the hills. The small scattered cedars screened the action for a while, and all I could see was an occasional flash of dog, horse or man. Dodging trees, rocks and cacti, I moved swiftly in to where I thought I could see something—and rode almost right into the center of it all! Jack was on his horse waving his gun and shouting for me to come quick and shoot, to save the dogs."

During our many days in the saddle Jack and I had talked about the habits of lions, and he had as-

(Right) TREE AT LAST, the lion somewhat resembles an enormous alley cat in appearance and behavior. The photographer could pass quite close to the tree to snap these pictures, knowing the animal would do no more than hiss and snarl. A fleet sprinter, the lion is no distance runner. He feels safest in trees where he can deal singly with each leaping dog



(Left) THOUGH the placid security of this tree-top citadel shows the instinctive wisdom of arboreal strategy, lions *will* occasionally fight on the ground. In the accompanying article Doctor Clark recounts the thrills of seeing a lion battle the dogs on their own level. But this is a rarity. The guide declared that only two lions of the 150 he has hunted remained on the ground



MUSEUM PREPARATOR, Waddy McFall, prepares the first lion skin prior to shipment to New York

(Right) MODEL of Mountain Lion Group, whose ultimate construction, like the expedition which secured the specimens, was made possible through the generosity of Mr. Beverley R. Robinson. No cubs can be shown—the father would kill them



sured me that when the time came I would have plenty of opportunities for good pictures, for the lion was sure to go up the first tree when hard-pressed by the dogs and, if he jumped out, he would soon go up another, never getting away once the dogs were on his heels. I had visions of wonderful photographs taken with long and short focus lens, close-ups of their snarling faces and a series of fine color shots, too. In fact, I dreamed of bringing back the world's best lion pictures, but this all went to pot when Jack shouted to me to "shoot quick and save the dogs."

Tooth and claw

I have no recollection of how I got to the ground, but the next thing I knew I was reaching for the gun while standing not ten feet from the lion, which was under a little tree with his back on the ground and his head and shoulders against the trunk. He had come to bay, to fight the dogs, who were now all around him, dashing in to take a bite, then withdrawing quickly to save themselves from the stroke of his powerful paws. I remember seeing Jim on the other side, and was conscious that Waddy was behind me. Jack kept shouting: "Shoot quick to save the dogs, but look out you don't kill one!"

Dog after dog rushed in, while the lion reached out with his claws to grab them and pull them in. I remember seeing him grab old Spud by the hind foot and hold him, while he bit at another he held down with his other paw. Again I saw him grab little Pilot and actually hold him in his lap with his extended claws, while he bit at his rump. During these few split seconds I was aiming at his heart, waiting for the moment when the shifting dogs would bare a spot so I could fire. At last a quick opening gave me the chance, and I fired, but he kept right on fighting and grabbing for the dogs. Another quick shot, and he relaxed and rolled over.

What a fight it was! What a picture that scene would have made! But in those few seconds our only thoughts were for the dogs. That he did not kill or badly maul several of them is a miracle.

We all gave a sigh and relaxed, and I turned to Jack and asked: "What's all this you've been telling me about lions always going up trees, and

where are all those fine pictures I was going to take—now?"

"Well, you know," said Jack, "that's only the second lion I ever saw in my whole career of lion hunting that stayed on the ground to fight the dogs, and the only reason I can see that he didn't kill some dogs is because these old fellows don't seem to have a bit of stamina. He got all petered out trying to get away in his short, fast race with them. . . . Those are some lion dogs of mine!" Jack added further. "If they weren't, they'd not be alive today." And I fully agreed with him.

He was an "old war horse," this lion, terribly scarred from many battles. One opponent had left a scar five inches long right across his face, which all but put out one eye. A big, festering hole, evidently made by a tooth, was in one shoulder and many bits of shredded skin with tufts of hair hung from his neck and shoulders, indicating that within the last few days sharp claws must have been flying fast and furious in a battle royal for the supremacy of the valley.

The remote had come to pass—from a secret belief that a lion would never be seen that morning, there came to our bag an equally remote possibility a fine "BIG TOM," one that a year's hunting might not have produced had we been out to guarantee it. So again our happiness ran high, with such a climax to our efforts.

Homeward

It was 12:30 when I looked at my watch, after measuring and taking a few photographs. Then I left the skinning to Waddy and Jim to hurry back to camp with Jack to make my train. Instead of taking two hours as we had estimated to reach camp, it took three and a half, and we were pushing hard all the way. We hadn't realized how far we had traveled while following the Old Tom's tracks, and when we reached camp at 4:30, we had been in the saddle just eleven and a half hours, without food or water.

It was a great hunt and a great battle. Now I could return with the satisfaction of having completed the Group by getting, at the eleventh hour, a fine big male. What more could one ask?

GEOMETRIC SPIDER

Have you ever stopped to watch this master artisan at work?

A story in pictures by LEE PASSMORE

ANY of the familiar spiders which spin a circular web composed chiefly of radiating and spiral threads are called geometric spiders or orb weavers. Perhaps easiest of all spiders to observe, they offer interesting studies in their spinning work, method of capturing prey, and reproductive habits.

Though possessing eight eyes, these spiders do not build their nests by the sense of sight but rely entirely on touch. To place the fact beyond doubt, spiders have been confined in total darkness and yet have spun webs as perfect as if they had been in broad daylight, nests whose beauty and delicacy of design surpasses anything that human hands

could accomplish no matter how skilled the artisan. Some of the webs are gossamer gems no more than two inches in diameter, made by microscopically small spiderlings; others may be three feet or more across.

Should the reader care to watch an orb weaver doing its spinning, an electric flashlight will be needed to illuminate the scene of operation, since most of the species begin the construction of their geometrical webs soon after nightfall. The light rays should not, however, be directed on the spider for long periods, because moths and other night fliers, attracted by the light, may fly against the web, damaging it and preventing the spider from finishing the job.

ONE OF THE LARGEST orb weavers of the Pacific Coast, the spider shown here [*Aranea gemma* (McCook)] is found from San Diego northward as far as British Columbia. More than 100 other orb weavers are known from the United States, and others occur in almost every part of the world where spiders exist. This spider bears a close resemblance to the well-known Cross Spider, but has distinct bumps on the abdomen. The young of this species will often build their webs in the daytime, but the adult weaves only at night



2 (Right) A THREE-FOOT WEB, woven in total darkness. The spider herself, almost an inch in diameter and actually dark in color, was given this spectral appearance by the brilliant glare of the photographic flashlight. She is spinning the last few strands before attaching the "telegraph" line which serves to notify her when an insect is caught in her snare, and is held as shown in the next photograph

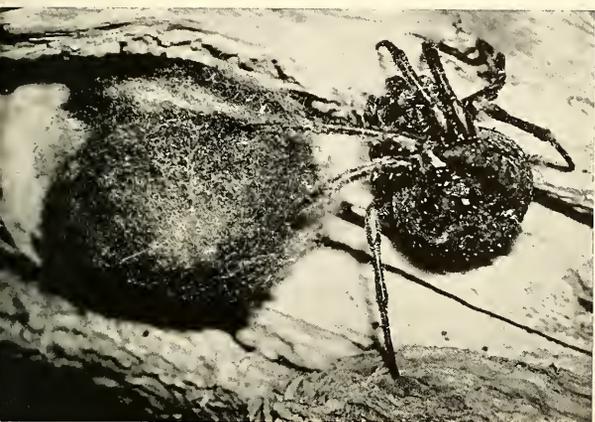




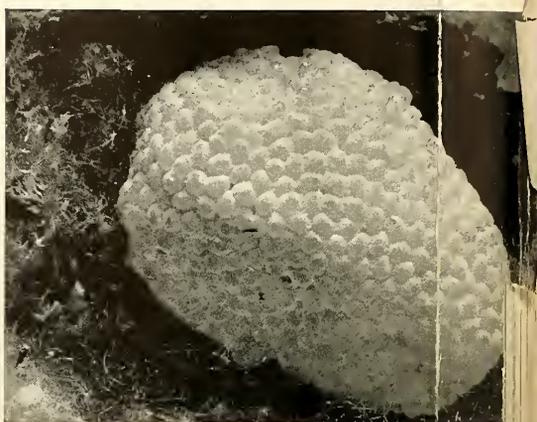
3 WAITING FOR A NIBBLE. No fisherman ever held his line with such a sensitive touch as Madame Aranea. Her "trap-line" is attached to the center of the web and when she feels the victim's vibration she hurries down it to bind her captive. Orb weavers seem to favor locations sheltered from the wind, to prevent damage to the web and also possibly to avoid false alarms



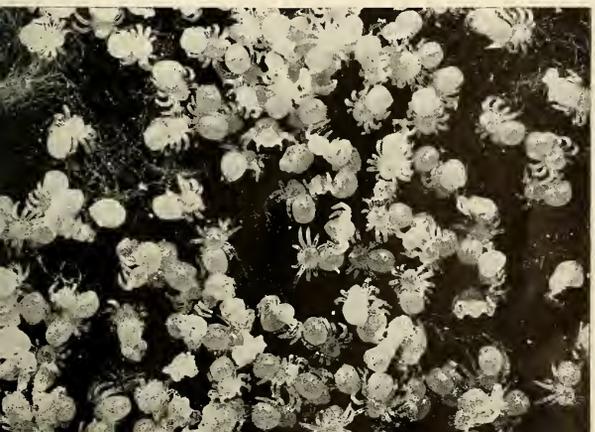
4 SHROUDED FOR THE FEAST. The insect victim is completely swathed in this manner by the spider before she begins her meal. The form of the small gray moth, one inch in length, appears quite distinctly through the almost transparent web. After the spider satisfies her hunger by sucking the juices out of her prey, she cuts away the strands of web, allowing the empty bundle to fall



5 PREPARING FOR OFFSPRING she will never see: a mother orb weaver remaining on guard beside her newly spun egg-case. The inner part of it is of loosely spun silk, the interior closely woven. Soon after laying the eggs she dies, as do all orb weavers, not living to see any of her descendants. Without parental instruction the young will know how to spin geometric webs, capture and bind insects, find mates, and provide for the safe hatching of the eggs just as she did.

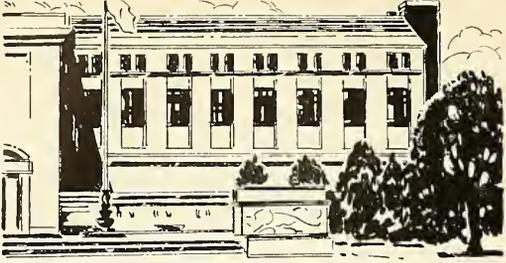


6 TWO THOUSAND PEARL-LIKE EGGS are the contribution of one mother orb weaver toward the future of her kind. The webbing was gently opened for the photograph and replaced so as not to interfere with the incubation of the eggs, which hatched a few weeks later



7 A NEW GENERATION of orb weavers breaking out of their shells: a small section of the nest, from which the spiderlings venture forth into the world by the ingenious method of spinning tiny strands of web which serve as "balloons." With these they may ride the wind for several miles, but the flight is ordinarily only a few rods.

The spiderlings moult several times before becoming full grown. Many of this large family, which may number 2000, will fall prey to birds and spider wasps, so that relatively few will reach maturity. It is one of the marvels of instinct that they will build their first geometrical web as perfectly as any of the hundreds they may construct later



WHITNEY WING

The new home of the American Museum's Department of Birds

By ROBERT CUSHMAN MURPHY

ON June 6, 1939, the Whitney Wing of the Museum, which extends northward along Central Park West from the Roosevelt Memorial Building, was formally opened in the presence of Mrs. Harry Payne Whitney and members of her family, the trustees of the Museum, the scientific staff, delegates from sister institutions and other invited guests. Addresses in celebration of the occasion were made by President F. Trubee Davison, by Mr. Cornelius Vanderbilt Whitney and Dr. Leonard C. Sanford, who are both trustees, and by Doctor Frank M. Chapman and the writer, of the staff, after which the visitors inspected the structure throughout its eight floors.

Whitney Wing is the result of a gift from the late Mr. Harry Payne Whitney which was equalled by an appropriation from the City of New York. The dedication of the building and the relation of the patrons to the Department of Birds are explained by an inscription on the second floor, which reads: "This wing of the Museum is the memorial of Harry Payne Whitney to his father, William C. Whitney. After the death of the donor, the collections of birds were greatly enlarged and the exhibits in the building completed in his memory by his wife and children."

Whitney Wing is the most commodious and best equipped ornithological headquarters in the world. It also houses the largest and most important collection of birds, numbering approximately 750,000 specimens. Coördination of the Museum's older material with the Rothschild Collection (likewise a gift from Mrs. Whitney and her children) and the birds obtained during the Whitney South Sea Expedition has produced an orderly systematic arrangement in new steel cabinets on seven floors of the building, so that every specimen of an ornithological nature is now readily available to investigators. In addition to offices and the "ranges" in which preserved material is safely stored, one floor of Whitney Wing is equipped with laboratories in which living birds may be bred and kept under observation in the course of studies relating to heredity and behavior.

Three floors are devoted in whole or in part to exhibition, these comprising an Art Gallery, a Hall of Biology of Birds and the Whitney Memorial Hall of Pacific Bird Life. The last, which is the present "show place" of the department,

opens from the main entrance hall of the Museum in the Roosevelt Memorial and thus balances the Hall of Asiatic Mammals and the Akeley African Hall.

Whitney Memorial Hall is at present about half completed and its exhibits are the subject of the following eight pictorial pages. Its wall cases provide for eighteen habitat groups of Pacific birds, of which eight have thus far been installed and opened to the public. Ultimately these displays will cover the Pacific Ocean by means of selected localities extending from the Galápagos Islands and the coast of South America on the east to the Philippines, New Guinea and the Australian Barrier Reef on the west; and from islands near Hawaii, in the northern hemisphere, southward to one of the small outliers of New Zealand, on the verge of the Antarctic. Directions in the hall are similar to those on a map. The visitor, entering at the south end, finds himself abreast of a group illustrating bird life of the West Wind Zone, in high southerly latitudes, and then walks northward through the tropics into the northern hemisphere as far as the island of Laysan, at the edge of the North Temperate Zone, which is the latest of the eight exhibits thus far completed. The succession of bird life exhibited in the sky overhead follows the same plan, leading from Antarctic Snow Petrels and Whale-birds to equatorial Man-o'-War Birds and Tropic-Birds.

Mural charts in the entrance halls serve a purpose both of decoration and orientation; on them the visitor will find the exact location of each exhibit, as well as information about ocean depths, prevailing winds and currents and other geographic factors that have had much to do with the present distribution of life in the Pacific. One of the four maps shows also the division of this greatest of ocean basins into its natural geographical regions, both of the sea and of the archipelagoes, and the courses of a limited number of vessels notable in the history of Pacific science. These comprise the tracks of the pioneering ships 'Resolution' and 'Discovery' (1776-1780), commanded by James Cook; those of the Russian cruise of the 'Vostok' and 'Mirnyi' (1820-1821), under F. G. Bellingshausen; the famous voyages of the 'Beagle' (1832-1836) and 'Challenger' (1874, 1875); the surveys of the United States Fish Commission steamer 'Albatross' (1888-1910); and, finally, the lengthy wanderings of the American Museum schooner 'France' (1922-1932),

during the Whitney South Sea Expedition. The first mural, at the right of the entrance to the Hall, is an enlargement of a chart published by Abraham Ortelius, of Brabant, in 1589. It reveals the European conception of the Pacific Ocean three and a half centuries ago, and includes a basal shield in which the Museum acknowledges its debt to two generations of distinguished patrons, personified by William C. and Harry Payne Whitney.

The reproductions of photographs on succeeding pages offer only a fragmentary idea of the Hall, since many of them depict no more than small details of the several groups. The latter are, however, labeled in such a manner that Museum visitors can readily identify every element of the bird life and find a record of the part played by each of the many individuals who have cooperated in the creation of this notable exhibition.

(Below) ONE HALF OF THE EXHIBITS of bird life designed to reproduce in miniature the far-flung islands of the Pacific. The dome of the sky seems to rest upon the common oceanic horizon of backgrounds. Suspended beneath the clouds by invisible wires are sea birds chosen to match the respective life and latitudes of scenes in the cases, which represent localities in the Pacific between the Antarctic and

the North Temperate Zone, including coral and volcanic, low and mountainous, islands, some of which are covered with teeming rain-forest vegetation while others are bare and arid. The memorial busts are portraits of Harry Payne Whitney (1872-1930), by Jo Davidson, and of his father, William C. Whitney (1841-1904), by Augustus St. Gaudens

AMNH Photo by Coles



SHIP-FOLLOWERS of the "Roaring Forties." Far south where strong westerly winds prevail over an ocean almost unbroken by continental land masses, vast numbers of petrels and albatrosses spend their whole life on the open sea except during the weeks of their breeding season. Such birds often follow sailing ships for food stirred up in the wake or tossed overboard, or because attracted by mere curiosity. Sooty and Wandering Albatrosses, Cape Pigeons,

Whale-birds, Mother Carey's Chickens and other Petrels show in this scene, southeast of New Zealand in mid-summer (February). Beyond the bulwarks and rigging of the vessel on which the observer is supposed to stand, can be seen the Whitney Expedition schooner *France* running under shortened sail before the brave west winds. (Numerals adjacent to photographs refer to locations indicated on the maps)

AMNH Photo by Bierwert

1



2

THE TOOTH-BILLED PIGEON: detail of the Samoan exhibit. This odd bird, which has been given the scientific name *Didunculus* because of a fancied resemblance to its big extinct relative, the Dodo, is the most striking and peculiar of all the birds of the Samoan archipelago. It lives on the two large islands of Savaii and Upolu, and nowhere else in the world. Although it is a member of the large, varied and widely distributed pigeon family, the Tooth-bill of Samoa has no very near relatives and is probably a relic of a branch of the pigeon group that has long since died out elsewhere. The Samoan exhibit as a whole shows a point on the slopes of Savaii where forest and grassland meet and where woodland birds consequently come into contact with those of the open

AMNH Photo by Bierwert



LIFE ON AN ATOLL in the Tuamotu archipelago: the island of Hao, showing the nesting ground of Man-o'-War Birds, Tropic-Birds, Boobies, seven species of Terns, the Reef Heron and the extremely rare Polynesian Sandpiper, of which a pair stands in the left foreground. The birds face the trade wind toward the pounding coral reef, with the lagoon of the islet showing at the left behind swaying coconut palms and pandanus

AMNH Photo by Coles

3







(Left) MARQUESAN FAIRY TERN: detail of the Nukuhiva exhibit. Most delicate of sea birds are the Fairy Terns, with their pure white plumage and huge dark eyes. This one has poised on filmy wings on the bough of a South Sea hibiscus. The exhibit as a whole shows a view over the valley of Taipi, scene of Herman Melville's "Typee" (1846), a romance of primitive life in the Marquesas Islands

(Right) GUANAYS, or guano-producing Cormorants, of the coast of Peru: detail of the guano island exhibit. A fledgling (at left) is begging its parent for food. The Guanay has been judged upon a purely economic basis "the most valuable bird in the world"

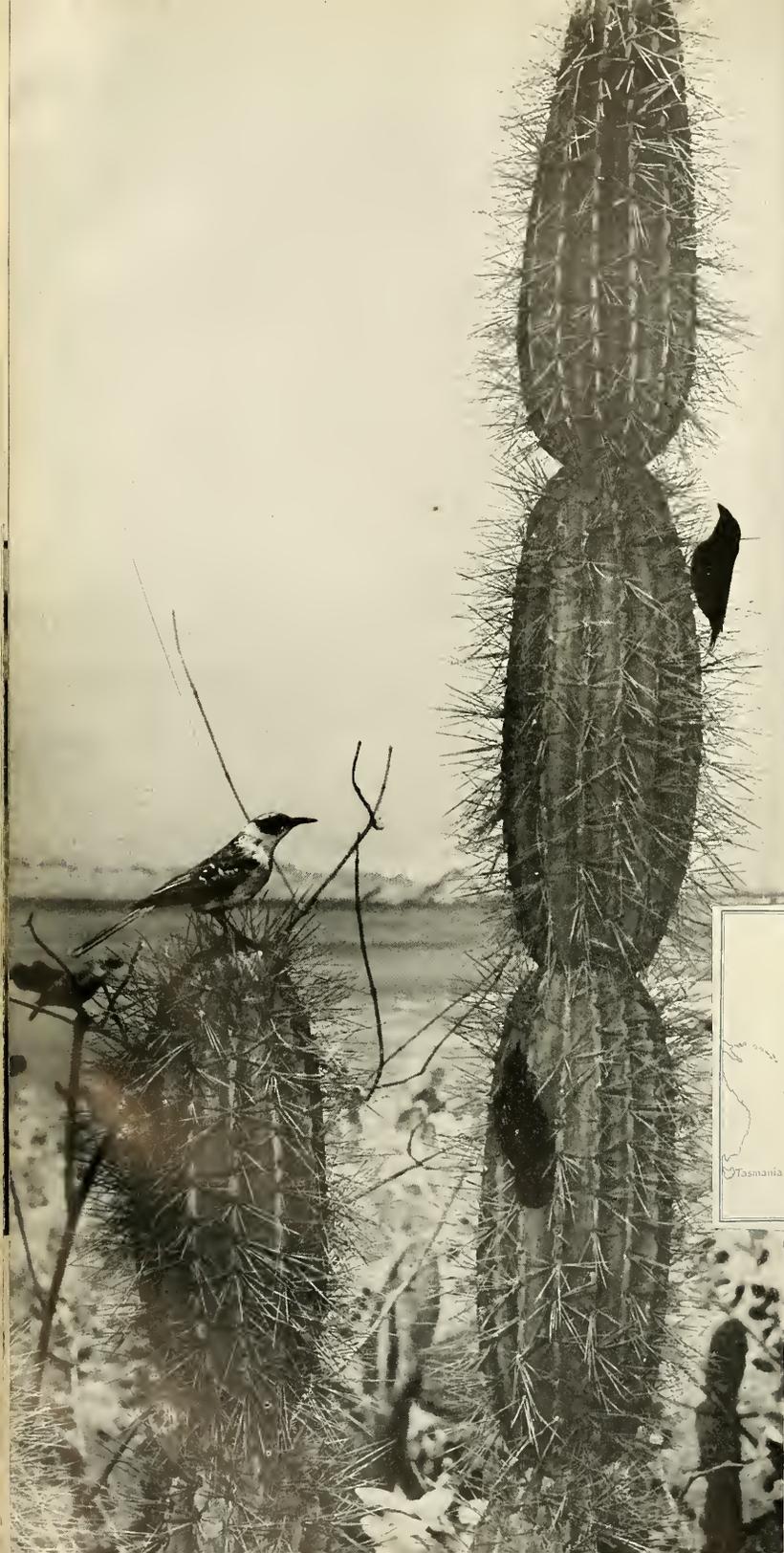
AMNH Photos by Coles



PERUVIAN GUANO ISLAND EXHIBIT: a scene at the famed Chincha Islands, looking southward across the Bay of Pisco. Peruvian Cormorants, Boobies (on the cliff at the left), and Pelicans make up a distinguished trio of sea birds which produce annually in this rainless

region more than a hundred thousand tons of marketable fertilizer worth 33 times its weight in farmyard manure. Guano exploitation in Peru constitutes the largest industry based upon the conservation of wild birds





MOCKINGBIRD AND CACTUS FINCH: detail of the Galápagos exhibit. The view is from James Island toward Albermarle. The volcanic Galápagos Islands, which straddle the equator about 600 miles west of South America, have been isolated for long ages, and the origin of their peculiar plant and animal life poses many scientific problems. The Cactus Finch, climbing the prickles, is a member of a family of land birds (*Geospizidae*) found nowhere else. Nine species inhabit James Island alone. The curious specializations of the bills of these birds gave Charles Darwin, who visited the Galápagos during the cruise of the "Beagle" in 1834, his first ideas regarding "natural selection" as a mechanism to explain the process of evolution

AMNH Photo by Coles





6

GALÁPAGOS HAWKS: detail of the exhibit. Fearlessness is a striking characteristic of the varied wild life of the Galápagos. It doubtless indicates an enormous period of time without molestation from man or four-footed enemies. Although dogs, hogs, goats, cattle and donkeys have been introduced and have reverted to a wild state, the native Galápagos animals retain a surprising tameness. These hawks illustrate two color phases of a resident species belonging to the cosmopolitan genus of our American Red-shouldered Hawk. They sometimes perch on the hats of visitors and readily step from their perches onto a proffered stick

AMNH Photos by Coles

SCARLET SICKLE-BILL (Hawaiian Group): a bird important in the human history of Hawaii because from its red feathers the gorgeous ceremonial capes of the ancient island chiefs were made. The Sickle-bill is a member of the curious family of Hawaiian Honeycreepers (Drepanididae), confined entirely to this mid-Pacific archipelago. Although all closely related, the numerous species show remarkable variations in the bill, correlated with diverse feeding habits. This exhibit looks down a great canyon on the island of Kauai to the ocean four thousand feet below



WANDERING ALBATROSS-ES: detail of the dome. This is the largest bird that flies, with a maximum wing-spread of eleven feet four inches. The huge sea fowl is one of the southernmost of its family, nesting on bleak islands close to the Antarctic and spending the greater part of its life on long travels over oceans well south of the equator



AMNH Photos by Coles



LAYSAN ALBATROSSES AND BRISTLE-THIGHED CURLEWS: detail of the Laysan Island exhibit. Laysan is an islet in the long chain northwestward of Hawaii. It was created a reservation by executive order of President Theodore Roosevelt in 1909, since when the resident birds have been free of the human marauders from which they had previously suffered greatly. The Laysan Albatross is one of three North Pacific species of its family, two of which nest at Laysan in impressive numbers. These birds return each year to dance and mate, not in our spring season but in November, the springtime of the southern hemisphere, where most of their relatives live. The Bristle-thighed Curlew breeds in Arctic Alaska and makes Laysan a way station on its long migration toward islands in the South Pacific



MAN AND MUSIC—*Our earliest ancestors may have sung before they spoke, creating out of the rhythm and melody in Nature what has come to be a manifold art that lives today in every civilization*

By MARY HUNTINGTON

MAN cannot be separated from music. This statement might appear at first a novel fantasy; yet, looking backward far into the beginnings of human thought and culture, music is found to attend every phase of man's existence. It accompanies him always—in warfare and hunting, in play, in love and in religious worship. It is a sort of universal back-drop to the drama of human life—a drama which grows increasingly absorbing and romantic as each succeeding act is unfolded through the magic of scientific investigation.

Those attempting to trace the beginnings of music as conceived by man, believe rhythm to be one of the oldest human impulses. Everywhere the rhythmic element dominates savage music. All life pulsates with it. It is in the ebb and flow of the tides, the rotation of the seasons, in the very heart beat. Insects emit sounds whose rhythm can be discerned in all its nicety only by the aid of precision instruments. Birds present a vast and delectable combination of rhythm with melody.

Primitive man may have sensed that some sort of self-expression was possible through imitation of the creatures about him; indeed the songs of many savage peoples (notably the American Indians) seem clearly to be copied from certain bird and animal calls. Many authorities believe that long before man thought of carving objects, moulding clay and building tombs, he found pleasure in rhythm. Probably he sang before he learned to talk (Renard thinks he did) and danced as early as he sang, thus establishing, though in almost unrecognizable form, two essential elements of true music—melody and rhythm. Taking his cue from nature, he began to develop a crude combination of howling and crying, of prancing and marching about, a form of self-expression which is said to be "as long prior to language as the brilliant colors of flowers are to painting."

And so it follows that the tone intervals used in civilized music may never have been invented by man at all! Many of the intervals in use today, such as the thirds, fifths, and octaves, in their perfection, may be found in certain animal cries, and, of course, in bird songs. Some of the latter are so simple, clear and true, that one can understand the urge to imitate them.

For example, almost everyone who can whistle delights in repeating the tri-syllabic notes of our American whippoorwill.

It may be that the first music grew out of the instinctive, primordial response to danger—a cry of warning or an expression of fear. Its association with the unpredictable dangers that surrounded primitive man may account for the strange, superstitious element which seems to run like an ever-present motif throughout primitive musical expression. The basic emotions must have invested man's first attempts at music with a mysterious power over both performer and listener. And the earliest music must have reawakened those instincts of dread, of courage, of desire, of aspiration, as ancient as man himself.

These emotions, interwoven with the beginnings of a religious purpose, must have caused man to regard his music as a sort of mystical link with the supernatural powers. He began, perhaps, with simple prayer-songs, which developed into potent "spells." The moment man started fashioning drums, many other idols may have been discarded to be reincarnated into rhythmic sorcery, in which the drum became a god and was worshipped. This drum-worship was prevalent in many parts of the world and forms a fascinating detail in the arabesque of musical and cultural development.

Mystery and symbolism surround the origin of music in recorded history. The early Greeks attributed its source and powers to the god Orpheus. The legend of his descent into Hades is delightfully naïve. You remember that with his lyre he charmed the rulers of the underworld and obtained the liberation of Eurydice—only to lose her because, in violation of his vow, he looked back, causing her to vanish from his sight. The Greek god Hermes is credited with the invention of the first lyre, fashioning it from the back of a tortoise. Such instruments exist today in Africa. The ancient Egyptians believed that the goddess Isis composed the first music, or at least Plato says so. Homer's fable of the Iliad tells how the gods were entertained by singing, which was regarded as a direct gift of the gods. The Japanese of today, as well as the Chinese, attribute the origin of music to divine inspiration. The ancient Chaldeans, probably the oldest astronomers, connected music with the movement of the heavenly bodies, as did the Hindoos,

Today in Egypt you may see an old man sitting on his doorstep in the shade, playing a double bamboo flute whose compass comprises but four or five notes, yet he will pass a tranquil afternoon repeating these notes until the muezzin from the tower calls him to prayer!

While the American Museum's Central Asiatic Expedition was encamped in the Gobi Desert in 1925, Major L. B. Roberts, topographer of the Expedition, noted down two Mongolian folk songs. He says in his diary: "The Mongols are singing again tonight. . . . I recognized the tunes as the ones they have sung ever since they joined us at Shabarakh Usu. Sometimes they sing these tunes for two or three hours steadily. . . . The complete stock of songs amounted to two distinct melodies." One is a love song, the other a war song, represented at the bottom of these pages.

In the search for musical beginnings, we come upon a mystery. Peoples so widely separated geographically that communication between them would be utterly impossible, have developed melodies strikingly similar. For example note the two songs below, one Carib, the other Polynesian. Both are confined within the interval of a *fourth*, and, except for rhythm, are

almost identical. (Play four notes on your piano, on the white keys, from middle C down to G.)

Arriving at the interval of a *fifth*, we have touched upon an important point in musical evolution. These five notes form a "scale" (c, d, e, g, a, on the piano). Peoples of different epochs and geographically separated seem to have evolved this succession of tones without any known contact with each other. For example, the music of the North American Indian, which has been elaborately studied, is almost wholly pentatonic. Motifs and themes of various tribes have been adapted to modern harmony. Everyone is familiar with Charles Wakefield Cadman's lovely songs. *The Land of the Sky Blue Water*, an Omaha tribal melody, is still immensely popular (*below*).

Among the modern savage tribes which use five tones are the Wei-Wei Indians, to whom Dr. William Hall Holden, head of the Terry-Holden Expedition to British Guiana (1938), referred recently in a broadcast: "Their music is based on a scale of only five notes. It is usually played on a flute made from a piece of bamboo, and has a very uncanny sort of wailing chant."

That the American Indian should use chiefly the five-toned scale is in itself perhaps not remarkable,

POLYNESIAN



CARIB SONG



FROM THE LAND OF THE SKY BLUE WATER



MONGOLIAN WAR SONG



but it becomes interesting when this same scale is found to be the basis of most Oriental music, notably that of India, Burma, Java, Japan, and China. Carl Engel states that "there was a common fountain-head in all Asiatic music."* The appearance of this scale in widely separate areas and races inclines certain authorities to conclude that the different stages of civilization must have manifested themselves in a repetition of experiences of some sort, perhaps ritualistic. The early Greeks used the pentatonic scale, but so did the Irish, Scotch, and early English!

One might surmise these five tones to be so deeply founded upon natural laws as to be almost instinctive at a certain stage of progress. Or perhaps they gradually came into being as man learned to count; for after all, counting was one of the earliest forms of speech and it often followed the fingers on the hand. It's an idea, surely, because an Italian singer, who is reputed to have been a resourceful person, used not only the fingers but the knuckles to indicate definite tones! His name was Guido d'Arezzo; he was born in Paris in 1050 and is one of the most important and colorful of medieval musicians.

It seems impossible to separate even rudimentary attempts at song from the rhythmic principle as expressed in primitive dancing. Here we find, portrayed in bodily movement, emotions of joy, thanksgiving (in which American Indian music abounds), supplication, grief, love, hate, and anger, the latter so graphically expressed in war dances.

Now that we have man singing, even though in many instances separate tones are not distinguishable, and dancing, even though the movements may be confined to jumping up and down, we begin to follow his impulse to self-expression through these mediums. Dancing and music have always accompanied man's worship of a higher power. Everyone is familiar with that extraordinary Hopi Indian snake dance, during which a prairie rattler is held between the teeth. Again, the lama "Devil Dance," performed by Buddhist monks in the lamasaries of Tibet, Mongolia, Siberia, India and China, is especially spectacular. The dancers wear costumes and masks representing devils, gods, mythological kings, etc. Considered an important festival, the "Devil Dance" is given each spring, "to chase out the Evil Spirit that hides in the land." Travelers, witnessing the dance performed before the magnificent lama temple at Peking, report it to be a grotesquerie which should frighten the most persistent devil! The Nautch temple dancers of India present an agreeable contrast. These lovely and highly trained young girls slowly girate in the dance, undulating their hands and fingers with unbelievable

*Carl Engel, *The Music of Most Ancient Nations*.

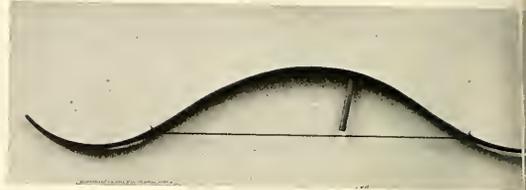
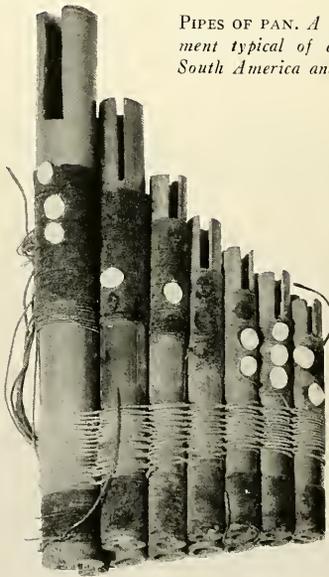


Photo Courtesy of Metropolitan Museum of Art

MOUTH BOW: a curious instrument believed to have been played by placing the mouth against the hole at the back of the bow and striking the metal string, the tone being varied by the lips

(Opposite page) MUSIC AND THE CARVER'S ART are wed in these exquisitely fashioned wooden drums of Mayan origin



PIPES OF PAN. A primitive instrument typical of certain parts of South America and Melanesia

AMNH
Photo

grace, the single jewel in the nostril gleaming as it catches the light.

There seems to be no doubt that dancing regularly accompanied the music of the early Christian church. In the Church of Saint Pancras at Rome one may still see the sort of stage near the altar, upon which these ritual dances took place. A papal decree in 744 abolished dancing—in churches and cemeteries! Nevertheless, after the middle of the eighteenth century there were still traces of religious dancing in the cathedrals of Spain, Portugal and Roussillon, especially in the Mozarabic Mass at Toledo. If memory serves rightly, church dancing was revived in a New York church several years ago. It created a sensation and was soon abandoned. It is said that in imitation of the early Christian practice, Mohammed instituted a sect of religious dancers known as Dervishes. (Dervish is a Persian word meaning "seeking doors," i. e.,

beggars). The performers whirl and twist their bodies with incredible rapidity until they lose consciousness. Then there are the Rifa'ites or "howling dervishes." During ecstasy, these performers "cut themselves with knives, eat live coals and glass, handle hot iron and devour serpents."

Instrumental music has from early times accompanied dancing, and the many magnificent collections of primitive instruments in ethnological museums make it possible to trace their development right down to modern times.

It is generally believed that the bow, being one of the first implements of hunting and warfare, was also the first stringed instrument. "Since Neolithic man had the bow," says H. G. Wells, "he probably also had stringed instruments, for the rhythmic twanging of the bow-string almost invariably leads to that." Instruments shaped like a bow frequently occur among savages, and astonishingly enough, not all were plucked or twanged. The possibility of a sustained tone on a string must have been realized quite early, for specimens exist of this earliest forbear of the violin and all the vast family of viols. Some have two or more strings, but the framework is so weak that tension as well as number is very limited.

Harps, lyres, and lutes are very ancient. During the period of the Druids in England (about 350 B. C.), the bard was a musician as well as a poet. He always accompanied his voice with his harp, and went with his chief and his clan to the field of battle, to lead their march against the enemy with the music of the harp.

Stone carvings show that Phoenicians and Egyptians had elaborate stringed instruments. The Egyptians evolved a vague scale, though we do not know how many tones they may have had. In 1928-1929 at Ur, when Doctor Woolley opened 454 graves, a precious find was brought to light—a harp with twelve strings, over 5000 years old. Doctor Magoffin reports that this harp was found in an elaborately adorned box engraved with mythological scenes. The upright of the instrument was bound with gold, while the keys were made of copper with gilt heads. The body was decorated with gold lions' heads, and the pole was topped with a beautifully executed figure, in electrum, depicting a donkey!

Many stories and legends surround the evolution of stringed instruments. The first one to be played with a bow is said to have been invented by a king of Ceylon about 5000 B. C. In India today, wandering minstrels go about playing a strange instrument with two strings, the rebek.

The broadening out of this family takes us gradu-



AMNH Photo

ally down the centuries to modern times. The cithera of 1700 B. C. is easily traced to the clavichord of the Middle Ages; then follow the harpsichord, the spinet, and finally, our pianoforte of today, which some people visualize as a harp laid flat. It has even been called a "couched harp." The first pianoforte was invented by Bartolomeo Cristofori in Florence, Italy, no longer ago than 1709.

The percussion instruments are common to all races and ages. Drums are represented in multitudinous forms from earliest times. All have some sort of skin stretched over a sounding box. Many interesting specimens even employ snake skin, though goat or calf skin are more generally used. Drums haven't changed very much through the ages. Yet what romance is embodied in the drum-beat, primitive man's ceremonial instrument and signal apparatus combined. In India and China, the drum seems to have been introduced from Central Asia, and was possibly of Scythian origin. There is a Chinese treatise on the deer-skin drum, written by Chieh Ku Lu, which dates from the ninth century after Christ.

The signal drums, with their complicated beats, amount to a sort of audible writing, while voodoo rhythms could make up a whole volume in themselves. Sometimes two separate rhythms are beaten at once—a sort of primitive counterpoint in percussion! One of the most interesting percussion instruments ever conceived is the Chinese "King," said to have existed as far back as 2300 B. C. It is made of sixteen different slabs of stone hung in two rows, one above the other, upon a tall frame. The player has to stand up to reach the stones, which he hits with a wooden mallet.

As for the wind instruments, abundant and interesting material exists. Maybe the first ones were the whistles, fashioned from reeds, horn, and bone, both animal and human, most of the latter being found in prehistoric remains. Signal horns were often made of rams' horns. The first trumpets may have been made of shell. Conch shell horns are familiar to everyone. "The sound of the conch of Samoa," reported an impressionable traveler, "is more *horrific* than that of the drum!" The lamas of Tibet assemble on the roofs of the various monasteries and blow trumpets and conch shells all night to drive away demons.

The syrinx, popularly called the Pipes of Pan, probably preceded the flute. The magic powers of the flute, usually made out of reed, are proverbial. It was the instrument of the savage lover, who played hopefully before the hut of his sweetheart—a romantic picture which diminishes somewhat in allure when we learn that the flute was probably first played

through the nose! As late as 1885 (and probably today), this way of playing prevailed in the Society Islands, the Friendly Islands, the Samoan group, the Marquesas, and practically throughout Polynesia, known as the "Home of the Flute."

Records of metal horns, often of most intricate shapes, abound. They were made of bronze, brass, and even of silver. Used mostly in warfare, the uproar of their volume was incredible. Now elaborately perfected, the horns, with their infinite variety of tone quality, form an important part of our modern orchestra. We must not neglect M. Sax, a Belgian, who invented the saxophone, the youngest of all wind instruments.

Music is slowly emerging from savagery into a semi-civilized period which is interwoven with the cultural advancement of the different races—advancement which saw the development of language and the invention of writing.

To the ancient civilizations, music was anything but an art. The relationships of tone intervals were still unknown. Once again, as the centuries pass, we come upon a mystery. Why did some peoples advance and others remain at a complete standstill? For example, Siamese music, while elaborate, has never been written; today, musicians play entirely by ear. The Siamese have a system which divides the octave into seven well-tempered tones, equal to $\frac{7}{8}$ ths of the whole tone of our system. No man can tell how this weird scale was evolved. In China, music has remained stationary from times of extreme antiquity. It is based on a scale of five notes (the pentatonic), and with true Oriental imagination each note is adorned with a wonderful name: "the Emperor," "the Prime Minister," "Subject Peoples," "State Affairs," "Picture of the Universe!" Fancy the complications of reading Chinese music—and, to boot, notation is vertical on the page!

Little is known of Babylonian music. The first written records of Hebrew music occur in the Old Testament (1000 B. C.). They had 36 different instruments, and some form of dancing was combined with religious forms "to produce ecstasy."

In ancient Egypt no trace of notation has been found, nor does any papyrus yet discovered relate to the subject of music. But by the seventh century Egypt was carrying on a brisk trade with Greece, and had become, in fact, a center of Greek culture. It is interesting that nearly all important works on musical theory were written in Egypt. Perhaps the Greek idea of music was supplied by Egypt; if so, the genesis of the medieval musical systems of Europe is to be traced to Egypt as well as to the Greeks.

So, just as we have seen primitive man singing,

dancing, and playing his barbarous instruments to honor his gods, we now find the most highly civilized people on earth, the Greeks, blindly attempting to evolve an art from this same primordial urge.

Most choral dances in ancient Greece were sung in honor of the god Dionysius, and in this choral dance, incidentally, the Greek drama had its birth. These dances were sacred and were given at the festival of the gods. Rhythm apparently depended upon the verses. Elaborate and artistic, they were really an organization of the rise and fall of the voice, heightening the emotional and dramatic effect of words and action. Attempts were being made to develop music as an independent art, and to these attempts we owe the basis of modern music.

It will be remembered that the downward *fourth* (C to G on the white notes) is possibly the earliest relationship which the ear learned to fix, and later became the basis of Greek music. But the first *conscious* effort to put together tones of different pitch and thus invent a rudimentary scale, we apparently owe to the four-stringed Greek lyre. These four tones form the basis of all Greek modes. The lyre was strung so that the plectrum or thumb struck the highest tone first, the outside string being lowest in pitch, thus following the natural downward cadence of the voice. These four notes were called a tetrachord

(tetra: four; chord: string). The inner notes comprising the tetrachord were played three ways; and, since the Greeks had a word for everything, they called them the Enharmonic, the Diatonic, and the Chromatic. (These three tetrachords Pratt presents as the "genera," and the series of scales evolved from them, the "species.")*

The first great epoch in Greek music began when Terpander of Lesbos (600 B. C.) added another three strings to the lyre and completed the octave. Two octaves were easily arrived at by repeating tetrachords. Gradually, the vast, complicated system of Greek modes or scales was worked out, but there was no inter-relation between them! Each one stood alone; the Phrygian, introduced by Terpander, was probably Asiatic in origin. The Dorian mode or scale was thought to be manly and strong, and was used for war-like strains. The Lydian mode was plaintive, appropriate for songs of sorrow; and so on, throughout the seven modes.

Elaborate and clumsy, Greek music is a land of two dimensions—those of melody and rhythm. The third element, harmony, without which no true music can exist, is lacking, and remained so for hundreds of years. The Greeks never tried to blend different

* Waldo Selden Pratt, *The History of Music*, G. Schirmer, N. Y. C., 1930.

THE KISSAR (*below*) is a sort of lyre, usually with five strings, used in Northern Africa and Abyssinia

A KISSAR from the lake district of Central Africa. Gourd body decorated with bristles, the opening covered with membrane; uprights of antelope horn



Photos Courtesy
Metropolitan Museum
of Art

(Below) BONE WHISTLES from British Guiana



sounds together. They never achieved concord. They were apparently quite contented with Terpander's octave, which men and boys sang, mostly in the speaking range, high and low. This was called *magadizing*, from their instrument *magadis*, on which an octave could be played.

Perhaps the backwardness of musical development may be laid to the absence of notation. The necessity of *recognizing musical sensations by means of the eye as well as of the ear* had been grasped even by the savage mind, though their notion of a scale was limited. (The American Indian notched a stick; the Peruvian made knots in a string.) The Greeks first gave names to the strings of the lyre, but these were changed to letters with the evolution of scales; the letters were placed over the word to guide the singer.

This was the very first civilized attempt at notation. But things became more and more complicated, because, as the various scales were developed, there were not enough letters in the alphabet to go around, so they were turned upside down, thus doubling their number.

In the sixth century B. C. occurred the greatest event in musical history. The diatonic scale (ours of today) was stabilized by Pythagoras. He fixed the ratio of the intervals by a criterion which could never be changed:

"Pythagoras is honored with the Invention of Harmonical Measures; and 'tis related how it happened. They write, that one Day, after he had been meditating a long while on the Means of assisting the Hearing, as he had already found means of assisting the Sight, by the Rule, Compass, Astrolabe and other Instruments, and the Feeling, by the Balance and the Measures, he chanced to be by a Smith's Shop, and heard several Hammers of different Sizes, beating Iron upon the Anvil. He was moved with the Justness of the Harmony, and going into the Shop, he examined the Hammers and their sound in regard to their Sizes; and, being returned home, he made an Instrument on the Wall of his Chamber, with Stakes that served for pegs and with strings of equal length, at the end of which he tied the different Weights, and by striking several of these strings at once he produced different Tones, and thereby learnt the Reasons of this different Harmony, and of the intervals that caused it."

Hitherto, music had no conscious harmonic principle to guide it; now, the foundation of musical acoustics became a mathematical science. We must mention Aristoxenus' "Harmonic Elements" (345 B. C.) which was one of the earliest complete treatises, and his "Rhythmic Elements," fragments of which still exist.

The next great step in the development of music, occurred when, about 130 A. D., Ptolemy, the astronomer, geographer, and mathematician, revolutionized the Greek modes or keys and prepared the way for the ecclesiastical modes and their eventual introduction into medieval music in Europe.

To music the Romans contributed little, except for several brass instruments for use in the army. However, they copied the Greek idea of letters to name their tones, using first letters from *a* to *p*, and later repeating a series *a* to *g*, as we have today. During this period, the scale was reorganized to begin on the lowest note, thus reversing the Greek method. It has remained so ever since.

The coming centuries were to witness further attempts at notation. Apparently the idea presented tremendous difficulties, and no one, looking at a page of modern music, even dreams of the efforts put forth to achieve it. No satisfactory solution had yet presented itself, and the historical transition from Greek music to that of the fourteenth century is difficult to trace. Progress made during the first eight or nine hundred years was so slight that only a little difference can be discerned between the music of the first century and that of the tenth!

Hundreds of years pass before the problem of representing melodies on paper is even partially solved. Music was in the hands of the Church. Early medieval music writers used a system of graphic signs, a kind of shorthand. No accuracy could be achieved; in the tenth century there was great lack of uniformity among the different scribes. Therefore, as a guide for the eye, they began to scratch a straight line across the page to indicate the position of a particular scale degree. How to indicate the *length* of a note must have presented staggering difficulties! As measured music advanced with the development of fixed rhythm, we find the neumes gradually assuming more definite significance.

Guido d'Arezzo laid out a system resembling that of the Greeks, but instead of tetrachords, he utilized hexachords, corresponding to our *c, d, e, f, g, a*. To represent their positions, this pioneer took the first syllables in a Latin hymn to John the Baptist to name his tones. It reads:

*"UT*queant *laxis. RE*sonare *fibris. MI*ra *gestorum. FA*muli *tuorum, SOL*ve *polluti LAB*ii *reatum, SA*ncte *JO*hannes."

In this you will recognize our "doh, re, mi . . ." in which the only conspicuous change has been from *UT* to *DOH*. In many European countries one learns the notes of the piano like this, instead of by letters.

By interlocking hexachords he simplified the process of mutation, and a range of almost three octaves

was produced. He aided notation by drawing a yellow line for C, a red one for F and a green one in case the B flat should be needed. Other needed lines were added in black, and thus we see the principle of the stave established. The invention of the clefs is also attributed to Guido d'Arezzo.

Meantime, printing had been invented and the intellectual life of the world entered upon a new phase. "It ceased to be a trickle from mind to mind; it became a flood in which thousands and presently scores of thousands participated," as H. G. Wells puts it.

Around the middle of the 15th century the first printing of music was done, possibly in 1465 but on more substantial authority in 1476, when a missal was printed in Rome by Ulrich Hahn. The difficulties were enormous, and it was about this period that the notes were first printed in black, then the stave lines were run off in red at a second printing—a process which did not allow for much accuracy.

England remained far behind the Continent, although Caxton, in 1482, printed some music—filling in the notes by hand! John Erskine says that the first English book of music contained 21 pieces. It was called "Parthenia" and came out in 1611.

It must be remembered that harmony and part singing seem still not to be seriously considered. After the magadizing of the Greeks comes organum (hence our word organ), then descant and measured music; and at last, with France de Cologne, the possibilities of music as an art are fully perceived.

The rest of the story, from the fifteenth century, unfolds like a tapestry, gathering richness, texture, and color with the years. We have glimpsed something of the difficulties encountered in perfecting a musical mechanism, how the simplest harmony must repose upon its own indestructible laws in order to pave the way to an enduring art.

The sixteenth century brought a clustering of notes, one placed above the other, or the making of chords; and these cradled the great theory of harmony and counterpoint. The next 200 years saw investigations into the ancient theories of musical acoustics; and the construction and relation of chords began to mould themselves into a system of true harmony. Only in the eighteenth century does music take

on the aspect of science, with its basic physical principles fully recognized. Thus this youngest of all the arts is really as old as the oldest principle itself—that of mathematics. Like many another great truth it has always existed; it remained only to be discovered and applied.

Contrast the pitiful attempts of the Indian to record a sound by notching his stick, or the first crude Greek notation, with the intricacies of a modern orchestral score! Think of the scope of our great symphony orchestras, where strings, percussions and wind instruments, in their bewildering variety, achieve, under the baton of the conductor, the unity of a colossal whole!

Then picture to yourself the groping effort of the savage fruitlessly twanging a string stretched between two pegs! Curiously enough, scientists working in the field have reported that primitive peoples, delighting in the victrola, preferred not jazz, hitherto imagined to be "elemental," but the great works in opera and symphony.

There can be no doubt that mechanical reproduction of music has exerted a world-wide influence. It makes one marvel at the courage of the early musicians; they worked in an epoch when communication was slow, travel difficult. Today, one turns a dial . . . and space ceases to be! Radio has made the works of the masters, interpreted by world-famous artists, immediately accessible.

The radio wave has been utilized in the making of new instruments. Electrical orchestras have been demonstrated, notably at the Radio Exhibition, Berlin, 1933. The possibilities of the "ether wave" as shown in the instruments of the Frenchman, Maurice Martinot, and the Russian, Léon Theremin, whose "shadow music," played with both hands in the air near the instrument, is well known to Americans. There are others, too, some of which are capable of imitating all classes of instruments, and while these devices are not entirely perfected, some of the tone colors produced are very beautiful.

Like a vast progression of concord, beginning softly and simply, as in the "Adoremus Te" of Palestrina, the art of music, with deepening crescendo, moves down the years to become a crowning glory of civilization.

SEEING NATURE

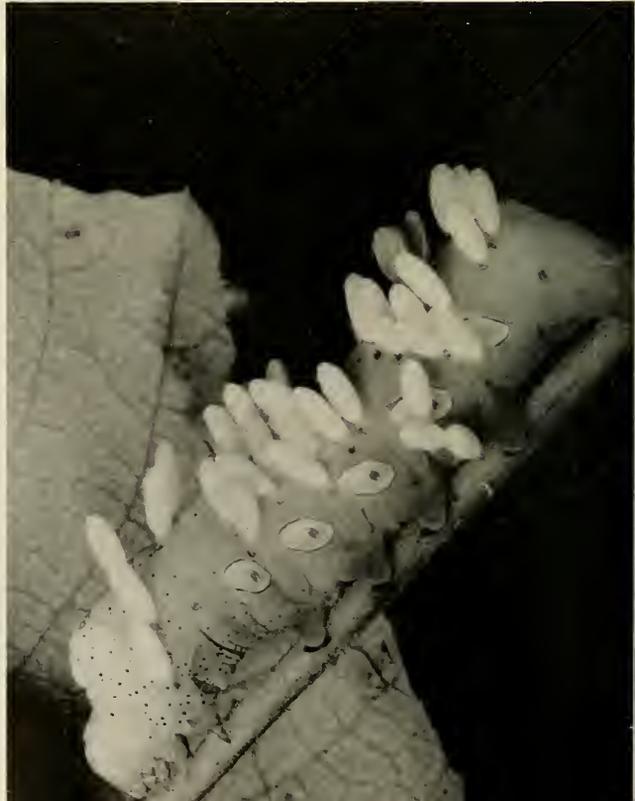
OPPOSITE PAGE

S FOR THE SNAIL

*From the "Alphabet of
Birds, Bugs and Beasts"*

THE GRASSHOPPER
AND THE THISTLE

DESTROYER'S DESTROYERS



through the CAMERA'S EYE

By HENRY B. KANE



INFORMATION TEST

A few informational high spots that may be gleaned from this month's *NATURAL HISTORY*

Score 5 points for each correct answer. Correct answers on page 127

1. The pocket gopher can run as well backwards as forwards. True..... False.....	12. What well-known woodland animal weighing about 10 pounds bears offspring weighing only 1/140 ounce each?
2. What animal gives birth to a seven-ton baby?	13. What is the largest bird that flies?
3. What is the youngest of all wind instruments?	14. The early Greeks ascribed great musical powers to (a) Orpheus? (b) Morpheus? (c) Calliope?
4. What 10-foot creature produces a baby only one-tenth of an inch long?	15. Where is the largest bird collection in the world?
5. What is the most valuable bird in the world?	16. Only the hoariest "Euclids" among the geometric spider, after a lifetime of practice, build the perfect geometric webs. True..... False.....
6. Although the geometric spider has eight eyes, it can weave its web perfectly in complete darkness. True..... False.....	17. Can a mountain lion climb a tree?
7. How many eggs do you consume when you eat a platter of shad roe?	18. What bird is celebrated for its ability to attack and kill a rattlesnake?
8. In which animal does the mother's nipple expand to hold the baby securely? (a) Kangaroo (b) Deer (c) Chimpanzee	19. A point in the sea where one can drink absolutely fresh drinking water is (a) Part of Ponce de Leon's legend of the Fountain of Youth? (b) The theme of the poem <i>The Ancient Mariner</i> ? (c) Actually to be found off the Louisiana coast?
9. What animal carries as many as four young with it when it flies through the air?	20. What animal skin is known by the name of "morocco" in the bookbinding trade?
10. A theremin is (a) A musical instrument? (b) A rare toad? (c) A bird of the South Pacific?	
11. The word "pentatonic" refers to (a) Poetry? (b) Medicine? (c) Music?	

Do Not Miss

A bird that lives by the sea, yet if it lights on it, it will drown. It can take flying fish on the wing, but if it lands on level ground, it may never rise again. Learn about this extraordinary buccaneer of the air in next month's *NATURAL HISTORY* Magazine, in an article by **DR. ROBERT CUSHMAN MURPHY**, President of the National Association of Audubon Societies.

Ever since their discovery, the giant trees of California have inspired man. In the next issue of *NATURAL HISTORY* let the celebrated nature writer **DONALD CULROSS PEATTIE** lead you through their ancient shadows to a full appreciation of their spiritual and evolutionary meaning.

An animal which instead of putting food in, takes its stomach out will be viewed at a ten-hour dinner in a striking series of photographs of a **STAR-FISH AT MEALTIME**.

A bird flutters out of friendly hands and starts on its unknown migration course, a tiny metal band about its leg. Weeks pass, perhaps months or years. Thus the most thrilling game in bird study gets under way in Edwin A. Mason's account of **BIRD BANDING** as practiced far and wide by over 2000 licensed amateurs.

Did you know that the same family of plants gives us such varied products as potatoes, tomatoes, tobacco and the deadly drug atropine? Read the strange story of this Dr. Jekyll and Mr. Hyde of the plant world in an article by Hendricks Hodge.

What happens when the earth is electrocuted? You may hope never to witness this event, but you will want to see and learn about the "lightning tubes" of sand that are produced by lightning or high tension wires. The article, based in part on specimens submitted by a reader of *NATURAL HISTORY*, is by Dr. H. E. Vokes.

THE BOOK AND THE BEAST

Have your books bound in the hide of a kangaroo, soft, pliant, yet so tough no pair of human hands can break it. Or perhaps dragon-lizard is more appropriate, or ostrich. At any rate, if such bindings become the rage a year or two hence you can thank Hamonneau, pioneer-artist and soldier of fortune

A DESTINY that leads one into Brooklyn to bind books with the skin of a lion is strange enough; but one that leads thither from the high seas, the French Foreign Legion, and the trenches of the Marne "is touched by that dark miracle of chance which makes new magic in a dusty world."

Today books bound not only in the skin of a lion but in that of zebras, pythons, sharks, elephants, alligators, and—though it is a matter of great secrecy—human skin, are displayed in the Main Lobby of the American Museum. They are the products of a lifetime of loving research and experiments in the profession of bookbinding. And for Maurice A. Hamonneau, sailor, soldier, adventurer and man of letters, they represent what he considers his masterpieces.

Monsieur Hamonneau is a charming, rather stocky expatriate Frenchman who lives in Brooklyn. He has for some 30 years dedicated his art to the pioneer use of diverse materials. Bookbinding, being one of the most static crafts in history, has confined itself for a thousand years to the same few leathers that were available during the Middle Ages.

"What," asks M. Hamonneau rhetorically, "will the average binder show you if you enter his shop? He will show you Morocco. And what is Morocco? A goat. He will show you Levant. And what is Levant? A goat. Always, he will show you goat!"

There was a time, M. Hamonneau points out, when the former excellence of tanning materials permitted the binder to supplement the despicable goats with calf and sheepskin. But the relative perishability of contemporary products made from such skins has discouraged the use of even these vari-



ants. Pigskin is beginning to be taken up to a certain extent. But the fact that it is apt to blotch at the slightest tool-puncture militates against widespread exploitation. "For years," said M. Hamonneau, "I have been trying to tell binders—to experiment in the exotic leathers—like kangaroo and the reptile skins now used for shoes, belts and luggage. But they say, 'We have never had any experience with these. They have never been used before.' And here M. Hamonneau will shrug. "They didn't know about them 1000 years ago so we can't use them now, *c'est ridicule*." For to M. Hamonneau, such slavish dependence on precedent is the soul of stagnation.

The startling extent of his untrammelled experimentation is attested by his current exhibition in the Museum—a display of books which will at once reveal even to the casual on-looker the dominant theme underlying M. Hamonneau's method. In his

eyes the unforgivable sin of the monotonous "goat bindings" is the consequent failure of the binder's art to individualize the book. As he himself declares, you could have the Holy Bible and the Confessions of the Marquis de Sade cheek by jowl and they would both look the same. If the binding cannot lend the book a distinction commensurate and consonant with the printed matter, then from Hamonneau's point of view, there is little point in binding at all. In the exhibit at the Museum, you will notice that the exotic leathers are by no means tossed about indiscriminately. The book so appropriately bound in the skin of a lion (fur intact) is an account of big game hunting in Africa. The book bound in the skin of a human being is an account of cutaneous diseases by a Philadelphia dermatologist. And so it goes. The binding material must be artistically in harmony with the pervading spirit of the

book itself. And it is his insistence upon this hallmark of distinction that has elevated the bindery of Maurice Hamonneau to its eminent position in the world of fine artistry.

Early beginnings

At the age of ten, young Maurice lived in an officer's quarters in Algeria. His father held a commission in the famous French Zouaves and despite military predilections, the paternal Hamonneau encouraged his young son's delight in books even to the tentative investigations which the boy made into the physical construction of the less expensive volumes in the household. It was, in his father's eyes, a hobby well worth cultivating, but after all, only a hobby. And when the time came, the business of the world must be pursued with soldierly directness.

As a youth, Maurice was permitted the luxury of bookbinding instruction in Paris, but he had to choose a *métier* acceptable to his father and accordingly apprenticed himself to the French Merchant Marine training

took his examinations and entered the naval school, through which he passed successfully. But the moment he had his diploma in hand, he felt that his obligation was fulfilled. He also felt that if there was one thing he wanted it was to be as far away from water as possible. He wanted aridity in the extreme. And he got it by the simple expedient of running off to join the French Foreign Legion.

Arms and the artist

Although ship captains and other naval officials had welcomed a number of his creations fittingly wrought in pieces of canvas sail and similar nautical material, he found that the aridity of the desert was, like the sea, somewhat of a cultural aridity, and that he had only a few precious furloughs in which to practice the art he so devoutly loved. While he had inherited sufficient of the family's African military penchants to enjoy the hard life of a legionnaire, he nevertheless looked forward with longing to the day his term of service would come to an end. Throughout his life,



ILLUSTRATIONS
BY IRWIN WEILL

corps. For three years Maurice served his apprenticeship largely under sail, since the training course had at that time not yet caught up with the rapid spread of steam-operated vessels. He was as prone to seasickness on the last day afloat as he was the first. But he stuck to it as a dutiful son rewarding his parents for the sacrifice they had made in providing this education. He

Maurice Hamonneau, artist to the core, had been subjected to the rigorous discipline of a life of action on land and afloat in the service of La Mère France. He did not chafe or become despondent under what must have been a frustration of his fundamental creative urge, he remained dutiful and content in all things—but he did look forward to the day his ser-

vice would expire. And at last it did. He was honorably discharged from the Legion in the spring of 1914.

Three months later on a warm Sunday afternoon, Maurice Hamonneau, civilian, writer, bookbinder, received notice of the *Mobilisation Générale*. At two o'clock on Monday morning, he was girding on a knapsack and boarding a windowless train—destination unknown. Two days



later, he was one of the many petty officers directing his platoon in defensive deployment against the first gray-green wave of the German onslaught.

For five years longer, Maurice Hamonneau, remained in the trenches where, as he says, his art of binding was mainly performed on his own skin. Finally, after the armistice, he withdrew from military service and returned to Paris at last to follow his career as writer and bindery artist. The latter accomplishment was never entered into as a matter of money. Maurice Hamonneau was not a professional bookbinder. He had come unconsciously to accept the view which his father had held so many years earlier to the effect that binding was a hobby—the living must be made elsewhere. Today, he still clings to this belief, but today he is a professional binder.

Binder's destiny

All binders, he says, sooner or later become professionals. You start binding books as a favor for friends. You make them presents of fine books which you bind in your spare time.

Soon your friends begin to come to you and say "Please, bind this book for me." Then the time comes when you no longer have the leisure to fulfill their requests. There is only one solution—you must turn professional. You must charge not only for the material, which you cannot possibly afford to supply gratis in wholesale lots, but you must charge for your time or face the possibility of starvation.

Although he did make a fair pittance from his exquisite bindings, the bulk of Hamonneau's income was the result of his writing for political publications in Paris. But it was not long before M. Hamonneau decided to insure against any further military inter-



ruptions of his chosen hobby by emigrating to America. Since 1925, he has plied his two professions in the city of Brooklyn, ferreting out all the myriad little-known source-springs of exotic leathers and silks found within the great western metropolis. From these, he has created the distinctive, individualizing bindings upon which he had set his heart in childhood.

However, *la vie militaire* is not quite ended for him. True, he does not fight any more, but he has by no means wrenched loose the soldierly past and cast it out of his life. As an incidental hobby he has built up perhaps the world's largest collection of books on the French Foreign Legion, many of which he has bound in the beautiful and painstaking manner which he has made peculiarly his own. This includes a magnificent illustrated first edition of P. C. Wren's *Beau Geste*, which is finished in exquisite silk end pages, a feature characterizing most of his bind-

ing. He is also National Commander of the Veterans of the *Légion Étrangère*—a position from which he derives considerable fame and no little remunerative prestige. You may have heard him introduced over the radio as a "guest star" on programs dealing with life in the Legion. And during the writer's visit a message arrived from one of our foremost radio commentators who wished Hamonneau to get in touch with him at once. M. Hamonneau did not appear to be at all exercised, and when I inquired if he were not going to comply with the request, he said airily and with charming independence, "Oh, he can call me on the telephone if he really wants to see me."

The Legion is exploited in other ways. Under a number of pseudonyms, M. Hamonneau writes, alone or in collaboration, perhaps ten stories a year concerning this romantic body of soldiers. He comes honestly by this talent, for he has long been connected with the literary monde. The late Rudyard Kipling was, incidentally, not only one of Hamonneau's oldest friends but godfather to his son, and Hamonneau's legionnaire fame has reached even unto Hollywood where he will shortly become technical adviser on a Legion film. From such activities as these, he derives most of the income which allows him to carry on his beloved art in the completely independent manner which he feels to be essential to the full-blown creative function.

For you cannot enter the *atelier Hamonneau* with a precise order in mind. All you can do is bring your book and tell Hamonneau how much money you are willing to pay. He will then tell you approximately how long you will have to wait. And that is all he will tell you. The book will be finished when, after careful examination and contemplative thought upon its contents, he, Hamonneau, has decided what in all the world would be the most apposite materials to serve as the book's cover. These are the terms on which you may have a book bound by Hamonneau. You can make no others.

The method

Among your dearest family possessions there is, let us say, an illustrated edition of Hudson's *Green Mansions*, dating from your early childhood. You have lived in five different over-heated midtown apartments in the fifteen years since your father's home was sold. Heat and moving vans have not done well by the binding. You'd like

to have it tricked out as a gift to your sister or as a permanent keepsake. Hamonneau is your man. Together you will decide on a budget of \$25. Then your part in the transaction ends and Hamonneau's begins. He reads *Green Mansions* keeping in mind what you've told him of your personal feelings for the book. Next, he disdainfully breaks off the crumbling Morocco cover, washes the pages and generally prepares it for his own binding. The following day he visits certain dealers who probably are collectively known only to himself. Their shops are located near the waterfronts of Brooklyn, Manhattan and Hoboken. Are there any jaguar skins? Jaguar would be so eminently desirable for a South American motif. But no. Either there are no jaguar skins or he would have to buy too large a piece to keep within your budget. If it's the latter case, Hamonneau may phone you, Jaguar, so beautiful, for only \$15 more. You decline politely. Hamonneau shrugs and turns to the dealer. Boa constrictor then, how about that? A new shipment of boa skins has just arrived. Hamonneau makes a mental revision of his plans and selects a fine strip of the reptile. Perhaps he is better off anyway. There is scarcely any waste when a snake skin is cut down to book dimensions. It is much more economical and so relatively easy to shave down and tool. Now there is another problem. Hamonneau rarely ever uses paper for his end pages. Cloth, especially silk, comes in so much richer a variety of design and pattern. So he leaves the Hoboken waterfront and



seeks out the impassive presence of a Hindu silk merchant deep in lower Manhattan. Bolts of silks are unfolded and carried out into the light. An hour passes. Then Hamonneau finds what he wants. A design of tangled jungle foliage in a shimmering, iridescent green. A yard is bought and wrapped up. A mere yard, but so important to

the scheme of the book. On his way back to Brooklyn Hamonneau remembers a certain stamp-die he once saw in the workshop of a wholesale binder. He phones the binder and makes ar-



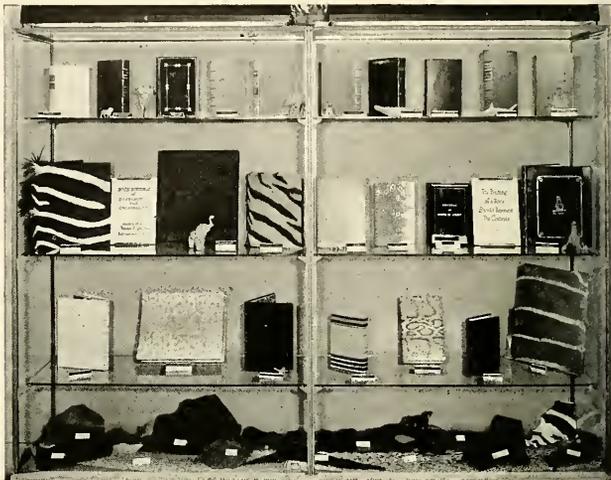
rangements to use the die for a single impression.

In the morning Hamonneau soaks the skin, shapes and cuts it to size and commences the delicate task of shaving it down to just the right thickness. It is like a surgeon performing an exacting operation—one slip will be fatal. For several hours Hamonneau works with devoted care on each detail of re-assembling the book and fitting it to its new cover. Finally the volume is ready to be dried out in finished form under the press. And what is the press? A

pile of padded bricks lying in the corner. None of your harsh, crushing mechanical presses for Hamonneau. His method goes back in fact and spirit to the days of handicraft. Each brick adds its extra pound of pressure softly and only when needed. Result? The scales of the boa retain the roughened, nat-

for the ages, at least for the decades.

And Hamonneau relaxes to soft music and a good cigar, and, as after every successful job, ponders the problem-book that has been troubling his sleep since its publication. Yes, he has in his possession a treasured volume the appropriate binding for which has con-



ural texture that God and Hamonneau intended. Now only the thoughtful selection of type-face and the actual printing are left. Then your book will be finished. A work of art if not

sistently baffled his artist's imagination. The title is *All Quiet on the Western Front*. Any suggestions you may have will be gratefully received.

D. R. BARTON

AT THE WORLD'S FAIR

THE AMERICAN MUSEUM'S EXHIBIT IN "GARDENS ON PARADE"



Photo by Mattie Edwards Hewitt

A colored diorama, 11 x 7 feet in size, designed and constructed by the Museum's Department of Arts, Preparation and Installation, and based on the conservation map, *S.O.S. for a Continent*, by Robert Cushman Murphy issued with the March, 1939, number of *NATURAL HISTORY* Magazine.

HONORS

DR. JAMES P. CHAPIN of the American Museum's Bird Department was elected President of the American Ornithologists' Union at its Fifty-seventh Annual Meeting, at Berkeley, California, June 19-24.

DR. ROBERT CUSHMAN MURPHY, also of the Bird Department, has been elected Honorary Member of the Royal Hungarian Institute of Ornithology.

DR. WILLIAM K. GREGORY has been elected Foreign Member of the Linnaean Society of London.

JOHN BURROUGHS ASSOCIATION

The John Burroughs Association desires to get in touch with all organizations in the United States and elsewhere that have been organized in honor of John Burroughs.

The purpose: To learn whether such groups would be interested in a yearly publication containing reports from these various units, as well as articles about John Burroughs.

Please communicate with Dr. Clyde Fisher, President, at the American Museum of Natural History, 77th Street and Central Park West, New York City.

The peculiar shirt and vest of the Northwest Indians

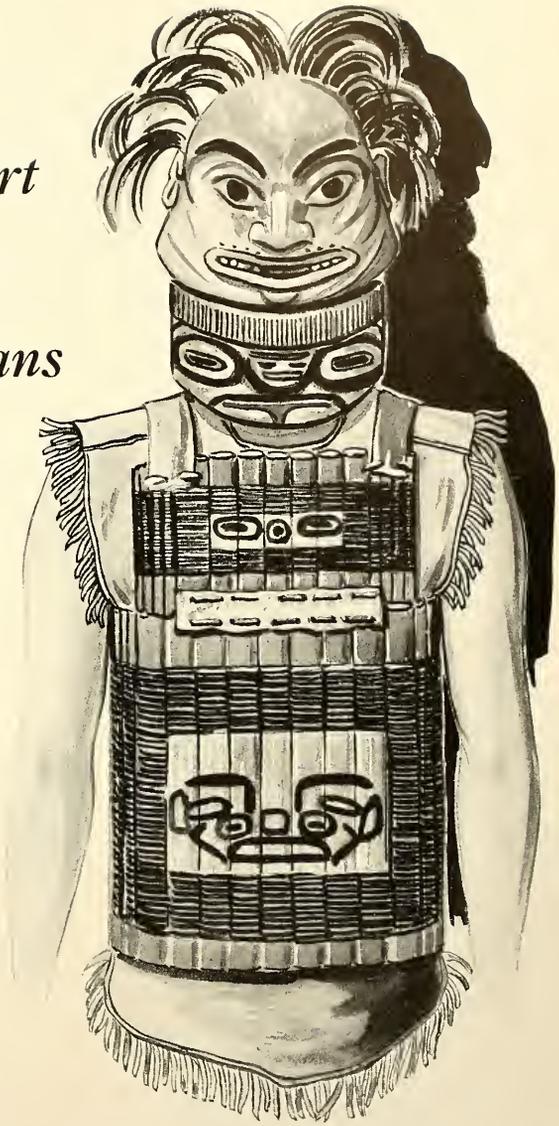
WHEN Captain Cook visited the Indians of the Northwest coast in 1778, he found that they had two types of armor to protect them.

The first resembled a sleeveless shirt and was made of a double thickness of elk or buffalo skin. The second was worn like a vest, and consisted of vertical stakes tied together by stout cords.

This armor gave the Indians excellent protection against the ordinary weapons of their enemies: spears and arrows and knives. Some of them took for granted that the armor was invulnerable, and they could hardly believe their eyes when one of Cook's men shot a musket ball straight through several layers of the skin armor.

Like these Northwest Indians, the man who drives a car may also think that his "armor" is invulnerable, only to find one day that a mishap on the road shoots his protection full of holes.

That's why you want to be sure that your auto liability insurance protects you when you are thousands of miles from home as well as it does in your own block.



The Travelers has thousands of representatives in the United States and Canada to lend you a helping hand, no matter when or where you get into trouble. They immediately take over all your worries, all claims for damages, and make it possible for you to continue on your journey with an untroubled mind.

Moral: Insure in The Travelers. All forms of insurance. The Travelers Insurance Company, The Travelers Indemnity Company, The Travelers Fire Insurance Company, Hartford, Connecticut.

YOUR NEW BOOKS

ON EATING WILD PLANTS AND GROWING TAME ONES WITHOUT SOIL • ANTS ARE LIKE MEN • THE MYSTERY OF BIRD MIGRATION • OLD MINING TALES • OUR NATIONAL PARKS • BATS

EDIBLE WILD PLANTS

— — — by Oliver Perry Medsger

Macmillan Company, \$3.50

OLIVER MEDSGER is one of the best all-round naturalists that I know—pre-eminently an outdoor person. Four attractive little books, entitled *Nature Rambles*, one for each season, earned for him in 1933 the award of the John Burroughs medal. He is Emeritus Professor of Nature Education, Pennsylvania State College.

Medsger tells us in a fascinating way when and where to find the edible wild plants, and how to prepare them if cooking or other preparation is necessary. He groups them as fruits, nuts, seeds and seedpods, salad plants and pot herbs, roots and tubers, beverage and flavoring plants, and sugars and gums.

Among the edible wild fruits one finds such alluring names as persimmons, paw-paws, black haws, and wild strawberries. Pecans and other hickory nuts, walnuts, hazelnuts, and chestnuts carry us back to our boyhood days. He relates the story of wild rice, and that of American Lotus or Water Chinquapin, both of which furnished food for the Indians.

He tells how he cooked and ate Skunk Cabbage—and Indian Turnip! Perhaps he should have told us that both of these plants contain a poison in the form of raphides of calcium oxalate, but all oxalates are soluble, and by pouring off the water once or twice the poison would be removed. I doubt, however, whether any one would eat enough of either of these two plants to be seriously poisoned, even without the precaution. It may be, as suggested, that the acrid taste of Indian Turnip (Jack-in-the-Pulpit), which every boy has tried, is due to physical effect, that is, to injury from the needle-like crystals of calcium oxalate.

Tea from Sassafras and from Spicebush win his praise. New Jersey Tea used during the Revolutionary War, and the seeds of the Kentucky Coffee Tree as a substitute for coffee give one a glimpse of pioneer life.

The author is a veritable walking encyclopedia of the fields and woods—consequently we expect him to know everything. It is, therefore, surprising that he does not know the nature of the delicious May-apples that grow on the Pink Azalea or Pinxter Flower. He expresses doubt that they are insect galls and suggests that they may be bacterial. In truth they are fungous galls, or gall-like bodies,

caused by *Exobasidium vaccinii*. At the fruiting stage of the fungus, the spores produce a kind of whitish bloom over the surface of the May-apple.

Only one definite mistake did this reviewer notice in the entire book, and that was the curious confusion of spruce gum with Canada balsam of the Balsam Fir. Spruce gum comes from the Spruce trees, but not from the Balsam Fir.

An excellent introduction by Ernest Thompson Seton gives the book an added charm.

Medsger is to be congratulated on the preparation of such a volume. I know of no one else who could have written it.

CLYDE FISHER.

OF ANTS AND MEN

— — — — — by Caryl P. Haskins

Prentice-Hall, \$2.75

IN the past writers who deal with ants have fallen into two widely diverse classes. In one are those scientific colossi whose productions are monuments of overpowering erudition. In the other is a group of "popular" writers whose presentation of the subject rarely gets beyond the kindergarten level. Thus the layman with an interest in ants has had to choose between an intricate monograph which he cannot readily comprehend and a formicid bed-time story. The appearance of the volume *Of Ants and Men*, by Doctor Caryl Haskins should do much to supply the need for a readable, authentic account of the activities of ants. Most of the phases of formicid activity are treated in a style that is often striking and always easy to read. It is to be regretted that the original observations of Doctor Haskins form such a small part of the book. Some of the most illuminating portions of the volume are to be found in those passages which deal with the biology of *Stigmatomma pallipes*, an ant with which Doctor Haskins is thoroughly familiar. He has, in addition, dealt faithfully with the great store of facts garnered by others in the field. Moreover, he has given to many of these facts a sociological interpretation which is undeniably entertaining. These interpretations, based as they are on a comparison of formicid and human societies, have their genesis in anthropomorphism. Doctor Haskins is anxious to avoid what he calls "the criminal error of hopeless anthropomorphism" but it is evident that he has convinced himself that all anthropomorphism is neither hopeless nor criminal. After in-

specting the ingenious comparisons with which Doctor Haskins has enlivened his volume one is inclined to agree with him. While a number of the "parallels" presented have appeared in other works on ants no other writer has heaped such a profusion of analogies within the confines of a single volume. Ants are compared with Iroquois Indians, African pygmies, southern slave-holders, Australian bush-men, Huns, Tartars, Athenians, Egyptians, Celts and, to bring the matter up to date, with Nazis and Communists. It may be doubted that the biologist will attach much significance to many of Doctor Haskins parallels. It may scarcely be doubted that the layman with scientific inclinations will enjoy them. It is to be hoped that he will not take some of them too seriously.

W. S. CREIGHTON.

GROWING PLANTS WITHOUT SOIL

— — — — — by D. R. Matlin

Chemical Publishing Company, \$2.00

THE principle of raising plants without soil, as this book points out, has been known for several hundred years, but only lately has the world been fired with enthusiasm over its far-reaching possibilities. Gardens on otherwise desert islands to provide food for transoceanic air passengers have become an actuality. Elsewhere, \$50,000 worth of tomatoes per acre, and celery with double the mineral content of the best grown otherwise, all without the plow and hoe!

It is possible that man's economy may be changed more radically by this new method of agriculture than by any other single development, but much experimentation must be done before anyone will know. To landholders, the most important thing might appear to be the power of tank gardening to make the rockiest, most unproductive land essentially as valuable as the most fertile.

This book contains an abundance of information on formulas, tank construction, growth hormones, budding and grafting, etc. Deficiency symptoms are analyzed with the aim toward governing the diet of the plants; and, perhaps a bit afield from tank gardening, the reader is given a section on the vitamins affecting human life, just for good measure.

The author is Professor of Plant Chemistry at Belmont Evening High School, Los Angeles.

E. M. W.

THE MIGRATION OF AMERICAN BIRDS

----- by Frederick C. Lincoln

Doubleday, Doran & Company, \$4.00

IF there is one branch of ornithology in which every bird student, professional or amateur, is interested, that branch is bird-migration. Indeed, interest in this subject goes far beyond the ranks of bird lovers. For untold ages, men have watched the passing ranks of wildfowl in the spring and fall, have wakened in the morning to find the woodland peopled with songsters where yesterday there were only the more silent visitors of the winter season, or have seen the flocks gather in the autumn, only to disappear overnight. Unfounded legends about these mysterious wanderers sprang up, grew, and were passed on to find their way into the writings of the early naturalists, some of them to persist even to the present day. Then as the science of ornithology developed and as new lands were opened by exploration, some of the mysteries of migration were explained, although there still remain unanswered questions.

Doctor Lincoln is Senior Biologist in charge of the Section of Distribution and Migration of Birds, U. S. Biological Survey, and his book brings together a great quantity of data from the files of the Biological Survey to amend and supplement the information available from other sources. Being a member of the well-known Nature Library series, the book is popular in style, without documentation, and certain controversial aspects of the subject are not exhaustively treated though they are not entirely omitted. Such are some of the theoretical concepts of the annual stimuli that start the birds on their journeys north or south (sometimes east or west!), the original causes of migratory movement in prehistoric times, and the phenomenal powers of orientation possessed by birds. The speed of flight, speed of migration (a very different thing), the altitude of flight, influence of the weather, nocturnal and diurnal movements, vagrancy, and similar topics are on a better than conjectural basis and there is much accurate information from which positive assertions may be made.

The title of the book might have been amended to show its virtual restriction to the subject of the migration of North American birds since there is as little given about the birds of Central and South America as there is of those of the Old World, although both are sometimes mentioned. Also, a bibliography, even a limited one, would have been of service to those students who might wish to pursue the subject further. The reviewer would question one or two of the statements made in the text. Birds are credited in general, with a very rudimentary sense of smell, but there is a great deal of important evidence to the contrary. The hummingbird is stated to have a frequency of wing-beat that may possibly reach two hundred strokes a second, but this figure is far beyond that obtained by several recent investigators.

There are twenty-one excellent maps of

migration routes and flyways that are of pertinent value. The other illustrations comprise twelve colored plates by Louis Agassiz Fuertes that already have done yeoman service in other places, having been used originally in Eaton's *Birds of New York* (1910-1914) and reprinted elsewhere. They have suffered in quality as well as in freshness through repetition and adaptation. It is unfortunate that new illustrations were not obtained for use in this new book. Despite this defect, Doctor Lincoln's volume presents a most informative account of what we know about the migrations of North American birds, written in a way that will be intelligible to the non-technical reader, and certain to prove highly interesting to anyone with unsatisfied curiosity about the seasonal movements of our feathered visitors.

J. T. Z.

PREHISTORIC LIFE

----- by Percy E. Raymond

Harvard University Press, \$5.00

DOCTOR RAYMOND, Professor of Paleontology at Harvard University, has gathered together in this book "the result of a constantly changing series of lectures which I have given at Harvard for the past seventeen years under the title of Paleontology I." This is obviously a survey course in the science and we have a book which gives the history of life through the past six hundred million years insofar as it is permitted us to read and interpret it from the fossil record.

While tracing the invertebrate lines from their first appearance and probable ancestry through the various suggestive transition lines of the early mid-Paleozoic times to the amphibia, reptiles, birds and mammals, including man, the author also notes a few of the lineages not on the main line of evolutionary development, including among others trilobites, cephalopods, insects, dinosaurs and most of the better known mammalian types. Included is a short discussion of the history of plants.

With such a comprehensive group of types it is difficult to understand why the brachiopods, "perhaps the most frequently met of the fossils of the Paleozoic rocks" should be dismissed with only nine lines; and the mollusca, other than the cephalopods, should receive only seven. Furthermore, it is difficult to justify the inclusion of the discussion of such typical invertebrate groups as the cephalopods and the insects between the birds and the mammals, though luckily even the uninitiated will recognize that such is not their true evolutionary position. This latter objection is of minor importance only, and while a number of similar questions might be posed, nevertheless, the book maintains a high level of accuracy and presents the most modern interpretations of the theories of the science.

It is not a book to recommend to the "casual" reader but it is one which is recommended to those who are anxious to have a wholly authentic summary of much of our knowledge of the history of life.

H. E. VOKES.

A APACHE GOLD AND YAQUI SILVER

----- by Frank Dobie

Little, Brown and Company, \$5.50

TALES of lost mines and buried treasures comprise the most intriguing part of our rich folk lore. There were tales of this kind in European folk-lore before 1492 but after it was discovered that the natives of Mexico and western South America possessed gold and silver in abundance, new and more moving stories took shape. Bandelier, former archaeologist and Spanish-American scholar, gathered some of the best into his book, *The Gilded Man* (1893). This was merely a native Indian myth but it moved many a Spanish adventurer to lead an expedition into unknown lands.

After the Spanish had exploited the country for two centuries, several classical tales of lost mines enlivened the folk-lore of our Southwest and Northern Mexico. Eight of these were selected by the author of this book for his volume entitled *Apache Gold and Yaqui Silver*. Two long narrations—"The Lost Adams Diggings" and "The Lost Tayopa Mine" take up more than half of the book. The author's method is to present the folk-lore in each case, then what are reputed to be accounts of a few of the many attempts made to find the lost treasures. They are good stories, well written and important contributions to our rich folk-lore.

Folk tales usually follow patterns and the prevailing pattern for the Southwest is the story of an Indian who keeps coming in with a little gold but says nothing and is too shrewd to be trailed by traders. Of course, he has found one of these famous lost mines and carries the secret with him to the grave. Several times the writer has met with people in the area covered by this volume, who claimed to have had such experiences with Indians. Further, he has received many letters from persons having copies of reputed maps, asking for assistance in locating such treasures, all of which is evidence that though the author of this volume has polished up his stories, they are not of his making. They are folk-lore.

CLARK WISSLER.

BATS

----- by Glover Morill Allen

Harvard University Press, \$4.00

DOCTOR ALLEN has at last adequately filled a long-felt need in the field of science. Bats, due to their specialized structure and nocturnal habits, have attracted the interest of mankind from earliest times and have been the subject for many eminent scientists and historians. Yet, their history up to the present has remained scattered through literature in a more or less inaccessible form.

A book on bats, such as the present volume, necessitates not only a wide knowledge of literature but personal experience and understanding of these remarkable creatures in their many ways

of life. And I do not know of anyone better able to write it than Doctor Allen.

The author has brought together a tremendous amount of information and treated it in a popular manner designed for the general reader but well worth the perusal of advanced zoologists.

A chapter on the ancient lineage of bats shows that the earliest fossil remains, dating back sixty million years, were perfect bats but their previous history is a blank. Bats have a sinister significance for most peoples which is not surprising considering their nocturnal habits. Some species are dainty furry little creatures while others are fantastic, with faces more hideous than our wildest imagination. The Chinese, however, show less prejudice toward these harmless creatures than most races. The figure of a bat is a symbol for happiness or good luck to the Chinese and it is frequently worked into designs in their handicraft. The Bat God was a powerful deity with the ancient Mayas of Central America, whose extraordinary temples and picture writing have excited the wonder of travelers and students. A study of the food habits of these mammals is especially interesting as it shows a wide diversity in development. While the great majority of species are insectivorous, many are fruit-eaters and others may be considered carnivorous. The highly specialized Vampire bats actually subsist on blood and there is proof that a large bat in the West Indies goes fishing.

G. G. G.

A SOURCE BOOK IN GEOLOGY

----- by Kirtley E. Mather and Shirley L. Mason

McGraw-Hill Book Company, \$5.00

THIS latest addition to the series of Source Books in the History of Sciences contains selections from the works of noted geologists who lived, wrote and died between the middle of the Fifteenth Century and the present year.

To many of us it is a matter of surprise to learn that Leonado da Vinci wrote on the "Origin and Meaning of Fossils," or that ex-President Hoover and his wife made a most admirable translation of the latin text of Agricola's "De re metallica."

Among the 132 geologists represented in this Hall of Fame, there are certainly some whose views on certain questions one would like to compare in a sort of "immortal symposium." The authors have done this for us by arranging groups of authors under subject headings in a Guide to Subject Matter which precedes the index. Here we find such subject heading as Cosmogony, with page references to Descartes, Leibnitz, Kant, Buffon, Laplace, Proctor, Bickerton and Chamberlin. Other significant groupings include, to name a very few of them, Fossils, with seventeen citations from da Vinci to Owen; Glacial Geology, Igneous Rocks, Mineralogy, Physics of the Earth, Sedi-

mentation, Structural Geology, Volcanism and Ore Deposits. From the scant four names under the last subject one misses those of the late Carl Richard Beck, and James F. Kemp, both notable authorities on this subject.

However, Doctors Mather and Mason are to be congratulated in getting such an amazing amount of classical geology into 681 pages.

H. P. W.

THE WORLD OF INSECTS

----- by Carl D. Duncan and Gayle Pickwell

McGraw-Hill Book Co., \$3.50

THIS book is, for the most part, concerned with the anatomy, physiology and general biology of insects, although there is one chapter on classification as far as orders, one on the control of injurious species, and several on collecting, rearing, and preserving insects. Typical chapter headings are: Insect Structures, How Insects Grow Up, Some Insect Food-getting Devices, How Insects Get Air, and Insect Voices. It is particularly pleasing to see a chapter on The Value of Insects.

Although somewhat suggestive of an elementary text-book and well suited for that purpose, it will be enjoyed by general readers who would like to learn how the

most successful of animals live. The fact that the examples cited are largely from the Pacific Coast does not detract from its usefulness to people living elsewhere. The quality of its nearly two hundred illustrations is good and the text is authentic.

F. E. L.

BEYOND YONDER

----- by Oliver Justin Lee

Chapman and Grimes, Boston, Mass., \$2.50

THE author of this interesting little book is Director of the Dearborn Observatory at Northwestern University. He states in the preface that the book was "written for all of those many people who wonder about the distances which the physical sciences deal with, and how they are determined."

He discusses the methods of measuring all astronomical distances from the size of the Earth to the diameters of the stars, from the distance to the Moon to that of the external galaxies. One could wish, however, that he had explained more fully or more clearly how the distance of the Sun from the Earth has been measured by means of a transit of Venus, and by the use of the orbit of Eros.

The book is somewhat spoiled by an inconsistency of style, which might be designated as partly poetical and partly scientific; in part dignified and in part flippant. And it seems to this reviewer that the title is hardly appropriate for a book about measuring engines and their uses. The plates are not numbered, although referred to in the text by numbers, and there is no index.

Perhaps for the first time has an astronomer conceived and executed a book with the central idea that of the measurement of distances; and much of real interest has been gathered together here.

CLYDE FISHER.

ROMANCE OF THE NATIONAL PARKS

----- by Harlean James

Macmillan Company, \$3.00

OUR National Parks have been described by Naturalists, Publicists, Essayists and Park Employees since the original area was set aside in 1872. In 1870, Cornelius Hedges said, of the Yellowstone, "There ought to be no private ownership in any portion of that region, but the whole of it ought to be set aside as a great National Park." Thus we find that people were talking about American National Parks before they existed. By the time Theodore Roosevelt laid the cornerstone for the Yellowstone entrance gate in 1903, reams of descriptive material had been published.

The fact that so many persons have written and talked about National Parks, in the past, constitutes one of the most important factors for the very existence of our Federal Scenic and Historic Domain today. Public interest built the Parks and

WILD ANIMALS

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all bookstores

MACMILLAN. NEW YORK

public interest and education must never be permitted to lag wherein the tremendous national values of the protected regions are concerned.

Miss Harlean James should receive the thanks of everyone who reads this latest book on the Natural Wonders of America. *The Romance of the National Parks* is the most satisfying and expert general Park book, this reviewer has ever read. Miss James is thoroughly acquainted with our Wilderness and Historic areas. She has lived in them, studied their marvels and fought for their protection. This beautifully written and illustrated volume should belong to everyone who has visited, or who contemplates visiting, any of our Great Parks and Monuments.

One hundred and twenty-three excellent photographs fully illustrate the volume. They have been admirably selected and add much to the value and attractiveness of the text. This is a fine book—a credit to the authoress, illustrators and publishers, and a necessary addition to the library of outdoor-minded Americans.

WILLIAM H. CARR.

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YOUR NEW BOOKS

Answers to Questions on Page 118

1. True. See page 67
2. The whale. See page 71
3. The saxophone. See page 112
4. The Pointed-tailed Ocean Sunfish. See page 72
5. The Guanay, or guano-producing Cormorant. See page 103
6. True. See page 94
7. 25,000 to 150,000 eggs. See page 73
8. (a) Kangaroo. See page 71
9. The bat. See page 71
10. (a) A musical instrument. See page 115
11. (c) Music. See page 110
12. The opossum. See page 96
13. The Wandering Albatross. See page 106
14. (a) Orpheus. See page 107
15. In the Whitney Wing of the American Museum of Natural History, with its 750,000 specimens. See page 98
16. False. It is one of the marvels of instinct that the minute spiderlings will spin their first geometric web as perfectly as any later ones. See page 95
17. Yes. See page 92
18. The Roadrunner. See page 78
19. (c) is actually to be found off the Louisiana coast. See Letter on page 67
20. Goat skin. See page 119

The story of a great naturalist



RUNNER OF THE MOUNTAIN TOPS

THE LIFE OF

Louis Agassiz

By MABEL ROBINSON, author of "Bright Island"

The life of the great scientist and teacher, who founded the Agassiz Museum at Harvard, and whose work with fishes, plants and fossils paralleled Audubon's with birds, makes fascinating reading for anyone. "It is written with simplicity, humor, understanding, and poetry."—N. Y. SUN. With a bibliography and Appendix. Illustrated with 20 chapter decorations by Lynd Ward, and 8 full-color plates taken from Agassiz's works. 290 pages. \$3.00.

How to know, tame and
raise small animals



OUR SMALL NATIVE ANIMALS

By ROBERT SNEDIGAR

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Color Photography of Flowers

By F. H. POUGH

Assistant Curator, Geology and Mineralogy

ONE of the most entrancing phases of photography is the use of natural color film to catch and keep the many hues of nature in their original freshness. Until the comparatively recent perfection of color film with a grainless dye image, it has been possible to preserve only dried herbarium specimens, with black and white photographs of them in life; the inspection of which is a poor substitute for the pleasure experienced by the botanist in finding some rarity in the field. Today with a natural color photograph to project upon a screen, or to reproduce on paper if one has the skill and time, the original beauty can still thrill all who are privileged to see it. The conservationist nature lover can find a unique specimen and preserve it, yet leave it for others to see and enjoy, allowing the plant to bear fruit and to perpetuate itself, instead of ruthlessly destroying it for a dead collection.

Color photography is at once simple and complex. There are many processes, but Kodachrome is the best now available. This film is only available in a few sizes, of which the 35 mm. for the so-called miniature camera is the most popular. The processing is done by the manufacturer, all the user has to do is to expose it according to directions and mail it; it is returned all finished and mounted in slides, ready for projection.

Exposure must be much more critical with color films than with black and white. However, if the instructions of the manufacturer which accompany the film, or which will be found in the very useful booklet recently published by the Eastman Kodak Company, are followed to the letter, perfect exposures will result. Unless it is unavoidable, do not take your pictures when conditions are anything but ideal: bright sun on a clear, windless day.

Then flower photography with the miniature camera is not difficult. A Contax with supplementary lenses makes it possible to focus at 8, 10 and 15 inches from the plant. A fairly good depth of focus is obtained even with a relatively large diaphragm opening, with short focus lenses. This means that it is not necessary to mount the camera on a tripod and surround the subject with a wind deflector to make a long exposure. My standard exposure with the sun behind me (though individual cameras may differ a little in adjustment) is $1/25$ th of a second at f. 10 ($2/3$ rd of the way toward f. 11 from f. 8) for white and light-colored flowers, and at f. 9 for darker flowers. A deliberate underexposure, f. 11 perhaps instead of f. 10, will give pale flowers a stronger color. If the day is very still, greater focal depth can be obtained by stopping to f. 14 and exposing for $1/10$ th of a second.

These figures are for bright sunlight on a clear day. Better results are obtained when the sun is lower than at noon, but avoid the redness of the very early and late hours; the color reproduction will be

affected. Great patience is necessary in such field photography, for even a slight breeze will spoil many pictures at $1/25$ th of a second, and a still fraction of a second never seems to come. Most of my failures today are caused by the slight movements so hard to escape.

In general, it is not advisable to take flower pictures under any condition other than that of full sunlight. However, it is far easier to say that than to practice it, if one is to follow the precept of doing the plant no harm, for many of the rarest and most interesting flowers grow where the sunlight rarely reaches them. Under these circumstances one has no alternative but to take the picture under the best light conditions available. For pictures of this type, a meter of the photoelectric cell type is indispensable. If sunlight falls nearby, a mirror or bright white reflecting surface may be used to cast light on the bloom. However, with all precautions the light color will not be ideal and the picture will be less satisfactory. Possibly filters could be used to correct for this, but a better method would be to use the artificial light emulsion film, Kodachrome A, and synchronized flash bulbs.

Backgrounds constitute the principle, and frequently overlooked, problem in wild flower photography. A plant with an artificially inserted even background is like a crystal without a matrix; beautiful, but it only tells half the story. The flower must stand out from the distracting surroundings, but the surroundings must none the less be visible, if only to show that it is a living, growing plant. If the flower is brightly colored, that alone will make it stand out in its green surroundings. If it alone is in sharp focus and all else blurred, that, too, will help. In an open field the grass should be well cleared out or beaten down both in front and behind the plant, to clear the view and blur the background.

Less intensely colored flowers can be made to stand out by getting someone or something to cast a shadow on the area which will serve as a background for the flower. In doing this, be careful that the shadow does not fall upon the plant itself, and have it come into the picture area at an angle so that it adds to and balances the composition and does not mar it by casting a dark line across the middle of the field. This makes plants stand out wonderfully and increases the third dimensional effect so marked in pictures taken with the miniature camera.

If the picture is to be taken in the shade of the woods where it is not possible to cast a shadow, a piece of bark from a dead tree may be placed behind the flower, far enough away to be blurred yet still to be recognizable as a natural object and not a completely artificial background.

Lastly, don't forget that seeds are interesting, too, and even the dead flowers are worth including in your series; do not trim the stalks to show only the perfectly blown blooms. A view of the plant, a close-up of a single flower or cluster, and

a picture of the seed make a perfect botanical record unequalled in any other form, secured without destroying a single specimen, and giving both the botanist and the photographer pleasure for many years.

PRIZE CONTEST

Have you an unusual natural history photograph? In both the October and November issues, NATURAL HISTORY Magazine will offer three prizes of \$10, \$5 and \$3 respectively for the best photographs submitted by readers.

The subject may be anything from a wild animal to a microscopic view of an interesting crystal or seed. A tree, a bird, a native type—anything in the broad range of NATURAL HISTORY Magazine is eligible. Other acceptable photographs submitted will be purchased as heretofore at \$1 each for the Letters page. The contest is open only to those who receive NATURAL HISTORY Magazine as members of The American Museum of Natural History.

Photographs for the October contest must reach the offices of the Magazine not later than September 14th, those for the November issue not later than October 14th. The photographs will be judged not alone on their pictorial merit but also on their significance. The contestant is, therefore, urged to paste any pertinent information to the back of the print, also to state when possible the camera, film, and conditions of exposure. Prints, not negatives, are desired, preferably glossy. NATURAL HISTORY Magazine cannot return entries unaccompanied by return postage. There is no limit on the number submitted.

Send in your entries at once to insure consideration for the October contest.

*Address: Photographic Contest,
NATURAL HISTORY MAGAZINE,
77th Street and Central Park West,
New York, N. Y.*

LETTERS

SIRS:

I have just read the interesting article on "Nature's Births and Babies" in your very fine September issue. May I draw your attention to the statement on page 72 referring to the Echidna: ". . . with a beak like a duck." This sounds like a confusion between the Echidna and the other Australian monotremé, the Ornithorhynchus, which certainly has a duck bill, for aquatic feeding. The Echidna, on the other hand, is an ant-eater, and has the long, tapering snout. . . .

As a member of the American Museum of Natural History, I always read your articles with the greatest attention and interest.

SYLVIA SEELEY.

Ottawa, Canada.

Miss Sylvia Seeley is correct in naming the Ornithorhynchus as the four-legged animal celebrated for its duck-like bill. But the Australian Echidna specifically referred to in the article, as distinct from the New Guinea Echidna, has a flat, blunt bill, which, though not so pronounced an example, can with reasonable accuracy be called duck-like—ED.

SIRS:

May I call your attention to a title on one of Mr. Kane's photographs in the September *NATURAL HISTORY* (page 116)? The insect in the picture labeled "Grasshopper and Thistle" is certainly a katydid, is it not?

BETTY HONE.

New York City.

* * *

SIRS:

Why shouldn't I feel badly? My beloved magazine has pictured a nice big katydid on a thistle and titled the picture "The Grasshopper and the Thistle" . . . Of course it belongs to the long-horned grasshopper group, but it is known everywhere as a katydid. (For reference I used "Fieldbook of Insects" by Frank E. Lutz.)

Don't get me wrong. I still like *NATURAL HISTORY Magazine*; I just couldn't help writing.

BEATRICE WILLIAMS.

Fayette City, Pa.

NATURAL HISTORY bows to Miss Hone and Miss Williams for their sharp eyes and a valuable reference book. The insect is a katydid, or a long-horned grasshopper.—ED.



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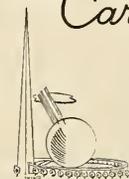
Here is a living tribute to hallowed memories which serves for all time to lift the hearts and elevate the spirits of the community. In the majestic beauty of their music is comfort for the aged, hope for the afflicted, inspiration for all. To the donor they bring the enduring satisfaction of having fulfilled, in a particularly fitting manner, one of life's most sacred obligations.

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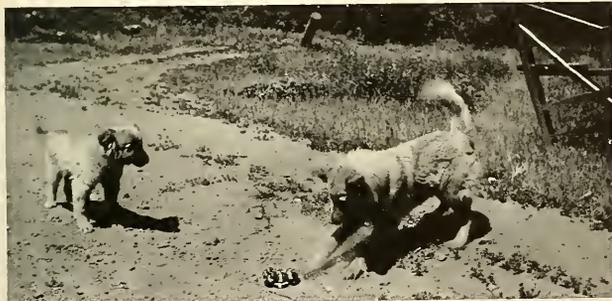
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SIRS:

In this chance scene of a mother dog showing her son how to fight snakes, the pup seems to be saying: "Will the world expect this of me?" The mother, a half-bred Husky, was an experienced rounder-up of rattlers; the pup was a three-quarter Husky, the snake a five-foot King.

PAUL T. PECHSTEIN.

Medford, Oregon.

SIRS:

I want to congratulate you on your magazine, *NATURAL HISTORY*. It grows more and more informative and attractive. . . .

A. C. KENLY.

Chestertown, Md.

SIRS:

Few people have ever demonstrated more impressively than Charles E. Jones, of Vancouver, B. C., the extent to which birds can be tamed. He tells us he has gath-

Continued on page 138





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NATURAL HISTORY

The Magazine of the American Museum of Natural History

FREDERICK TRUBEE DAVISON, President

ROY CHAPMAN ANDREWS, Sc.D., Director

VOLUME XLIV—No. 3

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PYGMY MAN-O'-WAR BIRD: an affectionate mother and youngster. The flimsy nest is on the trunk of a fallen *Caesalpinia* tree at the remote Brazilian island of Trindade, in the South Atlantic

Photo by Robert H. Rockwell



MAN-O'-WAR

By ROBERT CUSHMAN MURPHY

A sea fowl that cannot swim; a fish-eater that never touches water save with the tip of its bill; a glider equipped with elongate planes but devoid of landing gear with which to take off or return on any level surface; a being with the pinions of a dark angel, the insignificant feet of a hummingbird, the code of a buccaneer—such is the frigate-bird or man-o'-war.

The ocean is its larder, but its true home is the sky; no other bird spends so large a proportion of its life aloft on idling wings. From Cancer to Capricorn stretches the broad belt of its range, with extensions nearer the poles at mid-ocean islands and wherever a Gulf Stream or its counterpart tempers the shore waters of middle latitudes. Solomon's sailors must have encountered it as their quinquiremes pulled toward Ophir; ancient Greek adventurers to the Arabian Sea called it the *souspha* and recognized it as the most aerial of birds. Columbus saw it on September 29, 1492, thirteen days before the landfall at San Salvador, and entered in his journal an inspired record of its piratical behavior. Modern voyagers know it throughout the warmer oceans of the globe, because from Florida and Texas to Brazil and the Cape of Good Hope and India, from Mexico to Hawaii, Peru and Australia, it finds a base on nearly every dry speck in the sea and forages along all shores including the busiest of tropical seaports.

Corsairs by well-deserved reputation, the man-o'-war birds are capable, when it pleases them, of earning their own living as honestly as any fisherman. In the South Atlantic I have seen six of them hovering in a row, with a slow beating of majestic wings, above a shoal of surface fish. Thus poised close to choppy water, they would strike downward, swinging their long beaks like scimitars beneath their breasts, the hooked tips each time deftly seizing a small fish. Every bird caught three or four a minute and yet left the school oblivious of the toll taken from its ranks.

Takes flying-fish on the wing

More often, however, the man-o'-war rides high, spies its prey from afar, and makes its capture by the sheer speed of a power-dive rather than by subtlety. A fledgling sooty tern squatting on the pebbles far from the shelter and protection of the bay-cedars, a baby sea-turtle working toward the water from its incubator in the hot sand, a herring that incautiously reflects the sunbeams from its silver scales, a flying-fish shooting from the blue sea before the dash of

*
an albacore—they are all fair game to the man-o'-war. Nose-diving from the sky, with a whistle of wind through stiff quills, the animate bolt descends in unerring pursuit, flattens out in the last split second to avoid a crash or a breathless plunge beneath the waves, tosses its victim in mid-air so that it will slide down the smooth way, and then mounts with long sweeps of the wings back to its vantage level. There is something peculiarly dramatic in the plight of the flying-fish—driven into the air by a bigger fish that cannot fly only to find a grave in the belly of a bird that cannot swim!

Such are the usual habits of the flying angler during rough or blustery weather. Its better-known technique of banditry is reserved chiefly for lazy periods of calms and gentle trade winds, when it seems to express the traditional Anglo-Saxon sporting sentiment: "It's a fine day; let's go out and kill something." Strictly speaking, killing is not its aim at such times but, as among all pirates, torture and maiming enter when necessary into its persuasive methods.

Other birds its unwilling slaves

Other sea fowl, especially the fish-catching boobies of various species which share its range throughout the world, become unwilling slaves of the man-o'-war, whose real purpose is to appropriate goods amassed by the sweat of other brows. At such times the man-o'-war keeps a knowing eye on its neighbors instead of the ocean. Singling out a homebound booby that fatuously rejoices in a full crop, the rakish freebooter gives chase, following with dexterous agility every dodge and turn of the hapless runaway, and sticking like Nemesis until the booby disgorges in air. Then the robber tips forward to snatch the secondhand prize, which rarely has time to reach the water. But if mere unrelenting, contemptuous pursuit proves an insufficient threat, the man-o'-war is ready enough to add the cruel goad of its bill. Stubbornness on the part of a booby may lead to a torn neck or a dislocated leg; in the booby colonies one can often find cripples that attest the wrath of the implacable tyrant.

The female man-o'-war bird is always larger than her mate and is by all odds the boss of the family, even though the male displays an exclusive badge of masculinity in the form of an expansible throat sac. During the breeding season this is inflated by a series of pumping, gulping actions until it attains the size and appearance of a red toy balloon. It is then the love banner which produces the requisite excitement in the female, who alights on the tangled tops of shrubbery or swamp trees that the male has chosen for a nest. Both birds next assume a backward-leaning posture, face to face, raise their bills, allow their wings to droop limply, wave the heads and roll the bodies ecstatically while emitting incoherent gurgling and chuckling noises. At the same time the pointed, iridescent feathers on the back stand up like bristles and the lovers swell and tremble with an amorous ardor, of which the gorgeous red globe of the male is the most striking symbol. Despite all this mutuality of courtship, however, the major burden of home-care, including incubation and the brooding of the chick, falls to the lot of hen-pecked father.

Both birds of a pair take part in nest-building, the female toting lumber while the male, with his rubber throat blown up, squats on the platform under construction, arranges the incoming sticks and, what is more important, protects them against pilfering by strange females. He dare not leave his post at this critical juncture because "finding is keeping" in the morality of the tribe. Sisters, aunts and other men's wives swoop down on an unguarded nest and purloin every vestige within a twinkling. Ordinarily the twigs are snapped off in passing flight from the tips of dead branches, or are filched from the red-footed boobies—the only species of its kind which uses wood or builds above the ground—while they are carrying them homeward for their own domestic purpose. The alacrity with which the boobies yield to the highwaymen might lead an observer to suppose that the sacrifice of a stick is a means of saving their dinners.

Mild-mannered at the nest

The last would hardly be a sound conclusion, however, for breeding ground and feeding ground are two different worlds in the philosophy of the man-o'-war bird. The sea is for plunder, the nest for peaceful family life; at home the Jolly Roger is furled, the cutlass sheathed. When nest-building is finished, the man-o'-war covering their eggs or youngsters become the most mild-mannered of sea fowl. Not only do they sit inoffensively when a man approaches and touches them but, moreover, toward their dear companions, the boobies, they behave as though nothing had ever happened to mar the eternal friendship between the

two! Indeed, nesting boobies and man-o'-war birds a yard apart pay rather less attention to each other than either would to fellow members of its own species. All of which goes to show how fully the reactions of birds are determined by the particular stimulus of the moment, which retains no meaning in their consciousness after that moment has passed.

Awkward on ground

The man-o'-war bird's personal troubles stem mostly from its own awkwardness anywhere out of the air. There are hazards aplenty for such nearly legless creatures among the limbs of sea-grape and mangrove. The birds sometimes lose their balance and, before they can launch into flight, slip helplessly down the branches into the jaws of crocodiles or to a lingering death made certain by their inability to clamber out of the tangles to some jumping-off place. Furthermore, many an adult has been hanged by the neck in a crotch. Experiments with captured man-o'-war birds have shown that they are unable to fly among shrubbery. Birds placed on the ground, or tossed into the air a little above the ground, between bay-cedars at the Dry Tortugas Islets were quite incapable of making a get-away unless they had a clearance of at least eight feet, and then only when they were flying into the wind. Nearly everywhere their nests are built at an elevation that provides some sort of spring-off from which the birds can take flight. In a very few localities, such as Boatswain-bird Islet, off Ascension, in the tropical Atlantic, where the egg is laid on bare, stony soil, they may find it simpler merely to tumble into space from the brink of the adjacent cliff.

The ordinary tree nest is nothing to boast about for the safety of the single offspring. When an incubating parent takes flight, it sometimes bowls the egg off with itself. Daylight shows through the flimsy structure which, however, later becomes more firmly matted together by the droppings of the voracious youngster, cling as tight as a limpet to its cradle. In its early stages the chick must be carefully shielded by a parent from the curdling heat of the equatorial sun. Subsequently, when quills sprout through its fluffy white down, it faces a second perilous trial, for the quantity of blood in the shafts of fast-growing feathers weighs it flat, head and limbs, so that for several days its utter dejection and listlessness make it seem more dead than alive.

Thus far I have spoken as though there were but one man-o'-war, instead of many kinds. It is only a few years, indeed, since even ornithologists have realized that there are more than two, the old error being due to the seafarer's notion that individual man-o'-

war birds regularly cross thousands of miles of open ocean. We now know, on the contrary, that these birds are bound by firm homing ties to the stations where they roost and nest. A careful check of observations from all parts of the deep fails to substantiate the presence of any man-o'-war bird farther than about 200 miles from an island or continent. Broad reaches of ocean, however, are spangled with islets. The traveler in the South Sea, who sights the birds within a circle of unbroken watery horizon, would do well to consult his position on the chart before concluding that the palms of some forgotten atoll may not lie within eye-range from the lofty level of the man-o'-war. "Thou art all wings!", cried Walt Whitman, correctly. But since he next penned exultant lines about this glorious sea fowl's gyrations through spaces and realms of air—

"At dusk that look'st on Senegal, at morn America," it is unhappily necessary to point out that the only transoceanic flight really involved was a poetic one!

An eight-foot wing spread

There are, in fact, five species of man-o'-war birds, ranging in size from creatures of 60-inch span to others that stretch a full eight feet from tip to tip of the wings. A single species may inhabit a whole ocean, or more, as in the case of our own Florida bird, which has representatives as far apart as West Africa and the Galápagos Islands. But comparison of museum specimens reveals that the birds from these several localities are not quite the same; rather, they prove to be subspecies or geographic races which, as a result of long isolation, have come to differ more or less one from another. Such change is a familiar expression of evolution. The Cape Verde Island man-o'-war of the eastern Atlantic, for example, is one race; the Caribbean bird, occurring from the southern United States to Brazil and Peru, another; the bird at the Galápagos Islands, which lie in the Pacific within 600 miles of South America, is still a third. Contrary to many published reports, the last has never yet been captured anywhere away from the immediate vicinity of its own islands, a fact easy to determine because it happens to be the largest man-o'-war bird in the world. Incidentally, a race of a second and smaller species has also reached and occupied the Galápagos, but from a different direction, namely, that of the Polynesian isles to westward. Thus two kinds, one of Atlantic and one of Pacific source, now dwell side by side at "World's End" without actually mingling. Their nesting territories seem to be mutually exclusive as to colonies if not also as to islands within the Galápagos group.

In the steps of the process that is sometimes called "speciation" we discern further evidence of the sedentary disposition of a bird once supposed to wander far and wide at will. If the latter were true, continual inbreeding would prevent the segregation of distinct island strains just as surely as unfenced Plymouth rocks mix their blood with the Rhode Island reds of an adjacent farm.

Winds and distribution

How then have the world oceans become peopled with a dozen or more species and subspecies of man-o'-war birds? Here the power of survival with which their mighty wings endow them suggests an answer. Neither they nor any other flying creature can fight the full strength of a tropical hurricane, but they, more than other sea birds, are often able to ride it out and with good fortune to be carried in safety to a new insular home. Following a September "twister," a man-o'-war bird has been taken in Nova Scotia, as far from its point of origin as many a remote island in the sea. By similar means, we may assume, successful colonies have been founded during long ages, and each time the home-clinging instinct has reasserted its isolating and hence creative sway.

It would be rash to assert that the relative distinctness of a man-o'-war bird population is certainly correlated with the time that has elapsed since the Adam—or rather the Eve—of the settlement first arrived from somewhere else. We know, nevertheless, that wherever inter-island distances are slight and conditions for distribution favorable, birds of a single race inhabit scores or hundreds of islets, as in the West Indies and among the far-flung archipelagoes of the Pacific. On the other hand, the tiny and lonely volcanic peak of Ascension in the South Atlantic, 700 miles from the nearest island and farther from any continent, is the sole home on earth of a man-o'-war bird that has peculiarities not shared by any other. It would be idle to speculate as to how many eons the members of this tribe have reveled in uncontaminated, "pure Aryan" aloofness!

Let us turn, however, to a more creditable language of kinship and heredity. It is a truism that many closely related birds differ much more from each other in manner of life than in appearance. Among man-o'-war birds the opposite is so. All seem to be alike in structure and in habits; there is no equivalent example of basal uniformity, indeed, in any equally large group of sea birds. The specific distinctions between them relate almost wholly to size and to pattern of plumage. But it has never yet been recognized by naturalists that their variations bear an extraordinarily close resemblance to those that appear in

the thoroughly studied laboratory animals of geneticists, such as mice or insects or the countless breeds of poultry. Presumably the hereditary significance is the same whether applied to organisms in breeding cages or "in the open." In one species or another, man-o'-war birds exhibit, for instance, such familiar genetic mutations as "cock-feathered hens" and "hen-feathered cocks." Most adult man-o'-war birds, in fact, wear a plumage representing a stage in the development of some other kind of man-o'-war bird.

Plumage patterns

It might prove somewhat intricate to follow a verbal description of the plumage sequences throughout all the known species of the family, but the accompanying diagram will serve our purpose very simply. The central figure, illustrating both dorsal and ventral views, substantially represents the youthful dress of all, for in this stage every man-o'-war bird has a white head, neck and breast and a light-colored wing bar, regardless of its sex. The surrounding five pairs of figures show all the adult derivatives in both sexes. We may give the five species common names, and summarize their ranges, as follows:

- F. magnificens*, American Man-o'-war. West Africa to intertropical America and the Galápagos Is.
- F. minor*, Lesser Man-o'-war. Pacific, Indian and So. Atlantic oceans.
- F. aquila*, Ascension Man-o'-war. Ascension I., So. Atlantic.
- F. andrewsi*, Oriental Man-o'-war. Indian Ocean and East Indies.
- F. ariel*, Pygmy Man-o'-war. Pacific, Indian and So. Atlantic oceans.

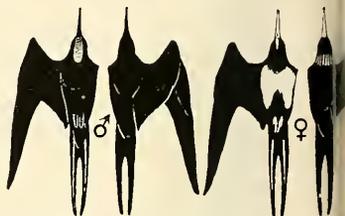
Ornithologists are still generally unaccustomed to looking at nature through the eyes of an experimental biologist. If, however, the various species of man-o'-war birds could be interbred in an aviary, under control, they might well become the delight of a geneticist, because during individual growth each of them reveals combinations of plumage characters for which the laboratory worker finds many parallels in his own records.

The amazing bodily proportions that give a full-grown man-o'-war bird its undisputed superiority over all rivals likewise make sense only when considered from a physiological point of view. They are nothing more nor less than products of unbalanced growth, determined by the bearers of heredity in ancestral germ cells and by internal secretions of glands that carry out the fore-ordained architectural plan. For example, the naked chick just out of the egg is hardly a man-o'-war bird at all. Rather, it is a mere "bird," and an extremely ugly one at that,

THE FIVE SPECIES

Illustrating the Genetic Relationships

Scale is disregarded: the species differ in size, and female birds are larger than males (♂ means male, ♀ means female)

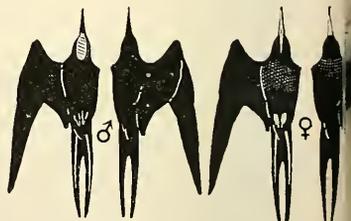


FREGATA MAGNIFICENS

Wing bar in ♀ only. All light areas of plumage completely masked in ♂. Violet iridescence on back of ♂

APPROXIMATE YOUTHFUL PLUMAGE

Wing bar in ♀



FREGATA AQUILA

Cock-feathered ♀, but with wing bar, breast and nape pattern of ♀ not completely masked. Green iridescence on back of ♂



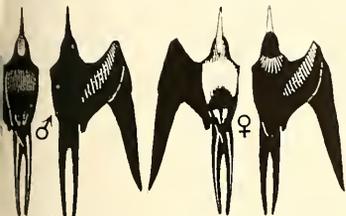
FREGATA

Wing bar in ♀

MAN-O'-WAR BIRDS

Image Pattern in Adults

of ♂ blackish, of ♀ reddish, except in *F. andrewsi*, the "hen-feathered" species, in which both sexes have pale feet.

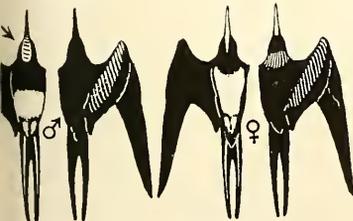


FREGATA MINOR

Wing bar in both ♂ and ♀. Breast pattern of male not completely masked. Green and violet iridescence on back of ♂

OF ALL SPECIES, BOTH SEXES

o iridescence



FREGATA ANDREWSI

An approach toward a hen-feathered ♂. Wing bar in both ♂ and ♀. Green iridescence on back of ♂



IEL

le iridescence on back of ♂

with a stubby bill, *legs actually larger than its wings*, and such a close resemblance to the young of its relatives, the pelicans, cormorants and boobies, that an interchange of nestlings might fool even the parents. But the nondescript baby man-o-war has no sooner shaken off its shell than the biological differential comes into play. The beak begins to lengthen and to form a sharp hook; the legs grow very slowly and soon not at all, while the bones of the wing rapidly double and redouble their length. By the time the fledgling is ready to leave the nest, a structural freak has been fashioned. The upper wing bone has become three and a half times as long as the thigh bone and fifteen times as heavy, the middle wing bones more than four times the length of the shin bone. The ultimate result is a highly specialized flying machine, with feet barely large enough to grasp a perch, but with wings a yard in length, each furnished with 25 per cent more flight feathers and 40 per cent more area than those of a gull or other sea bird having the same bulk of body.

Powerful flying equipment

Power, strength and rigidity are abundantly supplied to match the vast planes. The great breast muscles that work them comprise nearly one-fourth the weight of the whole bird. The plumage alone, which includes flight feathers seventeen inches or more in length, makes up another quarter of the weight. The long, forked, scissor-like tail, highly important in the man-o-war's aerial evolutions, is regulated by seven pairs of muscles attached to the spine, and its quills are firmly imbedded in a massive fibrous cushion. The skeleton is marvelously strong. The wishbone, unlike that of any other bird, is welded to the keel of the breastbone and to the two lateral stanchions of the shoulder-girdle, making a peerless frame for the attachment of the muscle-motor and for articulating the crank-shafts of the wings. A typical female of the Caribbean race that I recently handled in the flesh gave figures startlingly disproportionate when compared with any other avian standard. Its total weight was 2 pounds 2½ ounces; its wing spread 89 inches; the whole imposing structure of the bird depended upon a skeleton which weighed, when dried, about one-quarter of a pound.

Our fledgling man-o-war, therefore, begins its free life as an instinctive master of the light tropical atmosphere and an exponent of the effortless flight in which it excels every other bird. An albatross is impressive chiefly when the breeze is brisk; most smaller birds accomplish their spectacular feats by a rapid beating of the wings and high consumption of muscu-



ROOSTING TREES of Lesser Man-o'-war Birds, high above the glimmering Pacific at Etiau Island of the Marquesas group, in eastern Polynesia. To such perches the winged marauders come to pass the night in heavy, almost stupefied slumber, and during the Whitney South Sea Expedition of the American Museum many such dormitories were visited. So familiar is the man-o'-war to tropical island peoples all over the world that a more or less conventionalized *motif* of the bird appears in a wide variety of their decorative arts

Photo by Rollo H. Beck



Photo by Fahnestock Expedition

(Above) AMERICAN MAN-O'-WAR BIRDS, mostly males, on their scanty nests at Chame, a famous bird island in the Bay of Panama. This species, like the widespread Lesser Man-o'-war, often makes its home in the tops of tall trees, if they are available. The Pygmy Man-o'-war usually chooses lower sites, while the species found only at Ascension Island lays its egg on the dry and plantless ground

(Below) IMMATURE LESSER MAN-O'-WAR BIRDS, in training as "carrier pigeons," patiently awaiting their dinners at Nauru Island, in the western equatorial Pacific. Birds not yet fully tamed are leashed in this way on a perch and are

fed with fish just before sunset. Thus they acquire the expectation of receiving tribute, and later descend fearlessly to the racks

Photo by Rosmond Dodson Rhone; courtesy of the National Geographic Society





Photo by Toshio Asada

A MALE Man-o'-war in the full pride and vigor of the mating season, as observed at the Galápagos by an American Museum expedition in Mr. Templeton Crocker's yacht *Zaca*. The balloon is at its maximum



Photo by James P. Chapin

THE GLORY of the red emblem soon shrinks and fades, as shown in this incubating Lesser Man-o'-war at Tower Island, Galápagos. The power of expansion pertains strictly to the breeding season. When courtship is over, the pouch rapidly atrophies, to remain out of commission until the next breeding period

THEY PUT TO SHAME "the daring young man on the flying trapeze." Lesser Man-o'-war Birds performing for a free meal at Johnston Island, in the leeward chain of the Hawaiian archipelago. With alacrity and unerring certainty the birds catch food tossed into the air, a feat in which they have constant practice by recovering the prizes disgorged by harassed boobies. In this picture a fish about to be seized and engulfed shows just ahead of the lowest man-o'-war

Photo by Alexander Wetmore; courtesy of the U. S. Biological Survey





BIRD photography *de luxe*. Rollo H. Beck, for several years leader of the Whitney South Sea Expedition, snaps a portrait of a male Lesser Man-o'-war Bird on its nest at Christmas Island, just north of the equator in mid-Pacific. The presence of the Ford is accounted for by the extensive coconut industry of Christmas Island

Photo by Rollo H. Beck



(Left) PYGMY Man-o'-war Birds, female in the foreground, male behind, and many downy youngsters, occupying nests on or barely above the ground at Naido Island, of the Fiji group. The adults probably use the matted masses of vegetation as spring-offs from which to take flight

(Below) A MALE Lesser Man-o'-war Bird, with pouch distended, about to descend on the nesting site at Tower Island, Galápagos group. The flailing wings and greatly depressed, forked tail give the bird an attitude that is considerably more interesting than graceful

Photo by James P. Chapin



(Above) LESSER Man-o'-war Birds occupy adjacent nests atop the tangled shrubbery at Hatutu Island, Marquesas group. Their lithe speed and aggressiveness in air replaced by mildness and sluggishness when they alight. The gray throat of the female in the foreground is one of the distinguishing marks of this species





Photo by Rollo H. Beck

(Below) THE LONG, hooked, efficient bill of the man-o'-war bird, as illustrated by an immature, white-headed but fully fledged example of the American species. Note the notch behind the sharp hook of the bill, which enables the bird to manipulate a slippery fish. The photograph shows also the powerful wings and the diminutive and only slightly webbed foot



Photo by Fahnestock Expedition

(Above) AMERICAN Man-o'-war Birds incubating their eggs at Chame Island, Bay of Panama. Four adult males show in the foreground, including the bird that seems to be balancing itself with outspread wings. Those in the rear are chiefly females. There is considerable evidence that males assume the major share of brooding and other household duties

Photo by Anthony V. Ragusin



LESSER Man-o'-war Birds, every one of which appears to be an adult female, accompanying Mr. Vincent Astor's yacht *Nourmahal* toward her anchorage at Tower Island, Galápagos group. Several visitors to the Galápagos have noted that it seems to be the female man-o'-war birds that have the most time for such gay leisure, while their mates are covering eggs or young. When the birds are soaring in this manner, the forked tails frequently open and shut, like the blades of shears



Photo by James P. Chapin



(Left) ASCENSION Man-o'-war Bird on its nest at Boatswain-Bird Islet, off Ascension Island in the central South Atlantic. Here, in the complete absence of vegetation, the man-o'-wars nest directly on the arid and stony soil, using projecting rocks or the adjacent edge of a cliff as a jumping-off place. This was the first described of all the five species of man-o'-war birds, and for more than a century its technical name, *Fregata aquila*, was incorrectly applied to other species all over the world.

(Photographed on the Cleveland Museum of Natural History's "Blossom" South Atlantic Expedition.)

(Right) TALKATIVE FLEDGLINGS. While adult man-o'-war birds are mainly silent, except during courtship, the youngsters are capable of producing a good deal of clamor. These are examples of the American species photographed at Cay Verde, Bahama Islands, on their matted nests in the thickets of sea-grape and other vegetation, by Frank M. Chapman



lar energy; but the man-o'-war has the appearance of floating in air. He is the supreme model sail-plane; when man has solved his secrets, motors and fuel will be auxiliaries rather than necessities of long-distance aviation. Such reflections are almost trite to the modern navigator who approaches an island anchorage with a canopy of man-o'-war birds above his top-masts. At such times the birds are likely to show a curious interest in snipping at the pennon, a trait recalled by Herman Melville in the closing passages of "Moby Dick." As the *Pequod* sank to her doom, "a sky-hawk tauntingly . . . followed the main-truck downward from its natural home among the stars, pecking at the flag."

Cannot rise from water

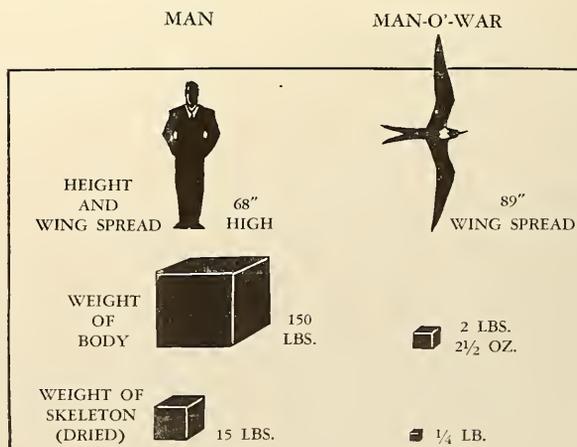
But, although the man-o'-war bird views the ocean all its days, it is meticulous to shun contact with its surface, because in the water this perfect glider is even worse off than when grounded. Once down, indeed, it is a helpless, floundering monstrosity, incapable either of making headway with its puny feet or of lifting itself back into the security of the air. Worst of all, its plumage quickly becomes water-logged because the oil-gland above its tail is a minute, atrophied affair, totally insufficient for the water-proofing purpose that this organ fulfills for all other sea fowl.

It is not unlikely that man-o'-war birds occasionally spend the night aloft during their longer wanderings from home. There is a persistent tradition among seamen that they sleep on the wing, but nobody has proved it. More often, at any rate, they

sail back to familiar roosts, and balance on their little feet from sunset until dawn. As night deepens, they become extraordinarily slumberous, or almost stupefied, so that to capture them is then an easy matter. Seventeenth-century accounts from the French West Indies tell of organized nocturnal raids by colonists and negroes, in which hundreds of man-o'-war birds were plucked from the branches and slaughtered for their fat, which was regarded as a sovereign remedy for rheumatic twinges, dropsy and paralysis!

In the hands of less bloodthirsty captors, man-o'-war birds are easily tamed and soon seem content to sit on a cross-bar and wait for fish to be tossed to them. Why not? No doubt they assume that they have subjugated an extraordinarily large, docile and effective kind of booby! Such ready adaptability to a new rôle explains why they could be employed as "carrier pigeons" by the Polynesians. Among the Samoan Islands and elsewhere in the Pacific it was customary to erect perches outside human dwellings and to feed the admired man-o'-war birds as they rested. When their excursions led them to other islands roundabout, they were quick to drop in at similar free-lunch counters. Thus, after the Christianization of Samoa, the missionaries found an ocean postal service awaiting their use, with written messages taking the place of the shell fishhooks and other small objects of olden time. Such post was not necessarily swift, but it was reasonably sure; one letter, placed in a reed cylinder and attached to the wing of a man-o'-war bird on a Friday, was delivered at an island 62 miles away on the following Sunday.

THE
SKELETON
OF A 7-FOOT
MAN-O'-WAR BIRD
WEIGHS ONLY
1/4 POUND





Philip Gendreau
Photos

IN THE DAYS OF THE GIANTS—*Descended from the era of dinosaurs, our Sequoias stand unchallenged champions. Five thousand years of living, 12 million pounds of growth out of a tiny seed, and no one has ever known a Sequoia to die a natural death*

By DONALD CULROSS PEATTIE

WE made a prompt start that morning, for we were going to visit giants in the earth. Of all that has survived from the Mesozoic era, which began 200 million years ago and ended about 60,000,000 B. C., Sequoia is the king. It is so much a king that, deposed today from all but two corners of its empire, superseded, outmoded, exiled and all but exterminated, it still stands without rival. And from all over the world, those who can make the pilgrimage come sooner or later to its feet, and do it homage.

In Sequoia we see the heroic age of plants, the age of conifers. This is best thought of as the High Middle Ages of plant life, just before its Renaissance when the world literally burst into bloom. In zoological terms, it is the age of dinosaurs, when birds and mammals and the higher insects were just beginning.

Of Sequoia there are two species left, though once they were as various and abundant as are today the pines, their lesser brothers. One is the coastal redwood of California, which is the tallest tree in the world, and the other is the Big Tree of the Sierra Nevada, which is the mightiest in bulk. These two surviving species were here before the last glacial

period. But as a genus or clan of species Sequoia has its roots in a day of fabulous old. This noble line knew the tyrant lizards; through its branches swept the pterodactyls on great batty wings. As they saw the coming of the first birds, crawling up out of lizard shapes, so the forebears of our Sequoia witnessed the evolution of the first mammals when these still laid eggs, when they were low-skulled opossum-like things, when they became scuttling rodents that perhaps, gnawing and sucking at dinosaur eggs, brought down that giant dynasty from its very base.

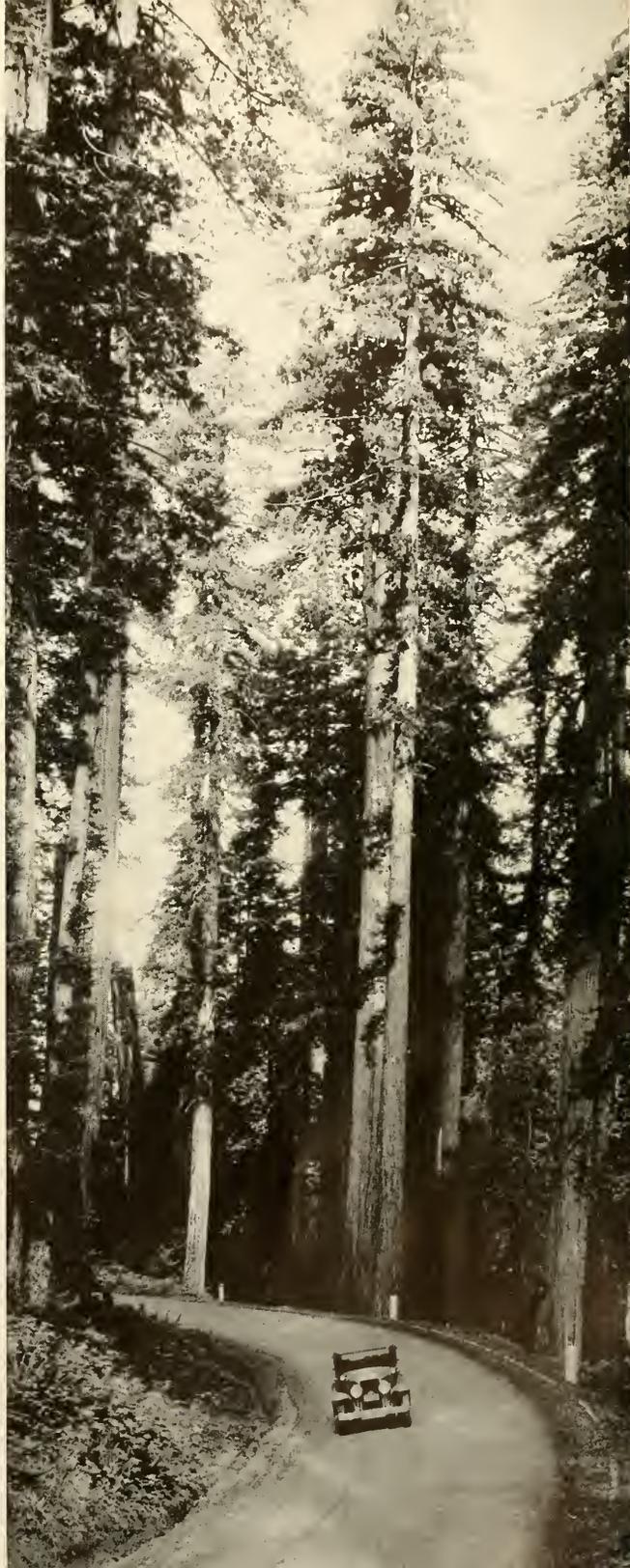
Sequoia as a tribe saw the rise of all the most clever and lovely types of modern insects—the butterflies and moths, the beetles and bees and ants. Yet since there were then none of the intricate inter-relationships that have developed between modern flower and modern bee, Sequoia sowed the wind. It had flowers of an antique sort, flowers by technical definition, at least; petals and scent they had none. But their pollen must have been golden upon that ancient sunlight, and the communicable spark of futurity was in it. For Sequoia towers still upon its mountain top, and I was going there.

Journey to the past

The way back to this reef out of the Mesozoic is over the coastal ranges and across the Great Central Valley. And that, in early summer, is a blue and gold wide basin of drowsy heat. You sweep from the hills into its sparse and arid range lands upon a long hot breath. Wheat and willows border the irrigation canals that lead the scanty thaw of Sierra snows out on this burning plain; here is a geography like Egypt's, perhaps like that of Mars. The playas glisten with the salt and gypsum left behind when the lake waters dried. Maybe when all our seas are shrunken to intensely salty sumps, when our air is thinner and earth is very old it will bear a vegetation like this, of tumbleweed and salt-bush, greasewood and short grass, with tule rushes and cottonwoods hugging the last of the marshy grounds. By noon—if the start was early—one is deep in the fertile bosom of the Valley. Green alfalfa or golden wheat, vineyards and orchards go by with the shining hours. A sweet stupor blows in one's face. And then at last the first groundswell of the coming mountain breakers lifts under the car.

It is a long climb still through the foothills of the Sierra. But now I sit up, with a lifted face. Beyond, higher in the east, portent is gathering. It takes shape, cloud-colored, gleaming with a stern reality where the sun smites a rocky forehead. Then appears that eternally moving miracle—snow in the summer sky. Sierra Nevada.

If the flora of the alkaline flats has perhaps the look of things to come, the foothill flora is all today's. Swift sprung, swift fading, shallow of root and delicate of bloom, bulbous or annual, it fits its hour. It is plant life as the dominant plants of the temperate zone must be to meet the terms of a planet with marked seasons, alternating rains and drought. It can face the diminishing forests, the advancing encroachments of man. Light freight of earth, these poppies and blue sage, these lupine and mariposa lilies are sure to please, were never meant to last, turned out



to meet a season's need, destined for the blades of the reaper.

Trees are thickening, among bigger boulders. Maul oak and black oak fall away behind, and dusty Digger pines, as vanguard. Greater things are coming; they send their breath ahead, a scent of rocks and resin, of damp and fern. It demands a deeper inspiration than the heavy valley air; it reaches to the bottom of the lungs, and braces a man for event.

The forests march upon the car; the ruddy soaring trunks of the sugar pines close around in escort. One hundred and two hundred feet overhead, their foliage is not even visible, screened by the lower canopy spread by western yellow pines which are giants in themselves. Groves of white fir, smelling like Christmas morning, troop between the yellow pines. Aisles of incense cedar with gracious down-sweeping boughs and flat sprays of gleaming foliage invite the eye down colonnaded avenues, fragrance drifting from their censors that appear to smoke with the long afternoon light. It grows darker with every mile, darker and deeper in moss and lichen, dim with the dimness of a vanished era. We have got back into earliest spring, at this altitude, and the blossoming dogwood troops along, illuminating the dusky places with a white laughter.

With each breath, I feel as though I gained in stature. This aroma seems health itself. The further men get, I think, from pines, the worse for them. Life, if we had never left them, might be plain and hard, and men would not stop fighting or even murdering because they lived in such a place as this—history dispels any such illusion. They might suffer bodily pain and know great weariness. But they would not toss with insomnia, or doubt till they could no longer act. Men to match these trees might raise the devil but they would never for one moment believe in the sicklier saints. You could hardly be small here. You might, sometimes, have a noble thought.

Geologic in scale

For now, as the land of sunny levels has fallen remotely out of sight, there is a prescience in the cold air, of grandeur. We have climbed into the shadows; the drifts of snow are thicker between great roots, and richer grows the livid green mantle of staghorn lichen that clothes all Sierra wood in green old age. The boles of the sugar pines, which are kings, give place before the coming of an emperor. The sea sound of the forest deepens a tone in pitch. The road is twisting to find some way between columns so vast they block the view. They are not in the scale of living things, but geologic in structure, fluted and buttressed like colossal stone work, weathered to the color of old

sandstone. They are not the pillars that hold up the mountains. They are Sequoia. The car has stopped, and I am standing in the presence.

Centuries of fallen needles make silence of my step, and the command upon the air, very soft, eternal, is to be still. I am at the knees of gods. I believe because I see, and to believe in these unimaginable titans strengthens the heart. Five thousand years of living, twelve million pounds of growth out of a tiny seed. Three hundred vertical feet of growth, up which the water travels every day dead against gravity from deep in the great root system. Every ounce, every inch, was built upward from the earth by the thin invisible stream of protoplasm that has been handed down by the touch of pollen from generation to generation, for a hundred million years. Ancestral Sequoias grew here before the Sierra was uplifted. Today they look down upon the plains of men. No one has ever known a Sequoia to die a natural death. Neither insects nor fungi can corrupt them. Lightning may smite them at the crown and break it; no fire gets to the heart of them. They simply have no old age, and the only down trees are felled trees.

Aerial world

In their uplifted hands they permit the little modern birds, the passerine song birds, vireos and warblers, tanagers and thrushes, to nest and call. I heard, very high above me in the luminous glooms, voices of such as these. I saw, between the huge roots that kept a winter drift, the snowplant thrust through earth its crimson fist. A doe—so long had I stood still—stepped from behind the enormous bole and, after a long dark liquid look, ventured with inquiring muzzle to touch my outheld hand. Bright passing things, these nestle for an hour in the sanctuary of the strong and dark, the vast and incalculably old.

That day I stood upon a height in time that let me glimpse the Mesozoic. It followed the Coal Age, the age of the fern forests, and it was itself the age of Gymnosperms. Sequoias are Gymnosperms. So are the pines, the larches, spruces, fir, yew, cypress, cedar—all that we call conifers. Though there are other Gymnosperms that do not bear cones.

The Gymnosperms are, literally translating, the "naked-seeded" plants. For their seed is not completely enclosed in any fruit or husk, as it is in the higher modern plants that truly fruit and flower. Neither is the Gymnosperm egg or ovule completely enclosed in an ovary, as in the true flowers. To make an analogy, you could say that the Gymnosperms are plants without wombs, while the Angiosperms, the true flowering plants with genuine fruits, are endowed with that engendering sanctuary.

But though the seeds of the Gymnosperms are

naked, they are seeds, and the seed is mightier than the spore. For the seed contains an embryo. Spores are very many and very small; they blow lightly about the world and find a lodging easily. But the seed is weighted with a great thing. Within even the tiniest lies the germ of a foetal plantlet, its fat cotyledons or first baby leaves still crumbled in darkness, its primary rootlet ready to thrust and suckle at the breast of earth.

Wood out of earth

This vital secret was inherited from the seed-ferns, back in misty days when the ferns were paramount. The conifers bore it forward; the true flowering plants were to carry it on and spread it in blossoming glory. Of that there was no sign in the Mesozoic forests. They must have been dark with an evergreen darkness, upright with a stern colonnaded strength. For they developed the power of building wood out of earth, not the punky wood of the tree ferns, but timber as we know it.

And we know no timber like the conifers'. No other trees are cut on such a scale. Where they grow, wooden cities swiftly rise, railroads are bent to them, mushroom fortunes arise from them, great fleets are built to export them. Scandinavia is one vast lumber camp, supplying western Europe; Port Oxford cedar of Oregon crosses the ocean in a perpetual stream of logs, supplying Japan and China; Kauri pines of New Zealand feed the wood hunger of barren Australia. The world's books and newspapers are printed on coniferous pulp; it is driving silk and cotton to the wall, as a source of cellulose and textile fibre. For beautiful grains, for capacity to take stains, the evergreen woods are incomparable. The living conifers are to us what the dead coal forests are.

But they can be replenished. They can be grown and cut as crops, and they yield a profit on poor sandy and rocky soil, or in swampy lands where no other crop could be hopefully tilled. Thrifty, fertile, tough, industrial, they are of all trees the most practical. Ancient in lineage beyond all others, they rise tall and straight in the pride of their aristocracy. Sea-voiced, solemn, penciled against the sky, their groves are poetic as no leafier places. Conifers stand in the sacred temple yards of Japan, where, with venerated care, their old limbs are supported by pillars. They line the solemn approaches to the tombs of the Chinese emperors at Jehol. Solomon sought them in the peaks of Lebanon for his temple. But in all the world there are none like those upon our western coast of the Pacific.

And it was in the Black Hills of Wyoming that a fragment of the Mesozoic lay hidden till the days when the West came to be called new country. Miners

on their way to Deadwood, cowboys riding herd, found strange stone shapes, and broke off fragments. What lay in those calloused brown fingers, turned over curiously, ignorantly, was once sprung in the Gothic glooms of the Mesozoic forests. These were cycads, which must have formed the undergrowth of those prehistoric coniferous woods, hundreds and hundreds of species of them. A few linger today, scattered thinly over the tropics of the world. Some call them fern-palms; they have an antique look, stiff, sparse and heavy; crossed in pairs upon a coffin, they impart a funebrial dignity. Cretin of stature for the most part, growing sometimes only six feet in a thousand years, they are beloved in the Japanese dwarf horticulture, cherished in family pride there, since a cycad of even moderate size may represent a long domestic continuity.

What pride, then, and what a ring of age was there in the first set of fossil cycads from the Black Hills rim to reach the men of science at the National Museum in 1893! Professor Lester Ward hastened to the field, and what he found there, besides the bones of a great dinosaur and the petrified logs of old conifers, were not imprints but complete petrefactions. Atom by atom the living tissue had been replaced by stone. Here were hundreds of fruits, all the leaves a gloating paleobotanist could desire, perfect trunks, every detail of wood structure preserved, and dozens of species, some dwarf, some colossal.

Protection

Ward took back with him what he could. Other students hurried to the find; Yale and the Universities of Iowa and Wyoming have great collections from Deadwood, and the government museums, too. Tourists carted away entire specimens, and what remained might have been utterly scattered and destroyed, had not Professor G. R. Wieland saved the last rich tract in the Black Hills. Close to the mountain where Borglum carved his heroic profiles, the scientist filed on the area under the homestead laws, and then presented his claim to his country. It has since been made Cycad National Monument.

These cycads, when the world was young and they were flourishing, must have brought into the dark monotony of the evergreen forests the first bright splashes of color. For the seeds of cycads are gorgeous scarlet or yellow or orange, borne on the edge of the leaf or commonly in great cones. They are sweet and starchy to the taste, and perhaps Archaeopteryx, that first feathered bird in all times, crunched them in the teeth that he still kept, reminder of his lizard ancestry. So, it may be, the earliest animals came to aid in

the dissemination of plants, as squirrels do today, and birds. Somehow, at least, the cycads over-ran the world. Their reign had grandeur, but its limits narrowed. There is evidence that some of the Mesozoic cycads flowered only at the end of their immensely

long lives—a thousand years, perhaps. Then, after one huge cone of fruit was set, the plant died to the very root. A hero's death, but a plan ill fit to breed a race of heroes. In the cupped hand of the future lay other seeds, with a fairer promise.

This article is a chapter from a forthcoming book on botany for every man by Donald Culross Peattie, published by G. P. Putnam's Sons.



Pictures, Inc.

Winter and summer the giant trees defeat the onrush of time and stand as man's oldest living link with the geologic past.

THE AMATEUR BIRD BANDER

An explorer who makes far-flung biological discoveries in his own back yard. Nature's uncharted fly-ways are his trails, the wings of his feathered friends his galleon's sails

By EDWIN A. MASON

A BIRD flutters into the air, out of friendly hands, and wings its way on an unknown course, timid but unharmed, and utterly unconscious of a tiny metal band that has just been placed around its leg. Weeks pass, perhaps months and years.

An Eskimo on the Arctic fringe of North America picks up a bird which he expects to eat for dinner and notices the shiny leg tag with numbers and writing that are quite beyond his understanding. He takes the tag to the local missionary, who realizes that the bird has a scientific story to tell, that it has been handled by someone thousands of miles away. In accord with a request stamped on the band he reports the finding to the U. S. Biological Survey, in Washington, D. C., where the bird's history is on file. The Biological Survey acknowledges the missionary's letter and notifies the person who originally banded the bird. This individual in turn writes to the one who found it. Thus another scientific fragment has been added to the jigsaw of migrations. This is typical of hundreds of stories in the annals of amateur bird banding.



Photo by
Nathaniel C. Nash IV

BANDING is the stay-at-home bird lover's method of "casting his bread upon the waters." Wherever a banded bird is found, the bander will be notified. Besides the numbered aluminum band, colored bands from a range of 14,406 combinations, identify the bird above at a glance uncaptured

THE BROWN PELICAN below requires an extra large band. Nine standard sizes accommodate all U. S. birds

Hugo H. Schroder photo



Bands that had been placed on young herons in the nest were later found in the belly of an alligator. Usually the cause of death is more commonplace: "Found dead on highway" or "killed by cat" appear more often on reports. Maddening in their lack of information are those saying merely "killed" (which might mean "shot") or "found dead."

But here is one that is different. "Caught in a rat trap" reads the card. A white-throated sparrow had been fattening-up at St. John's, Newfoundland, for his 1760-mile trip back to Carolina to spend the winter. His appetite doomed him, but the click of the rat trap gives us another complete record of summer and winter range.

In an Arkansas garage, one October day, a mechanic caught a small olive-green-and-black bird as it fluttered against the window. He wrote to the Biological Survey to find out about the bird with the band, and should have released it after noting its number. But he wanted to keep the visitor in a cage as a pet. Before he found out what it ate, the bird died. You could not expect a black-throated green warbler to eat seeds, or to thrive anywhere except in the woods. The route it was marking out extended from Massachusetts to Mexico or Panama, via the fertile valleys of the Ohio and Mississippi. We have a black line 1200 miles long from New England to Arkansas, but only a conjectural dotted line after that.

Are you sure that the brown thrasher you hear whispering his song in winter is the same one that wakes you from his perch in the treetop in spring? One thrasher was known to be no permanent resident, preferring South Carolina in winter and Maryland in spring. It is a pretty thought that you have a songster all your own, but have you?

From New England to the Carolinas, Georgia and Florida go the robins. The holly and the mistletoe, the dogwood and the black gum fruits are there, ripe and ready for the late fall arrivals. But do all the robins in the South in winter come from the Northeast? One robin with a band says "No!" A little girl with tears in her eyes rescued a spring robin from a cat. The silvery ring on its leg did the rest. When the little girl understood the long journey that robin had made to come back home to Fond du Lac, Wisconsin, she loved the robins more and cats less.

Bird banders are among the most enthusiastic of all nature hobbyists, explorers who make far-flung biological discoveries without leaving their own backyards. Their galleon's sails are the wings of their feathered friends, their trails are nature's uncharted air lanes.

The longest flight on record is that of an Arctic tern which traveled approximately 9000 miles, from Labrador to South Africa, in less than 90 days. This champion migrant nests in some places within eight degrees of the North Pole, yet during the northern



U. S. Bureau of Biological Survey photo

THE DROP-DOOR TRAP above, closed by a pull-string, is the form used by most home banding stations. Standard traps are available, but ingenious banders often experiment with their own improvements

winter it is seen in the South Atlantic and even below the Antarctic Circle. But the route followed had long been a mystery. In 1928, O. L. Austin, Jr., banded this particular Labrador bird, and three months later it was found on a beach in Natal, South Africa, indicating (with certain other evidence) that it had flown across the North Atlantic to Europe and then southward.

Since 1920, when the Biological Survey took on the work, over three million birds have been banded, mostly by the 2193 registered amateur banders. There is always the possible added thrill of finding a bird wearing a foreign band. One Louisiana cooperator banded 28,845 birds in 1938.

The bird bander usually is surprised to find how many of his own birds return to him. Endowed by nature with direction-finding equipment that would be the envy of any air pilot, they find their way back, often over thousands of miles.

This uncanny instinct is shared by such different birds as the soaring hawk and the tiny warblers. Some of these jewel-like creatures of the treetops, weighing but a fraction of an ounce and requiring a feather-weight band, annually make a 5000-mile trip from Canada to the tropics and back, including a 500 or 600-mile non-stop flight across the Gulf of Mexico. When one's own banded birds return from their long flights—traceable through the reports of other bird banders—one has almost the thrill of having traveled with the bird.

One of the earliest attempts at banding—in 1740—was an effort to determine whether it was true that European swallows hibernated in the mud like frogs. Red silk thread was fastened around the legs of some, the idea being that if the thread did not become discolored the mud-hibernation theory was false. Some of the birds actually did return, to prove that they had traveled, instead, to a warmer climate to pass the winter.

But many years elapsed before there was systematic bird banding. Audubon marked a brood of nestling phoebes with silver wire in 1805, but he did not attempt to distinguish individual birds. This was first accomplished 40 years ago by a Danish teacher, Hans Christian Mortensen, who marked storks, teals, starlings, and other birds, of which certain individuals were later heard from. Bird banding was popular in Europe before it came to America.

In 1920 the U. S. Biological Survey began to issue bands to bird lovers who asked for them, and to act as a clearing-house. Cooperation was extended to Canada and, last year, to Mexico.

A pioneer in America was Dr. S. Prentiss Baldwin, whose introduction came through no more exciting an undertaking than to rid his Ohio country

home of house sparrows. He wrote for advice to the Biological Survey, who recommended the Newton Trap. After Doctor Baldwin had set it, baited with seeds and bread crumbs, he found that unfamiliar birds besides his house sparrows were caught. He soon found himself corresponding with the Biological Survey, which asked why he did not band the birds. The good Doctor was supplied with bands by the American Bird Banding Association.

When he took a trap to his winter home in Georgia he made ornithological history. It was already known that birds returned year after year to the same place to nest, but it had never been guessed that migratory birds went to definite winter homes with the same uncanny accuracy. Twelve white-throated sparrows were his first subjects. In the same spot the next winter a small flock of white-throats were caught, and two of them already wore the telltale bracelets. After spending the summer in the North raising their families, these birds had come back to the exact spot in Georgia where they had lived the previous winter. Subsequent banding has proved that this habit belongs to many species. The indigo bunting, for instance, nests in the United States and winters in far-off Guatemala.



(Left) WATER FOR DRINKING AND BATHING draws birds to this Brenkle trap. A steady drip from the tank above has been found to make the bath more tempting. The birds can enter either from the top or from ground level

Howard Brann photo

(Below) HIP BOOTS and ingenuity here constructed a heart-shaped trap that is scarcely visible even to the human onlooker. Mallards and pintails have been caught in it and will be released when banded

U. S. Bureau of Biological Survey photo



Enthusiasm for bird banding was transmitted from Doctor Baldwin to a group of bird students who summered at Cohasset, Mass., and this little town soon had six operating stations. Others in the vicinity of Boston took up the work, and realization of the astounding discoveries that were possible made the need felt for a journal. The now greatly prized first issue of the *Bulletin of the Northeastern Bird Banding Association* (January, 1925) lists 352 members from practically every state in the Union and eleven from Canada.

Four regional organizations had been formed by 1930, and three of these then joined to publish *Bird Banding* under the editorship of Charles L. Whittle.*

Bird banding is the stay-at-home bird lover's method of "casting his bread upon the waters." It has a peculiar appeal, possibly because it brings the bird right into one's hand and makes it a recognizable personality with a history. Whether as a means of tracing the individual habits of those known to return year after year, or of analyzing scientifically the intricate behavior patterns of birds in two or more seasonal localities, banding is the way to "know them personally."

People in all walks of life address envelopes to the Biological Survey which bring the great thrill that comes to every bird bander when one of his birds is picked up. Farmers on their way to town, children walking to school, explorers, missionaries, traders and natives in remote lands—all are attracted by the shiny metal band which proclaims: "I am a special bird

*Published at 210 South Street, Boston, Mass., 75 cents a copy, \$2.50 a year.

—an emissary for science." Newspapers print dramatic stories of the finding of banded birds, and the whole brotherhood of bird banders thrills to each important discovery.

Bands issued by the U. S. Biological Survey are manufactured from tempered aluminum, stamped with a serial number and the inscription "Notify Biological Survey. . . ." This becomes the bird's key number, under which all known facts about it are filed. The bands are made in nine different sizes to fit any bird found in North America.

A new development makes use of colored celluloid bands, which enable one to identify his own birds at a glance without capturing them. This is useful when studying individuals in a limited area. A system has been devised that gives 14,406 possible color combinations.

The Linnaean Society of New York City is responsible for a plan, now in its third year, to determine the natal colony of herring gulls. Early each summer banders go to ten colonies, ranging from the St. Lawrence River to Long Island Sound, and band the juvenile gulls with color schemes that change each year. Twenty-three thousand are now wandering up and down the Atlantic seaboard. The plan has since been adopted on the Pacific Coast. Valuable information is already accumulating about the distribution and habits of these birds.

"How do you catch them?" is the question most often asked. Bird banders have contrived a bewildering array of contraptions, but their main standby is still the "funnel trap" by which seed-eating birds are

(Left) A KINGFISHER banded at the Austin Ornithological Research Station on Cape Cod, which bands more birds a year than any other station. Since 1920, when the U. S. Biological Survey took on the work, over 3,000,000 birds have been banded, mostly by the 2193 registered amateur banders

U. S. Bureau of Biological Survey photos



(Right) BANDING yields information vital to conservation. Each banded bird is an emissary for science, valuable in the study of migration routes, length of life, breeding habits, etc. The mallard shown was rescued from an illegal trap by officers of the U. S. Biological Survey and banded before being released



enticed into a compartment from which they have difficulty in finding their way out. Even more ancient is the screen propped up by a stick to which a long string is tied, often carried into the house and operated from a window.

Bird banding can be far more thrilling than bird hunting, and far more constructive. Follow the writer on a banding adventure in South Carolina. The sky begins to gray in the east as we huddle behind a blind built of pine branches. At the end of our string is a drop trap, four and a half feet square, set on the edge of a golf-course fairway. As the birds come to the bait, up with the dawn and hungry after their night's fast, we hear the *chip . . . chip* from which the chipping sparrow gets its name. They gather under the trap to form a dark mass. A hand moves, groping for the string and gently drawing it to take up the slack; then a strong pull, a thud, and the trap has fallen.

Your quick dash to the trap will be welcome after the cramped position. Its fishnet top bobs up and down as the flock flutters excitedly. A smaller cage is held against a door at the rear and the birds are herded into it. Forty-odd chipping sparrows at one haul!

Under the rays of the morning sun a half-hour is spent banding the birds and recording essential information. When the catch is released a new inquiry into the habits of these small sparrows has been launched. Two birds captured in South Carolina during the winter and spring months were found to have been banded six years before, one nearly nine

years before. This indicates a remarkable age for a chipping sparrow, or for any of our small finches.

Banding is the only method which proves definitely how long birds in the wild can live. The oldest age recorded in the United States is that of an osprey or fish hawk, 21 years. From Germany come records of herring gulls more than 20 years old, one reaching the ripe age of 26. Small birds are not long-lived, but the bander is almost certain to see some of his own birds return faithfully year after year after long journeys.

Special methods must be used to capture insect-eating birds and those that like fruit. Here the most successful trap lures them with a pan of water for drinking and bathing, one of the bright boys of the banding fraternity discovering that a steady drip of water into the pan makes the bath more tempting. It is always a game to see how many you can catch at one haul. Birds will congregate in large groups for the purpose of eating, but in bathing many species are more fastidious and object to crowds.

Start banding in a small way, and there is no telling how far it will carry you. Jack Miner, at Kingsville, Ontario, heard from his first banded bird in 1910, said to be the first completed record of a banding in North America. He now has banded more than 20,000 Canada geese and has become famous. He continues to use his own bands, distinctive in phraseology and in verses of Scripture stamped on them, but his records are all turned over to the Department of the Interior at Ottawa. Jack Miner has helped to solve the puzzle of the migration of ducks



A BAND makes a bird an identifiable personality with a history. The photograph at left shows how the "bracelet" is affixed without injury to a sooty tern at Dry Tortugas, off Florida. Another bird is waiting below.

Never fail to notify the U. S. Biological Survey if you find a banded bird

Hugo H. Schroder photo

(Right) BIOLOGIST F. C. LINCOLN, in charge of the Biological Survey's bird banding activities, bands a mallard. The biographies of over 3,000,000 birds banded in the U. S. are on file with the Survey. New information constantly helps this organization in establishing refuges at strategic points and in studying migratory habits, distribution and abundance

U. S. Bureau of Biological Survey photo



and geese, now known to follow four definite flyways. This knowledge has made possible the establishment of refuges at strategic points along their routes, which alone can preserve these waterfowl from decimation. The bird bander wins ever more acclaim as a conservationist.

Amateurs and scientists work shoulder to shoulder in bird banding. The amateur who bands perhaps two or three hundred birds a year is just as important as the dyed-in-the-wool scientist who spends his time in the laboratory classifying birds by their bone formations. Equally important, too, is Mr. Citizen who reports to the Biological Survey the finding of any banded bird. Humble contributions by "backyard" stations have proved important items in the known knowledge of many species; in fact, bird banding owes much to unpaid banders who operate stations scat-

tered over the whole continent. From reports constantly sent in to the Biological Survey by these cooperators a picture is gradually being put together which sheds new light on the migrations of birds, their distribution and density—knowledge that would be impossible without bird banding.

A permit to band birds must be secured from the Biological Survey and the State in which you wish to operate. The prospective bander obviously must know how to identify birds beyond question and how to handle them without injury. He must also be a mature adult with a definite research program. Because of these requirements, the number remains fairly constant though the caliber constantly increases. Their contribution to bird science is enormous, but any of them will tell you that bird banding is an exciting hobby.

(Right) BEGUN AS A SIMPLE HOBBY, Jack Miner's bird banding at Kingsville, Ontario, has increased until he has banded more than 20,000 Canada geese and become famous. Here geese are shown resting and feeding on an iced-over pond at his sanctuary



*Jack Miner
Migratory Bird
Foundation, Inc.*



(Left) DISCOVERY of a banded bird, whether from one's own station or another is the bird bander's great thrill. Many birds carry their bands several thousand miles yearly, sometimes over unknown courses. Wherever your bird is found, you will be notified

Howard Brain photo

THE CHAIN OF LIFE—*Beneath the mirror-like surface of a country pond live creatures whose delicately interwoven lives are more amazing than anything Alice saw through the looking glass. Here is a biologist's reverie which talks of links between cats and clover and Britisbers and kings*

By ROY L. ABBOTT

*Professor of Biology,
Iowa State Teachers' College*

"THIS is the maiden all forlorn who milked the cow with the crumpled horn that tossed the dog that worried the cat . . ." That vagrant bit of doggerel ran through my mind as, with fish pole in hand and legs hanging over the bank of a little Iowa lake, I idly surveyed my catch of black bass and bullheads. Why are children and adults like myself who have never really grown up, so fond of that jingle? Well, I suspect that it's because we like to have cause and effect follow each other so closely. Everything in it runs with precision and certainty right down to the House That Jack Built.

But, as a scientist, I believe I like it also because it suggests others of Nature's happenings—chains of events and doings all about me, some of which I can see and some of which I cannot.

Piecing the links together

I can see, for example, that the thick head thrust up through the scum yonder belongs to a huge snapping turtle, who is seemingly interested in my string of fish. I could exterminate him with a bullet from my rifle lying close at hand, but I won't for at least two reasons. One is that it would be a pity to kill a creature which Nature has been so long in fashioning—that snapper is many years old, his family many millions of years old. And the other is that knowing something of turtles, I have a sort of fellow feeling and sympathy for him. He is caught in the same biological web of circumstances that I am. He is a link in the chain of existence as I am. He has arrived at his years and huge bulk by simply incorporating into himself every edible thing that came his way. Aside from a more intelligent and aesthetic behavior in arriving at the same end, how do I differ greatly from him? Why, those very fish there on my stringer are to be eaten by me. Didn't I capture them too by the simple expedient of dangling one of their smaller brethren on a hook before them? One of the bass is

already dead. Let me see what it had for dinner. Maybe it too was a link in a chain of life.

A few quick slits with my knife and the creature's menu is before me—five minnows, a crayfish, and—Ho, ho! I have discovered something! A turtle about the size of a quarter. So this is another creature that eats them. I found one yesterday in the stomach of a bullfrog. I am beginning to see why turtles aren't more numerous as adults—creatures which once grown up are so notoriously long-lived and tough.

Pushing my experiment further, I perform a post-mortem on one of the swallowed minnows. I can't see any too clearly, but I can at least make out a few tiny crustaceans as part of its meal, and although I have now no way of following the matter further with my eyes, experience has told me that these crustaceans probably made their meals off the bodies of yet smaller creatures, the infusorians, and that these same infusorians dined off bacteria which used dead animal or plant bodies for their sustenance.

Behold the great chain of life and death! What was at one time a bit of dead organic matter was broken up by the bacteria which were engulfed by the infusorians which were devoured by the crustaceans which were swallowed by the minnows which were captured by the bass which will be eaten by me! The thought catches my fancy. Why here is one of these Houses That Jack Built before my very eyes! The crustaceans and the infusorians and the bass and the rest of the cast are only new actors in an endless series of similar Nature plays. And if tomorrow, by some mischance, I happen to fall into this lake and drown, the bacteria will have a chance to start this particular play all over again.

An unending cycle

I lean back lazily against the trunk of a tree and watch my dog as he casually noses for an elusive flea. There between mammal and insect is another of these chains of life and death right in the making. Suppose my dog catches the flea? A quick crunch and a gulp and that will be the end of the flea—but

not of the story. For that flea probably contains the larval form of a tapeworm which has been waiting, so to speak, for just such a mischance to the flea. Now each larva can develop into a tape worm which will cling to the dog's intestine to shed off eggs, some of which escaping in the excreta and clinging to the dog's hair, will be eaten by another flea to develop into more larva. The flea is a parasite on the dog, and the tapeworm is a parasite upon both dog and flea! Complicated? Yes, but not more so than thousands of other such relationships that are hourly turning unseen and unthought of by most of us, for no animal can live independently of every other animal. Each living creature is apparently only a strand interwoven with many others in the complex web of life. In a state of Nature that web is usually rather stable. Only when man enters the picture and cuts some of these intricate threads do we ordinarily see a disturbance in the harmony of the pattern.

Upsetting the balance

Suddenly in pursuance of that thought there flashes before my inner eye the hosts of passenger pigeons that once swarmed in the eastern United States—yes, even here across the spot where I am lying. Where are they now? All gone! And largely because of man's ignorance—he upset their adjustment to life and they never regained it. Why this very lake once harbored hundreds of wood ducks. I haven't seen a wood duck on it now in the last ten years. Forty years ago as I fished at this spot, there came to my ears from the prairies half a mile away the constant drumming of the cock prairie chicken; so far as I know there is not one within a hundred miles of me now!

But my reverie is soon interrupted by a harsh chattering, and just to my rear, on an open place where some picnickers have been feasting, I see even better illustration of my contention. Here, half a dozen English sparrows are quarreling over the leavings. Had my grandfather been at this spot in his youth he could not have seen these birds; they were not in this country then, for the ancestors of these little pariahs at that time were respected and prized birds in Europe. Man upset the balance of relationship by introducing them into America where, lacking certain conditions of restraint they had in Europe, they fairly overran us in 50 years. But recently there has come another break in the complex life series of which they are a part. The English sparrow is declining in numbers. Man has again broken a thread of the web. Consider the sparrow and the automobile for example. Not many years ago William Beebe, that keen observer of animals, happened to notice a group of English sparrows looking rather wistfully, he

thought, at a blob of waste oil on a city pavement. This "bit of denatured provender," as he had termed it, gave Beebe a keen bit of hindsight.

"If I had foreseen several years ago," he remarked, "the great decline in numbers of the English sparrow, I would have invested heavily in automobile stock."

And so would we all! For Beebe was here only shrewdly saying that the great swarms of sparrows which cumbered our cities a few years back depended for food largely upon the droppings of the grain-fed horses once so numerous for livery and dray purposes. The major supply of food of the sparrow vanished with the horses; crank-case droppings are no substitute for grain. Now that the sparrow is checked, we can see how he might have been avoided at first.

The trouble is that we cannot anticipate what will happen when we make a radical shift in the position of one of Nature's pawns. Who could have foreseen for example that our luscious blackberry, a plant prized throughout most of the world, would have become a pestiferous weed when transplanted to New Zealand, or that its spread would have been so greatly aided by that immigrant bird, the starling, which is fond of blackberries and through whose intestine the seeds pass unharmed? The mongoose is a great rat-killer, but those who introduced it into the West Indies for this purpose would surely have hesitated had they known that this fierce creature would soon become a dreadful pest, out-ratting even the rat both in numbers and ferocity. Would the patriotic Scot ever have carried the thistle, his native emblem, into California had he dreamed of bringing what was to become a vile weed to his fellow farmers? We can only reply that these are unforeseen relationships, as unforeseen in fact as was the case of the ox-peckers in Africa. These birds were accustomed to picking insect pests from the thick, insensitive hides of the rhinos; but they themselves became pests when they transferred their attentions to the thin-skinned domestic cattle that were introduced. A similar case is that of the Kea, a huge and harmless mountain parrot in its native wilds of New Zealand; it became a sheep killer upon the introduction of sheep into that country.

Recognized by the ancients

The astonishing thing about many of these inter-relationships among animals has been our slowness in recognizing them. Indeed, we have often refused to believe them when pointed out to us. Centuries ago, for example, Herodotus told us of the little bird that had the curious habit of entering the mouths of crocodiles and picking the blood-sucking leeches from the gums of these fierce creatures, but until re-

cently this tale was laughed at as fiction. From their carvings upon rocks, we now know that even the cave men 25,000 years ago knew of the somewhat similar habits of the tick-birds who then as now made meals of the ticks infesting the hides of the rhinos and antelopes. We read in *I. Samuel* that when a deadly plague slew great numbers of the Philistines, the priests and diviners prescribed a trespass offering of five golden mice. This relation between their plague and the "mice that mar the land" seems more than casual, as well it may have been from our present knowledge of the connection between rats and bubonic plague, though it took 3000 years for science to verify the verdict of these ancient diviners.

A hidden link

As a boy, fond of fishing, I frequently saw fragments of these Houses That Jack Built without having sufficient gumption to piece them together. For example, I often used grasshoppers for bait and several times I observed a long whitish, threadlike worm left dangling from my hook when the nibbling sunfishes had dragged off most of the "hopper." I know now that this worm was Gordius, the so-called horsehair worm or "snake" popularly believed even today to arise from horsehairs which fall into water. Biologists slowly piecing the facts together have discovered that this creature lives part of its life in grasshoppers or beetles. If one of these insects bearing the parasite falls into the water and drowns, the worm crawls out into the water and lays eggs. The eggs hatch into minute spiny-headed creatures which now must find some sort of water-insect, usually a May fly, into which they must enter before they can continue their growth. But scientists have never yet found out how these larva get from the May Flies to the grasshoppers where they again grow into horsehair worms. That link is still hidden.

I was equally dull also in learning the relationship existing between pearl buttons and fishes. I have used countless clams for bait, and am familiar with their larvae. Many times, too, I have caught fish (suckers) with their gills well covered with those peculiar swellings called "blackheads." But that these "blackheads" in the fishes' gills had any connection with clams never entered my mind. Perhaps it never entered anybody's mind until the rapid disappearance of the clam from the Mississippi and its tributaries brought button manufacturers face to face with the grim necessity of finding more clams. Then the biologist got busy, and soon found that young clams couldn't be raised apart from fishes. And this simply because one stage of the young clam must be passed as a parasite upon the gills or fins of fishes. No fishes—no clams.

No clams—no pearl buttons. But who would have suspected such a chain?

Many a golfer has cursed the wormcastings upon a golfing green without once dreaming of any closer relationship between himself and the creatures that made them than their ability to produce a deflection of his golf ball. I, too, once looked upon these castings as just so much nuisance-material upon my lawn, and upon the makers of these as good fish-bait and robin-fare. It took a Darwin to show me that these creatures are far closer to me than mere intermediaries between myself and the fishes. I now see that the very surface of the land is yearly changed by them; they link man closer to the soil.

From cats to clover

Indeed it was Darwin, as I see it, who first really popularized this idea of "chains" in animal and plant life. What student of biology isn't familiar with his now classical House That Jack Built, the relationship between cats and clover? The corollas of red clover flowers are too deep to be visited for nectar by the ordinary hive bees. But bumblebees, Darwin saw, have tongues sufficiently long to reach the nectar, hence red clover is visited and pollinated entirely by these insects. Now bumblebees, nesting as they do upon the ground, are badly bothered by field mice which are fond of the larval bees. Cats destroy field mice, therefore, cats and clover are opposite ends of the chain. One wag has added a whimsical addition to this chain by observing that since spinsters are the chief keepers of cats and that clover-fed beef is the staple food of Britain, spinsters are thus the backbone of the British Empire.

Flaws have been found in some of Darwin's deductions but there is no flaw in his general theme of the close interrelationship of animals; and following his basic idea, men have discovered hundreds of hitherto unknown and unsuspected connections in Nature's great web of life.

Manson suggested that malaria probably had an intermediate stage in the stomach of some suctorial insect, and following this clue Ross showed two or three years later that mosquitoes were the connecting link between man and this terrible killer. Other species of this same crew were soon shown to be intermediaries between yellow fever and man, and elephantiasis and man. Tsetse flies are now well known as disseminators of sleeping sickness, and the dreaded typhus no longer masquerades secretly in the bodies of human lice and rat-fleas.

Less sinister but none the less interesting and important are the facts that although termites eat wood they cannot get any nourishment from it without harboring certain protozoa in their intestines to per-

Continued on page 177

WHEN THE EARTH

Curious tubes of sand, once attributed to "underground fire," are known to be caused when lightning strikes the earth, an effect that can be simulated by high voltage wires



By H. E. VOKES

*Assistant Curator of Invertebrate Paleontology,
The American Museum*

ON OR ABOUT December 9, 1938, a power line carrying a current of 16,500 volts* was shot down in a dune area north of Point Happy, near Indio, California. The safety switch did not "cut out" and the broken wire was on the ground for a number of hours, during which the current passed into the sand of the valley floor. The heat generated at this time melted the sand grains. These cooled too rapidly to permit the recrystallization of the minerals, the mass hardening as a spongy glass. This condition occurred all along the path followed by the current and resulted in the long, many-branched forms illustrated. These were collected and presented to the Museum by Mr. William Pester, of Indio, California.

A discharge of lightning striking the earth often forms somewhat similar structures. These are known as fulgurites, from the Latin "fulgar"—lightning. In general, the greater force of the lightning discharge results in the formation of a distinct tube surrounded by a fused zone similar to that on the "artificial fulgurites" formed

*Facts through courtesy of Nevada-California Electric Corporation and R. H. Halpenny.

by the electrical power line. This tube is formed primarily by a purely mechanical thrusting aside of the material in the path of the discharge. In loose material the tube will generally be of relatively large size with thin walls; in more compact material the bore of the tube tends to be smaller and the walls thicker and more irregular.

Fulgurites vary greatly in size and in length. Perhaps the largest one known was found near Drigg in Cumberland, England, and was reported in the Transactions of the Geological Society of London in 1814. Three tubes were found within an area of fifteen square yards. One, with a maximum diameter of two and one-half inches, was traced to a depth of 30 feet, where it was broken and lost. At this point it had a diameter of one-half inch. A few years later the lower part of the tube was re-discovered and traced 10 feet farther to a bed of wet sand. A feature of this and most other fulgurites is the contorted and branching nature of the tube, particularly in its lower portion. The electrical power of the discharge seems to glance off any pebbles or other obstructions, even avoiding at times roots and similar combustible materials.

The present "artificial fulgurites" differ from the true lightning tubes primarily in the absence of any definite tube. The material is spongy in tex-

ture but there is no evidence of sufficient force in the discharge to permit a mechanical thrusting aside of the sand. Furthermore, the line switch failure permitted the current to flow into the ground for a much longer period than the almost instantaneous discharge of the lightning flash, so that the heat so developed fused a greater amount of sand than is the case with lightning, even though the latter carries a heavier voltage. As a result, the maximum diameter of the specimens, three and one-quarter inches, is larger than any reported for true fulgurites.

It has been suggested that the ancients must have recognized the rôle of lightning in developing fulgurites. Cicero uses the expression "*condere fulmina*" ("to dig up thunder bolts"), and the class of soothsayers known as "*fulgiatores*" carried out ceremonies on the spot where lightning struck. However, as in many other fields of knowledge this information appears to have been lost during the Dark Ages, and the earliest known discussion of these tubes, published in Brieg in 1711 by "Leonh. David Hermann, Pfarrer zu Massel," suggests a far different origin: "The vitreous tubes are similar to melted glass or molten iron.



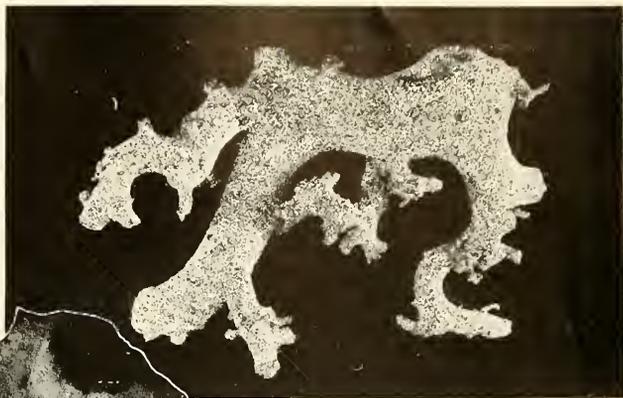
"SAND TUBE" (side and end views)
Lightning fused the sand in a hollow tube, thrusting aside material in the path of the discharge. One so-called fulgurite was traced to a depth of 40 feet

IS ELECTROCUTED

They grow in yellow sand upwards out of the depths of the earth . . . [the formation] is not often found on the surface, but only if one goes several ells deep into the earth. In May or June it is forced by nature to bore up into the surface, and strike through the sand, and its end hereupon either breaks off of itself or is struck off by the passing over it of men, animals, or wagons, and some beautiful pieces are found. . . Without doubt this growth is the fruit of a subterranean fire whereby are generated not only these tubes of melted and flowing sand, but by which also the two brooks at Massel and Ellgut, between which the tubes are found, become warmed in winter."

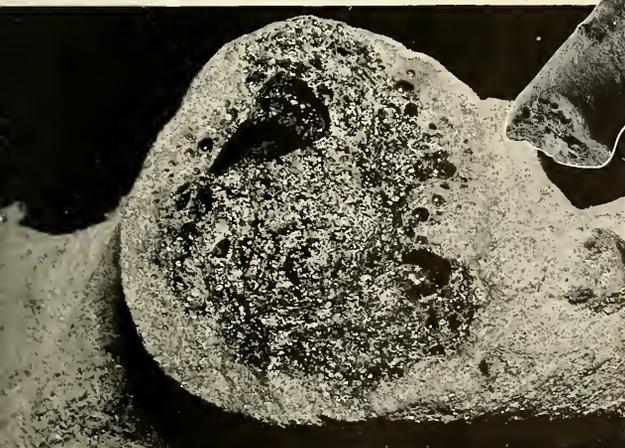
In 1786 Saussure described granite from the Alps which had been fused by the action of lightning, and thus was the first to recognize lightning as a geological agent. He seems to have been somewhat uncertain as to the accuracy of his conclusions and in true scientific fashion performed an experiment to test them. He passed a spark from a battery of Leyden jars through a piece of "hornstone" and found that the current formed vitreous bubbles similar to those he had found in the granite on Mount Blanc.

Subsequent observations and experiments have served to confirm Saussure's conclusions and there is now no vestige of doubt but that the fulgurites are formed by the electrical discharge of lightning.



"ARTIFICIAL" fulgurites, caused by high voltage current. These resemble the "lightning tubes" but are not hollow. The discharge melts the sand, which hardens into a spongy glass, much branched according to the path of the current. These specimens were contributed by William Pester, Indio, California

AMNH Photos
by Coles



FULGURITES caused by lightning were once thought to "grow" in the sand, but in 1786 the scientist Saussure deduced the electric origin and furnished proof by means of a Leyden jar.

The thickness of the artificial lightning tubes on this page, three and a quarter inches, exceeds that of any known true one, probably because the grounded high voltage wire, unlike lightning, continued to discharge its current for some time

The Nightshade Family

By HENRICKS HODGE

Medieval magic thrived on the poisons and potions derived from a family of plants which today serves man with a staggering range of products from tobacco to tomatoes

MAGIC, belladonna, French fried potatoes, penunias, long black cigars, red peppers, narcotics, love-apples—all these have a single common denominator, one Latin word grouping a great botanical potpourri, the nightshade family, or Solanaceae. Here is an assemblage of plants with as many uses as it has members, and which, in the realm of economic plant families, is an aggregation of opposites. Useful in balancing the dietary problems of a people, it also possesses poisons enough to cause their demise.

In Europe the history of the nightshade family in relation to man all started with a few Eurasian representatives in the days before baked potatoes, stuffed peppers, and sliced tomatoes had courted the salivary glands of continental epicures, and when the fragrance of tobacco was yet unknown to civilized nostrils. In those days members of the nightshade family were not so matter-of-fact; they were imbued with a Mephistophelian atmosphere. For example, look at the genus *Mandragora*, one of the plant props for the famous old Doctrine of Signatures.

This dark body of logic was based on the belief that God had labeled certain plants for man's use, in particular for the curing of certain diseases. That man might know which herbs these were, the Lord had placed his signature in the form of distinguishing marks purporting to show the use for which each species was intended. Thus, plants with leaves shaped like the human liver were specific for hepatic troubles; the red-stained roots of the bloodroot were a sure sign that God had intended them for stopping excess flow of blood. Just as in certain backward areas in present-day China where gingseng roots shaped like the entire

The Dr. JEKYLL and



Black Star Photos

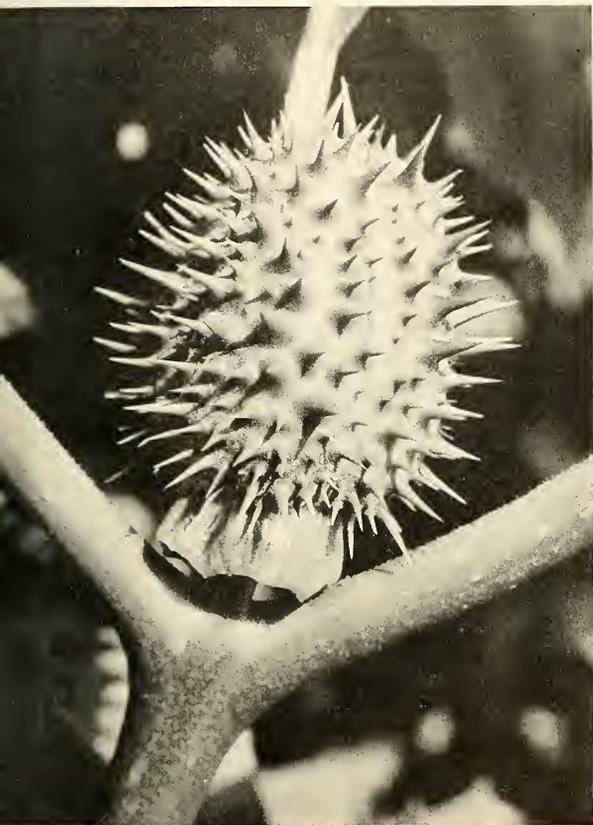
REPRESENTING the virtues of the nightshade family: the sprouting eye of an Irish potato, which though Inca and not Irish, is the world's greatest food crop

human body command large prices as a cure for all the diseases that flesh is heir to, even so in the Dark Ages the mandrake, whose roots possess a similar over-all likeness, was also supposed to be a complete panacea. But its use was beclouded with all sorts of magic.

Amusing to us now are the old directions for obtaining the mandrake, as set down in the last chapter of the *Herbarium* of Apuleius:

"This wort is great and illustrious of aspect, and is beneficial. Thou shalt in this manner take it. When thou comest to it, then thou shalt recognize it by this,

Mr. HYDE of the PLANT WORLD



MANIA, convulsions and death can be caused by the *Thorn Apple*, belonging to the devilish genus *Datura* which has earned an evil name for the nightshades

that it shineth at night altogether like a lamp. When first thou seest its head, then inscribe thou it instantly with iron, lest it flee from thee; its virtue is so great and so famous that it will immediately flee from an unclean man when he cometh to it, hence, as we said before, do thou inscribe it with iron; and thou shalt delve about it so that thou toucheth not with the iron but thou shalt earnestly with an ivory staff delve the earth. And when thou seest its hands and its feet, then tie thou it up. Then take the other end and tie it to a dog's neck, so that the hound be hungry; next cast meat before him so that he may not reach it, except

he jerk up the wort with him. Of this wort it is said that it hath so great might, that whatsoever thing diggeth it up shall soon in the same manner be deceived [i.e., shall fall down dead]. Therefore, as soon as thou see that it be jerked up, and have possession of it, take it immediately in hand, and twist it and wring the juice out of its leaves into a glass ampulla [or pitcher] and when need come upon thee that thou shouldst therewith help any man, then help thou him."

Whatever does not seem clear in the text of these old writings is usually shown unmistakably in the accompanying illustrations. From them we see that the mandrake possesses a frequently bifurcated, carrot-like tap root, suggesting to some the figure of a man, to others that of a woman. Like certain other members of its family, the mandrake has a volatile substance in its root whose odor, liberated when the plant is freshly pulled, may have once affected the senses as a narcotic, thus giving rise to the fable that to dig it up would prove fatal. As is so frequently shown in medieval pictures, the innocent victim in the drama of its uprooting was the dog—who appears to be the "guinea pig" for many ancient experiments.

Another story has it that the plant, pictured of course as semi-human in form, uttered shrieks when torn from the sod; and many an artist-herbalist depicted his bystanders holding their ears during the ceremonial, fearing the madness or death that such sounds were sure to bring on.

To show how comparatively recently these beliefs were respected, we have only to consult Shakespeare, who introduced into his dramas many a reference to the mandrake. Juliet responds to the holy Friar from whom she has received a potion:

"Alack, alack! is it not like that I,
So early waking, what with loathsome smells,
And shrieks like mandrakes torn out of the earth,
That living mortals, hearing them, run mad—
O, if I wake, shall I not be distraught,
Environed with all these hideous fears?"

A plant so magically endowed must surely have been credited with remarkable medicinal properties, and by reading old manuscripts we learn that it was not only the original headache powder (merely smear the forehead with its juice), and a fertility restorative for barren woman, but that as an aphrodisiac it would work unbelievable wonders! In addition, Philip De Lignamine (1480) even gives evidence of its early use as a surgical anesthetic when he writes: "If anyone has to have a limb amputated, or burnt, or cut, let him drink an ounce and a half in wine, and he will sleep so long that the limb may be cut off without pain or feeling."

Today plant narcotics are drably classed by the chemist as alkaloids. Members of the nightshade family possess more than their share of these useful but often dangerous ingredients which furnished the foundation stones for primitive magic. We have seen that mandrake possesses such a latent substance in its root. Compared however, to those found in related genera, this alkaloidal principle is impotent.

In old Greek mythology Atropos was one of the three Fates. Her task was to sever the thread of Life.



"CURE-ALL." Because its roots often approximate human form, the mandrake was widely believed to be a God-given panacea

(From the herbal of Apuleius)



THE DOG was a necessary agent in uprooting the mandrake: it was thought fatal for a human to do it
(Brit. Mus. Latin Manuscript of Apuleius, 12th century)

The life-cutting power that lies hidden in the foliage of another small European genus of this important family is reflected in its scientific name *Atropa*—the true deadly nightshade—cultivated on the Continent as a source of the alkaloids atropine and belladonna—toxic in any ordinary amounts. These principles used in minute medicinal quantities can either speed up the heart beat or cause paralysis of various nerves. Most common examples of the latter use is in optometry where belladonna, introduced into the eye, paralyzes the nerves controlling the iris and causes dilation of the pupil, thus helping the eye specialist in his diagnosis. Many a continental belle has found this starry-eyed reaction an asset in her boudoir preparations, hence the common and specific name, belladonna (beautiful lady).

A European companion to *Atropa belladonna* is *Hyoscyamus niger*, the black henbane, famous poison of classic literature, found as a local introduction in America principally along the southern banks of the St. Lawrence River. From the slimy fetid leaves of this herb is obtained an alkaloid, hyoscamine, similar to atropine in that it is a powerful depressant of the brain, often causing death by paralyzing the respiratory center.

Thus far we have been introduced to strictly European members of the nightshade family. One of the cosmopolitan genera bridges the oceans to link the two hemispheres. This is the devilish genus *Datura*.

A wolf in sheep's clothing

An annual or perennial herb, shrub, or in certain South American species even a tree, *Datura* is known and grown either for its dangerous seeds or in the conservatory for its large, white, innocent-looking, trumpet-belled flowers. On dumps or waste places our locally introduced *Datura stramonium* frequently flaunts its showy flowers, which are a source of delight to children, who often associate them with harmless petunias, pluck them and put them to their mouths as Angels' Trumpets, little realizing the "fire" with which they are playing. Fire it is, for *Datura* possesses the alkaloid daturine, identical in effect to that found in *Atropa* (a fact made use of during the World War when the United States was cut off from its normal source of atropine). Although this deadly ingredient is well distributed throughout the vegetative portions of the plant, it occurs in chief concentration in the seed, a fact long known to mankind, for wherever one delves into the magic and medicine of different parts of the world one is almost sure to find the local *Datura* species furnishing seed for evil purposes of one kind or another. Certainly

this genus of plants can be called "a wolf in sheep's clothing."

According to Safford*, the earliest account of a plant of this genus was an 11th century description by the Arab, Avicenna, relating the use of the seeds of the species known today as *Datura metel*. Ground up and introduced in minute quantities into wine, such seeds were in vogue as a source of love potions with Hindu inamoratos. Rajput women used to smear their breasts with the juice so as to poison their new-born female children. And natives in upper India, thoroughly familiar with its narcotic effect, introduced it into their liquors to increase their intoxicating power. Even today criminals in the Far East use the drug to stupefy their victims. (Ten drops of an essence made by distilling the seeds in water is guaranteed to cause a two-day period of stupefaction.) However, if they should feel the need to go the limit, the metel seed infusion is capable of "taking their victims for a ride" in an original Hindustani fashion.

The Americas are not without their narcotic *Daturas*, for long before these great western continents were open to colonization, the aborigines from the Peruvian Andes to the coastal plain of what is now Virginia, had their own purposes for the narcotic in this genus. The Quichuas of Peru used *Datura* seeds in their corn beer to make it more intoxicating, and their priests, like the celebrated oracles of Delphi, partook of them to produce delirium and frenzy, the better to exorcise evil spirits. Also the sacred green snakeweed seeds of the Aztec priests have been shown to be nothing more than the seeds of *Datura meteloides*.

Poison worshipped

According to old texts, these seeds were regarded with a reverence tantamount to worship. The Aztecs apparently burned candles before them and made sacrificial offerings to them on the altars of their oratories. It is recorded that the seeds were both intoxicating and maddening and that in addition to being served in potions to enemies, who consequently had "visions of terrible things," they were eaten by medicine men who immediately became clairvoyant and were able to answer all questions concerning the cure of any ailment and the location of lost or stolen articles.

Veneration of the *Datura* has persisted to this day amongst the Indians of our Southwest. Among the tribes holding it sacred are the Zunis of New Mexico, and the Yokuts and Mariposas of California.

Most familiar because often cultivated is our own *Datura stramonium*, whose seeds have long been

known to cause temporary "insanity." A well-known anecdote from Robert Beverly's *History and Present State of Virginia* best illustrates the origin of the common name, Jamestown weed. This story concerns soldiers sent to put down Bacon's Rebellion, who by mistake gathered young plants of this species to cook as potherbs. After they had eaten the concoction, they appeared to have become intoxicated for several days. According to Beverly, when one soldier blew a feather in the air, another began to "dart straws at it with much Fury and another, stark naked, was sitting up



THE MANDRAKE was supposed to shriek when torn from the sod, causing madness or death among bystanders

(An imaginative drawing of the mandrake conceived by a 13th century English artist)

*William E. Safford, *Daturas of the Old World and New*; Annual Report of the Smithsonian Institution, 1920.

A FAMOUS POISON of classic literature: Henbane. This is a European member of the nightshade family which has been introduced to America and is locally common in the northern states, Canada, and the Northwest. All parts of this plant are poisonous but its unpleasant taste usually prevents animals from eating it. Children have been poisoned by eating the seeds or seed-pods. The poisonous alkaloids it contains can cause death by paralyzing the respiratory center. The weed grows in dry or sandy soil



Black Star Photos

IT REMAINED for medical science to develop the benevolent Dr. Jekyll in this member of the nightshade family, *Belladonna* (above and right). A veritable Mr. Hyde in its native state, its berries tempt the wayfarer only to poison him. Yet properly administered, the ingredient belladonna is invaluable to the eye specialist in his diagnosis. Its power to dilate the pupil has also led to its use in boudoir preparations, hence the name, *belladonna* ("beautiful lady"). The action of the drug belladonna has been known for a long time. Introduced from Eurasia, the plant has been naturalized occasionally in waste places in the eastern states. Above is shown the berry, at right the flower



on the corner like a Monkey grinning and making Mows; a fourth would fondly kiss and paw his Companions and sneer in their Faces, with a Countenance more antick than any in a Dutch Droll." Although all their pranks appeared to be without ill intent, the soldiers were locked up to safeguard against their injuring themselves in their utter befuddlement—a state from which they did not recover for eleven days and of which they remembered absolutely nothing.

In the same history, Beverly describes the initiation into manhood (Huskanawing ceremony) of the eastern Algonquin Indians, which consisted essentially in carrying the more promising young men into the woods, keeping them from all society and in confinement for several months, and dosing them on *Datura*. Under such treatment: "They become stark staring mad, in which raving condition they are kept eighteen or twenty days. During this extremity they are shut up night and day in a strong enclosure made for the purpose. It is pretended that these poor creatures drink so much of the waters of the Lethe, that they perfectly lose the remembrance of all former things, even of their parents, their treasures, their language. This is probably partly assumed, for if they do remember anything of their past life they must be huskanawed again and the second time is so severe that seldom anyone escapes with life."

Valuable members

Of the many species of the nightshade family native to America, four claim especial attention as beneficial or useful ones, namely, white potato, red pepper, tomato, and tobacco. Closest to the narcotic genera already discussed is tobacco (*Nicotiana tabacum*), with the much argued alkaloid nicotine (two drops of which will kill a dog) occurring throughout the leafy portions of the plant. Had America's early explorers landed simultaneously at all the important centers of aboriginal culture they would have found at least one habit in common, the use of tobacco. That tobacco was known from the Straits of Magellan to the Straits of Belle Isle indicates the antiquity of its use, for the living tobacco plant is subtropical in its origin.

Although boasting narcotic and even deadly members, the nightshade family can claim its share of benefactions to mankind, in the form of baked potatoes, sliced tomatoes, stuffed peppers, or even a bed of *Cestrum*, *Salpiglossis*, or *Petunias* to cheer a gardener's heart. No bad actors these, yet with so many "black sheep" in the family it is little wonder that people were backward in accepting as actually edible our irreplaceable garden tomato (*Lycopersicum escu-*

lentum). As near to us as are our grandparents are the days when the tomato, "deadly poisonous," was grown in our country for the beauty of its large fruits, the so-called Love Apples (*Pommes d'Amours*) of Peru, their ancestral home. How times have changed! Today tomato juice is supposed to be almost on a par with bread, and the wonder is how, up to the debut of this elixir, the human body was ever able to exist without it!

Peppers

The early explorers in tropical America also recognized the usefulness of the peppery members of the genus *Capsicum*. Search for a new route to the Spice islands of the East Indies was the original driving force behind their explorations, and although these efforts were unsuccessful they did discover capsicum or red pepper, perhaps America's most important contribution in the spice line (though not to be confused with black pepper, a native of Malaysia and the East Indies and a member of the *Piperaceae*).

The dry, many-seeded berries or chilies produced by this genus had been cultivated in America long before the time of the Toltecs and were later one of the prime vegetable dishes of the Aztecs, and in ancient Peru these peppers were even regarded as vegetables of the royalty. Their discovery by the Spaniards was followed by such a rapid and successful human dispersal throughout the world's tropics that by 1600 they could be found thoroughly naturalized as far away as the Eastern Tropics. Even today the greater proportion of our commercial condiment comes from European countries, far removed from its original tropical American home.

It is a peculiar thing that most hot spices grow in the tropics; it almost seems as though the heat of a torrid sun had entered the tissues of such plants. *Capsicum* is no exception, the pungent principle, capsicutin, being so intense that but one part in 11,000,000 of water is sufficient to impart the peppery taste!

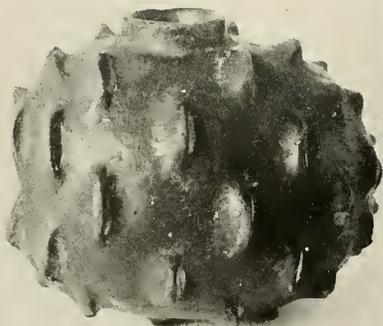
Pepper species are few but variable, the commonest being known as bell peppers, chilies, paprikas, pimientos, and tabascos. They run also a gamut of usefulness: mildest are our oft-grown, puffy bell peppers—eaten as garden vegetables on account of their sweetness, after the more pungent seeds have been removed. Likewise mild are the large, European-grown paprikas which come to our dinner tables as the stuffing in olives, as a powdered garnishing, or as the chief flavoring element of goulash (Hungarian paprika). The most pungent of the lot, owing to their abundant capsicutin, are the narrow-fruited chilies, which seldom attain the favor in northern countries that is reserved for them in tropical lands. Considered in many



(Above) JOHN GERARDE, a well-known botanist of his day, proudly holding a flowering branch of the Irish potato, newly imported from the New World
(From a later edition of his herbal)

(Below) ANCIENT INCA funeral vase in the form of a potato (From Harvard University's Peabody Museum)

(Lower right) OLDEST EUROPEAN drawing of potato plant (1588)



regions the most important spice, chilies make their hotness felt in a diversity of ways—in curries, tamales, and chili con carne; as medicinal capsicum; or as ordinary red or Cayenne pepper.

The white potato (*Solanum tuberosum*) has had little suspicion chalked up against it. Any question concerning it has usually been focused upon its place of origin, and indeed so complicated was its introduction into Europe that for a long time botanists were not quite sure of its original American distribution. Unfortunately, plants belonging to three widely divergent families have long been called "potato." The "potato" of the Algonquin Indians, *Openauk* (*Apios tuberosa*) is a member of the bean family (Leguminosae); the original "potato" (*Ipomoea batatas*), our sweet potato, is a member of the morning glory family (Convolvulaceae); and what we now call potato, the Irish or white potato (*Solanum tuberosum*), claims a place amongst the nightshade assemblage (Solanaceae).

In the early 16th century the elusive "Irish" potato, despite long cultivation as a basic food plant, was still hidden along the Andes in the regions lying between southern Chile and northern Ecuador. Though



greater civilizations were to bow before it, the white potato had already achieved kingly stature, and could boast a long reign of cultivation in ancient Incan civilizations. From prehistoric tombs has been unearthed many an excellent variety preserved either in "mummified" form or in the terracotta of *huacas* (ancient Incan funeral vases). The white potato was certainly a great staple food of the high plains of Peru and Chile. That it remained local for such a long period

(Below) The first published sketch of the potato, which appeared in Gerarde's herbal (1597) under the misleading name *Batata virginiana*. Being unadaptable to tropical lowlands, the so-called Irish potato traveled a long road from South America to North America, via Spain, Austria, England and Ireland



in northwestern South America was not so much due to its lack of demand in other parts of the two Americas as to the fact that the parts by which the plant was propagated (tubers) would not grow in the lowland tropics and could not withstand long transportation through such regions.

About 1588, after much effort, Charles L'Ecluse, keeper of the botanical garden at Vienna, first received a few tubers of these *Solanums*, and through the facilities of his garden the plant was made known to Europe. A few years later John Gerarde, a well-known botanist of that day, introduced into his herbal an illustration of the true *Solanum tuberosum* but under the misleading name *Batata virginiana*, which is derived from the colloquial name for sweet potato. There arose several myths. One states that Sir Walter Raleigh introduced the potato into Ireland; another that Francis Drake, returning from Virginia in 1586, brought it to Europe.

Both tales have been proved false, and it is now known that no true potatoes were cultivated in the colonies in the time of these Englishmen. True potatoes reached Ireland by way of Europe and L'Ecluse sometime before 1650. "Irish" potatoes are not Irish at all but Chilean, and first saw colonial America in 1719, when Irish immigrants settled in Londonderry, New Hampshire. Potatoes first saw the Caribbean when seed was brought to the West Indies from England about 1700. What a time and what a roundabout route the white potato (at present the world's greatest food crop, even surpassing wheat) has taken to get from South America to North America—from South America by the conquistadores to Spain, from Spain to Austria, from Austria to England and to Ireland, and finally to New England and the West Indies. So near and yet so far!

Such a phrase might even summarize the great family to which *Solanum* belongs and to which it has given its name, the *Solanaceae*. Close to us, as near as our stomachs, will always be the food-giving nightshades—potatoes, tomatoes, egg plants, and peppers; and perhaps for our moods, tobacco. To the magic of a bygone day let us relegate the evil narcotics of the dread trio, *Atropa*, *Datura*, and *Hyoscyamus*!

THE LOST JICAQUES—*The story of an ancient Indian tribe deep in the Honduran rain forest, into whose palisaded settlement even the neighboring natives had not previously been allowed to enter*

By V. WOLFGANG VON HAGEN

*Museum of the American Indian
Honduras Expedition*

IT was while searching for the Quetzal bird in Honduras that I came upon the Jicaque Indians. I had heard from a collector who had lived in Honduras that somewhere in the interior there were a group of primitive Jicaque Indians, but he had only the rumor of them. Dr. William Duncan Strong in New York had urged me to watch out for them. So far as the literature was concerned the Jicaques were a lamentable gap in our knowledge of the Central American Indian, doubly lamentable in that we had little knowledge of them even historically.

I had found a small dwelling of a Spanish family living in Honduras on the extreme borders of the junction of the Departments of Yoro, Olancho and Tegucigalpa, and soliciting for a guide to bring me to the rain forests of the region, I acquired as companion an elderly Spanish inhabitant named Lopez. We mounted and passed through the pine-and-oak regions (of which the greater part of Honduras' 46,000 square miles consists), and made for the rain forest which begins above the 5000-foot level.

First sight

Wearied by a long climb we had tethered the beasts and were sitting quietly resting when Lopez pressed my arm, and my eyes followed his pointing finger. Some yards distant, walking with his head inclined upward, looking for something in the trees, was one of the most primitive people I had ever seen in Central America. He was short in stature, not much over five feet; his black hair was cropped in a long uncombed bob, carelessly matted, looking more like the headdress of a Russian Cossack than hair. His sole garment was a piece of bark cloth, made into a sort of poncho which slipped over his head and was tied about his middle with another piece of bark cloth. Through his crude "belt" was a machete. In his hand he carried a long blow-gun. Slung over the shoulder was a sack of animal fur. As we silently watched him, he reached into the bag, put something into his mouth, placed the blow-gun to his lips and shot into the trees. Then as he lowered his blow-gun he became aware of our tethered horses, then

of ourselves. In a flash he was off into the forest.

Lopez called after him, "*Campadre! Campadre! un momento!*" But the Indian never stopped.

"You know him?" I inquired.

"*Si, Senor*, I know him. He is an Indo Jicaque, but they are all *muy cimmaron*, all very wild. They live in a place called *Montana de la Flor* and scarcely ever come down. They live behind a palisade, and when you go there they will have little to do with you. Sometimes I can make trades with them, a machete for some corn, cloth for some tobacco, but never have I been behind that stockade, and I never knew anyone who ever has."

The plan is laid

It was here that I made a bargain with Lopez. As soon as I finished my present work, I told him, I would like to come to the *Montana de la Flor*, put up my camp and try to make friends with the Jicaques. To this request Lopez assented and said he knew just the place for the camp. We set the date, the 15th of November.

Considerably stirred by this discovery, I returned to our camp (some five days' riding) to prepare for this trip and to conclude our work on the Quetzal birds.

As arranged, we arrived on the 15th of November at the *Montana de la Flor*. We selected an idyllic place for a camp, a flat area a few yards from the cold, rushing water of the Guarabueque River, the source of the greater *Rio Patuca*, which flows into the Caribbean. Our camp nestled among the pines and oaks, yet the higher mountains all about us were covered with the thick green vegetation, the *cejas de la montana*, the eyebrows of the forests.

Lopez, true to his promise had cleared a place and assembled his family of six sons to help us erect our camp. To safeguard against torrential rains, they built a structure 30 feet long and 10 wide, and placed our tent at one end, the kitchen at the other. The center was left open for a workshop and tables. It was my plan to have the Indians thatch the roof and by this means make contact with them.

Accordingly I left my wife, Christine, in camp to arrange matters there, and set off with Lopez to the village of the Jicaques. We were only a half hour's walk from the beginning of their domain, near

enough to arouse their curiosity, far enough away to avoid their resentment of our presence. As Lopez predicted the village, so we found it.

Stockade

On top of the highest hill in *Montana de la Flor*, at the summit of the pine-oak region at 4500 feet, was a long palisade consisting of oak posts six feet high, driven into the soil and enclosing a considerable tract of land. Behind the palisade were the dwellings of the Jicaques (pronounced *Hee-ka-kays*). The houses were squarely built, mainly constructed, as I later learned, of split *Heliocarpus*, a light bombacaceous wood. The roof was thatched with leaves of the *Suyate* palms, peculiar to the pine-oak regions. There was not a soul in sight. Lopez called again and again, finally after an hour's waiting an old Indian appeared, dressed like the Jicaque we had previously seen, save that he was wearing a tattered jacket. (This, Lopez

poncho, although their own were of cloth. All were short of stature, none over five feet three inches. Their skins were lighter than other Indians I had seen: the features, dominated by a hooked nose, almost resembled the Caucasian in color. The eyes were dark brown and dull, lacking the flashing intelligence that I had seen, for example, in the Jivaros of the Upper Amazon. The unruly matted hair lay like a ruffled doormat across their heads and was cropped in a short bob.

Shy and suspicious, they would not advance to the gate and take from me some small presents that I had brought. The Elder of the tribe, Beltran by name, kept up a steady stream of conversation with Lopez in gerundive jargon, a conversation marked with the peculiarities of present-tense personal "pidgin" English.

After an hour or so of this type of repartee, in which I played my part by reciting some Jicaques words and phrases that I had picked up among the Hispanized Indians of Yoro, the Indians began to grin and then melt good-naturedly in jests among themselves. Again we proffered the gifts, and the elderly chieftain came shyly to the stockade, where he received the gifts in an open leaf, but he did not touch them with his bare hand.

Fear of contagion

To satisfy my impatient look, Lopez said: "They are afraid of *catarro*, the common cold. That is why they will not touch what you offer them. See him going into his house? He will place those things about the smoke of the fire. After two days he will believe that he has smoked away the disease."

"But I have no *catarro*."

"That does not matter," said Lopez. "They think everyone of us has the disease and they die like flies if they get it."

We then asked some of them to thatch our house in the valley, but despite the present cordiality, we met with obstinate refusal. Reiterating, however, that we were not ill and that there would be no one else at camp but ourselves, the Indians fell into conference and after some minutes expressed a mere, "Maybe."

Their curiosity was aroused. They had seldom, if ever, seen white man, never a white woman, although they had had contact with the mestizos of the region.

On the morrow at dawn three Jicaques came through the forests to the house and were met by Lopez. He explained what he wanted, and they set to work gathering the thatch, cutting it from the large palm called *Suyate*. The Jicaques worked silently and smoked incessantly, and curiously they smoked a pipe,



confessed in an aside, he had previously traded him for some tobacco).

He spoke to Lopez and sat down near his house but made no attempt to come near the stockade. Presently he was joined by three other Indians, younger than himself, attired in the same curious



(Above) PRESENT HOME of the lost Jicaques (pronounced Hee-ka'-kays): Indians who until now resisted investigation and remained a gap in Central American ethnography. Evidence indicates that they brought their culture to the Honduran rain forests from South America in the remote past

(Left) UNDER the "eyebrows of the forest" the expedition unloads for its intended investigation of this elusive segment in the Central American picture puzzle

(Right) PROGRESS WAS BARRED by a stockade through whose crude portal no white man had probably ever passed. This oak wall was built largely to keep out the *ladino*, or half-breed, feared as a carrier of contagious disease. One of the dwellings is seen at the right, made of light wood and thatched with palm leaves. Only after an hour of waiting and repeated calling did an elderly inhabitant appear. He would not admit the visitors or come forward to receive gifts



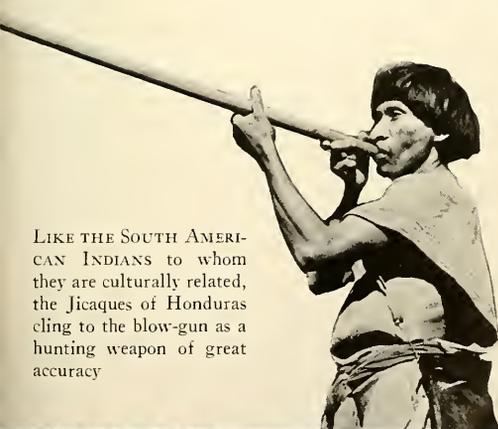


SHY AND SUSPICIOUS the Indians only at great length ventured to come down from their village hidden behind the banana trees in the background. Their greatest fear was of the common cold, to which they realized they were extremely vulnerable. They would touch no gifts until the disease had been smoked out of them

ASSURANCE that the visitors brought not disease but treatment won the Jicaques' reluctant friendship. Sometimes the length of the treatment was measured by the amount of ethnological information the author wanted to get from his patient, as with the native at right who suffered from a leg infection.



*Leica photos by
Wolfgang von Hagen*



LIKE THE SOUTH AMERICAN INDIANS to whom they are culturally related, the Jicaques of Honduras cling to the blow-gun as a hunting weapon of great accuracy



(Above) THE "LOST" TRIBE had never seen a white woman until the author's wife, gaining their trust through doctoring, trained them to collect plants for a botanical collection



(Left) CLAY PELLETS for the blow-gun, neatly reduced to the proper size by passage through a test hole bored in a snail shell. Too large a pellet will clog the blow-gun; one the right size will fly true, bringing down a large bird or a monkey

(Below) NATIVES building their type of dwelling for the author's residence while in their region. Here they are separating the leaves of the palmetto, which when properly laid will form a waterproof roof. As they worked they incessantly smoked green tobacco in wooden pipes of their own manufacture

(Below) NAILS were not necessary, the pine posts being tied with lianas, or twining plants. In the foreground the author's wife inspects what will be her home for some months

Open sides distinguish this house from the native's dwelling, which is windowless and has but one door. The interior of the native hut is dark and evil-smelling. Over the fire hang ears of corn, tubers, and tobacco, with skulls of animals close-by as luck charms



Leica photos by Wolfgang von Hagen

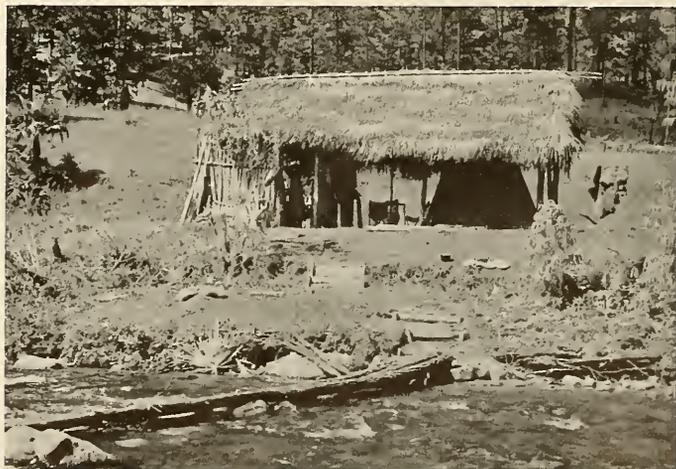


(Below) LENGTHWISE BRANCHES provided support for the thatching of the roof. The von Hagen's hut was arranged with sleeping tent at one end, laboratory in the center, and kitchen at the other end





(Above) EXPERT WOODSMEN and nimble climbers, it took three Jicaques but a single day to gather the thatch and lay the roof



(Right) THE COMPLETED HOUSE. Easily erected and costing only a few dollars, the simple building served the author and his wife well during their work with the Jicaques. The stream running by their door kept a mean temperature of 58° F., allowing them to develop the photographs on these pages without fear of losing quality either through impurities or excessive heat

(Right) NOT SO PURE, at least for fish, was the water when the Indians went fishing with poison. By striking the bundle of *tunkaye* bark, the poison (rotenone) is driven out, causing the water to become milky in color. Relatively rare in Central America, the poisoning of streams for fish is a common practice among certain South American Indians, which helps to link the Jicaques with them



(Left) AN INDIAN demonstrates the use of their bow and arrow. The weapon is quite ineffective, having been supplanted by a tribal shotgun acquired through trade

THESE INDIANS do not know how to weave cloth of any kind and do not even have a word for a loom. Aside from cotton which reaches them through barter, they manufacture cloth only from bark

(Below) THE "WILD" JICAQUE'S ludicrous mop of hair was once allowed to grow down the back. The Indian at right, who wears his shorter because he was recently ill, is conspicuous for his Roman nose. These Indians are the result of four generations of close inbreeding. Their skin is light copper in tone, their cheek-bones prominent below oblique eyes. Four centuries ago the Jicaques occupied one-fourth of Honduras. Shunning white contact, they were still living in a primitive state throughout the State of Yoro in 1850. Greatly reduced in number thereafter, the remnants fled to the isolated region where they now live

Leica photos by Wolfgang von Hagen



something of a miniature wooden Meerschau, manufactured by themselves. They smoked their tobacco green, and as the bowl of the pipe was small, they had constantly to refill it. The pipe was lighted with flint and steel, and for tinder they used rolled cotton.

Although still shy and suspicious, our first contact was successful and we became more intimate as the weeks went by. My wife employed one of them to collect plants and to acquire the names of the plants in their language, and I applied myself vigorously to the study of their language, and attempted to penetrate their ethnology. We were best aided in this by treating the Indians for ulcers, burns and other afflictions.

Medicine the master-key

Our real success came from one Indian who, plagued with numerous superficial ulcers on his legs (much like the veldt sores of Africa), submitted to our treatment. I kept him with his leg immersed in tepid solutions of potassium permanganate, and as he was fearful of going away without our removing the red stain of the potassium from his leg, I was able to question him days on end. The result of these visits was the first extensive vocabulary ever made of the Jicaques' language. We were careful not to make promises to them that we could not keep; our presents were ample without being fulsome; and in the course of four weeks we broke down the last vestige of suspicion, and I was allowed, with my wife, to enter the dwelling behind the stockade.

The Jicaques are polygamous. Each Indian, when he can, possesses two or more wives. The women were dressed much like the Spanish mestizo women in blouse and skirt, although when observed from outside I have seen them through my binoculars moving around with only a cloth wrapper.

In the dark interior of their houses, which are windowless and have a single door, the traditional Indian three-log fire burns in the center, and wooden sleeping racks line the sides. Above the fire hung ears of dry corn, tubers and tobacco. Near the fire, rising like a coat hanger from the mud floor, was a rack on which the skulls of deer, agoutis, and monkeys were placed—amulets for the success of future hunting. The dogs, the same ill-fed, vicious, filthy brutes that I have found in all Indian houses, were tied near the door. The houses were ill-smelling, eerie, dark places, more in keeping with the witches of a classic Teutonic *Walpurgisnacht* than what you would expect of a dwelling in the mountains of Honduras.

Beyond their palisades and far into the mountains the Jicaques have cut down the virgin forest to plant corn, tubers, tobacco and earthnuts (peanuts). The men assist the women with the crops, their activities

going beyond the usual male tasks of telling trees and preparing the earth, to planting, cultivating and carrying the crops to their houses, this gesture due in part to the present scarcity of women.

Barter in an "Ellis Island"

From one point on the peaks to which I climbed, giving a splendid panorama of the whole *Montana de la Flor*, I could see a vast patchwork of cultivated plots, mingling with the virgin forest. Tobacco, since it is an important item in their culture, is extensively grown, and when there is a great deal of it, it is bartered with *ladino* (mestizo) tradesmen of the lower valleys who come up spasmodically to bargain with the Indians. The Jicaques' fear of the *ladino* and diseases that he brings has caused them to build a structure apart from the palisade, where actual trading must take place. No one goes within the portals of the palisade.

The Indians hunt the virgin forests for birds, tapirs, deer and wild pigs; and curiously enough, the women join the men in hunting. Since their only effective weapons for large animals are machetes (large bush knives) and ancient rifles which they have gotten by trade, the chase is a serious and somewhat barbarous occupation, rather than a sporting event. To find the deer and the tapir, the Indian women circle a large area and then move toward the men who patiently wait behind trees with their dogs. Since the deer are fleet of foot they have to be shot; the tapirs, on the other hand, are dull-witted, and when aroused from their resting places are easily cornered by the dogs, who keep up a tirade of snapping while the Indian, with machete poised in hand, waits for the favorable moment to rush in and stab the animal to death.

As both animals are eaten, there are apparently no taboos against them as there are among other American Indians of my knowledge. Birds are hunted with the blow-gun and the bow and arrow. The last has degenerated into a small, ineffective weapon, and among the younger Indians is not a very expedient arm. The contrary is true of the blow-gun.

Their blowpipe is called *n'tutla* and is made from a single, extremely straight-growing branch of the *Saurauia** genus, which is rather ingeniously prepared. The branch is about an inch and a quarter in diameter and seven feet long. In the center of this limb is a soft half-inch of pith, which when dry is hollowed out—one might almost say bored out—by a sharp-pronged vine, spined in such a way as to be likened to the tail of iguana, hence its name by the *ladinos*, *rabo de iguana*. This vine is inserted into the

**Saurauia englesingii standl.*

center of the limb, moved back and forth until the sharp prongs have scraped out all the pith, leaving a straight, almost perfectly bored blowpipe.

The Amazon Indians, it will be remembered, generally make their blow-guns (to propel poison darts), by placing two sections of curved choonta wood together and winding them with a flat bast, the whole being then sealed with beeswax. The Jicaque doesn't use darts. The only ammunition is small clay pellets about the size of a marble. The Indian learns (like many an American boy with his pea-shooter) that care must be taken not to insert too large pellets into the blow-piece. The Jicaque has solved this by very patiently scraping out a hole in a big snail shell that tallies exactly with the bore of the blowpipe. When making the clay pellets he passes them through this hole and reduces them to the size that will pass through the blowpipe. Fired and polished, the pellets are as hard as stone, and accuracy can be had with them at as much as 40 yards.

The Jicaques have no weaving arts, and the white cotton that they use today is only the result of trade with the *ladino*. In the past they seem to have depended entirely on the Strangler fig tree and others of the Moraceae family for fibers from which to beat a fine bark-cloth, which was made into garments for both men and women. In many instances, the Indians today still employ the bark-cloth for garments. I have never seen a loom in their dwellings and no Jicaques could even recall a word for it! This, and the fact that they fish with poison, using the same technique as the Indians of South America, indicates their intrusion into Central America from the south—an origin which is wholly confirmed by their language.

Known history

Roughly, at the time of the fourth voyage of Columbus to Honduras, the Jicaques occupied about one-fourth of the modern territory of Honduras from the Ulla Valley to the Black River, from the Caribbean coast, deep into the interior. They were quickly subdued and forced to help the Spaniards. They continued under labor draft throughout the centuries of colonial rule. These Indians inherited the name Jicaques which was a general name given to a number of the wilder or more remote Honduras groups. The native name of these Indians is Torrupan. Jicaques, I learned in Guatemala City, is applied by the modern Kachikel Indian to our American motion pictures having wild Indians—so even now it has not lost its ancient meaning, "wild Indians."

Under white contact the Jicaques lost their adhesion and something of their cultural integrity. They shunned contact with white man except when they

were forced into it. Independence came to Central America, but not to the Jicaques; under the Republican government, the use of forced labor went on. By 1850, the Jicaques were still living in their primitive manner throughout the State of Yoro, when there came into their midst a Spanish missionary, Padre Manuel Jesus de Subirana, who by patient, intelligent action got them together in communities. He enlarged the number of cultivated crops, baptized them, gave them Christian names, and clothed the women in the dresses of that period as used by the Spanish mestizoes.

In 1860, Honduras became the source of the medicinal extract of sarsaparilla. This sharp-pronged vine, used medicinally for a mild tonic and alterative, had its habitat in the rain forests of Yoro, the principal seat, so to speak, of the Jicaques. Governor Quiroz of Yoro sent his soldiers to force the Indians to gather the sarsaparilla vine and carry it to the coast at Trujillo. Brought to the coast under draft, the Indians had contact with the unhealthy atmosphere, contracted the common cold, returned to their home to spread the disease. The tribe was severely thinned out. Padre Subirana resisted the efforts of the Governor to use the Jicaques and for a while was successful.

Then death claimed the Padre. One Indian who was baptized as Pedro carried the body of Subirana on his back for three days to the capital of Yoro where it was interred. With the knowledge that the death of their one friend would allow their persecution through forced labor to go on unchecked, he returned home and decided to leave the region. Joined by another married Indian called Juan, Pedro set out with his two wives and son to the isolated region of *Montana de la Flor*, five days' journey afoot. There, at 4500 feet altitude, out of contact with everyone, they built their homes.

Closely interbred

Out of this original five, grew the Jicaques colony. Father intermarried with daughter, brother with sister, cousin with cousin, and in half a century a colony of two hundred Indians developed. The little boy of that migration is Beltran, the chieftain of the present colony and the sole survivor of the trek. All the rest of the Indians were born in this region.

Back in Yoro, meanwhile, the Jicaques died out or were Hispanized. By the time ethnological science had progressed to the point where it was interested in these tribes to the south of us, the Jicaques had disappeared. Only a short note by Habel, who saw some in 1880, and slightly more information by the German geographer Carl Sapper, who met with a small group, have slipped into the literature. From Guatemala on the Caribbean southward to the Paya

tribes beyond Black River, Honduras, the region was one great ethnological blank.

Meanwhile, behind their palisaded villages, refusing (until recently) contact with the metizos, this colony of Jicaques continued on, carrying down with them through a very narrow funnel, the culture of their tribe. This, then, was the blank page of ethnology that we tried to fill in during our two months' stay among them. Working feverishly against time (for we had an exact program to maintain), we were able to get the most significant points of their ethnology, acquire the only collection of their artifacts that exists, make anthropological masks of six of the tribe, and prepare a long vocabulary and a list of plants

forming their ethno-botany. We learned that they do not call themselves Jicaques, but Torrupan, and that their vocabulary, as well as their cosmogony, links them, although distantly, with the Chibchan cultures, confirming the thesis Dr. Walter Lehmann hypothesized some years ago.

The discovery of the Jicaques was one of those "breaks" with which every explorer hopes his trek will be blessed. Perhaps from this accidental discovery students with greater preparation than ourselves will visit them, subject them to a more rigorous "going over" and push back further than we, the story of the tribes of pre-Columbian Central America.

THE CHAIN OF LIFE

Continued from page 157

form the digestion for them; that white pine blister rust is dependent upon wild gooseberry plants for its spread; and that we can get some idea of the weather and seasons of two thousand years ago by observing the widths of the annual rings in the stumps of our giant sequoias. And this last surprising statement is only one example of how scientists put two and two together in their discovery of these chains of life. A German has recently shown that the width of the annual rings of trees not only indicates differences in growth and moisture supply in different years but that these factors are apparently directly related to the number of spots on the sun during these same years. The more sun-spots, the more solar energy expended and consequently the more growth. The Hudson's Bay Company's records of the number of furs of certain animals purchased during a hundred-year period have also yielded some astonishing facts. Lynxes feed on snowshoe rabbits, and the curves of maximum and minimum quantities of these two animals as shown by the company's records follow each other with monotonous regularity. Plenitude of lynxes hinges directly upon a plenitude of rabbits.

But the story is endless. Probably every animal lives as a link in some chain of life, and of most of these we know but little. We have, however, discovered that it is dangerous to break these chains. The killing of the coyotes in the West may be followed by a plague of jack rabbits; the introduction of a new animal into a country may be only the beginning of a great pest—the English sparrow's quick conquest of America is still fresh in our minds, and today the starling bids fair to equal if not out-do the sparrow. Sometimes a seemingly wise move such as the introduction of the Irish potato into the Rocky Mountain region may be

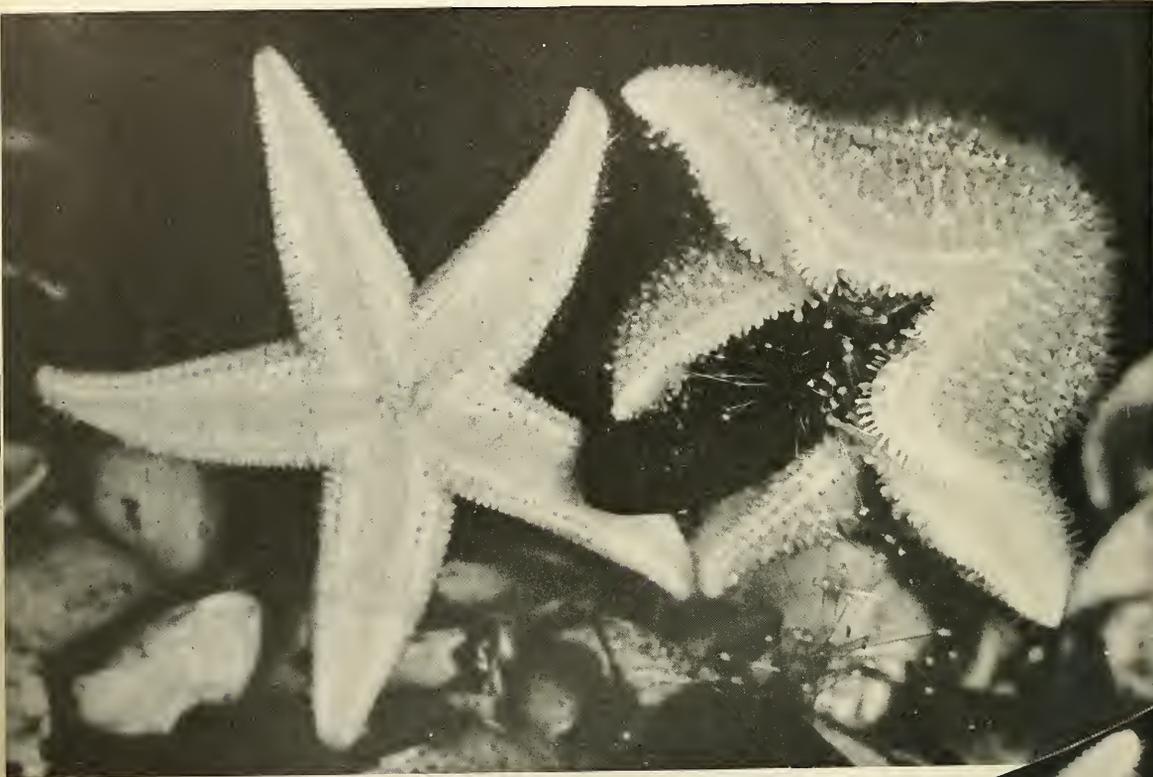
followed by disaster. As a result of that action the Colorado potato beetle now eats our potatoes wherever they are grown. If we trap our skunks too closely we may suffer a plague of June beetles—a large part of their diet. Destruction of our rough-legged hawks is almost sure to be followed by a scourge of field mice. Protection of foxes may reduce our rabbits; and the too free killing of certain animals, particularly those which harbor dangerous parasites, may lead to an attack by those same parasites upon our domestic animals or perhaps even upon ourselves. So it goes!

If we are to trust those who have studied the matter, even this placid lake with its life largely hidden is a balanced community of interrelated individuals. Shelford tells me for example that if I catch too many of the black bass, I will make it necessary for the pickerel to eat insects instead of the young bass upon which they normally feed. But fewer black bass will make life easier for the crayfishes which are victims of the bass. The increased number of crayfishes will decrease the number of water insects, which will now be eaten by both pickerel and crayfishes, and hence the pickerel will diminish because of lack of food. In the meantime, the bullheads, which will eat almost anything, will feed largely upon mollusks but will also tend to decrease because of lack of water insects. In the course of time, then, the black bass should increase again because of the decrease in numbers of their chief enemies the pickerel and the bullheads. Ho hum! One thing leads right on to another until it makes me dizzy to think about it.

Yet these Houses That Jack Built, though often wonderfully fabricated are pretty stable affairs when allowed to develop by the slow workings and free interplay of animals and plants. It is only when upset by man that they often fall with surprising results to the wrecker.

THE FEAST OF THE STARFISH

By KEES HANA



1



2



3

THE TEN-HOUR MEAL OF A CREATURE WHICH INSTEAD OF PUTTING THE FOOD IN, TAKES ITS STOMACH OUT

1 BATTLE OF THE MILLENNIA. Inexorably drawing the shells apart, this starfish carries on his ancient predatory war on mussels and their kin. The engagement below lasted ten hours, but the war itself has gone on for about 400 million years

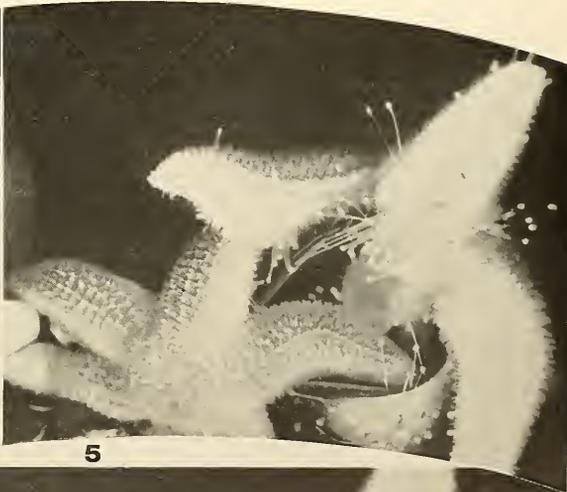
To CASUAL beach-strollers the starfish is merely a quaint object left helpless by receding tides, but to shellfish he is a ruthless, extremely active, usually invincible foe, and fishermen regard him as a plague. To curb him they formerly tore him in half on sight. Ironically this tended to double starfish numbers since each half promptly grew new rays, becoming *two* whole fish. Many starfish can shed these rays at will, and one species completely disintegrates out of water. Yet these rays, which vary in different species, comprise the starfish's feet, "lungs," and eyes. A complex arrangement of pipes and tubes extracts oxygen from water and actually uses water-power for walking. An eye is at the tip of each ray. It can distinguish only light, shade and direction, sufficient for undersea operation. Though toothless, the mouth of the starfish is the central organ of his anatomy. Pictures on these pages, showing an attack by the common European sea-star (*Asterias rubens* Retz) on a mussel, typify the methods of most species

2 AFTER CAPTURING its quarry, the sea-star tugs grimly with myriad, suctional tube-feet. Proof against sudden attack, the mussel's spasmodic contractions weaken under constant tension and finally yield

3 MOST AMAZING of starfish organs is the stomach. After "scouting" inside the shell with its versatile feet, the starfish protrudes this thin-walled sac and begins to envelop the mussel-flesh. Had this mussel been smaller, the sea-star would have omitted preliminaries and swallowed the mollusk whole, later ejecting the indigestible shell

4 CLOSE-UP dimly showing the completely enveloped prey through stomach wall. Digestion is performed by pouring stomach juices over mussel flesh, reducing it to fluid which is then absorbed through the walls of the everted stomach

5 ONLY TEN MINUTES are needed to retract the stomach, while a fellow sea-star vainly searches the empty shell for food. The insatiable victor is now ready for another feast. An arch-glutton, the starfish will eat more than 50 clams half his size in less than a week



5

6 FEAST'S END: only two gleaming shells are left of the victim. Although they eat practically everything, many starfish favor oysters, sucking them apart much as they do mussels. Recently Connecticut oystermen footed a starfish dinner bill of \$600,000. However, the starfish is kept from being a major menace by its many enemies (eels, small fish, sea-birds) and because of its wasteful reproduction

6



WAR AND WILDLIFE

THE only completely innocent bystanders in any of the international thug-fests enabled by the name of War have been, are, and probably always will be the animal inhabitants of the battle zones. Of course, these creatures have felt Man's might in time of peace. For the industrialization of a countryside has invariably implied the waging of an undeclared war against the non-human animals in competition for the same space. But what happens when Man turns his ever-increasing array of tools and weapons against himself? Are these innocent bystanders annihilated in the general holocaust? Or do the slowly learned lessons of modern conservation exert their checks even in war time? Also very pertinently, if Man must have wars—and it begins to look as if he must—are the most up-to-date military techniques easier or harder on the bystanders than those of the history books?

Let us hear the testimony a reputable war correspondent might have given, if newspapers were published in the 13th century.

Date 1219: En route with the armies of Genghis Khan several miles north of the Aral Sea. (Passed by Censor.)

According to an official communiqué issued from the tent of Our Leader, the Great Khan, operations on both the Mede and Persian fronts will be held temporarily in abeyance. Through his spokesman, the Grand Vizier of public relations, Our Leader made known his intention to consolidate his position at this point and to discontinue the attack until after the rains.

Later in the morning the Khan personally addressed his troops, warning them against the loss of their fighting strength through a forced idleness of four months. On the morrow all privates and non-commissioned officers would receive orders to report to their battalion commanders at the usual time and march under their direction deploying across an 80-mile front in battle formation.

To allay their curiosity, the Khan told his men that they were proceeding to the attack against the numerous wild animals of the region. It would be a four months' campaign. Although this was sport, he requested that the operation be conducted with the same dispatch and fervor which they had shown on the actual battlefield. The Khan enumerated the large flesh-eating animals who would oppose them and stressed the ferocity of these creatures when cornered. This announcement was met with an enthusiastic cheer on the part of the men, and when the sound subsided, the Khan outlined his strategy, a

As Europe's hills once more fling back the sounds of shot and shell, we seek to learn the fate of animals caught in the cross-fire of human conflict. Do man's deadlier weapons of today spell annihilation? Or will these innocent bystanders fare better than in the wars of history?



departure from usual procedure made possible, he said, by the fact that there was no espionage to contend with in the proposed engagement.

After summarizing the solitary fighting habits and the extreme mobility of the enemy, the Kahn pointed out that a piecemeal conquest was impractical. He had therefore issued orders to advance steadily across the aforementioned 80-mile front, gradually closing in on the enemy at the flanks. By beating through the bush, they would thus concentrate the enemy within an ever-diminishing area, and finally the flanks would join pinching off the last avenue of escape.

At this point, the Khan continued, the customary annihilation of the enemy would take place. He was careful, however,

to warn the men that the process must be carried out in orderly fashion. Once the enemy had been herded into position, the Khan himself would fall upon the larger and gamier animals, after which he would retire to a stately pleasure dome, even now under construction, whence a good view of the carnage could be enjoyed. Here the princes and higher nobles would join him, after taking their toll of the cornered beasts, then the next in rank would launch their attack until the meanest trooper had run the last and smallest quarry to earth.

In concluding his address, the Khan said that when this had been accomplished, the estimated four months' campaign of strength-through-joy-in-sport would have reached its climax, and the army, refreshed and in excellent spirits, might once more

turn its attention to the Persians. After being roundly cheered, the Khan gestured with his spear and re-entered the tent to map out details of the campaign with his general staff.

Now, we may return to the 20th century and the testimony of that era.

BRUSSELS, September, 1915. (By special cable.)

Reliable reports emanating from both London and Berlin point to a favorable autumn for at least one group of inhabitants along the Western Front. Official spokesmen in the Friederichstrasse declared that the German High Command was prepared to issue orders strictly forbidding the hunting of game birds or animals anywhere in the area occupied by the Kaiser's Imperial Armies. Almost simultaneously the London *Times* published a statement to the effect that a similar ban would be placed on game in and about the camps of the British Expeditionary Forces in France. The French and Belgians, it was learned, are expected to follow suit.

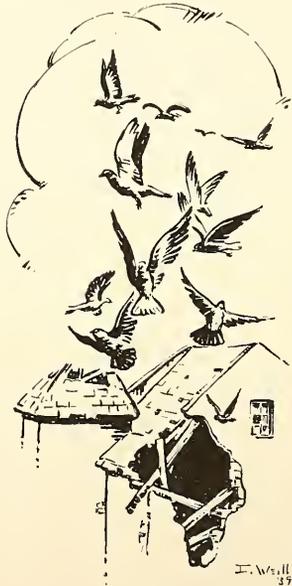
Whether or not such a bulletin ever filtered into print through the swarm of atrocity stories which saturated our press in the last war is of little account. The interesting fact is that these orders were given and obeyed in the midst of the most appalling human slaughter the world, at this writing, has yet witnessed. In the seven centuries which elapsed between the zeniths of Genghis Khan and Wilhelm II, something very definitely had changed in Man, the soldier.

The Khan, resplendent in oriental barbarity, had used the faunal bystanders of Persia as a kind of collective tackling dummy for his restless horde. And, if he had any ulterior motives they were certainly far on the incidental side. As against this, Messrs. Sir John French, Foch, and Hohenzollern, or their equivalents, bestirred themselves to guarantee the bystanders a degree of protection denied in times of peace, despite the fact that fresh meat is at a premium in any army.

Even if these orders had never been issued, the destruction of wildlife in the last war would probably not have assumed very serious proportions. Shellfire would inevitably be directed upon concentrations of humans, not fauna. And long range forays of wilful depredation upon game or other animals would scarcely be compatible with the military requirements of a war of positions. Furthermore, troops bent on a hunting party would find small pickings in the battle zone, since most four-footed game animals had migrated well behind the lines.

With the first barrage of heavy artillery duels, wild boar and deer beat

a hasty retreat into the mountainous areas on either side of the Rhine, the boar showing a marked and rather shrewd preference for Switzerland. Strangely, the wolf which is widely sung in German folklore as a follower on the heels of Mars, was very gunshy and took his departure with the other large game; whereas the timid hare stood his ground and, indeed, multiplied. Evidence of this latter fact comes from the account of an impromptu hunt organized on Christmas Day, 1914, during the informal truce which brought men from both sides of no man's land together. Hares were so



plentiful that the dogs used in the hunt were confused and could not concentrate on an individual quarry. The capture was finally made by two erstwhile enemy soldiers simply falling simultaneously upon a single startled hare.

Largely, we may surmise, because most men were engaged in hunting each other, these forms flourished in their new surroundings. Reports of a notable increase in wild boar were numerous in both France and Germany, which should considerably substantiate the generality that modern warfare reduces pressure on wild game.

In ancient times, however, there can be little doubt that the various European deer suffered during mass invasions like that of Attila, the Hun. They were, in the first place, food animals. Then, too, they were easier

to hit. But whether the weapon is spear, arrow, or modern bullet, the fact remains that the larger and more spectacular the game the more it suffers either in war or peace.

Since it was the fashion for armies to live off the land from Attila's time right through Sherman's March in the American Civil War, the Huns must surely have wrung a heavy tribute from the forested hunting grounds as well as from their erstwhile exploiters. That is simple arithmetic. More men must have more food. But the "cruising range" of Attila's warriors was certainly limited by topographical conditions.

It has been suggested that no such holocaust as that perpetrated in Persia by the great Khan would be feasible in the majority of European countries. Devoid of vast prairies, Europe is a continent wherein almost any operation along an 80-mile front would have involved an uncomfortable amount of swamp-fording and mountain climbing. Bush and forest fires could have been used only during the relatively brief summer season and would at any rate have wreaked but little havoc except over a small area, again because of a variable geography. Under such conditions many of the smaller animals would most likely have eluded the Khan's encircling "sportsmen." And, doubtless, then as now, game animals would migrate to points remote from the line of fire. The latter term is used advisedly and literally since the Tarter horde was given to burning as much of a conquered territory as it could lay a torch to.

Rather than confuse the issue, it should be made clear that the European deer and boar of 1914-15 were not fleeing from armed men intent upon their destruction; it being for the most part, a flight from noise. Artillery casualties were certainly not heavy among them, but the unprecedented din prompted rapid evacuation of the disputed terrain, because of the highly nervous character of these creatures. In this connection it is worth noting that mongrel horses give a far better performance before the guns than the thoroughbred varieties. The Cossacks with their famous fleet Russian mounts were at a distinct disadvantage in comparison to the more stolid German horses. The same is true of dogs. The long-trained domestic house dog was found most useful and least disturbed by the sights and sounds of conflict. As further evidence, stray dogs were observed living as

scavengers in and about the battle-fields.

War profiteers

Many of the birds, on the other hand, didn't mind at all. Whatever the literary merits of

"... while in the sky the larks
still bravely singing fly
Scarce heard amid the guns below ..."

—it appears to be sound natural history. Larks, blackbirds, nightingales and varieties of thrushes, finches, martins and warblers were all plentiful on the western front and furnished a grotesquely sweet counterpoint to the sulphurous disquiet raised in the inferno of 1914-18.

Birds, together with munitions manufacturers, profited on the destruction of human artifacts and flesh, since the ecology of no man's land was largely to their advantage. Edible insects swarmed to the bodies of the slain and the birds took heavy toll, feeding also on the freshly upturned worms of the shell craters. And, while some observers hold that the enormous influx of rats and allied rodents in the trenches was a menace to ground-nesting birds, these camp-followers supplied plentiful fare to kestrels and other hawks. Indeed, superstitious soldiers were reported to be frequently unnerved by the silent, baleful-eyed, swoop of the night hunting owl, regarding him as the lost soul of a dead comrade.

The first-hand ornithological observations of William Beebe sum up the interesting reactions of feathered life to the deadly rain of lead and steel. "In spite of the months and years of constant noise and flames, gases and dangers, wild birds have shown an astonishing disregard of these supreme efforts of mankind. They soar and volplane, they seek their food, quarrel with one another, carry on their courtship, mate and rear families in close proximity to the actual fighting and exploding shells. In fact, their numbers have increased near ruined villages, where they nest in shattered houses still smoking from devastating bombardments."

It thus becomes clear that whatever the fate of ground-nesters, those species partial to crumbled masonry enjoyed an avian "real estate boom," directly proportionate to the crash of human values in the same category. Devastated villages became a chattering paradise of swifts, swallows, martins

and similar species weaving undreamed of mansions out of the surrounding debris. Many a battered gothic arch housed an insect-fattened bird family, and great flocks were often seen issuing from the gaping shellhole in the roof of a derelict cottage.

The majority of birds, did not seem to link the distant report of the cannon with the geysering of black earth where the missile struck home. Many of them commenced a worm hunt almost before the shrapnel ceased to fall. Still more imperturbable were those who made nests in the camouflaged embrasures of large and active canon. And famous is the story of the insouciant swallow who built and maintained his nest a



bare two feet from the sputtering muzzle of a machine gun engaged in strafing the enemy night and day.

Dissonant notes

This picture of complete avian indifference is somewhat tempered by other observers who aver that the age-old migration routes of many European fowl were sharply disrupted by the war. For countless generations the Rhine and neighboring north-to-south waterways had patterned the route of these birds in their seasonal travels. At the outbreak of hostilities below, the flights seem to have veered westward or eastward and even terminated in previously unvisited sections of France, apparently out of fear of the guns. This factor is complicated, however, by persistent reports of geese and kindred fowl mingling unafraid with airplanes engaged in close-range conflict. Then there is the story of the pheasants in the North Sea lowlands whose extreme sensitivity to gunfire was manifested in a great commotion which took place during the naval battle of Jutland. This display of nervousness was all the more baffling in that the sounds were so far away that human dwellers in the vicinity had no knowledge of the battle until the next day.

The observations of still other witnesses that quail ran about marshes close to the front and raised their families in abandoned trenches would seem either to give the lie to opposing reports, or to prove that some game birds are not intimidated by war raging close at hand. Does this indicate something about the hearing range of birds as compared to humans? Is their ear adapted to receive far-away vibrations like those from Jutland? And are these fine senses, by the same token, paralyzed with deafening tumult at close range? For this we have no answer except to say that game birds seemed to recede in the war zone in spite of the No Hunting decrees issued all along the lines by both the Allied and Central commands.

It would be at the least unrealistic to suppose that these bans were scrupulously observed throughout the war. But we can be sure that nothing remotely approaching the systematic campaign of Genghis Khan was waged against animal life at any point on the western front. The picture in that region during the abnormal conditions of 1914-18 can briefly be summed up in the following table:

Wolves fled while rabbits swarmed.
Game birds appeared to decrease.
Most other birds flourished.
Many insects increased enormously, as did rats and other forms indigenous to trench warfare.

Four-footed mammals associated with hunting, i.e., boar, deer, etc., migrated to neutral territory, although foxes were sometimes seen in no man's land during lulls.

Wild boars and probably other migrants thrived behind the lines.

It is impossible at this early date to establish continuities between the animal behavior of 1914 and that of 1939 in roughly the same theater of war. However, if the Allies succeed in carrying the offensive into the industrialized Saar Basin, we can reasonably assume that the faunal bystanders will be aided rather than retarded. If nearly all the habitual French huntsmen are gunning in the rubble streets of German mill-towns this fall, even the pheasants should thrive along the former western front and we shall probably not hear of wildlife migrants to Switzerland.

Thus Man's latest war may well turn out to be the end product of a long-term reaction from the days of Genghis Khan. Whereas all previous conflicts may be surpassed in the despoliation of humanity, the present

Armageddon, by refining its techniques so as to concentrate on human centers, may paradoxically turn out to be the happiest in history for the innocent bystanders.

On the eastern front

From a wildlife standpoint the eastern front was made memorable in the last war by the episode of the European bison. Like his American kinsman, this bovid (also erroneously called the buffalo) had been hunted close to extinction. However, there remained in Europe two sizable herds, one of which was dwelling in the forest of Bialowies. This forest was stormed and

turies vanished for the moment from the bomb-torn European scene, as the Kaiser evoked the hoary and unwritten feudal law by which the game preserves of warring nobles were considered mutually inviolate.

Ensuing events proved that the conservationist advice was sound. For the herd suffered unavoidably as attack and counter-attack seasawed through their forest home. In time, what was left of them were removed to the estate of the Prince of Pless—where they should have been installed at the beginning.

This bison episode concluded ironically some time following the Armis-

traditional fox hunting week-ends became apparent. The *London Times* carried many offers to sell "shootings" (private hunting parks) and other sporting territories. One writer ventured that the frightful inroads of gunfire on British manhood placed a psychological damper on those who kept the home fires burning and that it was due to this factor as well as to mobilization that hunting lodges gathered dust and trigger fingers lost their itch in a not-so-merry England.

From such a state of affairs you might logically infer that game birds and animals waxed fat and numerous in the rural districts. Some of them, particularly birds, undoubtedly did. But foxes, oddly enough, were reported at one point to be dangerously near extinction.

The phenomenon is doubly surprising when you consider that not only men but horses are essential to the fox hunt and, since the average life of a horse at the front is no more than *eight days*, repeated conscriptions of these animals for military and draft purpose naturally followed. Yet despite the exportation of man and horse, the fox dwindled.

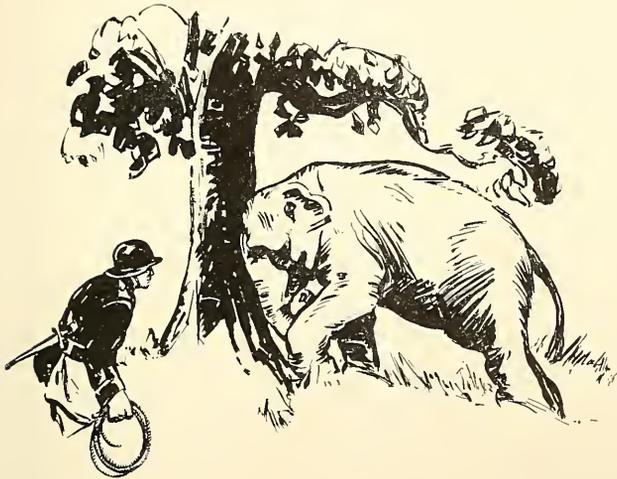
The fox's failure to share in the blessings* which war had brought to his fellow bystanders has been attributed to the zeal of gamekeepers who feared he would promptly overrun the country. To forefend against such a calamity, they allowed the dogs to roam at will and exerted every other possible pressure on luckless Reynard, so that, in the end, he, too, must have prayed for peace.

Animal concentration camps

The custom of detaining exotic animals in the zoological parks of our large cities gave rise to one startling atavism in the course of the First World War. Hannibal's most celebrated single achievement was, of course, crossing the Alps on elephants. But this was not destined to be Jumbo's final appearance in the military affairs of Europe.

In 1915, a German zoo elephant, named Jenny, was conscripted to level off wooded localities behind the lines. She uprooted large trees by pushing them over with her head and then

*A further by-product of war which appears directly to aid both wild and domestic animals raised for the purpose is the decline in the fur-trade. During the last war, the feather trade also suffered, when women's hats changed overnight from the stuffed-bird picture hat to the trim sailor and military cap.



captured by the German army in September, 1915. During the engagement the herd was reduced from 770 to 120 and there was every likelihood that the remainder would be utilized by German quartermasters anxious to avail themselves of so tempting and handy a meat supply. But Kaiser Wilhelm thought otherwise. He ordered that every effort be made to preserve the herd, although he refused to have them removed to a suitable region behind the lines—a step urged upon him by a number of conservationists. His reason was one of those curious legal niceties so dear to Man in the western world.

The Kaiser was given to understand that the herd was the exclusive hunting property of his cousin, Nicholas, Czar of the Russians. The matter was, therefore, simply a personal one concerning the two monarchs. Five cen-

turies. After Wilhelm had fled to Holland and revolutions were raging in both Germany and Russia, it was brought to light that the herd had never been the Czar's property at all. The bison belonged, it was disclosed, to the Russian people as a whole and could have been confiscated immediately for shipment to Pless according to any hair-splitting interpretations of international law which the Kaiser's odd quirks of conscience might have concocted.

On the "home" front

Continuities between the present year and 1914 will quite likely be traceable for the wildlife of Great Britain. The last war profoundly disturbed what might be called the even tenor of the English country gentry, and when its men were called to the colors, a corresponding dearth of the

hauled them to the main road. Later Jenny was hitched to a plow and set to work converting the territory into farmland.

Reputedly the working equivalent of from six to eight horses, Jenny sometimes surpassed even this respectable capacity her greatest achievement being perhaps the hauling of a small steam locomotive out of a ditch. Jenny retired from army service in 1916, was sold to a traveling circus shortly after the armistice and was heard from as late as 1927.

But for the most part, zoo animals fare rather badly in wartime. Many readers will recall listening to a relay of bulletins from the British Broadcasting Company during the portentous Labor Day weekend of 1939. Amid a flurry of spot news from Poland, the announcer's clipped, British accent gravely proclaimed something like the following: All poisonous snakes and reptiles and a number of the carnivorous animals have been exterminated at the London Zoo. Baba, the baby elephant, together with the giant pandas have been removed to a secluded district. "Otherwise our Zoo is carrying on as usual."

News from Paris was less outspoken. The *New York Times* of September 12 reported from Paris: "Like other communities in France, the Paris Zoo is being broken up and evacuated to the country. The censorship declines to reveal the destination, but the different groups in the animal kingdom are being caged, crated and shipped separately, and, in all probability, to different destinations."

The items above indicate what some

may feel to be the more desirable fate of animal captives. For, toward the close of the last war, zebras, antelopes, exotic deer and goats were literally swallowed by Germany's starving population. And among the inedible captives, casualties due to faulty nutrition were presumably heavy. To prevent any such recurrence, conservation-minded Dutch officials are credited with having offered refuge from the present hostilities to the rare animals of all belligerents. Germany allegedly has already sent its faunal rarities to be boarded in Holland zoos for the duration of the war. If these reports are true, they point to an increase in the peculiar altruism whereby Man demonstrates concern for his fellow creatures amid an apparent inability to take care of himself.

However, this is somewhat counteracted by a concomitant report from the Swiss frontier which asserts that the Germans, doubtless mindful of Jenny's feat in 1916, have recently pressed into service all elephants as well as zebras and camels from their thirty largest zoos. Some commentators take this as evidence of a careful husbanding of the German petroleum supply. Motor fuel, it is believed, will be reserved for military purposes while exotic beasts draw tractors across German farm lands.

Even more bizarre than Germany's use of elephants was Britain's drafting of seals to spy on enemy submarines. It is necessary hastily to add that these seals were trained to do this only in a controlled experiment. They never performed in actual war. Coaxed by rewards of fish to detect a submarine

motor under water and to trail it, they were equipped with muzzles to discourage fishing expeditions of their own, also with red floats to show their whereabouts while submerged. According to their trainers, they proved most willing and amiable, but the last war ended before they could prove their usefulness, which is perhaps just as well for all concerned.

The role of domestic animals

All manner of dog-heroism stories emerged from the widespread use of "Man's best friend" in the last war, and we can expect the precedent to hold true again. Horses, on the other hand, may not be so frequently called upon to enjoy the sweets of dying for their countries. The coincident development of highways and the much talked-of mechanized divisions indicate a diminishing of their service in the hauling of guns and caissons at least on the western front. And the revival of the quaint Flemish cart-dog in military transit is most unlikely. Here, then, appears to be another instance of the lessening of animal involvement in human folly. Our need of other creatures in devising our own ultimate extinction seems to decrease in proportion to the constant improvement in annihilatory gadgets. The main hope of dragging innocent animal bystanders down with us rests largely on poison gas. And numerous species of birds demonstrated their ability to fly above the lethal vapors used in the last war, so that, in any event, we shall probably depart amid their joyous music.

D. R. BARTON.

DO NOT MISS

The giant clam which nurtured a 14-pound pearl did not yield its prize until it had taken the life of a native diver whose hand was caught in its vise-like grip. And many months passed before the natives, who held this extraordinary specimen in religious esteem, could be induced to part with it to Mr. Wilburn Dowell Cobb, who tells the true story of **THE LARGEST PEARL** the world has ever seen, in next month's NATURAL HISTORY.

When winter's snows cloak the earth, amateur naturalists everywhere will take up the trail of their favorite woodland creatures. In a forthcoming issue NATURAL HISTORY presents a fascinating key to the identification of **ANIMAL TRACKS**, in which Ellsworth Jaeger shows the endless pleasure to be derived from the hobby of deciphering the movements and moods of animals unscen.

"**TIGER! TIGER!**" is the cry that rings out in the Malay jungles, where J. B. H. Thurston has passed 29 years. Replete with personal anecdotes, his article in the next issue of NATURAL HISTORY gives graphic insight into the temperament of the man-eater and his hunting methods.

Anyone sharing the popular misconception that the Eskimo is "dumb" will be offered many quite surprising and thoroughly amusing incidents in Philip H. Godsell's **THE ESKIMO IN LIGHTER VEIN**, which should force the most skeptical to eat his words.

Despite the notorious trap-door spider's gift for wily toils and stratagems, he has manufactured no defense against *Ocnaea Smithi*, a tiny parasite which gestates within his anatomy. *Ocnaea's* amazing ca-

reer in the spider's body and out, is recorded in a dramatic photo series by George Elwood Jenks.

In December 1938, a lungfish from Nairobi was placed in a tin can filled with wet mud. Slowly the mud dried to a hard cake. *Seven months later*, in Chicago, the tin can was carefully cut away. And the fish came out alive! The complete pictorial story of this death-defying member of the finny tribe will soon appear in NATURAL HISTORY.

A forthcoming issue of NATURAL HISTORY will reveal how the **VENUS' FLY TRAP** plant, one of the great wonders of the botanical world, lures flies and other large insects to their death. Equipped with "trigger-like" bait, the trap closes its spiked jaws on the victim within one-thousandth part of a second—and digests it!

YOUR NEW BOOKS

ANATOMY OF LIFE • NATIVE TURTLES • CARE OF WILD
ANIMAL PETS • STEFANSSON'S ICELAND • AMERICA BEGINS
AGAIN • FOSSIL FORESTS • FIELD BOOK OF ANIMALS IN WINTER

PATTERNS OF SURVIVAL: AN ANATOMY OF LIFE

----- by John Hodgdon Bradley

The Macmillan Company, \$2.25

DOCTOR BRADLEY'S book is a zoology of life and death. It is a product of the library rather than of the laboratory, a rather conventional interpretation of biological evolution with some reference to societal evolution. The author is a scientist-philosopher with a fertile mind and a flair for imagery. Perhaps most of his facts are well founded, but the same can hardly be said for his philosophy.

As many of these chapters were written independently and published in various magazines, there is hardly the unity and cumulative effect of a book single in its purpose, and some slight repetition is inevitable. His conclusion, which has been arrived at by many eugenicists and statesmen before him, is that in self-directed evolution is man's chief hope of successful survival. The difficulties, of course, begin with the questions, which particular superman is to direct the process, for what aims shall he strive, and how shall he overcome the enormous tangle of practical and theoretical difficulties?

Lack of restraint rather than brilliancy is to this reviewer the chief defect of the book. The trouble with all reasoning about nature is that we constantly tend to be tricked by the poetic character of even scientific language. We may kick the devil of anthropomorphism out the door but he comes back through the window. We mistake allegory for fact and we tend to draw inferences from the allegory, which follows our daily grooves of thought, rather than from the facts, which often cut across our preconceptions and wishful thinking. With these pitfalls in mind the reader may pick his way somewhat more securely through the lush jungle of the author's imagery.

W. K. G.

ICELAND, THE FIRST AMERICAN REPUBLIC

----- by Vilhjalmur Stefansson

Doubleday, Doran & Company, \$3.50

PERHAPS Stefansson's research in connection with his recent work on the lost Greenland colonies encouraged him to produce the present volume, possibly it was his own family connection with Iceland. Whatever the reason, the result

is good and will be appreciated by a wide variety of readers. For tourists who make a practice of reading as they travel it is "the thing," in that it is comprehensive and agreeable. Prospective tourists should be able to judge whether or not they will like the country and its people. For those who have enjoyed the English translations of the sagas, its up-to-date picture of the country provides a living and vital background. People with more specific questions can turn to it with reasonable expectation of finding the answers or at least a clue as to where to look.

Written with the author's usual characteristic thoroughness and charm, its text covers a well rounded range of topics. Indeed it is doubtful if any one individual is qualified to write a constructively critical review of the whole without retracing the original research. To give an adequate picture of the contents it would be neces-

sary to quote all the chapter headings and comment on each. Roughly twenty per cent of the total text deals with the history of the island in its political and geographical aspects; about thirty-seven per cent with modern Iceland and specific topics such as education, medical services, cooperatives and the various industries. In addition there are chapters on Icelandic literature, information for tourists and a record of the emigrants who left Iceland for the Americas. Besides the text there are fifteen illustrations, two maps, eleven statistical tables and a short analytical bibliography.

JUNIUS BIRD.

TURTLES OF THE UNITED STATES AND CANADA

----- by Clifford H. Pope

Alfred A. Knopf, \$3.75

THIS book represents the most comprehensive popular work on American turtles yet written. To say that this book tells you all about our native turtles would be an exaggeration. Nevertheless, it represents a painstaking job by the competent author of *Snakes Alive*, who has assembled information scattered through more than eight hundred papers and books, many of them technical and not accessible to the layman. American turtles have never been so adequately dealt with in a single volume.

Since each of the sixty-three turtles known to inhabit the United States, Canada and adjacent oceans is treated separately, the work is in a sense a handbook. Yet it goes far beyond most handbooks. By means of practical keys and recognition characters, supplemented by ninety-nine photographs, any turtle from the region under consideration can be identified. In addition, the most pertinent available information is given concerning the biotic relationships of each turtle.

The book includes the important published information for any given species, how long it has been known to live, what sort of terrain it prefers, when it mates and how it goes about its courtship. If one desires to find out how to tell the sexes apart or what is known about the nesting habits, the size of the eggs, when they are laid, and when they hatch, the information is all assembled for each turtle. Mr. Pope has likewise included data concerning hibernation, growth, migration and even accounts of psychological experiments that have been performed to determine the learning ability of the turtle,

"... Invaluable
to scientist and layman alike."

—DR. R. L. DITMARS

TURTLES

of the United States
and Canada

by CLIFFORD H. POPE

The only book ever written that
describes the structures and habits
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With 99 exceptional photographs
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- List of the American turtles
 - Keys to genera and species
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 - Directions for care of pet turtles
 - Bibliography
 - Index
- 360 pages
\$3.75



ALFRED A. KNOPF
501 Madison Ave., New York

as well as experiments dealing with the hearing and color vision; he tells you what parasites infest certain species, what turtles eat and how they eat it. Briefly he delves into the fossil record for each group and many genera have family trees dating back several million years. Finally he tells how each species may best be cared for in captivity, and what it should be fed.

In other words, whether it is his desire merely to keep a turtle as a pet, or whether he is seriously interested from a scientific viewpoint, the reader will find this to be a highly interesting and useful book. An extensive bibliography makes it essentially a documented account since information given in the text is credited to the original author. The style is popular and yet the facts given are precise and sufficiently adequate to provide a background for any biologist who wishes to undertake further research. The author has not only supplied abundant facts, but he has pointed out the gaps in our knowledge.

Readers of this book who know turtles only as antiquated exponents of armed preparedness may be pleasantly amazed to learn that turtles can be intensely interesting when one knows something about them. Furthermore, readers may be astonished to know that so much attention has been given to the lives of turtles. The extent of the literature proves beyond a doubt that there is something innately interesting in a turtle, be it biological, philosophical or—yes, even commercial.

C. M. BOGERT.

QUANTITATIVE ZOOLOGY.

Numerical Concepts and Methods in the Study of Recent and Fossil Animals

- - by George Gaylord Simpson
and Anne Rowe

McGraw-Hill Book Company, \$4.00

"ZOOLOGICAL literature is replete with long tables of measurements that prove nothing and the publication of which was unnecessary, expensive and really a discomfery to other students." The authors of this statement and of this valuable new book make it clear to these zoologists how they could make their data more significant. There are, to be sure, various handbooks of statistics available in nearly every zoological laboratory but none of these present enough examples from current zoological literature to make the student who has not had statistical training feel at home with these numerical concepts. The present volume will, therefore, fill a long-felt need.

The modern zoologist need not be a mathematician with a thorough knowledge of statistical theory, but he should be able to recognize the concepts which are most useful for his problem. "Paleontologists seem to use illogical and nonunit measurements more often than do neozoologists," the authors observe, and then proceed to give numerous illustrations from the field of paleontology to illustrate their points. There is a chapter which brings together the various graphic methods which have been utilized by zoologists. There is another which deals with the problem of growth and the way the data should be

recorded and presented. Recently, for example, it has been shown by Huxley and others that the increase in size, both during phylogeny and ontogeny, closely follows the formula for simple heterogony, and the authors give various examples to illustrate "the almost endless possibilities and extraordinary value of Huxley's coefficient." The authors in their preface warn the reader that the book concerns itself with the methodology of zoology and not with statistics. It seems, however, that the book will be very widely read by zoologists who want to familiarize themselves more fully with the best ways of making their data mean more.

The authors are to be congratulated on this splendid book which will serve a very important function in every laboratory.

G. K. N.

SCIENCE IN PROGRESS

With a Foreword by Harlow

Shapley.

- - - Edited by George A. Baitsell

New Haven, Yale University Press, \$4.00

THIS clearly written and profusely illustrated series of National Sigma Xi lectures is a significant contribution to a panoramic view of science. It is virtually a report of progress in various fields of scientific research covering such diverse subjects as the breaking down of atoms, the functions of chromosomes, vitamins, hormones, and internal secretions, the measuring of animal metabolism, and the electric potentials of the human brain. The work of an eminent group of authors is assembled here, and is representative of the vast amount of scientific research now being carried on. The authors are: Ernest O. Lawrence, Harold C. Urey, W. M. Stanley, L. O. Kunkel, Karl E. Mason, R. R. Williams, Edgar Allen, Theophilus S. Painter, E. Newton Harvey, and Francis G. Benedict.

H. G.

LEAVES AND STEMS FROM FOSSIL FORESTS

- - - - - by Raymond E. Janssen

Illinois State Museum, \$1.25

THIS book, Volume 1 of the Popular Science Series, is more than "A Handbook of the Paleobotanical Collections in the Illinois State Museum." It is in fact the best popular account and guide to the fossil plants of the Pennsylvanian period that I have seen.

Although primarily based upon the exceedingly rich and well-preserved flora found in the Mazon Creek region of Illinois, nevertheless, the book includes species found in all the Coal Measures of the state. For each species there is a short description stressing those characters which distinguish it from closely related forms, and one or more specimens are illustrated. Special commendation should be given the 165 illustrations, especially the line figures clearly showing the differences between the various genera of the Cycadoficales.

For the amateur and professional paleobotanists whose interests lie primarily in these late Paleozoic floras this book is

highly recommended as the best popular work yet issued.

H. E. VOKES.

OUR SMALL NATIVE ANIMALS—Their Habits and Care

- - - - - by Robert Snedigar

Random House, \$2.50

POETS and kindred sensitive souls have fought a war of words on behalf of the caged animals for a long time. The fact still remains that all kinds of animals are kept in captivity and probably will continue to be kept in captivity. The problem then becomes one of method rather than of principle. Yet, those who make it a business or a pleasure to keep animals in captivity have found that there are certain principles of humaneness that are worth practicing. In this excellent book on the habits and care of our small native animals Mr. Snedigar has drawn deeply from his many years of successful experience in keeping small wild animals. Here is no sentimental overflow, yet, those who believe that the only happy animal is a free one should read carefully the story of a certain grey squirrel named Jerry, the squirrel that could not keep away from people. I knew this particular animal and can vouch for the authenticity of the tale.

Between the covers of this book are hundreds of practical hints on the successful care of small animals, supplemented with numerous illustrations, diagrams and photographs of animals, cages, and terraria. Like Noah's ark, this book includes all manner of beasts, with the exception of insects and other invertebrates. Be it skunk or snake, raccoon or frog, the author has included practically every small animal native to our countryside which might be kept as a pet. Mr. Snedigar has also included enough of the natural history of each animal considered, to satisfy average curiosity. Most persons who keep wild animals in captivity know that one of the most difficult problems is that concerning feeding. The excellent final chapter on feeding does not attempt to solve this problem completely but it does provide some good practical suggestions for keeping an animal healthy. This book is to be considered an introduction to the care of wild animals as the author points out when, in conclusion, he writes, "This book can never be complete but it can have a continuation. Your notebooks, your photographs and your fun will be, I hope, that continuation."

The sound philosophy of the author will appeal to many. Especially when he writes, "The animal owner's attitude, if he is to succeed, must be one of patience, calm and willingness to understand. Discipline is necessary—not for the animal—but for his own human and thoroughly irrational temper." This is a book which should be of mutual help both to man and to beast. One feels sure that it will save many lives, animal lives to be sure, and then, perhaps, by introducing some novice to the pleasure and satisfaction which lies in the "magic" of a good hobby, save some human lives, at least from boredom.

JOHN R. SAUNDERS.

AMERICA BEGINS AGAIN

----- by Katherine Glover

Whittlesey House, \$2.75

FOR some time now the economic system of the United States has been run after the fashion of the Chinaman who burned down his house to roast a pig. The process provides a spectacular blaze and not too tastefully cooked pork. However, the beauty of the fire should not dazzle one to the extent that one forgets the inefficiency and costliness of that particular method of cooking.

Unfortunately the apologists of the present system of production have dwelt so much on the spectacle of the fire that they have diverted the attention of its dependents from its appalling cost. Katherine Glover in her book *America Begins Again* tells in an objective, scientific manner just what has been going on.

She describes how through ignorance and heartlessness a territory larger than the states of Texas, California, and Washington has been ruined or severely damaged by erosion. This destruction is increasing rather than waning—a capital loss the computation of which involves astronomical figures.

The author tells of the merciless cutting of the nation's forests which left barren the slopes on which they had grown so usefully and beautifully.

All these things contribute to the increasingly destructive disruption of the hydrologic cycle. The waters do not come slowly from the uplands but run off quickly bringing billions of tons of unprotected earth in streams whose floods continually increase in height and destructiveness.

Wild life, which is so necessary to control the balance of nature, is decimated owing to the depletion of cover and refuge.

Such practices cannot go on for the simple reason that the continent cannot stand up under the strain. Nature will force a showdown unless man realizes where he is headed and changes his habits. A change must come sooner or later. Now it will be somewhat voluntary; later it will be forced, for man is as much a creature of nature as any other animal. This fact has been forgotten by him in the feverish excitement of squandering his patrimony.

The author shows how a wise use of our resources can be made. Soil conservation, cropping rather than mining our forests, intelligent agricultural practices, valley planning, all are necessary to the survival of the continent which supports us.

The author explains clearly the nature of the conditions that are menacing our future. She describes the program which must be put in effect to remedy them. Every person of good will who desires that he and his children be good inhabitants of a fostering land should know and understand what is put down in the book which Katherine Glover so optimistically entitles *America Begins Again*.

JOHN N. CARLEY.

YOUR NEW BOOKS

FIELD BOOK OF ANIMALS IN WINTER

----- by Ann Haven Morgan

G. P. Putnam's Sons, \$3.50

HERE is a book that really tells what happens to animals when winter comes. It strips age-old secrets as bare as trees when the first snows arrive. Doctor Morgan has turned out another fine piece of animal documentation, a worthy addition to the already excellent library of the out-of-doors known as the Putnam Nature Field Books. This is Doctor Morgan's second contribution to the series as she is the author of the well-known *Field Book of Ponds and Streams*. This is a book that will probably cause a widespread desertion from warm firesides for many winters to come. One knows that the author has followed many animal lives through the cold months. She has succeeded in telling how many of the animals, large

NEW HORIZONS ON THE AIR

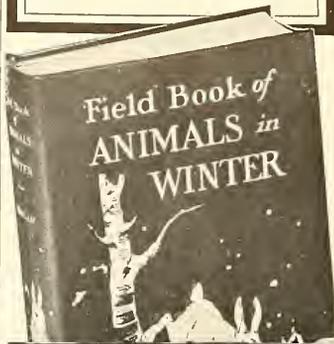
Starting Wednesday, October 11th, and every Wednesday thereafter during the current school year, the American Museum of Natural History will return to Columbia's American School of the Air with its program of natural history science and exploration entitled *New Horizons*. The program this year presents a sweeping and instructive panorama of the making of America's map—an inspiring biography of a continent. Broadcast over more than 100 stations, this program reaches 125,000 schoolrooms.

With Dr. Roy Chapman Andrews as commentator and with the Museum's vast North American collections as their background, these presentations will tell the gripping and romantic drama of our country's transformation from an uncharted wilderness to a mighty New World. Broadcasting from the Museum, Doctor Andrews will bring fellow explorers and members of the Museum's scientific staff together to discuss subjects as vital to the student as they are absorbing to the layman.

Starting with North America's map as it began in the days of Columbus—a mysterious land mass hidden below Man's horizon—the broadcast will trace the growth of this map through the adventures of the great explorers. Into this scene will be woven also the lives of the immortal naturalists, showing how their work contributed to the advancement of human welfare and the prosperity of our country. In a dramatic re-enactment of these phases of our national history, therefore, this series of broadcasts will illuminate avenues in the growth of America's life and resources which are seldom touched upon.

The program will be heard in states having Eastern Standard Time at 9:15 a.m., and in western states at 2:30 p.m., Central Time.

*A New Addition to
Putnam's Field Books*



Field Book of Animals in Winter

by

ANN H. MORGAN

Professor of Zoology, Mt. Holyoke College

author of

**"FIELD BOOK OF
PONDS AND STREAMS"**

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and small meet the crises and depressions of winter.

In her own words, "It is for the use of anybody who inquires into the ways of a wasp huddled beneath a window casing in December, or the state of a hibernating woodchuck in his hole, or the welfare of birds through a snowstorm." Man has long been puzzled about the welfare and whereabouts of certain animals in winter. In the past he has devised clever superstitions which satisfied his unscientific mind. However, slowly but surely, superstitions give way to fact and today we know that animals do not vanish into thin air. They can be found even in the dead of winter, if one only will look in the right places. True enough, they may not always look like the same busy creatures we saw so much of in summer. They have managed to find, each and every one, their own particular method of best surviving Nature's hardest season. This is the story this handbook so ably tells. We read of winter preparations and migrations, in all classes of animals from the microscopic roofer to the 500-pound black bear. Birds and fish, fresh-water sponges and deer, all must adjust themselves to winter, or die. Well written, well illustrated and well referenced, this book, though it is in the concise, outlined form its purpose dic-

tates, is a book that tells more thrilling than fiction, the amazing story of the never ceasing struggle for existence.

JOHN R. SAUNDERS.

THE FEATHERED FOLK OF AN ESTUARY

----- by Guy B. Farrar

Charles Scribner's Sons, \$3.75

THIS is a book about English birds, particularly those species that frequent the seashore and tidal marshes of the estuary of the River Dee, in Cheshire, but it should prove attractive to bird lovers of other countries than England. The author has a pleasing, conversational style that enables him to present a long array of varied notes before the reader without losing his attention. He tells of his experiences with birds and of their habits as he has observed them in the

field, largely at close range from concealment in a "hide" or blind placed a few yards above high tide where the incoming waters forced his visitors within shooting range of his camera. A series of thirty-two unusual photographs demonstrates his success in this branch of ornithological endeavor.

Occasional departures into the realm of speculation are made with statements of opinion, most of which are based on specific observations. Ducks are said to have a keen sense of smell, being most easily stalked upwind, and it is recorded how a sitting duck became alarmed only when a change of wind brought the scent of the observer. The Lesser Black-backed Gull was noted as attacking and striking with the feet. The Peregrine Falcons of the Dee estuary were found to have adopted an upward attack on their prey and a sudden grasp with the talons, presumably where experience had taught

NOTICE TO READERS

Readers are encouraged to submit their own photographs of natural history subjects. Those selected for publication on this page will be paid for at \$1.00 each, with full credit to the photographer. Return postage must be included.

LETTERS

Continued from page 129

ered together hundreds of birds, including about 50 varieties, forming a veritable league of nations, which puts to shame their human counterpart at Geneva for peace and harmony. Crippled by a fall at three years of age, Charles Jones has been an invalid much of his life, and this hobby has made life interesting for himself as well as the many visitors who call at his unique aviary from all parts of the world. His success lies in the hand-rearing of all nestlings and in his experiments with diet and other factors. Though his bird haven is known far and wide, Mr. Jones will not be satisfied until he can have a few acres enclosed in a park area where he can accommodate and breed birds on a really grand scale.

C. F. GREEVES-CARPENTER.

Adamstown, Pa.

SIRS:

I noted with interest Henry B. Kane's photograph, "Quartet in Four Flats," published in the April NATURAL HISTORY, and was reminded to send you the accompanying one which I took of four baby owls. The picture was taken at Basking Ridge, N. J. The owls occupied a hole in the tree, which was felled in a storm.

ELBERT W. MILLAR.

Westfield, N. J.

SIRS:

... Please let me take this opportunity to congratulate you on the extraordinarily fine work you are doing in producing NATURAL HISTORY.

HERALD STENDEL.

Washington, D. C.



that the normal downward stoop would knock the prey into the tide where it would be lost. There are many notes on the distinguishing marks of certain species in the field, their characteristic call-notes and habits, and there are hints on the photographic methods adopted by the author. The American reader, even if unfamiliar with some of the species here discussed, and many of them have close American relatives, is certain to enjoy this account of the habits of these many visitors to the "Sands o' Dee."

J. T. Z.

Recent Museum Publications NOVITATES

- No. 1027. Synopsis of the American Species of *Fulucella* Syrphidae; (Diptera). Part I. By C. H. Curran.
1028. Synopsis of the American Species of *Fulucella* Syrphidae; (Diptera). Part II. By C. H. Curran.
1029. Four New Species of Sobarophala (Diptera: Cludidae). By C. H. Curran.
1030. New African Dolichopidae and Drosophilidae (Diptera). By C. H. Curran.
1031. Two New American Diptera with Notes on *Asemosyrphus* Bigot. By C. H. Curran.
1032. Notes on a Collection of Spiders from Montana. By W. J. Gertsch and W. L. Jellison.
1033. A New Genus in the Phleidae. By W. J. Gertsch.
1034. A Study of *Tetrameryx* and Associated Fossils from Papago Spring Cave, Sonoita, Arizona. By Edwin H. Colbert and Robert G. Chaffee.
1035. Results of the Archbold Expeditions. No. 23. A Revision of the Genus *Emballonura* (Chiroptera). By G. H. H. Tate and Richard Archbold.
1036. Results of the Archbold Expeditions. No. 24. Oriental *Rhinolophus*, with Special Reference to Material from the Archbold Collections. By G. H. H. Tate and Richard Archbold.
1037. Report on a New Ricinuleid from Texas. By W. J. Gertsch and S. Mulaik.
1038. Notes on the Anatomy of *Ranzania truncata*. A Plecognath Fish. By Henry C. Raven.
1039. A New Species of *Chalcis* from the Dominican Republic. By B. D. Burks.

BULLETIN

Volume LXXVI Art. 3—The Indo-Malayan Species of *Trigona*. By Herbert F. Schwarz.

ANTHROPOLOGICAL PAPERS

Volume XXXVII Part I—Archaeology of the North Coast of Peru. An Account of Exploration and Excavation in Viru and Lambayeque Valleys. By Wendell C. Bennett.

INFORMATION TEST

A few informational high spots that may be gleaned from this month's NATURAL HISTORY

Score 5 points for each correct answer. Correct answers on page 192

- | | |
|--|---|
| 1. The flea is a parasite on the dog and the tape worm is a parasite on both dog and flea.
True..... False..... | 10. The man-o'-war bird is one of Nature's most spectacular fishermen. Why is he helpless in water? |
| 2. The longest individual bird flight on record covered a distance of
(a) 90 miles
(b) 900 miles
(c) 9,000 miles | 11. Anyone can be a bird-bander. All you have to do is write to the United States Biological Survey for bands.
True..... False..... |
| 3. Modern bombs and heavy artillery are certain to destroy all wild creatures in the battle area within a few weeks.
True..... False..... | 12. Which substance is driving silk and cotton to the wall as a source of textile fiber?
(a) Cottonwood
(b) Conifer pulp
(c) Ragweed |
| 4. At their peak, the giant Sequoias were contemporary with the
(a) First man
(b) Dinosaurs
(c) Post-glacial mammals | 13. Wolves, traditional "followers on the heels of Mars"
(a) Fled the war zone in 1914
(b) Lurked nearby to feed on the dead
(c) Attacked sentries in lonely outposts |
| 5. It is possible for a poisonous plant and a nutritious plant to belong to the same family.
True..... False..... | 14. The Irish potato was first grown in
(a) The British Isles
(b) Ancient Egypt
(c) South America |
| 6. The "Achilles' heel" of the man-o'-war bird is
(a) His delicate stomach which is constantly upset by a fish diet
(b) The cannibalistic tendencies of the parent birds
(c) His weak feet, which render his life on land precarious | 15. Man has trained the man-o'-war bird for
(a) Serving as "pilot" bird in fishing expeditions
(b) Acting as postman in South Sea Islands
(c) Chasing and bringing down enemy carrier pigeons in war |
| 7. That a certain bird habitually enters the mouths of crocodiles to pick blood-sucking leeches from their gums is nothing more than an ancient, discredited myth.
True..... False..... | 16. The width of annual tree rings is related to
(a) Sunspots
(b) The number of total eclipses
(c) The emergence of new galaxies of stars |
| 8. An early attempt at bird banding 200 years ago was inspired by
(a) The runaway habits of a pet canary
(b) The then current belief that European swallows hibernated in the mud
(c) A housewife's desire to distinguish her own from her neighbor's chickens | 17. What does the word "chili" in <i>chili con carne</i> refer to? |
| 9. During the last World War both the Allied and Central powers
(a) Issued a strict ban on the shooting of game animals in the battle zone
(b) Capitalized ruthlessly on the availability of game to supplement their meat supplies
(c) Tamed the larger wild animals for use in hauling cannon | 18. Efforts were made to use sea-lions in naval warfare as
(a) Message bearers
(b) "Sacrifices" to explode mines in advance of a ship
(c) "Scouts" to track down enemy submarines |
| | 19. The belief that a disease should be treated with an agent which outwardly resembles the symptoms or the organ affected is referred to by the phrase
(a) Hair of the dog that bit you
(b) The Doctrine of Signatures
(c) <i>Similis simili curantur</i> |
| | 20. What plant is of value to both the eye specialist and the beautician? |

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Miniature Monsters

By CHARLES H. COLES

Chief Photographer, American Museum of Natural History

THE photography of insects presents so many interesting problems as well as exasperating moments that at first it will seem a major undertaking to produce a picture that is satisfactory. However, as skill increases and the insect photographer masters all the problems of lighting and exposure, his album of "miniature monsters" will prove absorbingly interesting. His results may easily assume scientific importance, especially if he becomes a careful observer of the ways of his subjects and delves into their life stories. Subjects are plentiful in almost every locality; indeed, the photographer who sets himself the task of making a complete collection on the insects of even a restricted locality will usually find that he has years of work ahead. One of our Museum scientists has a present score of 1351 species in his 75'x200' yard.

The usual procedures followed in taking pictures are so reversed and changed that to make an insect portrait requires a slow and gradual adaptation to a new technique. The larger insects may be photographed in the field on flowers or other plants, provided the photographer is equipped with a long-focus lens and plenty of patience. The less timid insects may be transferred bodily to a leaf in a sunny location where the breezes do not shake the subject. The slightest movement of the leaf or flower during the exposure will spoil the sharp definition required. Some method of accurate focusing must be available on the camera that is to be used. A reflex focusing arrangement where the operator can check focus and position on a ground-glass screen just previous to exposure is the most effective type of equipment. The best miniature cameras have other but just as effective means for taking extreme close-ups.

The more nervous insects that object to the close approach of the photographer must be stalked unobtrusively. Usually some plant will be found that is attractive to these insects where the camera can be set up and focused on a specific flower or leaf. The shutter is set, and a long cable release or string tied to the shutter release is held by the operator a short distance away. An eagle eye is kept upon the selected leaf for the arrival of the prey and a quieting of the wind. When the insect has consented to pose and the leaf has become quiet, the shutter is tripped. Rapid results must not be expected by this method, however, as it requires great patience. An exceedingly useful accessory for such work is a small telescope that may be focused upon the same leaf as the camera so the position of the insect may be studied before exposure.

The highest speed films are indicated for this type of work. The faster the shutter speed used, the less will be the chance of movement causing blurring. Smaller lens

apertures are also advantageous in attaining greater depth of field and so bringing more of the background into focus.

Higher magnifications

When it comes to magnifications that exceed natural size, the insect must be brought indoors. It has been suggested that the insect be first slightly chloroformed until its ambition to walk away has been inhibited. A small dab of a quick-drying cement, such as Duco, is placed under the end of each leg and the insect set down upon a microscope slide. As long as the insect is alive, it will not tend to curl or shrivel, and a knowledge of the natural postures of the insect will guard the operator from allowing it to assume a position that is not true to life. After the cement is dry, which takes only a minute or

Continued on page 192

PRIZE CONTEST

Have you an unusual natural history photograph? In the November issue, NATURAL HISTORY Magazine will offer three prizes of \$10, \$5 and \$3 respectively for the best photographs submitted by readers.

The subject may be anything from a wild animal to a microscopic view of an interesting crystal or seed. A tree, a bird, a native type—anything in the broad range of NATURAL HISTORY Magazine is eligible. Other acceptable photographs submitted will be purchased as heretofore at \$1 each for the Letters page. The contest is open only to those who receive NATURAL HISTORY Magazine as members of The American Museum of Natural History.

Photographs for the November issue must reach NATURAL HISTORY not later than October 14th. The photographs will be judged not alone on their pictorial merit but also on their significance. The contestant is urged to paste any pertinent information to the back of the print, also to state the camera, film, and conditions of exposure. Prints, not negatives, are desired, preferably glossy. NATURAL HISTORY Magazine cannot return entries unaccompanied by return postage. There is no limit on the number submitted.

Address: *Photographic Contest,*
NATURAL HISTORY MAGAZINE
77th Street and Central Park West,
New York, N. Y.

PRIZE WINNING PHOTOGRAPHS



FIRST PRIZE

Shadow picture

By HORACE B. MAGEE
with Zeiss Ikon Ideal, f. 6.3, 1/50 sec.
Verichrome film, no filter.

SECOND PRIZE

*"Whitebird," a Sioux
Indian*

Chief said to be 94 when
picture was taken.

By ERICH SCHLAIKER



THIRD PRIZE

By J. P. MURPHY

Taken with Graflex 3 1/4 x 4 1/4, f. 6.3, 1/25 sec.
Verichrome film without filter.



so, the slide can be placed in a jar with a few drops of chloroform and the insect killed. Care must be taken that your chloroformed insect does not assume a weird pose.

The insect is now ready for its picture. A camera with a long bellows extension is required to obtain magnification of the image. This extension is only a relative one with respect to the focal length of the lens used. If a lens of two inches focal length from a miniature camera is to be used, the extension for a given magnification will be very much less than for a lens of six inches focal length.

One of the curious reversals of normal experience is encountered here when the relation of depth of focus and focal length is examined. For a certain size image of a given insect, the longer the focal length of the lens used, the greater the depth of sharp focus. Of course, a much greater bellows draw is required with a long-focus lens than with a short one. It is usually the limitation of bellows draw that prevents us from using as long a lens as we please. With miniature cameras, lens extension tubes take the place of bellows.

Lighting the subject

With small objects, correct illumination is difficult unless small lighting units are available. Small lights and reflectors make it possible to place the lights close to the axis of the photographic lens and so to obtain frontal illumination. If small lighting equipment is not at hand, small mirrors may often be used instead, arranged to receive a beam cast by larger lights and reflecting it axially upon the subject. Small bits of white paper and tinfoil placed at strategic points will illuminate dark corners and high lights which improve and add detail.

With translucent objects, transmitted light will often show more than reflected light. A small piece of tinfoil behind the specimen, reflecting through it a beam of light from a larger light source, will produce an interesting bright object against a dark background. The tinfoil may be shaped to the outlines of the subject and thus hidden behind it.

Making the Exposure

When the object is finally correctly lighted and focused on a ground glass, the exposure is in order. When possible, the image should be focused at the aperture that is to be used, because with some lenses the focus plane shifts as the lens is stopped down. This would be disastrous to sharp pictures. If insufficient light precludes such practice, focus at the smallest stop at which the image is visible. Incidentally, the lens can be stopped down too far. Although depth of field increases as the lens is stopped down, diffraction degrades definition at the smaller apertures. Only experience will tell how far to go. Try a few pictures and see.

Snapping the lights on and off is a better way of timing the exposure than with a shutter. The shutter may cause a vibration that will ruin the picture. A fast film will cut down the exposure length so that

vibration of the equipment will not be too serious.

The whole field of photomicrography is a fascinating one, where familiar objects take on strange aspects and harmless little creatures become monsters from nightmares.

Answers to Questions on page 189

1. True. See page 155-156
2. (c) 9000 miles. See page 150
3. False. See page 182
4. (b) Dinosaurs. See page 144
5. True. See page 160
6. (c) His weak feet which render his life on land precarious. See page 134
7. False. See page 156-157
8. (b) The then current belief that European swallows hibernated in the mud. See page 151
9. (a) Issued a strict ban on the shooting of game animals in the lattle zone. See page 181
10. Because it cannot make headway with its puny feet, and its plumage, inadequately supplied with oil, becomes waterlogged. See page 143
11. False. See page 154
12. (b) Conifer pulp. See page 147
13. (a) Fled the war zone in 1914. See page 181
14. (c) South America. See page 166-167
15. (b) Acting as postman in South Sea Islands. See page 143
16. (a) Sunspots. See page 177
17. It refers to pepper, specifically, the dry, many seeded berries of the capsicum. See page 165
18. (c) "Scouts" to track down enemy submarines. See page 184
19. (b) The Doctrine of Signatures. See page 160
20. Belladonna. See page 162

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Natural History

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LETTERS

SIRS:

I have just read your story on bird banding and I find it very interesting and informative. I wish you would continue such articles. . . .
Carmel, N. Y. MARTIN CHEROFF.

SIRS:

I cannot send the check for dues without adding a word of praise for your beautiful magazine. . . .
Winnetka, Ill. (Signed)

SIRS:

I enjoyed your article by J. Frank Dobie on Roadrunners in the September issue. The pictures taken from the film "Adventures of Chico" were taken in Laredo. I furnished the deer shown. . . .
Laredo, Texas. GORDON H. SHINER.

SIRS:

In NATURAL HISTORY for October is a very interesting article on bird banding. In this article Mr. Edwin A. Mason says: "One of the earliest attempts at banding—in 1740—was an effort to determine whether it was true that European swallows hibernated in the mud like frogs. . . ."

Izaak Walton, in the first edition of *The Compleat Angler*, published nearly a hundred years before Mr. Mason's date, in discussing the migration of salmon, also refers to tying ribbons on swallows. I quote from his statement:

"And for the salmon's sudden growth, it has been observed by tying a ribbon in the tail of some number of the young salmon. . . ; and the like experiment hath been tried upon young swallows, who

have, after six months' absence, been observed to return to the same chimney, there to make their nests, and their habitations for the summer following. . . ."

HAROLD T. PULSIFER.
East Harpswell, Maine.

SIRS:

I have read with interest the article in September's NATURAL HISTORY Magazine by James L. Clark.

It is evident that the habits of the Cougar, or Mexican Lion, as we in Texas call him, and that of the Rockies, as described by Doctor Clark, differ considerably.

First, while the lion is sometimes hunted with hounds in our section, as described by him in his article, in which the lion generally follows the rule and takes to a tree, or stays on the ground to fight, the usual method is to trap them, and this is done by setting traps about a kill, or along a small wash or gully, or on the banks of a pond where the lion waters. They may not often retrace their steps, but they do make regular rounds which may have a radius of 25 to 50 miles, or even more; and unless they have been chased by dogs, or otherwise disturbed in the interim, they return to the trap by identically the same route originally traveled. This is an invariable characteristic of the lions of this section, and makes it comparatively easy to trap them. A female with young cubs may not venture far, but the rule is for a male lion to return by the same route in 10 to 14 days, while the female makes it in from 7 to 8 days. A lion here in this particular sec-

tion will return to identically the same spot on the bank of a pond to water, and many have been trapped through this peculiarity. Also the lions of this locality do come out in broad daylight. I have shot at—and missed—more than one as early as 4 p. m., and my wife, who sometimes accompanies me on my rambles into the brush, was a witness to an attempt of a large lion to kill a deer which had come down to water in broad daylight. Less than three months ago the Game Warden, Mr. John Hearn, killed two lions about 3 p. m. with a rifle while they were playing on the bank of a creek. However, as a rule they do their hunting at night.

It is evident that the topography of a country, its climate, as well as the habits of the fauna which provide food for the lion contribute to these differences. Otherwise the description of the lion of the Rockies, as given by Doctor Clark, corresponds to that of the lion of southwest Texas.

Also, quoting John Hearn, the Game Warden, the Mexican Lion has no particular aversion to taking to the water if the occasion arises, or to cross a stream or pond if chased by dogs. Indeed, the Warden is authority that these lions, which drift in from the mountains of northern Mexico, often cross and recross the Rio Grande on their regular rounds, and this river, in the vicinity of Laredo, hardly ever gets low enough to cross without swimming. Some 200-odd lions have been killed or captured in this locality in the past few years, but still they come in. It is evident that there are other sections besides the Rockies where they thrive in spite of all efforts to eradicate them. As a lion will kill two deer a week all the year round, one can see what inroads are made on the deer population by 200 lions. John Hearn has captured, or killed, 114 of these.

Very truly,
Laredo, Texas. J. T. WARD, M. D.



SIRS:

It might be best not to give the location of this young green heron's nest any more definitely than "somewhere on Long Island," for bird collectors are apparently operating in the vicinity. On one acre of land surrounding the heron's nest were: 8 red-winged blackbird nests, 3 song sparrow nests, 2 savannah sparrow nests, and one each of seaside sparrow, killdeer,

clapper rail, and later, spotted sandpiper and sharp-tailed sparrow.

The day after this photograph was taken, the young bird, eggs, and nest had all disappeared. The marshes in this vicinity have a wealth of bird life, but with a collector operating, even within the city limits, it's just too bad for the birds! And for the bird lovers.

Brooklyn, N. Y. EDWARD J. WHELEN.

NOTICE: Readers are encouraged to submit their own photographs of natural history subjects. Those selected for publication on this page will be paid for at \$1.00 each, with full credit to the photographer. Return postage must be included.

THE TALL TRUTH

APPETITES

The necessities of nutrition in various animals are usually indicated by their appetites. The short-tailed shrew not only may but must eat approximately its weight in flesh every twenty-four hours. If it fails to get this relatively enormous meal it starves. The hyaena eats great quantities of carrion, but hardly its own weight. One ate itself into the body of an elephant that Theodore Roosevelt had killed and was caught there, trapped by its greed. Hyaenas and carnivores generally can go for long periods on very little food, however.

The African elephant spends most of its waking hours eating; its diet of leaves, twigs, fruit and grass has a relatively low food value. This is also the case with the giant panda which lives on bamboo.

The longest fast of an active mammal is that of the male sea lion and fur seal. These go almost three months without eating, and three months of fighting and mating activity on an empty stomach is quite an endurance test.

JOHN ERIC HILL.

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NATURAL HISTORY

The Magazine of the American Museum of Natural History

FREDERICK TRUBEE DAVISON, President

ROY CHAPMAN ANDREWS, Sc.D., Director

VOLUME XLIV—No. 4

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THE PEARL OF ALLAH

The giant clam yielded its treasure only after slaying a native diver trapped when its great jaws snapped shut. Worshipped as the gift of Allah, the 14-pound pearl was finally presented to the author by a Mohammedan chief whose son he saved from death

By WILBURN DOWELL COBB

MY companions and I were in a little fishing village in the outer reaches of the Philippine Islands when news reached us of the discovery of a giant pearl, which today is the largest specimen in the world.

We had pitched camp on the seventh day of May, 1934, and that night after supper we stretched out on our cots in anticipation of a good night's rest. I was practically asleep when suddenly pandemonium broke loose in the primitive huts of the Dyak tribe in whose fishing territory we had undertaken archaeological excavations. It seemed that every native in the village was screaming at the top of his voice, singing the quaint funeral dirge of the Dyak people. I shoved my automatic in my pocket and went out to investigate.

In the nearest shack I found "Capitan" Popong, an old Dyak who had been my guide on an investigation

in the same region two years ago. It was I who had given him the title of "Capitan," and today no Dyak would ever dare address him by any name other than this. We sat on the floor, and I asked him to tell me the reasons for the wailings and the dirge.

At first he was reluctant, but eventually I learned that his son, who was chief of the tribe, had brought his hungry people only a few days ago to fish in these waters. Bogtong, the young chief, had immediately organized the best divers of the tribe in an expedition to collect conch shells, which they would trade for the fishing implements they so badly needed.

Toward noon, the old man recounted, Bogtong had realized that he had missed Etem, one of his assistants, on the last three dives. All the men were alarmed. Suspecting a giant octopus, they unsheathed their knives and, as one, dove down in search of their missing comrade.

On the fourth dive they found Etem already dead. In his search for conch shells, he had failed to see the giant *Tridacna* clam which was partly hidden by coral rocks, its huge jaws held open ready to clamp shut with the strength of a bear trap. Etem accidentally got his hand between the shells, which snapped shut, and thus he met his death. With the aid of ropes, the men hoisted their dead comrade and his deep-sea murderer into one of the canoes.

In this locality a death must be fully and satisfactorily explained to the authorities. Bogtong knew there was but one thing to do and that was to take the boy just as they had found him with his left hand still in the grip of the giant shell to Panglima Pisi, the Mohammedan chief, who acts as the local notary pub-



THE AUTHOR shown holding the fluted "jaws" of the huge *Tridacna* clam which took the life of a native diver and yielded the world's largest pearl. It is not unusual for a diver to be caught in the jaws of one of these giant clams, which clamp shut with the suddenness and strength of a bear trap, leaving him helpless to drown

AMNH Photo

lic. There they would ask their old friend to sign an affidavit describing the death of the boy and absolving his six companions from any blame.

After three hours of hard paddling they reached the mouth of Boligay Creek, where they turned and headed for the little bamboo bridge just below the road leading to the Panglima's house. After being welcomed with the usual formal greetings, Bogtong explained his mission to the old man. Offering a cigar to Bogtong and lighting one himself, the Panglima asked to be shown the body.

The scene that greeted the old man's eyes at the creek reminded him sadly of his younger days, when he was the owner of the largest pearl fishing fleet in the Sulu Sea. He told the young men of two similar accidents that had happened in his own fleet and how he had hoped to be spared the sight of another such disaster. Motioning for Bogtong to follow, he led the way to the house.

When the old Panglima had finished writing, he folded one of the copies and handed it to Bogtong. Bogtong thanked the old man and asked him if he might leave a canoe-load of the conch shells for the service rendered. Smiling one of his rare smiles, the old man said, "You may leave me the conch shells if you wish, but please give me the giant clam that caused the death of your companion. I would like to keep it here on my porch to remind me of my pearl fishing days."

At this point in his tale, Capitan Popong fell silent for a moment, then continued:

"About two hours ago as they returned here in their canoes, they saw the light of a strange lamp in the center of the village. Bogtong motioned for silence. He thought it might be that the tax collectors had come on their annual rounds. Leaving his men with their conch-filled canoes hidden in the shadows along the shore, he crept close to the strange tent. Then he gave a sigh of relief, for he recognized your features, my friend. He was one of the men who helped you pull your motor launch free from the sand bar when you were stuck on the Iwahig River two years ago.

Dyak dirge

"Bogtong ran back for his men, sent one of them for me, and I joined the boys at their task. Five of them gently lifted the dead Etem in their arms, and with Bogtong holding a torch and leading the way, they laid the body in Bogtong's shack. Then my son, after telling me the story of their sad trip, picked up the old buffalo horn and blew on it the long-drawn-out death call of our tribe."

Startled out of their sleep, the cabins had come to life one by one. Frightened, anguished faces filled the

door of the hut where the body lay. At the sight of the drowned boy, the whole tribe broke out into the mournful prayer and wailing for the drowned.

"This, my friend, is the bedlam that awakened you. We will keep praying until sunrise, and then again until sunset, and yet again—for three nights. Because if we do not, the devils of the sea will keep Etem's soul forever."

Saddened by the tale, I watched them bury Etem the next morning under the shade of a coconut tree. His grave was fenced in with strong bamboo stakes to keep the wild boar and other scavengers from disturbing it. After harvesting the rice here in the lowlands, the tribe would come back for the remains of Etem, which would then be carried back to their mountain home and there buried properly.

I was very anxious to see the giant clam that had killed a man, so after the three nights of praying and wailing I asked Bogtong to guide me to Panglima Pisi's home at Boligay. And that afternoon, after leaving Capitan Popong in charge of my party, Bogtong and I set out for Boligay.

The sacred pearl

Nearing the Panglima's house, we were greeted by sounds that seemed to be the climax of some Mohammedan celebration. Mingled with the beating of gongs could be heard the singing of women, while the men, who must have lost their voices because of incessant shouting, were doing the spear dance to the rhythm of the brass gongs. I knew it would be dangerous for a Christian to venture forth while such a celebration was in progress, so I sent the young chief ahead to investigate. He was gone for about two hours. It was late in the evening when he returned with the story of the celebration.

It appeared that when they left the giant clam on the Panglima's porch a few days before, a strange incident had occurred. As the aged Mohammedan chief watched his men remove the meat from the shell, he suddenly saw an enormous pearl. Seizing it in his hands, he examined the surface and discerned the image of a turbaned face, formed by nature on one of the sides. In this image the Panglima was startled to discover a resemblance to Mohammed. Then as his excited servants stood in awe, the old man prostrated himself before the pearl and began to pray. It was this act of religious devotion that incited the frenzied celebration throughout the whole tribe which we were now witnessing.

Having at first merely expected to see a clam that had killed a man, you may imagine my eagerness to glimpse the pearl that it contained, with the image of a turbaned face. I never dreamed how big it might be. But Bogtong restrained me from going into the midst

of the celebration. He suggested that I let him keep an eye on the settlement, and he would let me know when it would be safe to approach the Panglima. I agreed to this and we returned to our camp.

About two weeks later Bogtong presented himself in my tent. He was ready to take me to Boligay, the celebrations having subsided and the Mohammedans having returned to their usual daily chores. Upon arriving at the Panglima's house, I found preparations had been made for me to pay him a prolonged visit. The etiquette of the Mohammedan people would prevent me from talking business until four days of festive hospitality had passed.

It was in the early afternoon of the fourth day of my visit, while having tea with the family, that I asked to be shown the pearl. The Panglima called an attendant, who came out and laid the pearl before us on the table. When I first saw the pearl I could hardly believe my eyes. There on the table in front of us lay the largest pearl ever beheld by human eyes. The gigantic gem weighed fourteen pounds, one ounce. It was nine and a half inches long and five and a half inches in diameter, and glowed with a highly reflective, satiny sheen. Two more attendants entered, carrying the half of the shell in which the pearl was found, and the old Panglima laid the pearl in its former bed. It seemed as though I were looking at a pearl that might have been taken from the pages of the *Arabian Nights*.

I asked my host to name his price, but was kindly but firmly told that the pearl was not for sale. Smilingly, the Panglima said, "It would be a sacrilege for me to part with this pearl. A pearl with the image of



(Above) PANGLIMA PISI, the Mohammedan chief who first owned the pearl. He saw in its shape a resemblance to Mohammed and out of religious veneration refused to sell it

(Below) THE SON AND HEIR of the Mohammedan chief surrounded by attendants. When author Cobb cured the boy of malaria, the chief pressed upon him the sacred pearl as reward



Mohammed, the Prophet of Allah, is earned by devotion, by sacrifice, not bought with money. I may not be a millionaire but I defy the richest man in the world today to show me a similar pearl. Please excuse my words, my friend, but the satisfaction of owning the largest of all pearls is to me worth more than mere money."

But on this April day in 1936, I was not thinking of the pearl. I was celebrating my birthday with my brothers in our home in Manila, wondering where I would spend my vacation during the hot season, when a postman arrived with a letter. It was from Bogtong—no doubt written for him by some village school teacher—telling me of the discovery of an ancient

AMNH Photos



(Above) SHOWN IN THE FULL LUSTER of its natural sheen, the world's largest pearl is compared to one on an expensive jeweler's ring

I was disappointed at not being able to purchase the pearl. Still, I could not help but admire the old Panglima's logic. We bade farewell then, and soon after I prepared for my return to Manila.

Two years passed. I had long been away from the Panglima's land. The giant pearl had not passed from my mind, but I remembered it now only as a fabulous experience I had once had which survived in my tales to friends. Sometimes I was piqued because I could see that my audience did not believe the gem to be as beautiful, as large, and as mysterious as I tried to depict it, and then the old longing to possess it came over me.

burial ground located just south of Panglima Pisi's residence. This seemed the answer to my vacation plans and I prepared to leave for Boligay Creek immediately.

I had hardly arrived and was in the midst of preparing to start my digging, when Bogtong came to visit me. He said in a very excited manner that Pula, the Panglima's son, was mortally stricken with malaria and that he wished my help. Leaving the party in charge of my head boy and giving Bogtong my first-aid kit to carry, we hurried to the old Panglima's residence.

We were met on the porch by the Panglima him-

self, who with tears in his eyes led us into the room where the boy lay. Looking at Pula, I hardly recognized him. He lay in what I thought to be an unconscious state, but he was aware of our entry, for opening sunken, staring eyes, his face a ghastly greenish yellow, he said, "Mr. Cobb, help, please help me. I am dying!"

"But where will you get this atabrine?" cried the old man. "My son would be dead before we could have it sent from Manila." I relieved him with the information that I had a large quantity of the compound with me. Hearing this, the Panglima knelt and pleaded with me, saying that he would give me anything he owned if only I would help his beloved son.



(Above) CENTURIES of growth in this clam shell matrix may have been required before the pearl could reach its unprecedented size. Here is another of Nature's masterpieces which Man for all his laboratory cleverness can never match

I felt the boy's forehead and pulse. He was burning with a severe malarial fever, a type very often mistaken for the dreaded blackwater fever. Leaving Bogtong with the sick boy, I asked the Panglima to step outside with me.

Confronting the heart-broken father, I gave him the bare facts of the case, and told him that if they were to continue the old quinine treatment, the boy would be dead inside of a week. There was only one remedy known to science that would cure such an advanced case of the disease, and that was the drug atabrine.

Assisting him to rise from his knees, I promised aid on the condition that I would be given a free hand and would not be interfered with by any of his local medicine men. With a smile of hope on his face, the old man agreed to my terms and went into the sick boy's room.

An attendant showed me into my quarters. I told him that Bogtong would be my assistant and asked him to bring the young chief to me. As he left my room, I realized into what a predicament I had plunged myself. If Pula were to die after I had so much as touched him with the tips of my fingers, my

death was assured. These Mohammedans would kill me, thinking, of course, that I had been responsible for his death. However, I had already given my word, so it was too late to change it. I decided to go ahead with the treatment, hoping the boy was not so far gone as to be beyond help.

About seven that evening the periodic fever of my patient had subsided a little, but he was still too weak to take atabrine by mouth, so I gave the doses by intramuscular injections. We took turns watching the boy day and night. For four days he seemed to hover between life and death. But on the fifth day the fever abated and from then on he steadily improved. The fever had burned him to skin and bones, and he was still helplessly weak. I had to devise some way of helping him to recover his strength, so I ordered him to be carried to the sea in front of his house for a daily three-minute dip. At first he seemed exhausted by this routine, and I could feel the strong though silent disapproval of the Panglima. But I persisted, and my luck held, for with this daily stimulant, Pula began to look more like himself. Finally he was able to join Bogtong and me in fishing and hunting, perfectly restored. Later they both took an interest in my digging and often joined me at the site.

But at length my work drew to a close. My patient was well again, and nothing could hold me longer with my pleasant friends. At dinner that night I announced that I must return to Manila. They all expressed sorrow at losing me, and the Panglima asked me how much he owed me for treating his son. I told him that he did not owe me anything, that he was my friend, and so was his son, and to me the continued friendship of the entire family was compensation enough. This surprised the old chief, and he became silent. He called an attendant and whispered something to him. The man left the room and a few minutes later returned holding the largest pearl in the world in his hands. He placed it in front of the old man.

The Panglima speaks

The Panglima laid his hand on the pearl and said, "Mr. Cobb, one week before you came, I knew that my son was mortally ill. I have seen so many of my tribe die of the disease, I was terrified. Quinine, the only remedy that we know, did not seem to do any good. I was helpless, I did not know what to do. That night, holding this pearl in my hands, I prayed to Allah for help. In my prayers I vowed to Allah that however much I valued this pearl I would willingly give it to anyone that he could send to help me save my son. As though to test my sincerity, you came.

"I remembered that two years ago you tried to buy the pearl. I wondered then if you were the man that

would save my son from his affliction, but you were a Christian, and it hardly seemed possible. Then I took you to the sick boy's room, and when Pula, who had been delirious for three days, saw you, recognized you and asked you to help, I thought that you might be the one.

"Well, my friend, you saved my son's life. Mr. Cobb, we are just on the outskirts of the jungle, where generally life is bought with life. This pearl was dearly paid for with the life of a young man. Now you have bought the pearl from me with the life of my only son as your payment. What more could a father ask? You have saved my son, and you have earned your reward. Here, my friend, claim this, your pearl."

Today the pearl is on display at Ripley's exhibit on Broadway, where it may be seen for perhaps a month longer.

A remarkable specimen

As Dr. Roy Waldo Miner of the American Museum, who has examined it, explained, this specimen, while so many times larger than any of the pearls we are familiar with, can be truly called a pearl. It was formed on the inside of a shell as all pearls are, presumably by some foreign body being imbedded in the shell material, perhaps when the shell clamped suddenly shut. The natives who found it, who are keen observers of natural history and have good opportunity as pearl divers to observe undersea life, believe that the foreign body which started the pearl growing was probably a small piece of brain coral. Some such origin as this is not contradictory to what is known about the formation of pearls. Where it was joined to the clam shell the successive layers can be seen in cross section.

As in any pearl, the surface appearance of this one gets its quality from the inner layer of the clam shell that was its host. The color of this giant pearl is pure lustrous white.

No one can say how old the pearl may be, for, as Doctor Miner points out, no scientific study has yet accurately determined the rate of growth of one of these giant clams. The natives thought that possibly 450 years had passed since the clam was the size of a fist, and that the pearl may have started growth when the clam was 100 years old.

That such a phenomenal pearl should have been found is surely exciting enough, but I constantly wonder over the strange coincidence that the clam which produced it should have taken the life of a native diver and that, even in a part of the world that is surrounded with so much romance and mystery, its story should also have been so remarkably connected with the saving of another life.

AN EVOLUTIONIST GOES SHELL HUNTING

By WILLIAM K. GREGORY

Curator, Departments of Fishes and Comparative Anatomy



SEA CAVES and broken arch, Mayor Island, New Zealand

What he found among the rocks and beaches in New Zealand and Australia

THE Michael Lerner Australia-New Zealand Expedition of 1939 had for its main objectives, first the scientific study of certain species of big game fishes, especially the marlins, second the furtherance of the Museum's plans for the preparation of exhibits representing the natural history of New Zealand and Australia. Of the many activities of the expedition shell hunting was my particular favorite. In New Zealand while Mr. and Mrs. Lerner were experiencing the strenuous joys of marlin and mako fishing and some other members of the expedition were busy making casts of the big fishes and recording measurements to be used in our scientific studies, I, on many an unforgettable day, was going over the hills to the beaches or climbing about among the steep rocks and the tide pools in search of sea shells dead or alive. At other times, when I was busy in various museums and government offices in many of the principal cities in both countries, almost every weekend found me on some rocky foreland moving along with eyes fixed on the rocks and sand.

As I was also trying to gain a broad picture of the geologic history of both New Zealand and Australia I welcomed the opportunity to acquire some first-

hand acquaintance with certain rock systems, even if only by climbing over them. And if ever my eyes were slow to recognize the old "Hokanui system" under some of its Protean disguises, my shoes and feet soon informed me that they were being pierced by the crystalline points of what has rightly been called the "backbone of New Zealand."

The geological histories of New Zealand and Australia, at least in their broader features, have been pretty thoroughly established by the labors of many geologists, and so I was especially fortunate in being taken by a number of different geologists to various places where one could see the evidence of some striking event in geologic history, or realize how profoundly the ups and downs of the old shore lines had influenced the lives and distribution of the animals that lived there.

Day after day of solitary companionship with the rocks, waves and shells gave me, I hope, at least a little realization of their interwoven histories. At Mayor Island, New Zealand, for example, there were wonderful sea caves and natural bridges in the obsidian cliffs, and by comparing different stages of them it was easy to see exactly how they had been fashioned. First, when the molten mass of glass rock

had cooled, the contraction had caused innumerable cracks or lines of weakness in it; then by the daily heating and cooling in sunshine and shadow the old cracks were enlarged and new ones formed. Meanwhile storms cleared away in part the debris that protected the base of the cliff and exposed it to the direct attack of the waves. Innumerable tides rose and fell, and the waves sucked and pounded away until several shallow excavations had been made in the side of the cliff; and as the waves continued their work they widened and deepened the caves and permitted larger waves to come in, especially during storms. Gradually the spray helped to loosen the pieces along the arches which had been left between the caves.

Meanwhile by a flank attack myriads of waves were boring on the other side of the salient. At last the two bores meet in the depths of the opposite caves, water sucks through from one side to the other, and by and by there is a tunnel; then after more ages have gone by, a great natural bridge appears. This has its brief day of 10,000 years; but the narrowing arch at the top drops its fragments to the devouring waves; in great storms the waves thunder at the bridge and strike it from below. One day a certain piece falls from the middle of the archway and lets in a trickle of rain from the top; then the days of the bridge, though still very many, are numbered; slowly the

top of the arch crumbles, until only the massive pillars of the bridge remain.

The relentless forces keep on and undermine the stately pillars of the bridge; and when they fall, later ages will see only a pile of ruins half buried in the consuming flood. But Nature the Destroyer is kind to the race of limpets, for they still cling to the rocks of that place as they have for countless ages past.

During these delightful wanderings no high adventure came to me. Indeed, although my memories of shell hunting in New Zealand and Australia are greatly treasured, there is nothing among them that would compare with the memory of the moments when in 1921 Harry Raven and I first saw a mob of great grey kangaroos making enormous leaps through the Australian bush, or when in 1929 I crouched beside him in the Congo forest and peered through the thick bush at a family of living gorillas. Nevertheless, certain of my shell hunting days in New Zealand and Australia were not without their "big moments."

One grey afternoon at Bermagui, New South Wales, I came to a place where the rocks that jutted out into the ocean were extremely steep, and as it was high tide, with a very rough surf, it looked as if I would have to turn back. However, after climbing up on the rocks I saw below and in front of me a

HARBOR of Mayor Island, with black glass rocks in foreground



tall and massive rocky rampart with the ocean on the other side of it and at the bottom a crevice-like passageway leading across to dry rocks on the other side. But just as I had slid down into this crevice in the hope of finding some limpets there, the surf on the other side of the rampart broke with a loud roar and came clear over the top and around the ends, and there was I in the midst of its swirling.

There was no real danger because I was clinging tightly between the rocky walls of the crevice, but as the cold bath subsided I even forgot to look for limpets and dashed through the crevice to the dry rocks on the other side. There I found myself pretty well marooned, but escaped, so to speak, by climbing over the roof, up the sides of the high cliff that at this point defended the land from the furious attacks of the sea.

At Glasshouse Rock near Mystery Bay, New South Wales, I climbed into an arena of incredible grandeur and wildness. The background was a huge irregular hill of black volcanic glass, which had been cut through by the waves as if with a giant saw. In the foreground I was stepping continuously over the glass-like broken edges of an enormous system of concentric V's and U's; these had resulted from the folding up under terrific pressure of an originally horizontal series of rocks; but the U's and V's had been pushed over onto their sides and were now being worn down to one general level by the waves. Even the limpets found this place too rough and inhospitable for them, but I rejoiced amidst its titanic ruins.

Another high point in my field days came in the harbor near Littleton, New Zealand, when I turned over a loose rock at low tide and found some living lamp shells (brachiopods) attached by their stalks to the underside of the rock. These are "living fossils" indeed, since their earliest known ancestors date from the Lower Cambrian age and are estimated to be nearly 500 million years old. Many of these lamp shells outwardly resemble certain members of the clam tribe but they belong to a totally different class, because the lamp shell animals wear one shell over their backs and another on their undersides, whereas clams, cockles, scallops, mussels, pearl oysters, edible oysters and all other bivalves wear their shells one on each side of the animal.

Although I collected all kinds of shells, I can say here little of the bivalves except that they manage to thrive wonderfully well with no head, next to no brains and a minimum of nerves. Nevertheless it is hard to catch them napping, for as every clam digger knows many of them are well adapted for digging down into the mud and sand.

Every one of the thousands of shells that I picked

up or that was given to me was of interest, either because it was another individual variant of a species already known to me or because it tended to connect two markedly different-looking forms already in my bag, or because it seemed "new to science," that is, new to my small stock of conchological knowledge.

Whenever I returned to our headquarters in Auckland, New Zealand, I went almost daily to that beautiful temple of science and patriotism, the Auckland War Memorial Museum. The exhibit of shells there is especially noteworthy, because it reveals conchology as a living science. The genial curator, Mr. A. W. B. Powell, not only took me in his launch for a delightful day of dredging for shells but also gave me access to his study collection, representing the 1667 recorded species and subspecies of New Zealand shells that are admitted to his official catalogue.

Now that my New Zealand, Australian and South African shells are all safely transported, unpacked, sorted out and considerably studied, what mite if any can I contribute to that venerable treasury of learning which constitutes the science of conchology? I must admit that I come empty-handed into the temple, in so far as I probably lack even a single "new species" to add to the shell faunas of New Zealand and Australia. Nevertheless I trust that the results of long-continued efforts to understand the broader features of the evolution of marine shells may be of some interest to the readers of *NATURAL HISTORY*.

A living limpet is of high interest to the student of the evolution of the shell-bearing mollusks, because his earliest known fossil ancestors are found in the rocks of the Cambrian period and are probably more than 400 million years old. But the limpet himself, as he clings tightly to his rock, exhibits only a strong negative interest in the activities of an amateur conchologist. And unless he can be suddenly caught off guard, it is almost useless to try to pull or push him off his firm base. The best way to dislodge him is to push the edge of a sheath-knife suddenly under his shell and break the suction exerted by his powerful oval base or "foot." This general type of broad, clinging foot is shared by thousands of other kinds of mollusks and it is so typical of them that this great class of mollusks has been named *gastropoda* (belly-foot).

The limpet would be good eating for the ogre that has torn him from his rock, but the unfeeling monster quickly cuts him out of his shell and throws him away to the crabs. Doubtless the limpet himself is worthy of endless study, but let us look now chiefly at his shell.



SHELL ARMORS OF DIFFERENT STRENGTH

SEA SHELLS of all kinds are but armor to protect the animal within. The limpet at left (slightly enlarged) bore the experimenter's full weight of 165 pounds. The one at right (about twice natural size) crumpled into thin, pearly layers like isinglass, composed of translucent flakes. The inert shell armor, whose pearly inner surface is well shown here, grows by addition of material beneath the old layers and around the edge to accommodate the growing animal within

A certain long-dried limpet shell was wrapped in a cloth, placed flat on the floor and trod upon; it successfully bore the experimenter's full weight of 165 pounds. Another limpet of a different species gave way under similar conditions, crumbling into thin, pearly layers like isinglass; these in turn were composed of exceedingly thin translucent flakes. Possibly these thin flakes are squeezed out of the shell glands in a plastic condition. The shell glands are especially abundant at the lower outer edge of the shell-secreting mantle. The mantle is like a tent with an ovoid base; it grows from the top outward and downward as the animal itself increases in size. Each very small flake of which the shell is composed is not wholly flat but has

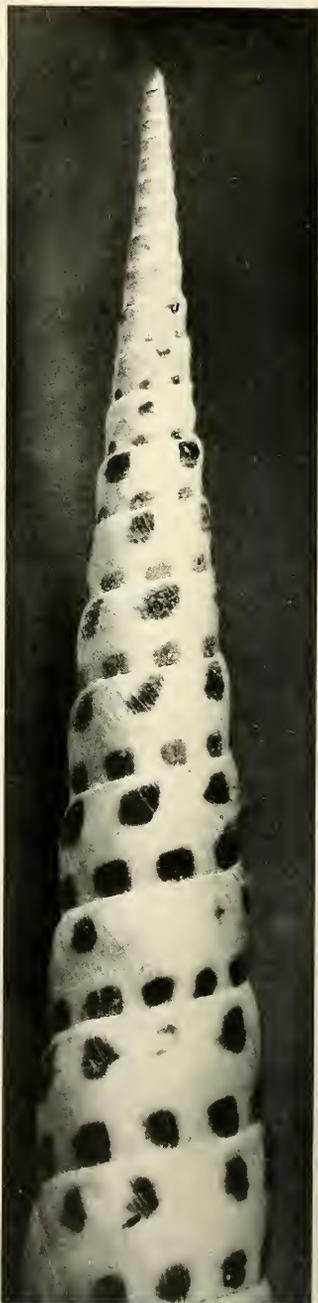
little creases and humps along its outer lower edge. The steady accumulation of these creases and humps where successive layers overlap each other builds up into a system of larger and smaller ribs, which run up the surface of the shell toward the top and add greatly to its strength. The dome of the shell is thick and strong; it is made up of a thin, dense, polished inner layer, a thick porous middle layer and a dense but polished outer layer. In many other kinds of shells there is a horny layer covering the surface of the shell, but in most of the limpets collected by me even in the living state the horny layer was thin on the sides of the shell and was often worn off around the tip, perhaps by weathering.

The raw material for typical shells



EXTREME TYPES OF SPIRALS ARE VARIATIONS OF THE SAME GROWTH PROCESS

MOST SHELLS take the form of coiled tubes. Just as the limpet shell grows by addition around its edge, so do the coiled mollusks by addition at the mouth of the open tube. Unequal growth on different sides of the tube produces differently shaped spirals in different types. In the nearly flat spiral snail above, the shell tube merely grows faster around its outer edge. In the "screw-shell" (Terebra) at right, however, faster growth of the floor of the tube produces a tall spire. (Side and top views)



is carbonate of lime, which is extracted from the sea water, but the "calcareous granules" found in the shell glands of the Indian apple snail, according to Prashad, consist of a double organic salt of calcium. Presumably the shell material secreted by the mantle of the limpet is not greatly different.

Mode of life

The limpet's shell offers a convex surface over which the waves at high tide pass easily. It is at this time that the animal must raise its shell a little to admit the new water to its gill, and then it moves about slowly until it reaches a patch of algae on the rock; upon this it feeds, rasping the weed off the rock with the ribbon-like band-saw which it carries in its cheek pouch.

Some of the earliest fossil gastropod shells, which are estimated to be 400 or 500 million years old (Cambrian), are spirally coiled, and it is probable that the low tent-like shape of the shell of the true limpets is due to the gradual loss of an earlier spiral tip through acceleration of the lower whorls. It is indeed stated by one authority that the European limpet, *Patella vulgata* Linnaeus, when young has a nautiloid shell. Moreover, it is well known that in the "keyhole limpets" or chink shells (family Fissurellidae), which

(Right) THE HUNGARIAN CAP SHELL may have been derived from a more normal spiral by rapid widening at the mouth and slowing up of the coil at the tip



All Photos AMNH

are common in Florida and the West Indies, the finally symmetrical oval shell of the adult is developed from a young stage in the form of a shallow spiral closely resembling that of the ear shell or abalone (family Haliotidae).

The Hungarian cap shell, *Capulus hungaricus* (above) although externally like some of the earliest Cambrian gastropods, seems to show a late stage in the reduction of an asymmetric spiral shell to a low oblique cone. However, by comparison with various living gastropods we can see that the beginning of the spiral twist is a result of the humping up of the intestine and the coiling thereof, as it increases in length faster than does the animal as a whole. And whenever spiral growth occurs among animals it is a

sure sign that one side of a tube has grown faster than the other.

The principle just noted has long been known to mathematically inclined students of growth.* It gives us an important key to the causes of many of the conspicuous differences between differing shell forms. If the spiral coil is very regular and open beneath, like the example below, it is because the growth of the mantle on the lower outer side of the tube has been only a little faster than that of the lower inner side. Such is the case in the existing sundial shell, *Solarium (Architectonium)*, as shown below, and its fossil predecessors. On the other hand, in tightly wound shells the outer side has evidently grown much faster than the inner. This tends to crowd the inner side of any given whorl toward the center, and is doubtless partly responsible for the appearance of a columella or spiral ramp at the core of many kinds of shells (page 208).

If a shell has a tall slender spire, this means that the floor of the tube has grown forward and downward faster than the roof and outer side. On the other hand, if the shell forms a low cone or almost a flat coil (extreme left, opposite), it is a sign of nearly opposite conditions.

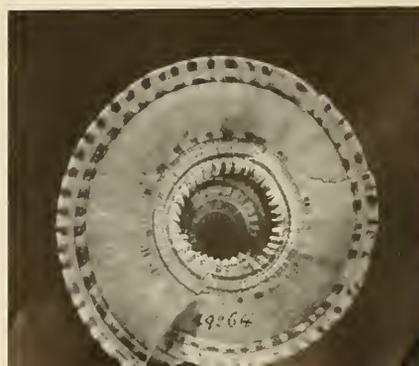
If the transverse diameter of the

* See the splendid chapter on "The Logarithmic Spiral" in D'Arcy Wentworth Thompson's book *On Growth and Form*, 1917.

COMPARED with the steep spiral at left, the two shells below (side and top) show progressive loss of height. (Left, Trochus; right, Calliostoma)



(Below) EVEN COIL with large central tunnel; sundial shell, from below





SUDDEN GROWTH
AFTER BABYHOOD

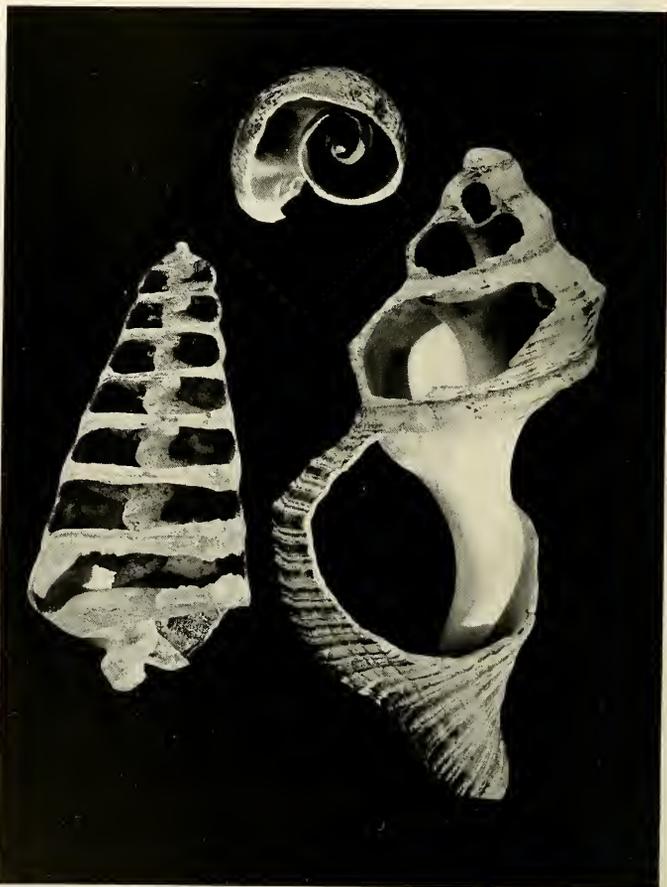
(Above) THE TIGHTLY COILED central portion was the shell of the baby mollusk (Melo); rapid flaring of the spiral as it approached adulthood gave it the voluminous capacity from which it gets its name, the bailer shell. Below, same shell, side view



shell tube, as seen from above, increases but gradually with the successive turns or whorls, a correspondingly regular slow increase in growth rates is evident. If on the contrary, as in many of the later types of shells, there is a sudden increase in transverse diameter as we follow the whorls outward, a correspondingly sudden increase in growth rates is implied. In some shells (as in the bailers and cowries) there is a marked acceleration in the vertical growth of the whorls

after the period of infancy. This is also evidenced by the marked difference between the protoconch or baby shell (which is often retained at the tip of the adult shell) and the youthful and adult stages (at left).

The spiral ribs which are found on many shells (right center, page 209) are deposited by folds on the surface of the mantle during its forward growth. The vertically disposed ridges, humps or processes (top, right), on the other hand often mark the piling



(Above) THREE SHELLS broken to show the winding of the coil around the axis or columella. Note the evenness of the spiral ramp in the corkscrew shell on the left and the rapid increase of successive whorls in the fusid shell on the right. In the cowry shell (at top) the axis is vertical to the page.

The shell of a typical mollusk cannot grow within itself but only as a lining especially enlarged and extended along the edge laid down by the living mantle. But in the cowries (above) and some others the mantle has the power of resorbing the columella and of redepositing the dissolved material elsewhere

up of shelly material whenever the forward growth of the mantle is temporarily arrested. This "stop and go" principle of growth is prominently recorded in the majority of shells, especially when humps and ridges are conspicuous. Sudden cessation of forward growth of the mantle produces seams or "growth lines" parallel to the edge of the mantle (at right). When the shell-secreting mantle is reflected over either or both "lips" of the shell it often lays down a smooth shiny surface

wherever it covers the shell (lower right). The "callus" on the inner lip of the shell aperture in the *Naticas*, *Neritas* (next page, bottom right) and many other shells is another secondary formation due in part to the pressure of the side of the animal against the columella.

Retreat to safety

The animals of most shells can pull themselves completely inside the lower whorls of the shell by means of a



STOP AND GO DEVELOPMENT

SHELLS which grow in fits and starts often send out spines or humps when the forward growth is temporarily halted, as in the spiny *Murex* above. Note the contrast with the smooth continuous growth of the tun shell (below)



(Above) SECTION OF A BUBBLE SHELL showing quickened vertical growth of successive whorls after the period of "childhood." As in the cowries the later whorls completely surround the earlier ones, which are thus enclosed one within the other almost like "Chinese boxes"

(Right) SHELL OF TIGER COWRY (*Cypraea tigris*), showing curved line where the right and left reflected lobes of the mantle have met on the outside of the shell. Thus the shell is completely enclosed by the mantle. However, the entire animal, mantle included, can be withdrawn through the narrow slit on the under side



THE SMOOTH SPIRAL RIBS of the tun shell, above, formed by folds on the mantle, are a sign of uninterrupted even growth



muscle which is wrapped around the columella or ridged core of the shell and inserted into the base or foot. On the upper back part of the foot is often located a shelly or horny lid called "operculum." When the animal is touched his head retreats first into the cavern of the lower whorl, followed by the main mass of the foot which rolls in by a spiral movement around the columella. The last thing that falls into place is the trap door or operculum (*at right*). In the neritid marine snails there is a movable hinge between the trapdoor and the columella, and the tendon of the muscle for closing the trapdoor is inserted onto a projection which is just inside of the hinge line. Such well-protected animals ought to be able to withstand the prying efforts of any crab or fish. In certain families, including the mitres, volutes and olives, the spiral ridges (*page 208, left*) along the outer surface of the columella seem to indicate the presence of several tendons or muscles which are wrapped around the columella and inserted into the foot.

Identification

In almost every kind of shell, after the infant stage has been left behind, the successive ridges, knobs, spikes, etc., tend to resemble each other, so that even a broken fragment of a shell is often sufficient to identify its genus and species. On the other hand, by acceleration or retardation of growth certain ones of a series of similar parts



TRAP DOOR

THE ANIMALS inhabiting many shells can complete their protection by drawing a shelly or horny lid into the entrance after them. The massive trap door is seen in place in the photograph above of a South African Turban shell. At right is the trap door of a Neritid, showing the grooved hinge-line and projection for door-closing muscle. Compare Neritid shells below.

may be selected for special emphasis.

From the foregoing viewpoint every shell will yield on analysis a good deal of the story of its own individual and racial history. The shell is merely, as it were, the overcoat of the animal to which it belongs, and similar-looking overcoats sometimes cover very different kinds of animals. Hence the "families" and still more the "orders" and "subclasses" of the shell world are based not on the shell characters but on different anatomical characters of the animals themselves, such as the structure of the gills, heart, nerve loop, or on the number and arrangement of the teeth in each cross row

on the radula. This is a flexible band-saw which many gastropods carry in their cheek cavity. While experience shows that superficially similar shells may be borne by very different animals, yet a comparative study of most shells, in the light of what is easily accessible knowledge, will in the great majority of cases be sufficient for the purpose of identifying the shell, at least as to its genus.

The evolution of a few of the most conspicuous and easily recognizable types of gastropod shells with special reference to the relations of the spire to the other whorls may be broadly outlined as follows.

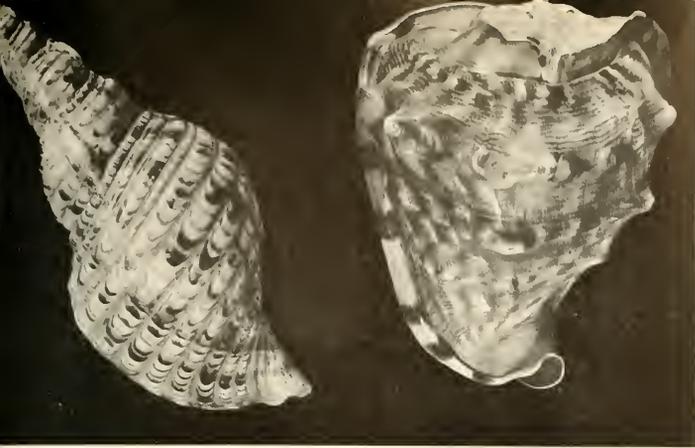
(Below) POISONOUS cone shell (left) and harmless "mimic" (Strombus luhuanus). Both from Heron Island, Great Barrier Reef, Australia



(Above) NERITIDS from Bali, showing progressive reduction of spire

(Below) UNDER SIDE of same, showing hinge-line on inner edge of opening





The left-hand shell (a Triton) has a well developed spire. The helmet shell (right) shows reduction of the spire to a vestige

From certain anatomical evidence it seems probable that mollusks, long before they appeared in the fossil record of life, had been derived by modification of a creeping animal something like a worm but not divided into segments. Almost at the dawn of fossil history we find low, tent-like forms, pillbug-like forms which are rolled up in a fore-and-aft direction, and true spiral forms with unequal growth of opposite sides of the shell tube.

The spiral form thereafter followed many divergent paths. In the sundials, turbans and starshells the shell spread widely but remained low; on the other hand, in tops, towers and augurs the

spire heightened as the pitch of the screw increased.

In the earlier spirals the shell tube increased slowly in cross section while maintaining a moderate rate of increase in growth, the result being that the successive whorls increased gradually in size. In many other families the later whorls increased rapidly and practically surrounded the upper whorls. A well developed spire seems in many cases to be a relatively primitive character and the spire was often reduced as the lower whorls increased.

In the neritids (previous page, lower right) the spire was much shortened and the lower whorl became globose.

In the earshells (haliotids) and *Sinum*, the shell, becoming flattened, gives a most beautiful example of the "logarithmic spiral." In the calyptraeids and crepidulids the spire became flattened and the inner edge of the columella was widened into a "deck."

In the mitres and volutes the spire, originally long, became shortened and the lower whorls became lengthened rather than broadened. In the olives the lower whorls likewise increased greatly in length and never became wide. In some of the cowries the young retain a trace of the spire, but the overlapping mantle usually absorbs this and the adult shell consists of more or less parallel series of the lower whorls (page 208). The cones (extreme lower left) developed a "reversed conical" type by reducing the spire, emphasizing the "shoulder" of the whorls and tapering the lower or anterior end.

A number of families and genera reduced the spire and greatly widened the lower whorls. Many families developed a siphon tube on the lower or anterior end of the shell and this siphon tube is usually conspicuous in the tritons (top left), and in the spindles (Fusidae), turbinellids, muricids, and some others. It becomes sharply upturned and twisted in the conchs (Strombidae) (lower right).

The color patterns of shells are fully as interesting as the structure, but much less easy to decipher as to their history. In this article I will give only a single example, that of color

(Below) DIVERGENT DEVELOPMENT of the outer lip of the shell as an adult character in the conchs (Strombus) at

right and in the spider shell at the left. The primitive stage at the bottom has not developed these specializations.



variation in the olives shown at the foot of the page.

The history of the gastropods offers some interesting contrasts to that of the vertebrates—that class of which Man, *Homo sapiens*, regards himself as the most noble example. The gastropods like other mollusks, were primarily clinging and creeping animals, the dominant organ being the muscular base or foot; their locomotor ap-

paratus was never constructed on the metameric or many-unit plan; so that few gastropods became free-swimmers and none ever equalled the vertebrates, which very early adopted a metameric system and became active swimmers and, we must admit, highly successful robbers. The gastropods, being clinging animals, early developed the radula or flexible band-saw as an efficient tool for rasping a hole in their neighbor's armor. The vertebrates on the other hand, disdaining such patient safe-cracking tactics, developed devouring jaws and swallowing gill arches. When in danger from foes the typical gastropod shuts himself into his strong tower and awaits safer times; most vertebrates, on the contrary, either flee quickly away or make sudden and aggressive counter attacks.

In keeping with their slow movements, but few gastropods have developed a real brain; in the very nervous, not to say jumpy vertebrates, on the contrary, the brain becomes a vastly complex control-center for the elaborate activities of feeding, locomotion and breeding.

In the deeper levels of being, limpet and man are fundamentally much alike. Indeed a cynic might name some

points in which the limpet would have the advantage.

It would be easy to extend such comparisons and contrasts, but the Tree of Life among the gastropods has branched and branched again through the ages, much as it has among the vertebrates. I am deeply thankful that amid the solitude of the rocks and waves I have had many a vision of the glory of these perfect forms.



(Left and upper right) DIVERGENT MEMBERS of the conch group, showing different development of the adult outer lip. At left, *Rostellaria*; at right, "*Pelican's Foot*" (*Chaenopus*)

(Below) OLIVE SHELLS from the island of Bali, showing variation in color pattern from cream to zigzag. These shells also show every gradation to solid black



TIGER! TIGER!

Adventures with man-eaters in the Malay jungles

By J. B. H. THURSTON

As told to LIEUT. H. S. MAZET

A SMALL clearing in the jungle, with the faint outlines of a palm-thatched hut built about eight feet from the ground on poles; overhead the deep blue sky spangled with shimmering stars; perfect silence. A gentle breeze rustles the leaves and heralds the Malay dawn; faint twitterings of the earliest bul-buls in the bush tell that day is at hand.

Down the wooden ladder of his little house comes Amat the Malay, his cotton sarong held closely to his neck as he faces the damp morning mist.

Movements within the hut announce that Mina, his wife, is astir, and soon she, too, makes her descent, carrying water-pots. She moves cautiously along the narrow, overgrown path toward the riverbank to fetch water for cooking the morning rice.

Suddenly the air is rent by a roar and a thin scream. Before Amat can spring up the ladder to grab his spear and knife and rush to the spot, a tiger has made its kill and is away to the jungle with its victim.

How they become man-eaters

This typical tragedy befalls the Malay or Chinese peasant all too often on the edge of the jungle, and where once man-eaters have learned to kill in this way, they will continue to carry off human victims until they are either trapped or some European hunts them down with a rifle and shoots them. Tigers soon discover, when once they have overcome their natural dread of man, what a really helpless creature he is, lacking fang or claw, and what an easy way it is to obtain a succulent meal. At the same time, these killers seem to be aware that the death of a man will stir up a hornet's nest, so that the behavior of a man-eater is quite different from that of the ordinary animal.

A tiger, perhaps because of his size and strength, has not much to fear, and as a rule hunts the wild deer and pig that abound in Malaya without seeming to trouble too much about using scent or sight as we ordinarily suppose them to do. I have approached very close to tigers that were lying in wait, without their knowledge; again while hunting I have rested on the ground at night with my back against

a tree and had them pass so near to me that I could plainly hear their hushed breathing. They never knew I was there.

A true man-eater would be a very different creature, full of wile and devilish caution. I have waited up all night over a "kill," only to see and hear nothing. In the morning I would find that they had been watching just inside the jungle fringe for hours, being too wary to come out and take the kill because something made them cautious far beyond their natural instincts. The normal, lumbering tiger, once he has turned killer, can approach without a sound and may spend hours watching his prey before seizing it.

The typical man-eater

During my stay of some 29 years in Malaya and Sumatra I have found that a man-eater is not the old, toothless animal we have all read about; he is not a semi-helpless old brute unable to strike down a deer or pig and forced to turn to defenseless humans. On the contrary, I have found him as well-nourished and powerful as any other tiger, and the biggest specimen I ever shot, a perfect animal, was a man-eater. Furthermore, a man-killer will take its young out and teach them to kill man, as I well know from first-hand observation. Young tigers as well as adults develop the man-taste in their mouths and cannot forget it.

Normal tigers haunt the jungles of Malaya, but few Europeans see them, as they generally keep well out of sight and dread mankind. One can live for years out here without catching sight of a single stripe. Up country on the rubber estates, tiger tracks may be seen so frequently that they cease being a matter of interest; in fact, an observer comes to recognize the individual tracks of each animal. But he may never glimpse the owner.

Sometimes tigers are met on the Government roads through the jungle, at which rare occasions they are scared by the noise of the automobile and quickly bound off into the brush. Man is usually so noisy in his movements that the average animal merely "freezes" until he passes by, well knowing that he will not be perceived.

With this trait in mind, I have often found that the way to flush them is to stop suddenly and keep very still, until the nerve of the animal breaks and

he bolts, thinking, no doubt, that he is being stalked. But I do not recommend this procedure on wild tigers!

Although Malaya is the home of the tiger, man-eaters are luckily quite rare, simply because their natural food—pig and deer—is plentiful and there is no necessity to kill man. It is my conviction, based on years of observation, that most man-eating arises from sheer accident. A tiger is suddenly confronted by a human being and cannot avoid him. He charges and kills the unfortunate victim in self-defense, and now with the taste of human blood in his craw he is the more ready to attack again. Soon he abandons stalking more cunning prey for stupid man.

Definite hunting areas

Customarily a tiger lays claim to a distinct area or territory, and he will quickly give battle to other tigers found there and chase them away. The extent of such areas depends upon the amount of food they contain for the tiger. Younger animals have poorer domains and must poach on the preserves of veterans. Any area vacated by natural death or a hunter's bullet is snapped up by a neighboring tiger, and woe betide any other tiger which attempts to infringe.

These big cats lie up in all sorts of places, and I have come across them even in *lallang* grass about three feet high while hunting for flighting green-pigeon. Usually they will start on the prowl about five o'clock in the evening, beginning the hunt just before dark. Once they make a kill, they go to sleep and rouse again at four in the morning, once more to retire before dawn at six.

Any moving thing is fair game. I have known tigers to take crab-eating macaque monkeys that go down to the seashore, and even crabs and frogs. When nothing better is available they will devour a species of small clam called *lokun*, which they roll in small heaps in the mangrove tidal creeks at low tide, and I have known them to gorge on carrion that was days old.

At one time I was stationed in a part of Malaysia that seemed to have more than its share of these beasts, and after some days the local headmen came to my bungalow with the story that a couple of man-eaters had been killing their men in the scattered holdings and rice-fields. They asked if I would help, and naturally I agreed to do what I could. A fresh clue soon made it possible to take instant action—a tiger had tried to push over the flimsy hut of an old man and woman. I left at once and met several of the men upstream armed with spears and knives.

A short walk brought us to the hut, where high-

pitched yells told us that the tiger was still there and had been devouring the fowls in a pen under the house.

Very cautiously we approached through the low scrub and grass, but could see nothing. Then I yelled loudly, and almost at once a big head came out slowly from behind a jungle tree stump.

The range was short and it was impossible to miss. A shot through the head knocked the animal over at once. It was a well-grown female. The old couple then lowered a rough ladder from inside the hut and came down on shaky knees to tell us what an ordeal they had experienced throughout the night, with that snorting beast striving to knock their home down by rearing and pushing against it. We left them busily reinforcing their walls and foundations.

A dangerous approach

Some two weeks after this incident I was awakened early by a similar report that a woman who had gone out just at dawn to collect the young padi plants for planting had been seized by a male man-eater. He was seen dragging her into an overgrown padi field nearby. This time there was a much greater turnout of encouraged Malays, who hitherto had been thoroughly cowed. Sentries were posted on tree stumps to watch the movements of the tiger by tell-tale waving of grasses and reeds.

No tree was at hand, and the thought of walking up to a big man-eater with his kill and having to wade through knee-deep water, accompanied by splashing and breaking reeds, in grass some eight feet tall, did not appeal to me. A better plan would be to make him charge us, so we started yelling and throwing odd roots and clumps toward him.

He charged all right, but would not charge home, keeping constantly near his kill. His growls were menacing, for he was in a frenzy of wrath at being disturbed; and much as I wanted him to come out into view, I was wary about tempting fate too far.

The constant short charges by the tiger trampled down the reeds for a considerable area, so we kept him at it. Finally I managed to get a fleeting glimpse of him while he was lashing out in a snarling attack at tormenters in another direction. His right shoulder came into my sights through a patch of broken reeds, and I let drive. Then the real excitement started.

The tiger appeared to go completely mad now, and went careening around in a small circle, roaring, leaping and splashing in great style, and I thought that any minute he would surely charge home. I was about to show myself when there was sudden silence.

Had I killed him, or was he sneaking up on me? I had no idea, and under the strain our nerves and

tempers were distinctly frayed. Still nothing happened.

We started yelling and hurling clods again. "Tuan," said one of the Malays, "He is dead!"

"Well," I replied, more bravely than I felt, "then I will go in and get him. But if he is only wounded it will be worse than before—he will attack at sight, so look out! Who will come in with me?"

"I will," said the old fellow. "I and my three sons." And with the utmost caution, they did. The old man crouched at my feet, chopping the reeds with his big knife, while his sons guarded us with their spears.

In the center of the trampled space we found the dead woman, and the tiger lying quite dead nearby with his head under water. He was a fine specimen, fully grown, fat and in excellent condition. We could see on his hide the scars made by spears of those who had stood up against him and gone to their deaths in past years.

This particular rubber plantation was rather good for tiger hunts, as I found out before quitting it six months afterward. Three of us in that time killed nine tigers, and when I left the district it was believed that five tigers were still roaming at large.

Face to face

On another occasion, up-country, I came face to face with a tiger. Pushing through thick scrub and fern along a narrow trail, I burst full upon a tiger coming up the trail toward me. At a distance of about twenty feet we faced each other, and I freely confess I was scared absolutely stiff.

I was armed with a good rifle. My game was to get that rifle from the trail to my shoulder, but whether it should be done slowly or in a flash, I could not decide. While I frantically debated, the tiger crouched, its head close to the ground, eyes not directly on me but slightly to one side. Then I saw the tail start to twitch; natives say this is an infallible sign that the tiger is about to spring. I chose to attack first and, snatching my rifle up, fired between the eyes and a little high.

The beast gave a moaning roar, and I let fly again in the stress of the moment, fortunately with good result.

I thought I had long since become immune to astonishment at anything in the jungle, but the strength of these wild tigers quite amazed me when, one day, I observed a pair of them together lift up a dead humped bullock from inside a byre—access to which they had scratched through a hole in the roof—up and over walls of hardwood poles ten feet high, and away into the scrub. Even one tiger can manage to

get under a bullock, heave it on his shoulders and thus transport it, the only track being the dragging hoof-marks of the dead animal.

Sometimes we have real trouble with tigers, but fortunately it does not happen often. In a district of Malaya where I was stationed for a sixteen-month stretch, a man-eater roamed which was credited with more than one hundred victims, mostly Chinese. He was so bold that he would prowl in the daytime, and I have heard him at eleven o'clock in the forenoon. All of us five Europeans in the vicinity tried at various times to bag him, using every conceivable method without success. This particular animal played such havoc with the coolies on small plantations that certain districts were abandoned; nobody wanted to remain. At times, work was discontinued for days when this tiger was known to be on the loose. He was never killed. Some time later he disappeared, and presumably he died a natural death.

A year later, however, another man-eater appeared in the same district, and I fancy this must have been one of the cubs, since it was of inferior size. This newcomer one day chased a Chinese on a bicycle on the Government road until the oriental became so winded and scared he fell off. Quite incapable of rational behavior, the Chinese scrambled to his knees and prayed to the tiger not to kill him. But the tiger came up to the fallen bicycle and stood over it watching the spinning front wheel and taking no notice of the man whatever. Just then a Public Works truck came round the bend, and the tiger bounded off into the roadside jungle. The Chinese, who related the story to me, said that he gladly took a lift in the truck in preference to continuing his bicycle ride.

Narrow escape

It is unwise to predict what one of these big cats will do under even normal circumstances. I once saw a tiger dash into a gang of Javanese women weeders and carry off a girl. When I got to the spot with a rifle and some men with firecrackers and tin cans, we started into the thick scrub after this latest outlaw. Suddenly we came across the woman, unconscious but unharmed.

After a few days in the estate hospital the woman had recovered her scattered wits sufficiently to tell us what had happened. The tiger had dragged her off, then put her down on the grass and lain at full length, purring loudly and occasionally rolling on its back, just like a cat. She admitted she was so terrified that she had no recollection of hearing the noise we made coming to find her, nor of being taken to the hospital.

Tigers not only instinctively fear man, but unless

on the hunt will almost never venture close to his habitations. There is one notable exception in my experience. One evening in our bungalow my wife called to the boy to produce the cocktail shaker. We got no reply. When she called again and received no answer I went back to see what was wrong. I was just about convinced that the boy had gone out when a muffled voice from the kitchen said, "Look out, Tuan! There is a tiger sitting on the ground under your bedroom!"

The back and front doors were quickly bolted, and one of us held a light while the other cocked the rifle. We lay down with eyes glued to the floor-boards, trying to get a chance shot through the cracks, but without success. The next morning we found its tracks under the house where it had laid down as if in its own den.

Pets

I once kept a couple of tiger cubs, which had been caught in the jungle as very small, blue-eyed kittens, and fed them by bottle. They were delightful pets at first, and enjoyed the freedom of the bungalow, playing with my dogs and cats as a happy family. On occasion they were the innocent cause of consternation to some of my visitors, who spied what they thought to be wild tigers peeping at them around the door jamb.

But as the cubs grew up they began to revert, and once were seen stalking some of the coolies' goats from behind the garden hedge. A short while afterward, I found them stalking the telegraph boy in the same way, and thinking they might become too dangerous to keep as pets, I handed them over to a circus, which I visited a year later. The young tigers recognized me at once, and allowed me to handle them as before.

A grown tiger is fearless in the jungle and will stand up to practically anything. One animal he respects, however, and avoids: an old, solitary boar which has been ousted from the herd owing to viciousness. These outcasts are ugly customers and ready to rush any animal or human on sight and rip him, being absolutely fearless and most difficult to stop. When Old Stripes meets one of these cantankerous fellows on the trail, there is a mutual appreciation of prowess, each knowing full well that it will be a fight to the death—and most likely death for both. So as a rule they walk very gingerly round each other, and then continue on their respective paths.

The common pig, on the other hand, is tackled without hesitation. Once, while waiting for pig at a runway, I was surprised to see one come rushing out of the scrub at full speed—a most unusual occurrence. I held my fire, waiting to see what the pursuer looked like. In a moment it burst forth—a tiger—running out hot-foot, tearing after the luckless pig.

The pig was going "all out" and swerving in a desperate effort to distance the tiger. They were now rushing through a field of young rubber which was quite free from other vegetation so that I could see their progress plainly. When the tiger eventually caught up with the porker, with a single paw on its shoulders and the other on its snout, he jerked its head back, breaking the neck at once. The pig's agonizing squeal terminated in a pregnant silence as the tiger, mouthing its dinner, slunk away into the jungle.

Tigers do the same thing to bullocks—or try to. I have watched them make the attempt. Failing to break the neck, they pull their prey down by sheer weight and bite through the jugular vein.

But an ordinary tiger does not leap full upon its victim as we see so vividly portrayed by fanciful artists. It can leap, that is true, and I have seen tigers "fly" a fairly high fence, but only in a slow leap. The more usual manner of attack seems to be a rush from close in, a pause, and then a rearing up with the collapse of the victim from the weight of the tiger's body. A broken neck or a torn throat usually results. If the animal chased be small, tigers give it a side scoop with a forepaw, or crush it down with a paw on its shoulders midway in a bound.

Mating quarrels

During the mating season, tigers are continually fighting, making a frightful roaring, rolling on their sides just like a couple of tom-cats fighting, endeavoring at the same time to rip out each other's entrails with raking swipes of their hind legs. I have watched them fight on a few occasions and have yet to see one kill another. When a tiger feels that it has had enough, it turns tail and bolts, chased by the victor.

Tappers at work on the rubber trees are sometimes taken. In almost every case the victim was working at a task which required intermittent stooping close to the ground; each victim was wearing dark clothing, and was invariably a Chinese. In such cases the tiger watches from the jungle edge and sees a figure darting from one tree to another, bobbing down, straightening up again, running to the next tree and repeating the same puzzling routine. The tiger, unable to resist what he must think is a peculiar kind of monkey having a game, rushes out and kills him. The job is done very quickly as a rule, but in one instance it must have been stark horror for the victim.

This boy was a Chinese, substituting for the regular tapper who was ill on that particular day. In broad daylight at about nine o'clock in the morning, a man-eater all unsuspected was watching the tapper steadily from the jungle's edge. After a while

Continued on page 244

IT'S TURKEY TIME

By EWALD GNILKA

I AMERICA'S NATIONAL FEAST BIRD in the West Virginia woods (*left*) and in a barnyard nest (*below*). Cortez found the turkey a native of Mexico and bought some home to Spain, whence they were introduced in England in 1524 and rapidly carried into the rest of Europe. Thus the first colonists to reach America numbered turkeys among their livestock, and the bird thereby completed its round-trip from the New World to the Old and return. Small wonder that this bird became the official symbol of Thanksgiving, for the early settlers also found abundant wild turkeys inhabiting northeastern America. Though these were of a different subspecies (*Meleagris gallopavo silvestris*) from their newly arrived cousins (originally *M. g. gallopavo*), frequent cross-breeding has made clear identification difficult today



Wild Turkeys





2 (Above) MOTHER TURKEY listens to crackling warnings that mean her 12 to 20 chicks are growing restless for the outer world. During her long setting period (27 to 30 days), she has not left the nest save when forced off to eat. Father turkey must be separated for a time from his family. Due to some cannibalistic quirk in his nature, he would break up the nest and kill the chicks if he could. Because of this, and because the young birds are very delicate until they have "put forth the red" (the red protuberances of head and neck characteristic of turkeys), they are usually kept penned up for 6 to 8 weeks

3 (Above) WINDOW ON THE WORLD. Will the baby resemble its snow-white mother? If breeding has been purposively controlled in this direction, it will, unless this chick proves a pied "throw-back." The tendency to return to normal turkey plumage crops up every now and then to confound the best efforts of breeders

4 (Below) BEGINNINGS: a yellow bill pecks through the egg's hard shell. For 24 hours chicks go unfed; they are still digesting the yolk absorbed at birth

5 (Below) THE NOSTRILS appear as our chick, using oxygen drawn from the shell's inside air layer, tears through the shrivelling membrane. During setting in unseasonably hot weather, the eggs are dampened to prevent this tissue from drying on the chicks



7 (Right) WET AND WRIGGLING, the chick pushes out of the shell. His over-sized feet are active, but his head is too heavy to lift; he calls for aid, and Mother clucks reassuringly. This exchange is not what is meant by "talking turkey," however. It originated in the hunting trip taken by a white man and an Indian. When the spoils were divided, the white man said, "You may take the buzzard and I will take the turkey, or I will take the turkey and you may take the buzzard." Unperturbed, the Indian replied, "You never once talked 'turkey' to me"



8 (Below) ONE HOUR OLD: fluffy and self-reliant, the turkey chick is ready for life



9 (Below) ALL PRESENT. Soon they will leave the farmyard to roam the fields, graduated from their egg and bread-and-milk diet, able to pluck succulent insects from the grass and eat dandelion leaves. Out of this brood many will be chosen for the ominous solitary pen where milk and meal will fatten them for the Thanksgiving table



Gnilka Photos from Three Lions, Publishers

6 (Below) THE FIRST CRY: as in human babies, the first sign of external life is the "cheep!" of the chick as he begins to draw breath through the open bill into his lungs. When grown, he will probably not weigh more than 10 to 20 pounds. Breeders now cater to the smaller American family where once they provided huge 45 to 50 pound birds



A True-to-Life Story

THE RED QUAIL

From his birth among the last brood of autumn to that fateful moment of hesitation as his mate plummets heavily to earth, Colinus' story becomes the symbolic biography of one of America's best loved sporting birds

By GEORGE H. HALL

COLINUS* scrambled to the lip of the hole his parents had dug for a nest, and looked upon his world for the first time. It was about two hours since he had hatched out, and his natal down, originally saturated, was now well fluffed out over the wrinkled skin. He inflated his infant lungs and flexed his muscles. Through the arched grass he could see the hen and the cock quail herding eight little ones like himself out into the sunlight, their great pale beaks jutting from bristled heads. They were moving slowly away from the nest; already they were merging with the background, and Colinus feared suddenly they were leaving him behind.

He chirped in panic, jumped two inches to the ground, and stumbled after them on thin pink legs. The large birds heard his shrill peeping and they waited until he had sprinted up to them. They guarded the chicks with anxious cries and a brush of wings.

The sun was warming his buff down, and everywhere around him were tantalizing sights and sounds. But when at length on strengthening legs he began to investigate things for himself, the cock swept him on with no regard for his protests.

They came to a fence and along its decaying oak rails they traveled toward the woods.

Colinus had delayed again to stab at a pea-green louse on a stem of crab grass when the cock whistled an alarm. Something in him responded automatically, and by instinct he froze against the earth.

A shadow like a fat cross fell upon him and overhead appeared the compact, slender body of a Cooper's hawk. The quail saw his dust-blue wings and the ravenous, searching eyes. The raider passed, silent as his shadow, and disappeared in the timber some fifteen yards away.

**Colinus virginianus*.

Nothing moved.

Colinus hugged the earth in the midst of the other birds, squeezing himself so tightly that his brown eyes seemed ready to pop from their sockets. But it was tiresome work, this sitting motionless when there were so many things to discover and so much new energy pumping through his arteries. The minutes passed slowly and he grew impatient. He relaxed, stretched his fuzzed wings, and stood up.

Instantly the cock arose with a despairing cry and hustled the chicks deeper into the fencerow. Drooping, the hawk opened his wings and caught the wind, and with terrifying speed converted his dive into a flat glide. Silently he planed to their hiding place, hovered, and unsheathed the curved daggers from beneath his breast. He landed and began to force his clumsy way into the wild plum thicket.

The quail chick watched his slow and purposeful advance, watched him slash angrily at the restraining wall of twigs. Soon he burst into the open space where the birds covered. The cock met his challenge with shrill cries and drumming wings.

Colinus, the young aristocrat, saw then the rash courage and devotion of a father, his primary social heritage. And he saw, too, the swift, inexorable death that always thereafter would keep its vigil over him.

The hen placed herself beside her mate, between the raider and the chicks. Together the old birds screeched and circled, trailing their wings on the ground to simulate cripples and inviting danger to protect their young. The hawk would not be diverted. Driven by an instinct as strong and as much a part of the scheme of life as the fear that gripped Colinus, the hawk came on. Desperately the cock took to the air, wings raking the boughs overhead, and flew like a fury in the invader's face. He beat at the red-rimmed eyes and by the madness of his attack momentarily drove back the destroyer, who was four times his own size.

THE RED QUAIL

The hawk recovered his poise and shifted his glance craftily from the chicks to the reckless male. He waited, and then his four black talons reached out and spitted the cock in midair.

It was quiet in the thicket. The hen stood submissively while the hawk, dragging his prey, made for the open. His claws pierced the cock's back from rump to wing but drew no cry of pain. From the hen came no word of reproach for the chick who had moved too soon.

In the sunlight the hawk feasted on the bird. Then he waddled a few feet and took wing, vanishing among gold and crimson autumn leaves.

Colinus did not forget his father's blood, nor the color of it which would dominate his life. Even now there were indications in his natal down that the plumage of his maturity would be a gleaming auburn red, a rare and beautiful phase of his race.

That night the chicks slept beneath the spread wings of the hen, snuggling to her for warmth. Now and again she shook herself and they shifted their positions. On still feeble legs they drove their bodies closer to her breast, and Colinus fought off the others to hold his place near the surge of her heart.

In the dawn they heard a long call, disconsolate on the rising mist-filled wind. It came again, "bob-white," and the hen answered. A cock appeared at the edge of the field, patrician head moving inquiringly on his slender neck. It was late in the year for an answer to his mating call. He came nearer, hesitating, white throat pulsing above a low brown collar. Then he walked among them and as if by some unspoken contract adopted them as his own, and they him.

Thus before his father had returned to earth Colinus saw him replaced, and the family moved into the field for food and the finding of a new roost.

Colinus' life began against an extraordinary background of time and circumstance. He was hatched during October's wind and rain, to which cold added its weapons, and food and cover were becoming

scarce. The last hatch of the year, and doubly hazardous for the quail who would wear the strange red garments.

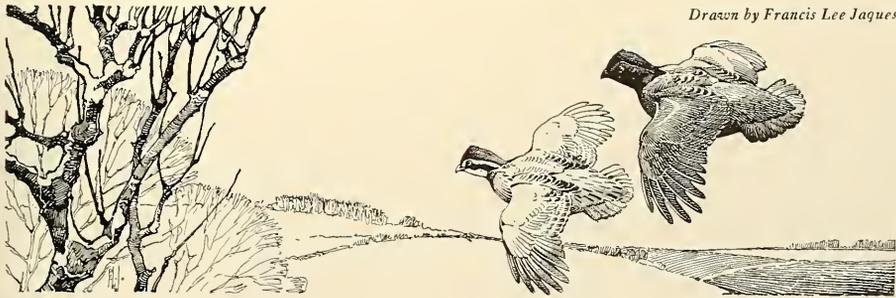
On the other hand, his parents had been wise in their nesting. They lived not far from a creek, and down its brush-grown causeway they could safely travel through wheat and corn and alfalfa and clover, through a pasture and an ungrazed woodlot of white oak and shagbark hickory and juniper. Colinus' ancestors seldom had migrated farther than half a mile from the abundance of this range.

Then, too, paper placards fixed to trees warned of a closed year on upland game, and there were no hunters. He cared very little about this in his early days. He was completely happy, eating, romping, exploring, and resting much beneath his parents.

Daily he found new insects. Grotesque beetles with iridescent wing sheaths on their backs looked at him with large compound eyes, waving their antennæ. They flew slowly and laboriously, and he could sometimes run after them and nip them in the air. Not so the swift flies which flicked out of reach on veined translucent wings. He had a great experience with a grasshopper, a fantastic creature in green armor, who stared at him with speculative eyes.

As he had seen the cock do, he stalked the grasshopper, thrusting out his neck and snapping his beak. He skipped back and forth, feinting, eager to make the kill and yet afraid. He came in so close he touched the segmented antennæ and saw the palpitation of the insect's naked abdomen. Then the cock saw and pounced upon the grasshopper. In the subsequent dismemberment Colinus secured a fat thigh for himself and took it aside to eat it.

He found few juice-filled berries at this season of the year and he learned to drink dew by touching drops on the grass tips with his bill and letting the cool water flow down his tilted throat. He fed himself from the beginning. He was proud of his able foraging and vain of the pinfeathers emerging through



Drawn by Francis Lee Jaques

his natal down. He was arrogant, independent, aggressive. He strutted ridiculously.

The family kept close together during the day, conversing in an undertone as they searched for food. Perhaps once in every hour the cock or hen gave a warning signal and the chicks froze instantly. When the danger had passed they moved again. Colinus was usually the first to break; ten minutes was as long as he could sit still in spite of the lesson his father's death had taught.

“. . . like icy birdshot”

The day he was a week old he knocked from his darkening beak the tiny egg tooth he had used to chisel from his shell. It was late in coming off. Almost vindictively he gobbled it up, and it entered his gizzard to mix with the grains of flint and limestone he already had swallowed.

The rain came down like a shower of icy birdshot. It had rained all night and the quail chicks huddled miserably beneath their parents. No chance to forage in the rain. Their down was warm but it was not waterproof. Their crops were flat and empty and they peeped hungrily.

It rained harder as the light increased, and from his cozy shelter Colinus watched the rivulets of water thread past his roost. They formed on the slope above and bore down with them bits of mud and pin-sized sticks and now and then a grass seed or a struggling insect. Colinus moved to the edge of his shelter and once dared to dart out and seize a fat spider that floated by. He was amazed at the power of the falling water and, cheeping, ran back.

The rain pounded on the clay, and the streams flowed faster. Under the roost water began to run in the eroded cut. It was coming closer, rising below them, and Colinus peered down through the grass matting on which he lay. In the darkness he saw the yellow flood tugging at the loose brush, and soon he felt the cold water beneath him.

The birds leapt to their feet as the water rushed through the bottom of the roost. Colinus crept close to the hen, comforted somewhat by her nearness, and watched the small tributaries above him on the slope slip into the larger stream that passed beneath them.

The water was rising steadily, carrying away pieces of the roost. He felt the structure quiver, as solid water tore at the red cedar boughs and oak sprouts. The rain was driving now and the older birds were shifting from one foot to another, shaking their wings.

Colinus felt the roost lurch, and water poured in. He scurried for higher ground, but the roost was floating, jerking, bouncing, and falling apart. He was torn from the hen's wing and, clinging to a

tuft of grass, was swept downward toward the delta. He sped through inch-deep canyons of orange clay. The freezing water was on his skin, sponged up by his soft down. The roar of the torrent drowned his feeble chirpings. Sky and earth blurred.

Whirled and tossed, he struggled to scale an oozy bank, his feet sinking deep in slime. He could see his parents running from one small stream to another on the delta, seeking their offspring. The cock noticed him and directed him to solid ground on the creek bank.

Five chicks were found and brought together beneath the spread of a small juniper tree where they were warmed by their parents. When, later in the day, the rain stopped and the famished birds moved out for food, two chicks were left behind. They had died of exposure and starvation.

After the rain there was food in plenty, washed from the tall weeds and shrubs and gathered in depressions by grass strainers. It seemed that nature was making restitution for the lost lives by giving bounteously to the survivors. Colinus feasted and grew rapidly in strength and knowledge. His juvenal plumage appeared, and at two weeks his wing feathers would shed a light rain. He acquired a stub of a tail and depended less upon his parents.

Wings

He began to flush when disturbed and to soar a few yards, thrilled as his world dropped away and the horizon rimmed new lands of promise. He kept pace with the old birds and learned the meaning of their varied tones when they talked with one another.

Some things he learned by imitation, some came to him instinctively. Instinct told him to accumulate grit in the horny grooves of his gizzard, and food in the membranous enlargement of the esophagus where his neck joined his breast. He could control the passage of food from his crop to his gizzard, and by instinct he sent it along for grinding during the rest periods at noon and night.

He learned that the screaming jay, feared by his parents as a nest robber, now was a faithful friend when danger threatened. He observed that his parents froze when they heard the jay, and he came to do likewise.

One day he soared over the rail fence. The sun was on his back and he was so stimulated by the crisp morning air he felt that he could fly to the horizon. But he had not gotten much food lately, and he tired before he reached it. He stopped at the edge of a new field, golden yellow with shocked corn, beside low bluffs over the creek and shielded from the wind.

Here he foraged throughout the day, eating and loafing in the sun, toying with small striped beetles

and field bugs, watching the wrens and buntings, and hearing the cool sound of doves. It grew colder at sunset and he realized with a sense of loss that he was separated from his family. His plaintive calls went unanswered. He flew a little, but he was too exhausted and bewildered to hunt the sheltering wings of his parents. He crawled unhappily into a blackberry tangle, tearing his new feathers on the thorns. Here he spent the night.

In the morning there was frost. It glittered in the sun with a hard and brittle light. The ground beneath was flinty. That day he wandered, seeking the family that he never again saw as a unit. He heard quail calling but he could not find them.

Quail comfort

At twilight a call sounded nearby and he went toward it hopefully. Quail were flying in to roost in a compact flock. When Colinus came up to them, he did not know them. They were large birds, as large as his parents, and there were many of them. They all looked at one another, making low musical noises and circling about a patch of soft grass. He watched them from a distance, the small wanderer who had tried his wings.

Soon one of the birds, a hen, squatted down, and immediately another was beside her. A third followed and the others ranged themselves alongside. They formed a rough circle, tails skyward and to the center, shifting and squeezing until they formed a tight bracelet. Colinus, who had come closer, found no opening for himself.

He was too young to understand what they were doing. No wing offered itself to canopy his body. But he was cold and he burrowed his head deep between two crouching birds. He felt them move, and at the same time he realized his error. He turned quickly and backed his stub tail in the narrow opening. The larger birds separated and he wedged in. He drew his head well down between his shoulders, as he saw the others do, and he was warm and safe. He watched the moon rise and the tenuous black shadows feel toward the silent covey. His feet gripped the ground and he looked straight ahead, blinking his eyes sleepily. Behind him, and beside him, the other birds kept watch, ready in an instant to abandon rest for flight. After a time he slept. At dawn the ring broke up, leaving the characteristic necklace of white-capped droppings.

Colinus ate some fragments of acorns left by jays and squirrels, but food was scanty, and by the end of December he knew that he was starving. One snow had come and melted, and another now was swirling through wind-rattled oak leaves. For days he had

run through the soft woods mould, strained and anxious, never quite able to fill his crop. Chickweed and the small crabgrass seeds had disappeared. Fall-ripened berries and dormant insects no longer were to be found. He was thin and scraggly, little more than half grown. His adult feathers had come in on his breast and sides, but his head and rumps were covered with shabby juvenal plumage. Heavy blood quills emerging on his wings hampered his movements, so that he could not venture far from cover.

He took chances and felt the breath of hawks' wings on his back. Something whipped him on, muscled his slaty legs.

In January a brief thaw brought fresh food, torn from the ground for his growing frame. His wings became steel blades; his body burned like flame in the sun.

Then winter again, but mild. He came into February on the eve of his maturity, lean, tough, and proud; and as he felt the hunger in his body wane, another grew. He began to seek his kind again.

Despite his scanty diet, seven ounces of well-knit bone and sinew were sheathed in his auburn plumage. His throat and crest had become a deep red-black, and the band that streamed back from his eyes had reversed the normal white.

A young man's fancy

Spring found him lingering near the covies, drawn by the exciting stir and motion among the birds. The chattering cocks had become pugnacious. When there were hens near they puffed out their breasts and stalked ferociously.

The covies traveled well spread out with no designated leader, keeping together by sight and frequent calls. Colinus trailed them sometimes, unnoticed, watching the cocks and hens and yearning for their society.

In April he felt in his throat the same cry he had first heard when, after his father's death, the lonely cock had come to take his place. The whistle volleyed forth one day, an eloquent and passionate "bob-white." Frequently afterwards he stretched upright and whistled with all his strength. He would raise his head as the whistle grew in volume until, with a jerk of his tail, he would hurl the ringing call against the sky. But sometimes he would utter a soft and plaintive cry, hardly more than a whisper.

New foods and flowers and colors appeared daily. He foraged among blue violets, lemon bellwort and wild phlox. Shadbush and redbud bloomed among the oaks, junipers became a fresher green, and later on the woods were snowy with haw blossoms and graceful dogwood bracts.

He followed a particular covey, for in it was an

Continued on page 242

THE LUNGFISH

Which made a 10,000-mile trip of several months in a dry cake of mud and lived "to tell the tale"

The lungfish, *Protopterus*, lives in the lakes of Central Africa as far south as the Zambezi River, in the basin of the Congo, and in the Senegal and Gambia rivers in the north. It is especially interesting because it breathes by means of a lung instead of gills, the latter being vestigial. At frequent intervals, the fish rises to the surface to fill its lung with air, which it expels again at the next ascent. During the dry season, when the marshes fringing the lakes and rivers are drained of water, the unfortunate fishes that are trapped in these marshes bury themselves in the mud before it dries to a hard cake, and there they remain in a state bordering on suspended animation until, in the following rainy season, the marshes are flooded again.

1 In December a lungfish from Nairobi was placed in a tin can filled with wet mud. This was allowed to dry slowly until it was extremely hard. As the mud dried, the fish became immobilized at the bottom of the more or less vertical passage through which, while the mud was still wet, it had risen to the surface to obtain air. This state of "summer sleep" is called estivation. Several months later, at the General Biological Supply House in Chicago where these photographs were taken, the tin can was carefully cut away

2 Throughout the period of estivation, the animal continues to breathe air, though at a greatly reduced rate. The air is made available through the narrow opening of the passage at the top of the mud, to which the forceps point. Since the estivating fish cannot eat, it must endure upon the fat stored in its body and the protein of its tissues. Under scientifically controlled conditions, lungfish have lived in estivation for four years and can probably endure much longer. These figures represent the longest, authentic fast of any animal on record, all legends of buried frogs, horned toads, etc., to the contrary



TEXT BY
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PHOTOS: KEINIGSBERG-GRAPHIC FEATURES

3 When removed from the mud cake the fish is covered by a waterproof envelope or cocoon resembling cellophane, in which lies the secret of its survival. For if the fish is removed from water and placed directly in the air it will die. This "cellophane" wrapper is formed by the drying of an abundant, slimy secretion over the surface of the fish. The cocoon envelops the fish closely and completely, except at the lips, where a small aperture opens into the mouth

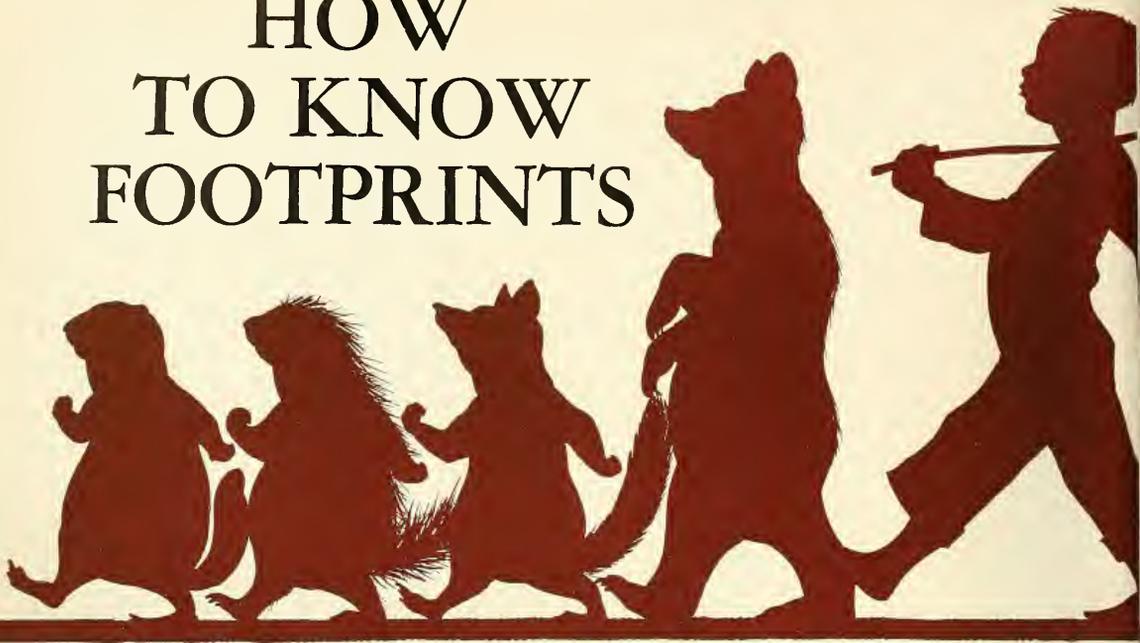
4 When the covering is peeled away, the skin beneath is as moist as though the animal had been freshly removed from water. After prolonged estivation, the fish are generally "sound asleep" and almost inert. But this fish, having been asleep only a few months, was moderately active, squirming in the experimenter's hand and making a barking noise by the rapid expulsion of air from the lungs

5 The lungfish is a survival from the Devonian Period, 300 or 400 million years ago, a time when all the higher fishes breathed by means of lungs, and it is probable that the evolution of the lung was an adaptation to periodic aridity comparable to that which forces the modern lungfish into estivation. It was a distant cousin of the Devonian fish which evolved into the air-breathing, terrestrial animals. This cousin had broad, spatula-like fins, whereas the fins of the lungfish, as can be clearly seen in this photograph, are elongated ropes and practically useless for locomotion. The forked pelvic fin of this animal is probably due to regeneration after injury. It is interesting that the lungfish, very hardy in so many respects, is capable of regenerating not only fins but practically the entire tail if these are bitten off by its cannibalistic brothers. This animal was returned to water and within a few hours, when figure No. 5 was photographed, it was fully active and apparently normal, except for its emaciated condition.

A second genus of lungfish, *Lepidosiren*, lives in South America, and a third, *Neoceratodus*, in Australia. Only *Protopterus* and *Lepidosiren* are capable of going into estivation



HOW TO KNOW FOOTPRINTS



Winter's snows will soon cloak the earth, and amateur naturalists everywhere will take up the trail of their favorite woodland creatures. Learn to know them and derive the endless pleasure from deciphering the movements and moods of animals unseen

By ELLSWORTH JAEGER

UNCOUNTED centuries before man scratched his first crude pictographic records on the rocks of his cave home, diaries were written by Nature's children in the snow, dust, and mud of the primeval wilderness.

To the Indian, trails and tracking were of vast importance. Food was primitive man's greatest problem, and to secure game with primitive weapons called for great skill in tracking and woodcraft. An intimate knowledge of the ways of the woodfolk was a primal necessity, hence the need for a deep study of trails and tracks, which contain a truthful record of everything an animal does or tries to do. Most animals are nocturnal or seldom allow themselves to be seen abroad, and so their tracks tell secrets of their doings that otherwise could not be learned.

Just as individual animals themselves have peculiarities, so, too, do their tracks, but each species has general characteristics easily recognized. As shown

above, there is a group whose members walk on the flat of their feet, a "flat-foot fraternity" as it were. Membership in this group includes such animals as the beaver, porcupine, skunk, raccoon, bear and even man himself. The hind feet of this group are longer than the fore feet, just as your tracks would show, if you walked upon your hands and feet.

All of the bear family are "flat-foots." "Three bears" of this continent shown above are the small or black bear; the medium-sized or grizzly; and the big bear, the Alaska brown bear. All three tracks are so similar that it is difficult to tell them apart except by size. The black bear's hind foot track measures about six inches in length, the grizzly's twelve inches, and the Alaska brown bear's from fourteen to fifteen inches. The grizzly has extraordinarily long claws, and these often identify his track. The length of the grizzly's claws of his right or left fore paw depends upon whether he is right or left-handed. The claws on the paw he uses most will be worn down.



THE FLAT-FOOT FRATERNITY



BLACK BEAR



GRIZZLY



ALASKA BROWN

The black bear's trail could once be found over a great part of North America, but he has been driven out of many sections today. The grizzly's trail has always been found in the West, especially in mountainous sections, while the Alaska brown bear's is found from Alaska to British Columbia on the Pacific Coast.

Numbers of ripped open rotten logs is another bear sign. The black bear is a great trail blazer. In fact trails are traditional with him, for he seems to follow the footsteps of past generations of bears wherever he can. Bears select with uncanny sagacity the shortest and easiest routes, and once the paths have been established they become deeply worn by repeated use.

Bears seem to be very conservative in regard to their trails and seldom wander from the original straight and narrow path, even suffering inconveniences at times rather than change. There is no thought of improving the trail, any obstruction being gradually erased by use. In thick forest country the brush on the trail is only worn away to the height of a bear walking on all fours.

In some parts of bear country a "bear's sign post" is sometimes found. This is a tree along some well worn bear trail, used perhaps to communicate information to bears in that area. At least all bears who pass seem to register by gouging and tearing the green

bark with teeth and claws. Sometimes the tree is plastered with mud and hair.

The polar bear of the North makes a track that clearly shows he wears fur moccasins. The other bears have naked soles.

The beaver and porcupine also belong to the flat-foot fraternity, and their tracks are the funniest in the woodland. When walking, they toe-in so much that they make a most ridiculous track. The porcupine has long and very strong toenails for climbing, which show prominently in his tracks. Four register on his fore feet and five on his hind. In deep snow, porcupine tracks are in a trough-like trail. The fat little animal's body nearly touches the ground when walking, and so he must push himself through the snow like a snow-plow.

Most of us recognize the coon by his identifying mask and ring tail, but how many of us know his footprints. Long ago the coon, finding he had worn out his shoes and stockings, decided to go barefoot. On his tracks now, you'll find always his naked toes and soles plainly imprinted. Like the bear, he has five toes with claws on each foot and like the bear, too, his hind feet are longer than his front ones. The fore foot tracks of a full grown coon measure about three and three-quarters inches, while the hind feet are around four and a quarter inches.



BEAVER



COMMON SKUNK
GALLOPING



LITTLE
SPOTTED SKUNK

The beaver covers the tracks of his fore feet with those of his hind feet. Being an aquatic animal, his hind feet are webbed. He also has a curious split toenail on the second toe of the hind foot, which puzzles naturalists. Some think it to be a comb to get rid of ticks and other vermin, while others have suggested that it is a sort of toothpick to remove splinters from the teeth after a hard day at lumbering.

A common track of the countryside is the skunk's. He, too, is a flat-foot. His front claws register prominently, the hind ones scarcely at all. An unusual feature is the diagonal position of the skunk's feet when galloping.

The little spotted skunk is the smallest of the skunks. He ranges in size from a very large chipmunk to a fox squirrel. His track, too, somewhat resembles a squirrel's in that the fore feet are almost evenly placed back of the hind feet. This track formation is especially interesting, since it reveals the climbing ability of the little spotted skunk, as distinct from the ground-walking animals, whose hind feet are generally placed irregularly. But the form of the prints clearly identifies the little spotted skunk. First, the tracks are more stubby-toed than a squirrel's. Second, the skunk's fore foot track registers all five toes, while the squirrel's shows only four. Unlike the common skunk, the claws of the hind feet also register plainly.

A relative of the skunk is the weasel. When he registers in the mud and snow pages of Mother Nature's guest book, it is sometimes difficult to tell whether he is a ground-dweller or a tree-climber. The fore feet register in a sort of in-between manner. This indicates that although he is a ground-dweller he can also climb trees. A tell-tale sign that establishes the identity of a weasel track is the extra long space between the hind feet and the fore feet, a characteristic often seen in the trail. The weasel has a long body. When making an extra spurt his hind feet are shoved much farther ahead, creating the characteristic track. Since he is usually in a hurry, his track is blurred and his toe-prints are seldom seen. At times his tail registers between the footprints as it brushes the earth at each bound.



CHIPMUNK



OPOSSUM

MUSKRAT

If you should see a trail that looks as if some tiny person has been walking along on his hands, you will know that the dwarf was that queer animal, the opossum. The imprints of his feet are about an inch and three-quarters in width and clearly show a well developed thumb on the *hind* foot. Both front and hind feet have five toes with claws on all except the thumb. The trail seems to have been "made with gestures."

When we see the track of a gentleman who toes-in slightly, stepping upon his own heels and swaying gently from side to side, we may be sure it is our friend the muskrat. Between the alternating foot-

prints, a rhythmic, wavy line is penciled in the mud by the muskrat's rat-like tail. Five toes show in the footprint of the hind foot, while only four are visible of the fore foot.

Muskrats' trails are found over a greater area upon this continent than those of any other North American mammal, and it is interesting to note that he is ever expanding his territory. However, widespread as his family may be, he individually is a homebody. Travel seldom enters his mind, unless it is forced upon him by the loss of his home marsh. Evidently it is only the home seekers who look for new worlds to conquer.

LONG HIND LEGGERS

The animals whose hind legs are longer than their fore legs might be classed in another group. When in motion they always place their hind feet ahead of their fore feet. Rabbits and squirrels belong to this group. Mice tracks, too, are similar in construction, but not in size.

Rabbit tracks differ from squirrels' in that the rabbit's fore feet are placed irregularly back of the large hind feet, while the fore feet of the squirrel are paired.

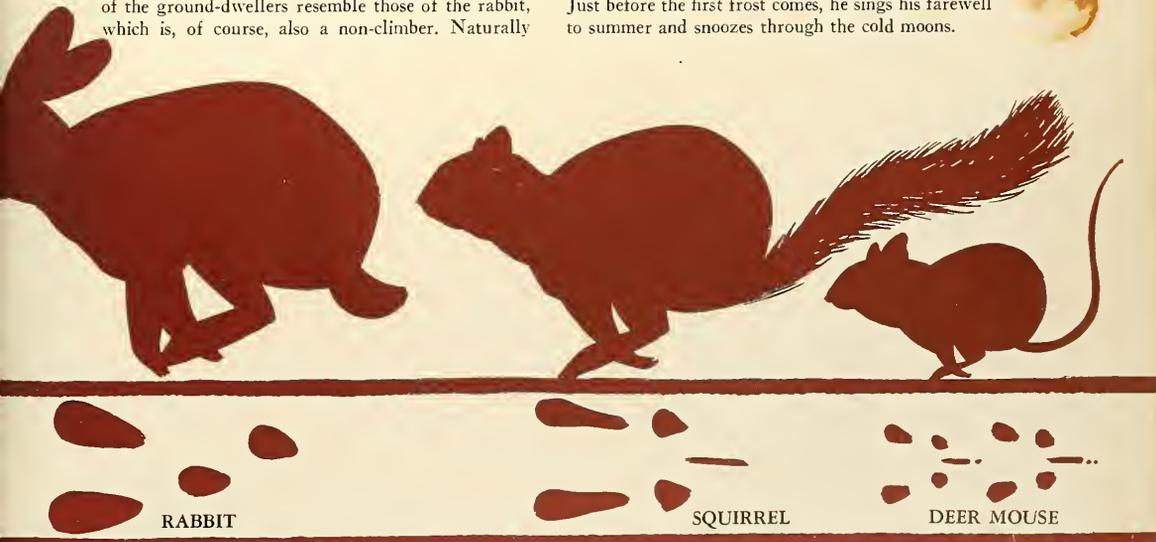
In most sections of the country, two general types of mice tracks are found. That is, mice can be roughly divided into two groups, the ground-dwelling and the climbing mice. A naturalist can tell by a glance at their tracks to which group they belong. The tracks of the ground-dwellers resemble those of the rabbit, which is, of course, also a non-climber. Naturally

the mouse track is much smaller, but the position of the feet is the same. The meadow mouse makes a track of the latter sort.

The deer mouse, who loves to climb, makes a track which resembles in structure that of the tree-climbing squirrel. Here the deer mouse *pairs* his fore feet behind his hind feet.

Sometimes there is a slight tail mark in the squirrel's track, but the rabbit's tail seldom registers, if at all, down.

The chipmunk track is that of a ground-dweller and also resembles a rabbit's track in miniature. A glance at the drawing shows the typical irregular arrangement of the ground-dwellers. Although you may find his track in dust and mud, you'll never see it in the snow. You see, the chipmunk sleeps all winter. Just before the first frost comes, he sings his farewell to summer and snoozes through the cold moons.



RABBIT

SQUIRREL

DEER MOUSE

THE TOE-WALKING FRATERNITY

Another group of animals might well be members of a ballet, for they walk upon their toes. Cats, dogs, wolves and foxes belong here.

A good place to start hunting for tracks is in your own backyard. Two very common animal tracks, easily found in the city, are those of the cat and dog. Much has been written about how to tell a dog's track from that of a wolf, but experienced huntsmen say that it is next to impossible to distinguish them. A large dog's track will give you a very good idea of a wolf's footprint. You will realize then how close the wilderness is to your doorstep.



DOG AND WOLF



LYNX AND CAT

While the dog never worries about his claws and leaves a prominent impression of them at every step, the cat has more important work cut out for his sheathed daggers, and they do not register as he walks. Cat and dog tracks resemble their wild relatives, the lynx and wolf. The lynx's track is rounder, of course, and much larger than the cat's.



The cat is a "perfect walker" for the hind feet fit exactly in the tracks made by the fore feet. This perfect walking is characteristic of nearly all animals that stalk their prey.

The track of the fox is another good example of this, but unlike the cat's the fox's claws are present, since he belongs to the dog family. His tracks, however, are much more delicate and graceful than those of the wolf or domestic dog. The small pad impressions are characteristic, the toes also being more widely spaced. Another identification is the straightness of the trail; and in the snow the fox never seems to drag his feet, for the snow is unruffled. Occasionally the fox's brush or tail drags, leaving an impression in the intervals between the footprints. Filled with uncanny wisdom and alertness, as one would expect, the fox is "always on his toes," which is true literally as well as figuratively for he belongs to the toe-walking fraternity.

FOX



THE FEATHERED FRATERNITY



GREAT BLUE HERON



Bird tracks are usually very beautiful because of their delicacy and well balanced rhythm. Often in the shore mud you can find the footprints of the great blue heron (*left*). These reveal his cautious, dignified personality. Both great blue heron and bittern tracks are similar except in size, the latter being smaller. Usually the track of only one bird will be found, for the great blue heron is a solitary feeder. The claw of the middle toe has a peculiar comb-like growth. This is sometimes said to be used as a comb in cleaning and arranging the plumage, but its true function is unknown.

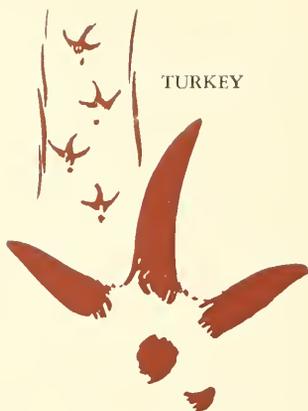
Turkey tracks, whether wild or domestic, are of the pattern shown above. These are the largest of our game birds. The turkey toes-in when he walks, the middle toe being slightly curved inward, which adds to the effect. When strutting, the stiff wing feathers often leave their marks on either side of the footprints, as indicated.

The Canada goose also prefers to toe-in when in his stride; and the webs between his toes register very clearly. Although we consider the Canada goose a water bird, he spends much time ashore, and it is then that you can see his track as he "goose-steps" along. When selecting their feet, both the ducks and the geese were evidently like-minded for the only major difference is the size of their feet. Occasionally the rear toe of a diving duck is larger than that of the surface-feeding duck; but taken as a whole, these aquatic tribes have feet very much alike.

Since the pheasant has been imported for game purposes, his tracks are more or less common today. He places his feet exactly, one directly in line with the other, making a straight line track, as shown at left.

Various species of grouse have tracks which so greatly resemble each other that the only general way to tell one from the other is by the length of the stride. The partridge tracks at right show the general type. All of the grouse family walk with the middle toe pointed inward. The ruffed grouse and the ptarmigan are among those who take the shortest steps and have the smallest tracks.

Common bird tracks are those of the robin and sparrow. The sparrow's track is typical of a perching bird, for it shows the pairing of the feet as the bird hops. The track of the robin shows two characteristics; it shows the paired footprints of the perching bird as well as the running trail of the ground bird.



TURKEY

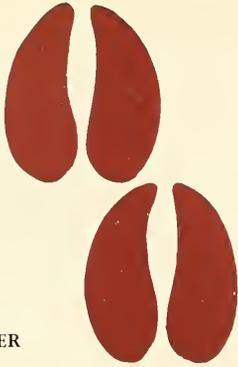


PHEASANT



PARTRIDGE

THESE WALK ON THEIR TOENAILS



DEER

Like nobles of the Middle Ages, the moose and deer carry the seal of their royal lineage, though not upon their fingers but upon their toenails. Instead of implanting their royal crest upon sealing wax, they imprint it on the soft bosom of Mother Earth. Sheep, goats, cows and horses are other good examples of the group of animals that walk on their toenails.

Your first sight of a clearly defined track of that lordly monarch, the moose, is usually thrilling and exciting. The track of the bull moose may measure six to seven inches in length, while the cow moose track is smaller and more slender. Other evidences such as nipped twigs and antler-scraped trees also indicate moose. The supreme experience, however, is to find the giant himself. The picture of a bull, half immersed in the shallows, draped in wraiths of early morning mist, is a never-to-be-forgotten picture.

In many cases the accessory hoofs of the moose show prominently because of his immense weight. The bull moose spreads his feet wider apart than does the cow. The cow, ungainly though she is, is more ladylike in her stride. The hoofs of the bull are usually more blunted than his mate's because of his characteristic pawing of the ground. This seems to be a habit of the males of all the antlered family.

The petal-like track of the Virginia or white-tailed deer is a beautiful imprint commonly found in the eastern and northern countryside and woodlands.

The white-tailed buck seems to saunter along nonchalantly, at times dragging his feet like a lazy school boy. This is one of the distinguishing features of a buck's trail, especially during the rutting season. The doe has a smaller track and she places her feet more daintily upon the ground. Signs of hoofs having pawed the ground is another buck sign. The tracks of sheep, goats, and even the unromantic pig are often mistaken for those of the deer. Though the domestic animals have cloven hoofs, often the same size as those of the deer, they lack the shapely grace of their wild relatives. In walking, the tracks of the deer's hind feet almost cover those of the fore feet, showing the deer to be a perfect and silent walker.



MOOSE

As we come to the end of the trail, we realize that Nature's children are confirmed diary addicts. All seem to record their daily doings, be they large or small. Whether it be the huge spoor of an elephant, the microscopic trail of a tiny water beetle or the silver slime trail of snail or slug, each has a fascinating tale to tell, provided you have seeing eyes with which to read.

TWO DEER IN A GLADE

First Prize Annual Award of the Poetry Society of America for 1938

Two deer disturbed, alert to an alien sound,
Tautly aware,
With delicate ears up pointing and fore-
foot lifted
In the still air,

Then, not once with their great eyes
looking
Backward again,
Bound out of the glade, on through the
wood, through thicker and clearing,
Over the plain.

Not once looking backward, or daring,
At the green glade
Of sunlight, or moonlight, fern bed and
small pool,
Or quiet shade.

When speed shortens the breath, when the
walls of the heart are shaken,

When strangling fingers of fear
Are laid on the throat, and eyes burn in
their sockets,
Remember the deer.

Is there no glade with pool for the
thirsting and fern for the weary
Safe from the hunter's foot;
Safe from the sound of the horn, of bark-
ing, of lean hounds;
Safe from pursuit?

Must always the hunters halloo and the
dogs discover;
Must always the gentle flee from cover
to cover?

Pause, eat the willow buds now, my fel-
low-hunted.
Browse in the glade, and drink from the
untroubled stream.

Stand knee deep in the bracken beneath
the branches;
The past, a fable all told; the future, a
dream.

The forest is full of the breath of the
hound and the hunter.
There is no escape.
But all that is past is gone and therefore
is powerless; and the future
Has not found shape.

This only is real: this moment of sunlight
and water,
Aside from the trail.
Though the forest be full of evils pur-
suing, impending,
... For the moment, they fail.

HELEN MORROW.

INFORMATION TEST

A few informational high spots that may be gleaned
from this month's NATURAL HISTORY

Score 5 points for each correct answer. Correct answers on page 256

1. The largest pearl in the world weighs
(a) 14 pounds
(b) 14 ounces
(c) 14 grams

2. Who is Margaret Mead?

3. Does the shell of a shellfish produce
the animal or the animal the shell?

4. The American domestic turkey origi-
nated in
(a) South America
(b) Mexico
(c) Massachusetts

5. Tigers eat humans only when too old
and helpless to run down other game.
True..... False.....

6. The beaver, although an aquatic ani-
mal, does not have webbed feet.
True..... False.....

7. How can a clam murder a man?

8. The rows of spines on certain shells
are formed because of
(a) The necessity for developing
weapons of defense
(b) Cycles in the growth of the ani-
mal
(c) Resistance to tossing by the waves

9. What bird gives the call "bobwhite!"

10. The average turkey today is smaller
than he was 100 years ago because
breeders now cater to the smaller
American family.
True..... False.....

11. Of what vital use is a cellophane-like
wrapper to the lungfish?

12. What is the origin of the phrase "talk-
ing turkey?"

DO NOT MISS

The Strange Story of the Stephens
Sculptures will thrill you as one of the
most absorbing tales in the history of
archaeological exploration. The man who
discovered them deep in Central America
was a writer of best sellers; but who could
have guessed that these images of a van-
ished people would stand for many years on
an island in the Hudson River as an arti-
ficial ruin, before coming to the Ameri-
can Museum. Do not say that archaeology
is not full of high adventure until you read
this story.

African natives who could break all rec-
ords for the high jump are described in
action in a variegated article by Martin
Birbaum, whose writings on African
travel have fascinated NATURAL HISTORY
Magazine readers.

It is the climax of the millionaire's ban-
quet and the substance of the beggar's plea.
Empires have fought for its control, and
science says it makes a man a better chess
player. Do not miss the romantic Story of
Coffee.

13. Stories of frogs that have survived
many years of imprisonment in rock
layers are
True..... False.....

14. What is the one animal the tiger al-
most invariably avoids?

15. What animal is the world's longest
sleeper?

16. The modern name for Persia is
(a) Iran
(b) Iraq
(c) Ibid

17. A limpet is a
(a) Bird
(b) Worm
(c) Mollusk

18. How long does a fur seal go without
food in the mating season? (Answer
must be correct within two weeks.)

19. A short-tailed shrew will starve if it
does not eat approximately its weight
in flesh every 24 hours.
True..... False.....

20. What have the following in common
(a) Rikki-tikki-tavi
(b) Colinus
(c) White Fang

IRAN

A modern land, once the center of the ancient Persian empire, yields specimens of little known animal life to a Museum expedition exploring its picturesque hills and deserts

By SIDNEY J. LEGENDRE

Pictures by GERTRUDE S. LEGENDRE

THE KLM plane touched the hard-baked surface of the desert. "Baghdad," said the steward in the disinterested voice of a subway guard calling out a street.

Baghdad—our first stepping stone to Iran, or Persia. It seemed unbelievable that after two years of preparation we were finally on our way. George Goodwin of the American Museum was standing by the steps as Gertrude and I descended. As I walked toward the customs building, he told us that he had already passed our equipment and guns through the customs, and that we would be able to leave for the Iranian border within a few days.

Baghdad lies across the Tigris river from the aerodrome. We crossed this muddy stream on a pontoon bridge in company with a never-ending line of porters, donkeys and haughty camels.

At the end of the bridge the car climbs a little hill, swings to the left, and is on the principal street of Baghdad. It is here that you feel the full blow of the heat. The asphalt pavement and the mud walls of the houses form an oven, through which the hot desert wind races, driving ahead of it clouds of dust.

Two days later this hot wind crossed the desert with us to the Iranian border and died there, at the foot of gaunt mountains stretching across the horizon.

These piled-up ranges of red rock are a fiery inferno through which the dusty road winds back and forth. Their peaks either rise straight up like the walls of a room, or tilt to the horizon in a series of shelves. In the valleys between, herds of sheep and goats grazed on the sparse grass.

At nightfall the mountains that had run parallel to the road all day closed in, and squeezing the road between them, forced it upwards. Enormous trucks roared out of the blackness, leaving us balancing on the edge of cliffs. At nine that evening we arrived in Hamadan, after motoring for eighteen hours.

From Hamadan on, the land flattens out, and mirages of swamps and lakes appear and disappear.

(Above) BEHIND SILVER AND GOLD DOORS this Persian mosque dazzles western eyes with the brilliant complexity of Oriental art. Its silver and gold doors give entrance into a mosaic interior where thousands of mirrors reflect the light of countless candles.

Though we know her history, Persia's animal life had been largely uncharted by science until 1938, when Mr. and Mrs. Sidney J. Legendre led an American Museum mammal expedition into the Iranian mountains. Scaling rugged cliffs at right, the expedition hunted the famed ibex. Elsewhere they secured a representative collection of boar, deer, gazelle, rodents, etc.



Villages increase in frequency, and then Teheran, the capital of Iran, emerges from the flatness of the desert, and one is rolling along its paved streets.

Teheran has a population of 360,000 and is the center of the government. Here we obtained the necessary permits to travel about the country to collect specimens. This required 24 days and during this time we visited Persian houses and the Legations of European countries.

Most Persian houses are surrounded by a mud wall. An iron-studded door of heavy timber set in the wall opens into a short, vaulted archway. On either side of this passage are the rooms of the concierge. Beyond, a broad gravel path leads to the house. This is generally built with the central portion higher than the wings. A pool of water always lies in front of the central portion of the building, and around it are planted rose bushes, orange trees and various flowering plants.

To move from house to house one hires a droschky. These carriages are similar to an open victoria and are drawn by two horses. A ride of fifteen minutes costs only a few cents, so they are used by the rich and the poor.

While we were waiting for our permits, his Excellency, M. L. Petrucci, the Italian Minister, gave us several fine specimens of bear, sheep, ibex and antelope that he had shot in the mountains to the north of Teheran and on the plains that sweep from their feet southward.

He helped us in every possible way and his kindness and hospitality did much to make our stay in Teheran attractive.

The day that we received our permits we left for the Mazanderan. Our party consisted of Gertrude (my wife), George Goodwin, six Iranian boys, and Mr. Richard, an Iranian who was to be our interpreter. Our equipment and food, which we had brought from America, was loaded into a Studebaker truck, and the boys were placed in an open Ford. We had

rented these cars in Teheran and they were a constant source of trouble from the day they left the city.

Gertrude, George, Richard and I rode in the Buick that we had brought from America. It is far better to bring all cars from America, as a Ford costs over \$2000 in Teheran.

The road followed the base of the Elburz mountains to Quazvin. There it turned abruptly to the north and started the long pull over the Elburz range.

Gradually great towering cliffs, beetle-browed crags against the blue of the sky, closed in on us. The mountains seemed folded and creased above one another as if bent and forced together by some giant hand. At times a peak would be thrown up into the air by the pressure, or a knife-edged protuberance would run along the side of a hill until it broke into a series of jagged sawteeth. At five o'clock it began to snow. The whirling flakes spatted against the windshield and were pushed down into the corners by the wipers. There they froze into a solid mass. The wind howled through the canyons, and our headlights lit up feebly the rims of gorges filled with darkness.

The next day we were in the warmth of Mazanderan Province: a narrow strip of land a mile wide lying between the Caspian sea and the Elburz mountains.

Jutting out from this land is a peninsula called Mian Kaleh. At the end of this peninsula Richard told us we would be able to make an excellent collection of animals. However, there was only one way to go there, and that was by sailboat. At the port of Bander Gez we hired an ancient vessel, piled our cases on its deck, spread its square sail to the wind, and slowly drifted away from the dock. The sail hung listlessly, the ropes, limp pieces of cord, swung in curves from the masthead to the blocks aft. The tar in the seams bubbled in the heat, and an air of drowsiness lay over the ship like a heavy mantle.

When I awoke the following day it was to peer



(Left) PICTURESQUE and amusing was this journey aboard an obsolete lateen rigged vessel. Tar bubbled in the deck seams as the boat crawled across a windless stretch of the Caspian Sea. Next morning the Legendres gazed on the mud flats of Mian Kaleh, a peninsula bereft of the large game the guide had promised. However, George G. Goodwin, Museum mammalogist, saved the day by trapping rodents for comparison with species in other sections of Persia's varied topography

through the early morning mist at a mud bank that stretched back a quarter of a mile to a series of hump-backed, grass-spotted sand dunes. I could not believe my eyes. Surely Richard had not brought us to this desolate spot to collect animals.

We remained there for three days while George collected rodents. On the third night a storm struck the camp. The pegs of the tents failed to hold in the sand, and daylight found mounds of canvas immersed in the sheet of water that covered the mud flat.

Everything was loaded back onto the boat, and pushing off from the shore, the captain hoisted his sail and headed the boat into the wind. The result was a loud crack, and the main spar broke in two and fell to the deck. The crew regarded the mass of tangled ropes and canvas for a moment, then murmured "Inshah Allah," and sat down and commenced eating.

Two days later we were back at Bander Gez, and our little procession of cars filed out of the town and onto the road leading to Gumbad.

The country was magnificent. On the south side were the forested slopes of the Elburz, and on the north, woods and fields alternated, giving one occasional glimpses of the vast Turkoman plain. At three o'clock we pitched camp on a grassy bluff overlooking a tiny stream and sent out word that we wanted native hunters.

Natives

In the morning, two men of medium height with flashing black eyes set in bearded faces, arrived. They were dressed in brown homespun coats that reached to their knees, and trousers of the same material. The latter resembled loose jodhpurs. On their feet were moccasins of cow hide, with the hair on the outside. In place of socks, their feet were wound in a burlap material. This winding was continued six inches up the lower legs of the trousers. Curved bone-handled knives were thrust into their belts in front, and they carried short-stocked, long-barreled guns. The barrels of these guns were bound to the stocks with a series of engraved, highly polished brass bands. Around their heads were turbans of faded blue cloth, the ends tucked in to form a knot behind.

Together we left the camp, pierced the woods to the left, and came out on a clearing. In the center was a village of mud huts with thatched reed roofs. Beside each house was a roofed platform on stilts, 20 feet above the ground. These two buildings were always enclosed by a four-foot fence of laced reeds. As we entered the village, little girls dressed in red skirts and blouses, with rows of copper and silver coins on the front of their blouses, and boys dressed in brown homespun coats tumbled through the gates of the fences and shouted at us. Fuzzy white dogs gazed

at us mournfully from their beds in the dust, but made no effort to rise.

Women attracted by the commotion came out and shaded their eyes with one hand as they peered. They were all dressed in full pleated skirts and blouses of magenta or red. The blouses were Russian in design, reaching almost to their knees and buttoning up the side. On their heads they wore batik handkerchiefs in browns and golds, while the children wore embroidered skullcaps.

Across the desert

Leaving the village, we went down the center of a plain. Thorn bushes reached out eager fingers to grasp our hands, leaving long streaks that turned red and emitted bubbles of blood. Patches of short stubble grass grew between stunted bushes, and an occasional low hill arose bare and forlorn. Suddenly the wall of trees on my right broke, and through the opening I could see the vast reaches of the Turkoman desert.

Tiny dots on its surface marked Turkoman villages. The houses of these people are built of mud, round in shape, with thatched roofs of reeds. The floors and walls are covered with hand-woven rugs in which red predominates. In dry weather this flat land on which they live is a desert; in rainy weather it is a sea of mud.

With the setting of the sun the temperature dropped ten degrees, and we pushed into a clump of trees that filled a hollow at the foot of a hill.

One of the guides gathered wood for a fire, and the other climbed a tree and, settling himself on one of its topmost branches, drew a cow horn from his pocket. As the first flames curled up through the pile of twigs, he put the horn to his lips, and I heard what is known as the "roar" of a stag. Actually, it sounds like the bellow of an ox, and always starts with a soft, low grunt and ends with a long-drawn-out bellow. When he had finished he sat silently and then, within a minute, we heard an answering "umph" in the distance. Unfortunately, though we hunted here for two weeks, we never had a shot at a stag, but we did make an excellent collection of boars, roe deer, gazelles and rodents.

Our next objective was the village of Gulidow. Here a main camp was pitched, and taking six horses and two weeks' supply of food, Gertrude and I and three guides struck out across a sandy plain toward a range of mountains that towered in the distance.

We did not ride on saddles, because the Turkomans do not have saddles, but on piles of blankets. Our legs dangled over the ends of these blankets and around the horses' necks, instead of against their sides. At the end of nine hours we slipped off our

mounts in pretzel-like positions, and heaved a sigh of relief.

We were now in the ibex and sheep country. Our guides made tea, and unrolling their blankets produced an enormous loaf of bread. This comprised their dinner, and, in fact, bread was all they ate during the entire time they were with us. In the end it was our diet. It was much simpler, and we found that we could walk farther and feel less tired on it than when we ate meat and canned vegetables.

Around us the mountains were piled in serried ranks. The steeper slopes were bare of vegetation and rock-ribbed. The gentler slopes were covered with grass and sparsely dotted with stunted cedars.

Hunting in the mountains

In the early morning the sheep grazed on these grassy meadows, and with the coming of evening worked higher onto the rocky ridges. Though numerous, they were difficult to stalk owing to the scanty cover and the fact that they quickly detected the least movement with their keen eyes. One might stalk a flock for two or three hours only to peer cautiously over the last ridge and see them climbing another mountain a quarter of a mile away. Generally one old ram would look back as if to say, "What foreign dog is this climbing about our hills?" Then he would turn and follow the others.

The ibex were easier, in that they live on the rocky sides of the mountains, where overhanging ledges and boulders give one an opportunity to creep up within range.

I have never seen such magnificent heads, and I am certain that there are record horns waiting for a good shot. The number of times that I missed fine specimens still makes me blush.

Every day we started hunting at five in the morning, returning at night to the new camp that had been pitched by one of the guides. Gradually we worked higher and higher, until on the fifth day we topped a ridge and looked down on the world. Below were ranges of mountains like waves in the sea. They rolled on and on to the horizon. The air had that bright luminosity of high places, and the cold north wind nipped our noses and pulled the horses' manes and tails out into a straight line. That night we camped on the edge of a grassy plateau above a dark valley, misty green with trees. In that valley we hoped to kill our stag. We saw two in the distance, but the dry autumn leaves on the ground made stalking impossible and we were forced to leave empty-handed.

The wind that had nipped our noses on that high range followed us down to the lower sheep country.

It carried with it whirling flakes of snow that whitened the land and buried our pup tent. George, who had joined us, returned to the main camp as he could not set his traps. Finally, at the end of two weeks, Gertrude and I awoke one morning in a howling blizzard, with the realization that further hunting in these mountains was impossible.

Packing the sheep and ibex skins and skeletons onto the horses, we returned to our main camp, to find that during our absence Richard had left us and had returned to Teheran.

"You will be able to shoot stag at Dasht," a native told us.

"Where is Dasht?" we asked. He did not know, nor were we able to obtain definite information on the subject from anyone in Gulidow. It is extraordinary how little these people know about their own country. There are not any maps showing the more remote roads and trails, and finding one's way about is rather a hit-and-miss method.

At first we passed through a land of rolling hills covered with long grass. In the ravines between were small clumps of beeches and oaks, their leaves crimson and gold in the autumn air. In the distance were the snow-capped mountains in which we had hunted, their whiteness accentuated by the brilliant sunshine and the turquoise sky. Occasional sheepherders leaning on their staffs, their curious speckled coats hunched over their shoulders, watched us pass. Their dogs, magnificent big white animals with heads of huskies, ran by the side of the car, barking furiously. Gradually we dropped from an altitude of 3000 feet into a land of furrowed mountains and arroyos.

We meet a chief

The road differed from the rest of the country only in that horses had passed before us. It wound back and forth until it fell into an enormous valley, at the end of which we saw the town of Samarkand. As we approached we could see men standing on the walls, their robes flowing in the wind. Their chief came out through the gate and bade us welcome with that courtesy that one finds everywhere in the country. We spent the night in his house, and with the dawn, once more set our faces in the direction of Dasht.

When we arrived there we found the town in ruins, but the local chief provided Gertrude and me with horses and guides, and we started the long climb to the top of the forested mountain that shadowed the village. It was a terrific pull, almost straight up, and the poor animals labored under their loads. This did not seem to make any difference to the caravan men who climbed on top of the packs and urged their mounts on with whips.



TWO CAMP SITES of varied climate. Above, a rain storm washed away the tent pegs at Mian Kaleh. Later, two weeks of unproductive stag-hunting ended abruptly when the Legendres awoke in a howling mountain blizzard. The ex-

pedition then proceeded to Dasht. Here was more snow, but the maral stag was secured before guides balked at further hunting in the intense cold

Photos by Gertrude S. Legendre



(Left) AN EXPEDITION GUIDE. Shown here in drab hunting garb, he stands in contrast to the colorful costumes observed in villages on the expedition's route



(Left) EXPEDITION LEADER: Sidney J. Legendre astride his horse in the Turkoman desert region. Wherever possible, however, motor cars were used as transport. A Buick was brought from the smooth roads of America to absorb astonishing punishment along craggy Persian trails beyond the main highways

(Below) SADDLE HORSES are the principal means of transportation in Persia, though they are now being replaced by automobiles on the main highways. Mrs. Legendre illustrates the Turkoman style, riding on blankets piled high across the withers. After 9 hours of "blanket-back" horsemanship, the Legendres dismounted "in pretzel postures"





(Left) PERSIAN SHEPHERDS at their knitting as the expedition passes. Their ancestors probably tended flocks on these grass lands from earliest historical times. Below, the guides take bread and tea, a staple diet, which the Legendres found more healthful than canned goods



(Below) TYPICAL VALLEY in the southern Elburz Mountains. In a nearby village, the Legendres were entertained at the house of the Chief. Persian hospitality is generous and elaborately ritualized. As elsewhere in the Orient, host and guest exchange long speeches, the former belittling his own hospitality



(Left) THE WILD ASS of Persia, an alert, swift-footed desert animal which many believed exterminated. Conflicting reports and directions baffled the expedition for weeks until mammalogist Goodwin spied the only specimen seen on the trip and obtained it for Museum studies

At first we passed patches of snow hidden under ledges, and then some of the exposed rocks were fringed with it. Gradually it covered everything, and we entered the forest. A snow-bound forest is the deadest thing in the world. There is neither sound nor movement. The bare trees rise straight and black, their snaky boughs ridged with white. The ground has a smooth, even surface, its depressions and mounds leveled out, its contours flowing into one another.

The cold was intense, penetrating, touching our bones with icy fingers and contracting our muscles so that we moved like old people.

Dawn broke the next morning, cold and gray. Low, heavy clouds scudded before a bitter wind that sighed in the trees about us. Only the tents were to be seen. All of our boxes, saddles and cooking pots were buried under the freshly fallen snow. We moved about in a dead white world.

Gertrude and I each took a guide and went in different directions.

Stag hunt

My guide walked with his hands behind his back, one thumb held between two fingers. His head was bent, and his eyes were on the ground, as he plodded on. The snow squeaked under my boots, and when I stepped into the drifts it came to my knees. I felt despondent, for it all seemed so hopeless. The roaring time for stags had been over for a month. It would only be luck if we saw one now.

An hour from camp we topped a little ridge. On the far side there was a tiny valley, and then another slope tilted upwards. Halfway to its top a stag was standing black against the snow. I knelt, and looked down the barrel of my gun and pressed the hair trigger. I had waited so long for this opportunity that I could not miss now. My finger tightened and the gun recoiled. The stag stumbled forward, recovered and ran to the top of the crest. He stood there for a moment outlined against the sky, and then fell backwards, and rolled down the hill until he lodged against a tree in the valley below, his coat covered with powdered snow, his antlers plunged deep into a drift.

George joined us that evening, and we hunted for several days while he trapped. Then the cold became so intense that our guides refused to remain any longer, and we were forced to descend.

To the east lay the city of Meshed, capital of the province of Khorasan. We arrived there one evening just as the golden and turquoise-blue domes of the shrine of Emam Reza were disappearing in the gathering darkness.

This mosque grips your attention and leaves you spellbound in wonder. The exquisite delicacy of its mosaic interior leaves nothing to be desired. Only an Oriental mind could conceive such splendor. Inside, immense silver and gold doors and ivory-colored marble floors are reflected a thousand times in the mirrored walls. These mirrors are cut into facets, so that the walls give one the impression of being a vast sheet of diamonds, sparkling and shining under the light cast from the thousands of candles in the gold chandeliers. On priceless carpets—exquisite soft patches of color against the ivory of the floor—knelt men. Bending forward with arms outstretched, they touched their foreheads to the ground, and then sitting on their heels they chanted their praises of Allah in voices so low and melodious that one felt it was music from an organ and not the sound of human voices that filled the great rooms.

"You will find the wild ass to the southwest," we were told. The wild ass—what memories it evoked. When we had left America we had been told that it was extinct. When we arrived in Iran we had been told stories varying from the extinct theory to ones where certain of the local residents had been charged by these beasts. Under the guidance of His Excellency the Italian Minister, M. Petrucci, George Goodwin had succeeded in shooting one, 50 miles from Teheran. But this was the only one they saw, and the question still remained whether they were to be found in numbers or not. Though our searches for the wild ass were fruitless, I would like to tell about the fantastic country we traversed.

At the village of Abbasabad we received information that there were herds of wild ass to be found in the desert 80 miles away, near a salt spring. The only difficulty was that there was no automobile road leading there, and we would have to cross over the desert as best we could.

A guide was obtained, and filling up our canteens and empty gasoline cans with water, Gertrude, Henri (our chauffeur), and I started. The desert which had looked so flat and smooth from the walls of the village, now became a maze of gulleys, filled with sand, and ridges of black rock around which we had to detour.

Late that evening we arrived at the salt spring where we had been told we would find the wild ass. There were tracks everywhere, and it really seemed as if we had come to the right place. Half an hour after our arrival it began to rain. This was bad for two reasons. First because we had not brought a tent and, therefore, had to sleep under the car; secondly because the desert, though rocky in spots, would

quickly become a sea of mud with a heavy rain, and we would never be able to get out with the car once the soil became saturated.

The next morning the skies had cleared and we commenced hunting. It was a fantastic country—a lost world of red, green and black rocks—a land of vast mountains cascading to the desert in series of shelves and wind-sculptured figures.

But there was something extraordinary besides the scenery. Something morbid, which I could not at first place. Then I realized what it was. This was a dead world. During the first three days that we spent in that heat-tormented wilderness I never saw one living thing.

We hunted that country fourteen hours a day on foot. The car could not move any farther on account of the roughness of the ground. We searched the horizon; we sat on the mountain tops watching the desert below with our glasses, but we never saw a wild ass. At the end of the fourth day two men approached, and we asked them if they had seen anything. They replied that the wild asses had all migrated to the south two months before, and that they would not return until spring. They assured us, however, that they were to be found in herds of ten to forty around the salt spring, from June until September.

We could not follow these herds into the waterless desert ahead, so sadly had to give up the hunt.

One thing stood in contrast to the lifeless wastes—the warmth and hospitality of the natives, as illustrated by a minor misfortune we had in this region. At eleven o'clock at night Henri dropped the front wheels of the Buick into a well, and there they remained until the following morning.

Natives came from a neighboring village and asked us to spend the night with them. Their chief, Haji Baba, led us to his house and knocked on its immense iron-studded, wooden door. There was no answer. He then let out one of those wavering cries that only Persians and Arabs are capable of emitting. There was a great rattling of chains, and the door swung back. We entered a dark narrow passageway and turned to the left. A flickering lamp, a wick in a jar of oil, lighted the bottom of a steep stair. Mounting, we found ourselves on a flat mud roof surrounded by jutting towers and the rounded domes of the rooms below. In the center of the roof was what would correspond to an American penthouse.

Entering this building, we found ourselves in a

room twelve by eight feet. The only light was from the fire place where a dull red heap of charcoals glowed. The floor was completely covered with rugs which overlapped one another and in some places extended up the walls several inches. An old man sat in front of the fire, gazing into its shifting colors with the vacant stare of those nearing the end of their term. Haji Baba opened another door and stood aside to let us pass. This was a much larger room, fifteen by twenty feet, and its floor and walls were covered with rugs, warm in their rich reds and golds. We sat down on the floor, crossed our legs and waited for Haji Baba to start the "greeting."

He commenced: "This is an evil day that you should be entertained in such a rude and wretched house. Will you in your generosity and tolerance excuse the poor hospitality that I am offering. My village is only a small village, and not worthy of your presence."

When he had finished, and you must always let the speaker finish in Iran (interrupting a speech is unheard of rudeness), I took a deep breath and started, going through to the correct ending, "and when you come to America my house is your house and my servants are your servants." But my speeches were never quite right. They never attained the dignity and poetic charm of my hosts'.

When I had finished, a samovar was brought and placed next to Haji Baba, and he made tea and passed us each a little glass full and a bowl of sugar. We would take a lump of sugar, place it in our mouths and then drink a mouthful of tea. You never place the sugar in the tea in Iran.

When the tea drinking ceremony had finished, heaping mounds of rice and chicken were brought in on a lovely, hand-wrought brass tray. The tray was set on the carpet and we sat around making slow talk, and eating. I shall always remember Haji Baba as one of the most charming hosts I have ever known. Such chance friendships as these, encountered on the desert trails, leave a lasting impression of the ancient and picturesque country of Iran.

Our mammal collection adds a great deal to the very limited knowledge of the fauna of Iran. Except for a few relatively small collections previously secured, almost nothing was known about this animal life; and the specimens we secured, not without some difficulty, comprise the only representative collection of its kind in America.

THE RED QUAIL—Continued from page 223

elegant little hen with a tender voice that captivated him. She disdained the company of the cocks, who fought frequently and viciously but with little damage. During these encounters she would retreat with the other hens to a brush shelter, to come out when the trouble was over.

No longer content merely to gaze at her, Colinus came closer to the little hen when she fed away from the covey. He paraded and showed off his plumage. He would lower his head and turn it around so that she could see his brilliant markings, and fluttered with his long-shafted wing tips brushing the ground. Puffed out all over, he would make short rushes toward her. Sometimes she would look up at him, but more often she would continue her search for food. Occasionally she would dash to a patch of grass and freeze. This would puzzle him.

Combat

One of these playful rushes brought him against another cock and instantly Colinus found himself on his back. Recovering from his surprise, he jumped to his feet, throwing off the other's grip on his head feathers. The hens fled alarmed, and he heard them gossiping in their hiding place. He looked fixedly at the brown aggressor and he hated him with a ferocity he had never known before. He advanced, thrust with his bill, and in a moment stood breast to breast with his opponent, stabbing furiously stroke for stroke. Feathers raised on backs and bellies, the birds rasped warlike cries, pecking with lightning motions.

Colinus lacked experience, but he made up for it with strength and violence. In a few seconds the other cock turned and ran, the routine climax to these spring battles. But it did not satisfy the red quail. The imprint of bitter, lonely days left little tendency to mercy in him. He caught the fleeing cock, threw him flat, and savagely stabbed at the base of his skull. He bit through to the bone, again and again. Blood was on his tongue and flecked his red feathers. Soon the brown cock ceased struggling and lay quietly.

Colinus crowed in triumph. The hens came forth with ruffled plumage and quivering wings, and the covey moved on again. He walked beside the shy hen and suddenly, unpredictably, she squatted and he squatted beside her. She had accepted him and henceforth they were inseparable.

They left the covey and for a week foraged together, the hen walking ahead, Colinus on the lookout for danger. They chose a nest site in the shelter of a rail fence; it might have been the fence of his early days, he could not be sure. But it was a good place, full of sun and close to food and cover. Colinus built the nest while the hen sat nearby and encouraged him.

He did it in one day, scratching and shaking the weeds around the spot he had selected. He dug with beak and claws, forming a cup of dirt inside which he stood and pulled grasses down into a sort of hood. Every little while he would come out so the hen could go into the nest and see if it was being built to her fancy. After these inspections they would eat together, and he would return to work. By evening he had finished.

Offspring

Next day he stayed near the nest but he did not enter it. Something was happening that concerned the hen alone. He stood guard a few yards from the entrance, and when the hen left the nest he hurried to look rapturously and long at the pure-white egg. Then he flew away with her.

He was much in love, proud of his dainty mate, eager to show his affection. Her manners were impeccable, she never openly questioned his authority, and she constantly flattered him. Day after day he watched while she entered the nest, rolled the preceding day's egg aside with her beak, and turned toward him. When she got up they would go away together to wallow in dust and ashes near a burnt log, letting the fine stuff trickle through their feathers and whirling it up in great odoriferous clouds.

Colinus learned a fine discrimination in his feeding. He became adept at hulling soybeans and cowpeas, and he sampled sorghum and oats and corn. Luscious blackberries furnished food and drink. He ate the blue berry of the juniper and the fruit of the sassafras and wild grape. His taste for insects was not so strong as it had been, but he liked an occasional ant or grub. He was never sick.

He returned to the nest one day as usual, after the siesta in the shade of a sumac thicket, to find it ravished. The empty shells were strewn about the ground, tops bitten off by a skunk. The frustrated cock raged while the hen stood sadly by the violated nest, permitting his anger to speak for her. Then she turned away and started toward another section of the fence. Colinus followed, to build a new nest in a more secluded area.

Here the hen labored again until in twelve days the bowl of the nest held that many eggs.

When the last egg was deposited she began the three-week period of incubation. From that time on the cock remained away from the nest. This was her job, and he would not interfere unless circumstances should force her to give up. He waited nearby, whistling when he had located food. She would come and eat hurriedly, play for a few minutes, and return.

Colinus increased his vigilance. Skunks were not the only egg-eaters. Needle-toothed 'possums roamed

at night, dragging their scaly tails; squawking jays might carry the eggs away to smash them on their perches in the oak scrub; fat crows and lumbering raccoons were fond of eggs. Once a wild turkey sauntered by, glittering in green-bronze dress, and Colinus flew in his face with a great bluster of wings, driving him away.

Once a man walked along the fencerow toward the nest, and when it seemed his boots must surely crush the nesting hen, the red cock rose and dropped in his path. He dragged one wing as he had seen his parents do and led the man aside. When he had drawn him a safe distance away he surged again into the air.

Then came a day when new life stirred in the nest. The chicks had pipped their eggs, but it was to be two days before they actually began to hatch. Colinus did not come and stay at the nest but he kept in close touch during this critical time, when the peeping that came so mysteriously from the shells might reach the ears of hungry animals.

Fatherhood

The first flake seemed to be a signal. Then all the chicks were hammering rhythmically at the shells and Colinus watched the steady progress of the fractures. The cuts moved in the same direction, counter-clockwise. In an hour one chick wriggled out, sodden, feeble, and ugly. The others followed within a few minutes. The powerful nest scent had spread over the ground; and when their wet bodies had dried and their legs were gaining strength, the march for safety began, the cock proudly leading his brood.

All the summer Colinus tended his chicks, providing food and shelter, romping and dusting with them, and protecting them from harm. He watched their down become plumage and their bodies ripen, watched them whir their young wings impatiently. On hot nights he held them on his back and on hot days shaded them with his wings. He was the father, dictator in his little sphere, serving and asking nothing but respect. As they developed he saw that some were red like himself and he felt less strange among them.

Often they strolled through brushy lanes from field to field, conversing in musical tones and snapping at flies. They walked erect, with chests thrown out like turkeys. When they were frightened they snaked over the ground, bodies horizontal, necks astrain, wedging through the grass. Sometimes they crossed the creek but they did not touch the water. Dust baths kept them immaculate and they drank dew when berry juice did not suffice. As they grew they learned to roost and to flush in unison, and to give the scatter call.

Summer passed. The chicks matured and the family was joined by another covey, and later by another, so that there were 30 birds or more in the group. The nights grew colder and the birds squeezed closer on the roost. Leaves were falling, turning to scarlet and brown and gold. They went into autumn.

There was a boom a long way off early one morning. It resounded from the hills and it stirred in the quail a vague, unknown fear.

Two more booms in quick succession, echoing and dying!

They fed on a sunny slope that afternoon in the lee of the woods, and Colinus watched two dogs come over the rise and down the trail where they had fed. Back and forth they zig-zagged, coming closer as they crossed each other's trails. They ran silently, broken tails spinning screwlike. Behind the dogs came a man, and Colinus sensed unrest in the covey.

He could hear the animals now, panting and crashing through brambles. Suddenly the noise stopped and a swish that might have been the wind was all he heard. He tightened. The other birds were motionless, though none had sounded an alarm. He was aware of the lead dog then, looming large in the grass, tongue between jaws and eyes fixed upon them. The dog, too, was frozen into immobility.

The man was approaching, kicking the weeds and crooning to his dogs. Colinus remembered the broken-wing ruse he had used before, but there was no nest to protect today. The man came on until the quail could see his boot nails.

Colinus sprang, and around him the whipped air roared as the covey exploded from the ground, spirit and defiance in their getaway. With the hen at his side he drove for the woods and hurtled into the trees at 40 miles an hour. He dodged and twisted as he had learned to do the previous winter, a shining but a difficult target.

Before he reached cover he saw a spurt of feathers far to his right, and the sound of the gun. Momentum gained, the two birds coasted on bowed wings through the trees. In the evening six quail failed to gather with the covey.

Colinus and the hen survived the first days of hunting. He led her straight for the woods when they were flushed, or rocketed toward the sun. And when the hunter stood between him and the woods, he swept around him in a close, fast arc. He had formed a habit, too, of making a sharp turn the moment he reached cover so that it was difficult to mark him down.

They were feeding in the sun after a hard freeze when two men followed a sleek red setter up the creek bottom. Colinus knew they were coming long before the creeping dog stiffened above him, but some-

thing held him: instinctive hope, perhaps, that he would not be discovered. The click of the safety catches sounded as the men kicked on with their guns ready.

Again he burst from the ground, exulting in the thunder of beating feathers. He flew toward the timber, keeping low for speed. There was a shot, and he glanced beside him at the hen following below his left shoulder. As he looked she crumpled. Her legs dropped from their doubled-up position under the feathers of her sides, where the shot had torn. Struggling helplessly against the downward pull, she fell with a thud.

Colinus saw this in an instant, in two wingbeats. Involuntarily he banked, swooped toward her, realized the danger, and made for the trees a few yards away.

TIGER! TIGER! *Continued from page 216*

the tiger started to creep up on the man, going from one small pile of heaped wood to another, while the tapper was hurrying on with his work. Soon the tiger was close. He made a quick rush upon his victim who was bent over tapping a tree. A slight check about fifteen feet away, a swift run, and the tiger reared on the unfortunate man, sending him to the ground.

Imagine the horror of the Chinese when he saw what had sprung upon him! It is true that other tappers were on either side of him and fairly close, but none had a weapon, and the poor fellow must have realized that death was upon him. The tiger's snarling face was in front of him and its hot breath fanned his eyes. The victim in his desperation managed to regain his feet, only to be sprung upon again and hurled to the ground. The tiger then seized him by one ankle and dragged him through the barbed-wire fence into the jungle, depositing him in a spot about a hundred yards from the edge.

Living death

During the whole of this time the man was alive and conscious. But the terror and mental agony of the poor chap was soon ended as the tiger took him by the throat, sinking his fangs in deeply and drinking the life-blood as it pumped out of the severed veins. The body was then dragged in farther and the customary meal made off the hindquarters.

Every incident of this tragedy could be read from the tracks on the ground as clearly as one could wish. I came upon the scene some four hours afterward, tracked the man-eater to its kill, which we left undisturbed, and put two men with guns up trees to watch for the return of the beast. I promised to return

In that instant of heartbreak and indecision he heard a whine as of distant bees and a patter of dry leaves, as the gun boomed. He, too, felt the shock of lead in his body, and sudden weakness.

He reached the woods, turned, and rode on quivering wings toward the fencerow where they had built their first nest. In sight of it he came slowly to earth and staggered to cover in an eroded hole beneath the roots of a black walnut tree. With great effort he wormed in head first, leaving nothing to show but his tail tip, and that invisible against the red clay. There he waited.

The strength was draining from him. It was only a matter of time. But he accepted the pain without fighting, having left part of himself behind. Colinus, the good father, had planted his seed and nursed it to maturity. That was his job. It was finished.

with coolies and lights if we heard a shot, and to come back to remove the body about midnight.

It was a bit of a job getting the party together, but with the aid of two other Europeans we collected a score of people with torches, and some Chinese stretcher-bearers. When we reached the spot the Chinese refused to touch the body, and we had to threaten to leave them there unless they complied.

It was far from pleasant there in the dark, even though five of us stood guard with loaded rifles, knowing as we did that every move was being watched and that it needed only a roar and a charge to set the whole crowd off in a panic. It would have been nasty then, indeed, with torches thrown away, everyone running heedlessly, the man-eater in the midst of the party and wild shooting in the general confusion. However, we kept the gang close together and managed to get out safely.

We found out later that a couple of man-eaters were causing the damage in the vicinity, and before the pair was trapped and shot they had killed more than 30 coolies.

On another occasion in Pahang on a plantation where I used to shoot wild pig and deer, I often saw the tracks of a young tiger. Finally I asked the manager of the estate if he would place some oil of valerian on the track, to see if the tiger would be at all attracted to it. I knew it attracts cats as aniseed draws dogs, although it had been tried out in India without success.

A feline League of Nations

A couple of days later the manager spoke to me most reproachfully, claiming that I had led him into a fine mess. He had poured out the oil onto a piece of cloth which was intended for the trail usually taken

by the tiger. Unfortunately he poured out too much, a quantity fell on the ground at the back of his bungalow, and that night his house cats, all the cats from the coolie-lines, and some dozens of cats from the native plantations congregated at the back of his bungalow. There they formed into a feline League of Nations, screaming and fighting among themselves, and creating such an uproar that sleep was out of the question for anyone within a mile in any direction. The manager's wife told him her opinion in no uncertain terms; the baby woke up and joined in the chorus. In certain quarters my name was anathema.

Incidentally, although he carefully dragged the oil-soaked rag across the tiger's favorite trail, the contrary animal took no notice of it whatever.

Man-eaters always cause plenty of trouble, and some European planters have suffered heavy loss of income through desertion of scores of coolies in fear of prowling and hungry tigers with bad records. Native Malay holdings as well are also thrown into panic by rumors of a local "*chenako*" or were-tiger, for these people are extremely superstitious. *Chenakos* are comparable to the were-wolves or the *loup-garou* in lycanthropy, and in the Korinchi region of Sumatra, the men are said to possess the power of turning themselves into tigers.

A well-known story concerns a Korinchi traveling cloth-seller up in the Malay States many years ago who was overtaken by darkness just before he could reach the next village, and as he hurried along the narrow trail he heard a tiger roar close at hand. Terrified, he hurried on and came upon a large type of tiger-trap with a hanging door. He hesitated a moment before it. Another roar behind him made him bolt inside. He pulled the rope release on the door. Hardly had it dropped into place when a tiger came sniffing up to the entrance. The traveler within trembled with fear but knew he was safe for the time being. The tiger prowled around outside for a long time, trying to find a way in, but finally had to give up.

The following morning a crowd of armed Malays came along to inspect their trap, and seeing the closed door imagined that they had captured a tiger. The Korinchi yelled out to them that he wished to be released, and the natives crowded around and asked what he was doing inside. He related the whole story, but it was received in stony silence.

Then said the headman, "We know you are a Korinchi, and that you have been to our village be-

fore. On each occasion after you had left, tigers killed one of our people. All around this trap are tiger-marks where you walked, and inside are only human footprints. In the shape of a tiger you were trying to get at the goat which we placed as a bait, and when you entered to get at it from the inside you found yourself trapped and changed back to human form."

The Korinchi protested against this and pleaded innocence. But he received scant sympathy. Reviling him as being accursed of Allah, they slid their weapons in between the side uprights of the cage and calmly speared him to death.

Contrasted with this tragic tale is one in which a Chinese played the unsuspecting part of a hero. We have all been told of the imperturbability of the Chinese, whose impassive face is supposed to represent serenity and calm. How untrue is this conception is recognized by those who know the Chinese as actually the most noisy, excitable and hysterical of peoples. This tale, however, proves the exception to the usual Chinese reaction and in a way lends great credit to my headman, Lin Sing.

I had sent him off with a note to another plantation, and he finally came back with the answer after a few hours absence. After reading the reply, I told him all was well and that he might go. Then he said, "My luck has been very good this day."

I told him that I was glad of it, and inquired what this good fortune might be.

"Well, the Tuan knows that part of the road where there is a plantation of sago-palms. It was when I came to it that I saw a large tiger lying across the road."

"Wah!" I exclaimed. "That was bad—what did you do?"

"Tuan, I at once got off my bicycle and watched that tiger for some time, and then seeing that it took no notice of me, and since I had to deliver the letter to the other Tuan, I took my bicycle into the ditch and went toward the tiger. As I got close to it, I kept ringing the bell and kept ringing it all the time until I had passed it."

"And what was the tiger doing all this while?"

"When I was just level with its hindquarters it turned its head around and looked at me. I then lifted my bicycle back onto the road and went on to the other Tuan's bungalow where I gave him the letter. On the way home I found the tiger had gone."

Perhaps Lin Sing benefited from a lack of imagination!

EXPLORING HUMAN NATURE

How Margaret Mead became one of the foremost women explorers; her life among strange brown people in the Pacific islands; and how the "Primitive Experiment" revises our most cherished notions of human behavior

MARGARET MEAD burst upon the literate world in the golden year of 1928 when *Coming of Age in Samoa*, her first book, perhaps did more to stimulate a popular interest in anthropology than any work published since the first World War and became one of the very best sellers of the day. Why did it sell?

Psychology was still in its popular heyday, with Eugene O'Neill's *Strange Interlude* holding audiences for six hours in packed houses. It was still the era of Flaming Youth, Fitzgerald's sad young men, Hemingway's lost generation, Mencken's *Prejudices*, all with their undercurrent of intergenerational maladjustment in the post-World War decade, were favorite literary topics. And along came a girl ethnologist with a literary touch to give the public startling food for thought.

It was a public already indulging in a kind of national introspection fostered by the feverish insistence that adolescents were having parent trouble and vice versa. But Margaret Mead advanced the heretical notion that there was nothing everlasting about this dilemma and that it was quite possible to make adolescence a much easier transition stage in the human journey toward maturity.

Here was certainly a new departure, and with it young Miss Mead boldly set a precedent for her later investigations wherein the evidence obliged her to attempt further mayhem on beliefs no less strongly held. Against for example:

- (1) That the differences which society attributes to men and women are innate.
- (2) That a new world can be built by a new system of education alone.
- (3) That it is one of the eternal verities that human mothers naturally love and protect babies.

Upon all of these tenets Margaret Mead has placed very grave doubt. Who, then, is this lady Lochinvar of science who proposes so rashly to upset our appercart of traditional ideas?



Margaret Mead
From a drawing by Caroline Mytinger

We had better glance back at the days when Margaret Mead, aged four, was standing patiently on a scale being weighed by a sociologist. The sociologist was her mother. And Margaret Mead's growth progress was to be compared with that of a group of first-generation Italian immigrants which her mother was then studying.

Don't infer that the child was regarded merely as a convenient object of coldly comparative scrutiny. At the age of ten she was taught psychology, if you please, in order to record the speech development of her younger sisters. Seldom attending school with other children, she received her education mainly in the home. Thus she never learned to pointedly hold her nose at the peculiarities of the immigrant children or to patronize them in any way. From infancy she accepted Italian habits, modes and ceremonies as objects of study.

"Mine was a straight-line development," says Margaret Mead, "I probably became attached to social science because it had always been around the house."

Her father was an economist, her mother a sociologist. And through them contact with other specialties was inevitable. Later, at Columbia, she came under the influence of Franz Boas, one of the greatest pioneers of

the science of anthropology. His teaching became, in her own words, "the ground under one's feet."

The search for an objective that could absorb all her energies ended in Doctor Boas' classroom. It was there that the pressing need for ethnological field workers was first made plain to her—workers who would go out into the few remaining dark pockets of the globe where the white man's culture, implements, and clothing had not yet penetrated. The need was indubitably pressing, for with the improvements in the airplane alone, to say nothing of the many other means of communication, anthropologists were witnessing a rapidly merging World Culture. According to their estimates, the institutions of primitive man will certainly never survive the 20th Century. The great danger, therefore, was that all man's clumsy, or adroit, fantastic and contradictory beliefs and ways of getting-a-living might dissolve without a trace in an inter-continental melting pot. It will be a far more capacious pot than that of the 19th Century America, and one in which the "soft parts" of all weaker cultures will swiftly be liquidated. Such skeletal material as survives will be tossed aside to sink ever more deeply into the sand. Mayhap in 30,000 A.D. an earthquake or some climatic erosion will disgorge a few carved sticks and stones, a fossilized skull with part of a headdress wrought from the feathers of a long-extinct bird—a fragmentary skeleton—all that will be left of a culture that was a living, breathing phenomenon in the first half of the 20th Century. Thus the World of Tomorrow, for all its present glitter in the Flushing meadows, will be a world undisciplined by the priceless and illuminating contrasts inherent in primitive ways of life.

All this was foretold to Margaret Mead in the year 1924, when the Lynds were about to focus a social microscope on the strange ways of the city of Middletown, and when archaeologists had recently disturbed the ancient bones of Tut-ankh-amen.

Meanwhile, clusters of little-talked-

of men would occasionally watch a swift-moving shadow pass across the hot sand of their village clearing. And glancing upward, they would stare innocently at the great droning bird the white man had learned to make—a winged god gliding away beyond the tree line now, but a god who would return presently to make a refuse heap of their own puny deities.

For years Doctor Boas and his colleagues had insisted that a scientific record of these living tribes was at least as important to civilization as the relics of long-forgotten potentates. After all, what was each group of huts in these far-off places but a natural laboratory? And what was the behavior of the residents if not a unique, unself-conscious, experiment in human life?

Here, then, was a critical moment in the course of the science that makes its province the study of Man and his ways. Whither anthropology? Should it not provide competent observers for these experiments which had so little

all-important funds to finance the work? There, indeed, was and is a rub. And who would be the volunteers? Margaret Mead for one was ready and willing.

For her maiden assignment, Miss Mead was sent to discover just how adolescent girls lived in Samoa and just what trials and tribulations, if any, were involved in their reaching maturity.

There arrived in Pago-Pago in the fall of 1925 probably the most unethical looking ethnologist officials had ever seen. Only two years out of Barnard, she scarcely looked older and was actually shorter and slighter than the adolescent girls she proposed to study. There chanced to be but one hotel in Pago-Pago, the hostelry where Somerset Maugham's *Rain* was conceived and partially written. Unavoidable as a place of lodging, these spiritual stamping grounds of Sadie Thompson were a curious scene for a young lady's professional debut, even though

played with the children, and most of all "hung out" with her all-important adolescents. In short, for several months Miss Margaret Mead, late of New York City, lived very much as a young Samoan girl.

Previous to Miss Mead's Samoan inquiry, educational circles, both in Europe and America, had long ago given up on adolescence as a hopeless



A JOURNEY through the bush in the Admiralty Islands where Doctor Mead made one of her earlier studies of primitive education



THE MANUS BABY grows up in a world of water. While studying the irresponsible ways of his childhood, Doctor Mead lived in a native pile dwelling and waded about the village in rubber boots. Manus children learn to swim at three and expertly handle canoes when scarcely past the toddling age

time to run? The crux of the problem was and continues to be whether well-trained, devoted individuals could be dissuaded from the more lucrative, the more popular and in some respects the easier walks of academic life to join this scientific rescue squad. For there were many obstacles, the pressure of time apart, to this salvaging of primitive culture. Who would provide the

her type of assignment was a new and daring departure.

The adolescent girls, though shy, were quickly won over by Miss Mead's equable size and manner and she soon became their intimate friend. She lived in their villages, ate their food, learned the ceremonial politeness expected of those attending their feasts, watched the dances and the women at work,

period of storm, stress, soul-searching, and emotional heartburn. The standard pedagogic work concerned with this age level had reached the conclusion that adolescence was characterized by emotional growing pains which were about as inescapable as the measles. But when young Miss Mead returned from Samoa she published a book purporting to demonstrate that this theory was false. If it can be shown, she asserted, that there exists one culture where the pangs we associate with adolescence do not occur, then the theory is disproved.

Into a ferment of parental antagonism toward "the plastic age," came the announcement that an island of benighted savages had been quietly solving the problem of stormy conflict in adolescence and appeared to offer valuable clues for its amelioration in our own society. All that appeared to be necessary was to select that aspect of their society which could be shown to contribute toward relatively painless adolescence and see if it might guide us in suggesting beneficial environmental changes in our own culture.

The question, then, becomes what do the Samoans have that we haven't? And one answer is homogeneity. Dip up a sample spoonful of American society, and what do we see? Looming large is the nut and bolt factory of J. H. Doe. Nearby are the homes of his workmen. Predominantly Protestant, these homes, numbering among them 24 Methodists, 18 Episcopalians, 17 Presbyterians, 6 Agnostics, 5 Baptists and 5 Roman Catholics can scarcely be called religiously uniform. Furthermore, the factory was built in 1927 and the community is no more than 12 years old. Only the younger children of those longest employed by Doe were born here. Fifty percent of the mothers and 40 percent of the fathers were born within the state. Ten percent of the men and five percent of the women were foreign born. The remainder came from 18 other states in the Union. Out of this melange emerge special standards, discipline and values for every home in the community. Intramural family life here is probably the motliest in the world. The only non-material regimentation is produced by the school, the radio, the movie. Thus the boy or girl coming of age near Doe's factory has a tremendous number of choices to make. Shall *he* be a Doe machinist like his father, or a soda jerker in the local drugstore studying pharmacy at night, or just take it easy and try to beat the races by phone from the local pool hall? Shall *she* try to marry the first suitor that comes along holding a steady job at Doe's, or wait for that dream man who'll look like Gary Cooper. Or try for Mrs. Doe's scholarship at the state university? Or take a job in Woolworth's and keep on trying at amateur talent nights? It is true, isn't it, that all Americans have an equal chance at fame and fortune? How about skipping Doeville and trusting to luck in the state capital? Or New York, or Hollywood? Meanwhile in his room at Princeton, J. H. Doe, Jr., is fretting over whether to devote his youth to nuts and bolts or leave all that to his younger brother and go to Paris to write.

When it is realized that these are merely the vocational choices and leave out the highly variable home pressures in regard to curfew, sex and religion, we see at once that if there is anything that is emphatically not offered the youth of America it is homogeneity or a single standard. Now, the Samoans appear to offer these very things. And the Samoans, having greatly narrowed the choice-possibilities, take their ado-

lescence easily. Shall we, then, fly in the face of our traditions and chop our culture down to a choiceless level in order to administer a torrential post-pubertal paregoric? God forbid, says Margaret Mead. In the first place, we couldn't if we wanted to. In the second, we have paid too dearly for the development of our heterogeneous culture to suppress it. We should merely develop it further in the direction of

virtue of the unconscious cooperation of a primitive society we were able to offer a diagnosis and suggest treatment for one of our more puzzling social ills. Can anyone doubt that Samoa has been of service?

The agent of this service was, of course, Margaret Mead. But that young lady never waited to see how civilization reacted to the Samoan experiment. While editions and public



THE PEACEFUL ARAPEESH, a tribe where men and women are expected to have the same type of personality. Unable to think of dolls as inanimate, Arapesh girls treated them with an anxious parental solicitude

comfortable adjustment so that the cost of upkeep will be reduced. And the sovereign specific for this is training for choice. Let us stand back and admire the majestic sweep of choices which our culture provides. Let us lead our children upon a hill and bid them gaze at the panorama of choice that spreads on every hand. This, we may tell them, is their world—well-nigh boundless in its variety. And out of this world they must choose a way of life. Then we must say that we are glad to cooperate without prejudice or dogmatism in the making of these choices in order that they may choose that particular course which seems best fitted to their temperament.

But what, you ask, have such fine notions to do with Samoa? Precisely this: we sought in the native laboratory of Samoa clues to the nature of human adolescence which we could never have discovered in America. Samoa yielded what we sought. Thus by

plaudits multiplied at an astounding rate, she had renounced the world for a coastal fishing tribe in the Admiralty Islands. Here she lived in the midst of a tropical lagoon with a stilt-supported hut for home. Samoa had vanished from her mind and so most certainly had a book describing how young girls attained maturity on that isle. All her days were spent in patient observation of a totally new experiment, conducted far beyond range of the mails, by a remarkably different people. And so it was not until *Coming of Age* had been selling like the proverbial hotcakes for five months that news of its success reached her out-of-the-way nook in the Pacific.

Glad tidings these and pleasantly startling to a scientist who had never even secretly aspired to best-sellerdom. But there was new work at hand.

After landing in the territory of the Manus tribe, Doctor Mead was astonished to find that certain elements in

their culture happened markedly to resemble those of our own. It occurred to her that the Manus might offer a different kind of evidence in the problem of how to bring up children and that whereas Samoa had taught through contrast, the Manus might teach through similarity.

The father Manus is a rugged individualist and primitive capitalist who adores his children but whose main

arrangement which is obviously without counterpart in America.

But it was with the education of the young child among these people that Doctor Mead found what she judged to be significant parallels between our own and the Manus culture. And, descending an age step from Samoa, it was upon these young children that she concentrated.

Manus children appear generally to

in the next come running to her with a bit of garbage found floating on the water to ascertain whether it is something he may have or something belonging to another.

Since his early life is made up of a relatively constant vocal demand and material supply, and since he has no chores to do and learns about his future responsibility only by hearsay, this epoch should logically be the happiest in his life. And so it is. For adult life among Manus women is frequently a harrowing routine of family bickering produced by badly confused ties of loyalty. And among the males it is a long dreary process of finding new ways to pay off old debts.

Inextricably caught up in the complex socio-economic machinery which they have themselves set in motion, the Manus spend their lives amassing shells in a ghost-fearing drudgery that is a far cry from the institutionalized nonchalance of the Samoans. As in America, a Manus man is admired for his wealth only. In short, he himself is never admired. His possessions alone deserve reverence. He buys wives and all his art works and even, with pampering sweetmeats, the love of his small children. He is not a happy man.

What then did Margaret Mead deduce about American civilization after witnessing the Manus experiment?

The Manus seem to teach us that no matter how careless we are about education—that is, the passing on of the cultural traditions to our children—they will inevitably adopt the prevailing way of life. Aside from two or three forceful taboos, the Manus child receives absolutely no formal mental education at all. Yet their butterfly-to-cocoon culture is changeless from generation to generation. Childhood and the adult life are diametrical opposites among the Manus. Yet year after year, Manus children become Manus adults. The summing up: Americans have always been prone to place their faith in education as a cultural corrective. But since the Manus child's "education" emphasizes values so different from those of the adults—and with little effect—surely we had better temper our faith in "education." Doctor Mead doubts that any culture can be enriched by the younger generation alone. It is the older generation, those in the saddle, who must evolve the germs of enrichment for our culture. It is they who must resolve, grudgingly at least, to be tolerant of other values, so that each child may step into that particular walk of life



AMNH Photo

MANUS TRADERS AFLOAT, a section of the miniature Melanesian habitat group constructed at the Museum under Doctor Mead's direction. On a scale of one-half inch to the foot, this group portrays a complete Manus village within the confines of approximately sixteen square feet

business in life is accumulating shells and dogs' teeth (money). However the shells and dogs' teeth are not stored up against Junior's bills at the Manus' Princeton or to buy him a seat on the Exchange. They are to pay off a relative who once advanced a long-term loan to buy Junior's mother. So soon as that debt is canceled, accumulation continues in turn to buy Junior a wife. Thus each man invests in some younger man's matrimony rather than in some stranger's factory.

Junior Manus knows who his wife will be about the time most American boys are seeing their first evening movie. But tribal taboo forces him to hide from his child betrothed and she from him. Nor can they ever mention each other's names. Of course, by the time they are ready for actual marriage they have been such a mutual nuisance all their lives that they often despise each other—a courtship ar-

resemble juveniles in the upper levels of American society because in neither community are they given an active part in the daily work commensurate with their ability. Junior Manus is perhaps the most pampered primitive child in the world. He is given free license to punch mother in the jaw if she tries to bend his will to her own purpose in any way. He plays nearly every waking hour, coming home to order a hot meal at any time that suits his fancy. He demands everything his father has and laughs at "the old man" for giving so generously. This scandalous situation is counterbalanced by the curious fact that breakable knickknacks are absolutely safe in the same room with crawling Manus infants. So strong is their taboo against touching the property of others and so early is it instilled, that Junior can grow up with the temerity to let mother have one on the chin at one moment and

for which he is best fitted, with head held high—not in febrile defiance of his father's wrath.

By writing this definitive codicil into the social contract of Education, Margaret Mead fulfilled the promise of research in child training that had begun, years previously, with charting her sister's speech development. Today she is one of the leading figures in the international education movement, being actively connected with the work of such organizations as the General Education Board of the Rockefeller Foundation and the Progressive Education Association. As Assistant Curator of Ethnology of the American Museum she is known the world over as the authority on primitive education. Thus she not only acts as one of the chief liaison officers between the extensive education work in the Museum and that practiced by outside organizations, but she strongly links the science of anthropology with scientific education. In fact all three of her popular books* were written not as ethnological documents but with an eye to develop closer coordination between these two disciplines.

Indeed, it is here, Margaret Mead feels, that the woman scientist can do her best work. The study of primitive education is, she believes, one line of endeavor for which a woman is better fitted than a man. Patent are the difficulties that would beset a man attempting an intimate investigation of female adolescence in Samoa or anywhere else. The same social and sexual factors would militate against his study of native childhood. But the woman ethnologist by simple virtue of her womanhood can obviate or circumvent nearly all of these pitfalls. It is clear then that any young woman seeking an opportunity in social science need not look further than the primitive "schoolhouse." In that figurative edifice her abilities will yield greater scientific dividends, meet with greater appreciation, and in brief, be more efficiently assimilated, than in any specialty wherein men can at least fare as well.

"What are little girls made of?"

... Sugar and spice and everything nice, that's what little girls are made of." The boys, of course, are made of scissors and snails and puppy dog tails. In other words, not *nearly* so nice. Smile though we may at this antique jingle we are nonetheless inclined to credit it with half truth. After all, girls and boys are different. At any rate we've always told them so. Of course, Doctor Mead was and is aware of the obvious differences between the sexes, but what interested her was the effect this insistent telling had on their personalities. And off she went to the Cannibal Islands to find out for herself.

New Guinea is not customarily referred to as a cannibal island. The government, however, has yet to catch up with a few groups of what might be called the varied-diet or technical cannibals, and among one such wandered our intrepid iconoclast. But so Protean is the cultural climate in New Guinea that she was also able to wander among a most amiable tribe

called the Arapesh, who lived only about 40 miles away from the cannibals and wouldn't think of eating anybody. Still another tribe dwelling roughly midway between the cannibals and the Arapesh presented the engaging picture of men who often cooked their meals, did all the shopping, invented tricky new dance steps, "embroidered" various ornaments and generally brightened up the tribal life while their wives went to work.

Doctor Mead's observations in these three neighboring tribes disclosed that difference in personality between little boys and little girls cannot be flatly attributed to difference in sex. That is to say, all our sugar-and-spice notions seem to be the work of "that old debble" Cultural Conditioning, who can do just about anything he wants even on a sex basis. In New Guinea the Arapesh ordained that the ideal man or woman should be made of sugar and spice. And sure enough the vast majority in their tribe seemed to be so constituted a large part of the time. On the other hand the cannibals believed that both men and women should be made of scissors and snails and puppy dog's tails. They liked their women as well as their men to be tough. And nearly all of them were. Meanwhile the third tribe declared that men should be graceful dancers and artists taking the passive rôle in love affairs. And thus we find them.

It is, therefore, a safe assumption, Doctor Mead believes, that were we to take an Arapesh baby and bring it up in cannibal-town, he or she would develop into a big, tough cannibal. Among the Tchambuli he would become an artist-dancer, while his sister would be the doting breadwinner. "We are forced to conclude" said Margaret Mead, "that human nature is almost unbelievably malleable. . . . These types display the personalities that are peculiar to the cultures in which they were born and educated. Our attention has been on the differences between Arapesh men and women as a group and Mundugumor men and women as a group. It is as if we had represented the Arapesh personality by a soft yellow, the Mundugumor by a deep red, while the Tchambuli female personality was deep orange and that of the Tchambuli male, pale green. But if we now ask whence came the original direction in each culture, so that one now shows yellow, another red, the third orange and green, by sex, then we must peer more closely. And leaning closer to the picture, it is as if behind the bright consistent yellow of the Arapesh and the deep equally consistent red of the Mundugumor, behind the orange and green that are Tchambuli, we found in each case the delicate, just discernible outlines of the whole spectrum, differently overlaid in each case by the monotone which covers it. This spectrum is the range of individual differences which lie back of the so much more conspicuous cultural emphasis, and it is to this that we must turn to find the explanation of cultural inspiration, of the source from which each culture has drawn."

The forgotten primitive man

All of the foregoing has been a mere touching upon the high spots of Margaret Mead's observations on phases of the spectacular primitive experiment as it took

place in Samoa, the Admiralties, and in the natural laboratory of New Guinea.* It is hoped that no thoughtful reader can fail to perceive therefrom the priceless worth of a scientific remembrance of the forgotten primitive man. For his experiment, once snuffed out, can never be re-produced. His unconscious contribution toward a rational reorganization of human life on earth will be forever lost. Our instruments are daily destroying the barriers of distance. World culture is inevitable. And the primitive experiment can tell us much of that elastic thing called Human Nature, which must be the basic building material of that culture.

Already armies of white men, commercial and military, have ruthlessly smoked out countless irreplaceable and unrecorded experiments in other quarters of the globe. New Guinea is foredoomed; other regions are fast going. Shall we not strive to jot down all before the lightning strikes?

Who will do the jotting? Preferably the best available brains in every humanist specialty. A museum expedition sent out to collect fauna has bird experts, mammal experts, entomologists and so on. It includes background artists, skimmers, mounters, preparators. Surely an expedition to record human culture should at least approximate so versatile a personnel. Psychiatrists are needed, and gland experts; specialists in parasitic diseases; child psychologists and pediatricians, indeed every possible type of practitioner that can be marshaled toward the discovery of human nature under the banner of a scientific international patriotism. Time, meanwhile, is cruel and fleeting.

The reward and content of such an undertaking should not be frantic compilations alone. On Margaret Mead's latest expedition to Bali she and her Cambridge-antropologist husband, Mr. Gregory Bateson, made a complete pictorial record of the Balinese way of life. Mr. Bateson took thousands of feet of motion pictures as well as abundant stills, so that, just as we have habitat groups showing exactly how the bear lives in his native surroundings, we now have the Balinese transported as it were from the jaws of Time and immortalized on film—their culture as it lived and breathed. Thus beneath the sobriety of scientific measurements flows an aesthetic appreciation of a romantic experience in an alien, though in some strange way, a common world. Something of this experience is transmitted in Doctor Mead's writing and underlies all her books. Let us turn to the latest of these, and the artist-dancing men of Tchambuli:

"The play goes on, new masks with the slanting eyes that suggest the face of a werewolf, new flutes with graceful little birds adorning the ends, are made, and as the sun sinks over the smooth, unreal lake, the music of flute-playing rises from the men's houses. If the actors are more interested in their own steps than in the whole dance, still their dancing is perfect. It is true that a slight unreality pervades the whole life. Realistic emotions are so muffled by ceremonial observance that all feeling becomes a little unreal, until the

*Doctor Mead has written in addition to these books many scientific monographs dealing with other aspects and other localities than those mentioned above.

Continued on page 256

YOUR NEW BOOKS

THE JAQUES' GEESE • HISTORY OF CAPE HORN • SELECTIONS
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CAPE HORN

----- by Captain Felix Riesenber
Charts by William Briesemeister

Dodd, Mead & Co., \$3.00

THIS is a history of the lower tip of South America in its relation to world exploration and the development of navigation and trade from the time of Magellan.

The records of many voyages reach a climax with their Fuegian experiences. By skilfully combining these high points, using well-chosen quotations, Captain Riesenber has produced a work which will hold any reader's interest.

The author's conclusion that Drake discovered an island westward from Cape Horn which has since disappeared beneath the sea, may provoke considerable argument. Having once sought shelter in the lee of what charts showed as a good, solid island, only to find it had been cut in two by those same seas, the reviewer does not doubt the possibility of such a phenomenon. But it is questionable if this island of Drake's should be called Elizabeth, for that is the name, still in use, that he gave to one lying well within the Straits. His name, "Elizabethides," for an archipelago in the Cape Horn section may perhaps be the source of error.

Illustrative of how easily one can be confused by early records is the author's mistake in locating Drake's landing at Isla Mocha (Lat. 39° N., in a region where the Indians were cultivating maize) as having occurred just north of Magellan Straits in Lat. 52° 15' S. This is far south of the limits of native agriculture.

The good tempo of the history is somewhat broken by the amount of space devoted to the voyages of King and Fitzroy, but is regained in the treatment of the subsequent chronicles.

The author unfortunately repeats the contention that the missionaries share much of the blame for the ultimate decimation of the native tribes. Like others, he has overlooked the fact that a related tribe, the Tehuelche, has suffered the same fate without any mission influence.

A few other errors have crept in, some of which he can in no way be blamed for repeating. But such a one as the mention of walrus in the Falklands is uncalled for. So much reference work has been necessary for this volume that the few omissions can be overlooked. It is regrettable, though, that the extensive modern mapping and exploration by the Chilean navy is not included.

JUNIUS AND MARGARET BIRD.

THE GEESE FLY HIGH

----- by Florence Page Jaques
Illustrations by Francis Lee Jaques

The University of Minnesota Press, \$3.00

IN this volume the Jaques turn from the lakes of Minnesota toward the coastal marshes of Louisiana, stopping *enroute* to spend New Year's with the mallards of the White River Bottoms in Arkansas. As in their earlier volume, *Canoe Country*, Florence wields the pen, Lee the brush—or whatever the tool may be by which he achieves his pictorial effects. In any event, he evidently employs the technique which has already won him distinction. Working now in a field which he has made his own, he presents us with a series of sketches as animated as the text that accompanies them, while for pure technique the camp scene on page 24 is a triumph of his method.



*A man with a sketch-
pad, and a woman
who can write about
wild-life . . . made
this book.*

GEESE FLY HIGH

by Florence Page Jaques
and Francis Lee Jaques
(authors of "Canoe Country")

In an Audubon-like journey they followed the ducks and geese down the Mississippi flyways from Minnesota to the alligator-infested rivers of the Gulf Coast game preserves, where millions of wild fowl winter.

"Geese Fly High" is a book for all who enjoy experiences of the wilderness—see Dr. Frank Chapman's review in this issue. Its thirty superb full-page drawings by a famous bird painter—a member of the American Museum's staff—make it also an item for the collector of beautiful books. \$3.00

Autographed copies may be ordered from the Museum's bookshop.

University of Minnesota Press
Minneapolis

Its depths, its lights and shades might be the product of a full palette rather than of some black and white scratch-board process.

As for Florence's pen, she has an entirely new one of larger caliber and carries a battery of many-colored inks. Northern Minnesota won her affection and she has only praise for it. But in this world of southern swamps and marshes she is less at home. She finds much to attract, but also much to repel, and the two keep her constantly on the alert. There isn't a stereotyped phrase in the book. On the contrary, her highly sensitive nature finds spontaneous expression in fears and apprehensions, in joy and keen appreciation. Her pages throb with vivid impressions. Likes and dislikes are given equal voice. One becomes the foil of the other, and in the end you see both sides of the shield. And always she holds your interest. There are no waiting moments; the motion is continuous.

Almost in a paragraph she jumps from Arkansas to Louisiana. There, as guests of the National Association of Audubon Societies, at the Rainey Bird Sanctuary, they were in the very heart of the home of wintering wildfowl. At first she lacked sympathy with these masters of space and speed. The ducks she tried to photograph were "idiotically cautious. . . . They kept up their tense hyperthyroid look all morning long. I longed to shake them. . . . whenever I'd see a scap a dart of irritation would snap through me."

But in time she recognized their place in nature, and wrote: "It is no wonder that ducks and geese have always appealed to man's imagination. For one thing, they are so much of their own masters that simply to get near them gives one a feeling of intense triumph. But their particular fascination is the power compact within them. Charged with energy as they are, their smallest motion is electric with zest; their swimming and their flight, even the turn of a head or a wing stretch, show an excess of vitality. There is a contagious exhilaration in such quicksilver life." Even a duck-hunting enthusiast would approve of that paragraph and find in it thoughts he probably had never been able to put in words for himself. I hope that it is read by the Arkansas game warden who believed that women and ducks wouldn't mix. But other things besides ducks and geese claimed the attention of this responsive observer. With equal success she "mixes" with everything her pathway crosses, from flowers to alligators. The result is an informing, fascinating picture of a little-known country.

FRANK M. CHAPMAN.

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by David Haig-Thomas

An appealing story of the author's expedition to Greenland that reveals a very true understanding of the country, its inhabitants and animals. Illustrated. \$3.00



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by F. Fraser Darling

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GEM TRADER

----- by Louis Kornitzer

Sheridan House \$2.75

IN these days, when current literature is somewhat overloaded with biographies and autobiographies, we may expect to find a book in the latter category by an author whose background is that of a dealer in gems. Mr. Kornitzer, according to his own statement, has bought and sold gems from Paris to Peking.

The story of his travels and experiences is well told, and some of the secrets of his trade would certainly be hard to find elsewhere; but a captious critic, like the reviewer, would perhaps find his account a bit too personal, and the interesting points that he has failed to tell, too numerous to make his book of primary value to the gemmologist.

Where he has deviated from narrative to statement of fact (sic) we find such remarkable assertions as: "According to the geologists, all agates were formed beneath the sea bottom of deep oceans, and are deposits of the hard, pure silica shell or the outer casing of minute living creatures."

On the other hand we find such examples of cynical wit as "even our ladies of the scarlet claws would draw the line at Jade nail protectors."

On the whole, we should not take the *Gem Trader* too seriously, and those of us who are prepared to discount its occasional misstatements will find in it diverting reading.

It seems remarkable that such a book should go to the length of inserting as Appendix III an alphabetical list of 40 of the most famous diamonds of the world. It is even more surprising that this list gives the origin of the Regent diamond as Brazil instead of India.

H. P. W.

THOREAU: REPORTER OF THE UNIVERSE

Selected and arranged by Bertha Stevens

John Day Co., New York, \$2.50

HERE is a selection of brief extracts from Thoreau's writings made by one who has used them in her nature teaching with young people. Since nature never grows old, we appreciate the aptness of Miss Stevens' characterization of her book as a selection of this philosopher-naturalist's writings for all readers from eight years old to eighty.

The excerpts are arranged in more than a dozen groups, the opening one titled, "Musical News." Perhaps Thoreau responded more thoroughly to the sounds and rhythms of nature than to anything else—the songs and calls of the birds, insect notes, the rustle of the leaves, the wind in the pines. He writes of the "melodious hooting of the owl," the wild cry of the loon, the chirruping of crickets.

"One would think," writes Thoreau, "from reading the critics, that music was intermittent, as a spring in the desert, dependent on some Paganini or Mozart—but music is perpetual, and only hearing is intermittent." This feeling is probably correlated with the musical nature of this man who played the flute.

Among the other headings in the book are, "The Clock of the Seasons," "Signs for Those Who Can Read Them," "Sun, Stars and Magical Moon," "The Red Man and His Mark." The collection is especially adapted for reading aloud, and may be opened anywhere with confidence of finding a stimulating piece of writing.

"It is my hope," writes Miss Stevens in her acknowledgments, "that the selection will send many readers to the complete works of Thoreau, and to the biography by Dr. Henry Seidel Canby." She might have added that, according to the critics, Doctor Canby's new work "will remain the standard biography of Thoreau for a long time to come."

Thoreau was a philosopher of nature, with much poetry in his make-up, always trying to comprehend the relationship of man to his surroundings. He was a seeker of the wild and untamed. He has put himself in his writings as few naturalists have succeeded in doing—in all of his writings, but one might mention especially his essays, "Walking," and "Wild Apples," and his book, *Walden*. Thoreau was certainly one of our greatest nature writers, possibly our leading literary naturalist. In the opinion of this reviewer, the only American who has closely approached him is Burroughs, and Burroughs once said, "All our other nature writers seem tame and insipid beside Thoreau."

CLYDE FISHER.

THE MUSEUM IN AMERICA

----- by Laurence Vail Coleman

Three volumes

American Association of Museums, \$7.50

THE Director of the American Association of Museums has rendered a real service to the museum world in the production of this monumental work. He gives the reader a critical study of the 2,480 museums in the United States, its Territories and Possessions, in two volumes of text and one of appendices, including chronologies, tables, and classified lists. For more than a decade Mr. Coleman has traveled over the country, scrutinizing the workings of both large and small museums. In the results of his personal observations presented in this treatise, which is good reading for anyone interested in social institutions, one finds a record of museums as a whole, their different patterns, their growth and work, with commentaries on their limitations and opportunities.

The museum scene is first presented as a social movement, one which has seen varied and swift developments in recent years. The increase in museums and in new kinds of museums (the greatest number in any field is that of 1,235 for history), has been accompanied by extensive changes in methods of display, collecting, research and education. No matter in what kind of museum one may be interested, it is described in Volume I along with a discussion of present practices, trends, and problems with sane suggestions for their solution. Chapter XI in this volume is devoted to a presentation of that crucial need of museums—an adequate income. The best results are shown to be obtained when the sources are diversified and the income se-

cured through gifts, taxes, sales, memberships, and endowments. The last chapter discusses changes in architectural styles which attempt to make new museum buildings more artistic as well as more effective for their increased services.

Museum trustees, workers, and laymen interested in the subject should read Volume II with care for this is concerned with museum work and museum people. Collecting and caring for materials, and installing permanent and temporary exhibits, are discussed from many angles. Problems concerned with public relations—attendance, hours, publications; the museums' educational work with adults, children, and through schools; and the necessity for well-rounded programs of research receive critical attention. One interested in the future of museums as educational institutions will note the lack of objective measures of the effectiveness of present programs, and will recognize the necessity for more extensive scientific evaluations. In the discussion of museum workers the conclusion is reached that museum work is capable of being a profession although museum workers have entered into it professionally in varying degrees.

Throughout these three volumes much effort has been made to bring all information up to date, a difficult task considering the number of institutions involved and the changes frequently made in their programs. Few minor errors have crept in, while many pages reflect the author's years of critical and integrative thought about museum problems and practices. The future career for museums depends, the author states, upon their becoming people's institutes, with staffs effective as community faculties.

GRACE FISHER RAMSEY.

SERENGETI

----- by Audrey Moore

Charles Scribner's Sons, \$4.00

AUDREY MOORE, the author of *Serengeti*, is the wife of a game ranger stationed on the Serengeti Plains in Tanganyika, where occurs the greatest concentration of big-game animals to be found anywhere in the world today. With such unexampled opportunities for observation a nature lover might be expected to gather a great many interesting facts and experiences over a period of continued residence. Mrs. Moore has written a very entertaining and useful account to demonstrate that she has appreciated these opportunities.

The author develops her subject according to a well-arranged plan. The book opens with a brief description of the Serengeti district and enough biographical data on herself and her husband to provide a personal background for what is to follow. Then comes the section which will probably make the most appeal to the average reader, the description of the life history of the lion and stories of actual behavior. The lion occupies the center of the stage in the Serengeti, as indeed he does wherever he occurs, but circumstances are so favorable here that one can all but shake paws with him. Instead of a furtive yellow shape disappearing in cover, the visitor to this part of Africa finds the big cat out in the open, coming to man instead

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of avoiding him, and altogether a different beast from what one might expect. Photography of lions has become ridiculously simple, and shooting a lion, well, it just is not done.

Because the lions are the feature actors of the Serengeti the reader can understand the apparent sympathy of the author for these predatory creatures which take such a toll of the other animals about them. The mammal hordes are ample to stand this toll and it is encouraging to a conservationist to know that there is this wild life sanctuary where natural biological forces are seldom disturbed and predatory mammals are admitted to have inherent rights. This statement needs some qualification because the hunting dogs are apparently shot on sight and do not rate the consideration given the lions, an inconsistency which need not be debated here.

Part of the book is devoted to an account of seasonal activities, June to December and December to June. The author is versatile and gives the reader a very good idea of the numberless episodes which follow the leaves of the calendar. As a concluding section she gathers up under the heading "The Year Around" a number of vignettes or sketches, each complete in itself.

There are five appendices dealing with the fauna and flora.

The author is at her best when she gives eye-witness stories. Sometimes she steps beyond these factual limits and attempts imagined life history. These make plausible reading and perhaps things did happen that way, but who knows?

The illustrations are fairly good, although a few are not up to standard, but they do not seem to have developed the full possibilities of this very extraordinary region.

H. E. A.

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Camera Safari

By CHARLES H. COLES

Chief Photographer, American Museum
of Natural History

PERHAPS a friend has proudly shown you a photograph at close range of a dangerous animal—a lion, or a gorilla beating his chest in savage defiance. "I shot this fellow myself," he may say with the assurance of a seasoned hunter but with a careful eye on your credulity. "We were moving cautiously through the semi-darkness when suddenly I saw him practically at my elbow. Slowly, deliberately, I took aim, and—there he is, the best shot I've made this year. I'm certainly glad I had my camera that day in African Hall."

Every day of the year amateur picture makers can be found in the various halls of the American Museum of Natural History, making pictures of subjects that would be impossible to make in any other way without a long trip to remote parts of the world. The Museum issues permits to make these pictures on condition that they will not be sold.

Making photographs of the habitat groups in such a way that they appear natural and out-of-doors is a fascinating problem, and the results are often strikingly beautiful. It is a problem which is never simple and always presents a test of skill and understanding.

Illumination of the groups

The first step in analyzing the problem of habitat group photography is to study the lighting in the cases. All the illumination comes from the light box above the plate-glass windows. This lighting is carefully balanced to produce as smooth and artistic a representation of daylight as is humanly possible. In a great many of the groups in African Hall, the foreground is lighted in a soft and subdued tone to simulate a shady spot, while the background is brilliantly flooded as a wide expanse of landscape would be in sunshine. In other groups, the foreground is in sunshine as well as the background.

However, in spite of this apparent similarity to daylight—or perhaps because of it—the tenderfoot explorer in African Hall may find that his first shots fail to appear convincing. Because the light all comes from the top of the case, the shadows on the under parts of the animals are very dark, especially on those animals near the glass window. In this respect the lighting is different from daylight, for under outdoor conditions the shadows are usually filled with diffuse light from the sky and surrounding landscape, permitting detail to be recorded in the parts not receiving direct sunshine.

On the animals toward the rear of the groups, diffuse light from the foreground fills the shadows to a considerable degree, making the general illumination here resemble more closely the out-of-doors. The depth of the shadows may be readily evaluated by observing the group through a blue viewing filter.

Continued on page 256

PRIZE WINNING PHOTOGRAPHS



FIRST PRIZE

RICHARD D. FULLERTON

A Nightblooming Cereus of Hawaii

SECOND PRIZE

BRUCE COLE

First Trip from the Nest:

A Rose-breasted Grosbeak



THIRD PRIZE

PHILIP N. KNOX

A Juniper Overlooking

Lake Tahoe, California



CAMERA SAFARI

Continued from page 254

The foregrounds of the groups contain solid, three-dimensional figures, while the backgrounds are usually two-dimensional paintings on curved walls. It is impossible because of the nature of pigments to obtain the same range of tones, photographically speaking, in a painting that a solid object yields. This restricted tonal scale, therefore, makes the painted backgrounds less contrasty than the foreground. Any shadows painted on the background are represented as being filled with diffuse light, which further reduces contrast.

So here we have a neat problem in picture taking: a contrasty foreground and a relatively weak background with a restricted contrast range. Usually more complications are evident. The background is, as a rule, more brightly illuminated than the foreground to add distance, interest, and perspective to the scene.

Even with out stereoscopic vision with two eyes, it is sometimes difficult to tell right off where the solid foreground of the habitat group ends and the painted

background begins, but try this experiment. Stand opposite the center of any of the groups in African Hall about three feet in front of the glass window. Now close one eye and without moving your head try to tell where the background meets the foreground. It is extremely difficult to find the joint.

The background perspectives are all projected from a point about five feet high, three feet in front of the center of the windows. This, then, is the place from which the most realistic view of the group may be obtained. This same point is, of course, the ideal place to put the camera. By setting the lens at the same height as the horizon line, this line will appear straight in the final picture. If the camera is placed below it, the ends will curve upward in the picture.

Composition

With the camera placed at the ideal viewpoint, only a portion of the group will be encompassed by the angle of ordinary camera lenses. Any number of interesting compositions may be selected by turning the camera or tilting it. By grouping objects placed well back in the group, better illumination will be found and the final print will be more realistic and convincing. The use of a relatively wide lens aperture will throw the background slightly

out of focus, still further enhancing the realism of the photograph.

Accurate exposure is important to retain as much of the contrast of the painted background as possible. Filters are a great aid in adjusting the value of the sky and enhancing the cloud forms. Deep, sharp-cut yellow filters are the most useful for this type of work. Polarizing filters are of considerable assistance in subduing reflections in the glass windows.

If the group as a whole is wanted in one picture, the deep shadow under the animals closest to the glass is a real problem. A small electric hand torch is most useful to throw light into the shadows during exposure. Watch out for the reflection in the glass window. It's quite a trick to make it work.

Color photographs are very satisfying if you're not too fussy about accuracy. The deep yellow color of the lights in the cases makes the pictures too brown. A blue correcting filter will improve the results considerably. It is doubly important when making color shots not to attempt to include the animals in the foreground, because of the previously mentioned excessive contrast. Sharp contrasts are best avoided in all color photography.

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EXPLORING HUMAN NATURE

Continued from page 250

expression of anger and of fear becomes also only a figure in the dance. So from the plashy edge of the lake where the young men are bathing come screams of agony, shouts for help, and the rattling sounds of death. This is no one drowning, although such drowning does occur—did occur last week, in fact, when the child of Kalingmale waded out of his depth and was entangled by the weeds. But these shrieks are only the young men playing, playing at death."

Now let us go backward in time and eastward in the Pacific to Samoa.

"The life of the day begins at dawn, or if the moon has shown until daylight, the shouts of the young men may be heard before dawn from the hillside. Uneasy in the night, populous with ghosts, they shout lustily to one another as they hasten with their work. As the dawn begins to fall

among the soft brown roofs and the slender palm trees stand out against a colorless, gleaming sea, lovers slip home from trysts beneath the palm trees or in the shadow of beached canoes, that the light may find each sleeper in his appointed place. Cocks crow, negligently, and a shrill-voiced bird cries from the breadfruit trees. The insistent roar of the reef seems muted to an undertone for the sounds of a waking village. Babies cry, a few short wails before sleepy mothers give them the breast. Restless little children roll out of their sheets and wander drowsily down to the beach to freshen their faces in the sea. Boys, bent upon an early fishing, start collecting their tackle and go to rouse their more laggard companions. Fires are lit, here and there, the white smoke hardly visible against the paleness of the dawn. The whole village, sheeted and frowsy, stirs, rubs its eyes, and stumbles toward the beach. "Talofa! Talofa!"

—D. R. BARTON.

Answers to Questions on page 233

- (a) 14 pounds. See page 199
- A celebrated woman field anthropologist, Assistant Curator of Ethnology, American Museum. See page 246
- The animal produces the shell. See page 206
- (b) Mexico. See page 217
- False. See page 213
- False. See page 228
- By clamping shut on an arm or leg, thus holding a diver beneath the water to drown. See page 197
- (b) Cycles in the growth of the animal. See page 209
- The quail. See page 223
- True. See page 219
- It seals in the necessary amount of moisture to sustain life during the lungfish's long summer sleep. See page 225
- A white man's attempt to cheat an Indian on a hunting trip. See page 219
- False. See page 224
- The solitary wild boar, outcast from his herd because of age and viciousness. See page 216
- The lungfish, with a record of four years. See page 224
- (a) Iran. See page 234
- (c) Mollusk. See page 205
- Three months. See "The Tall Truth," page 193
- True. See "The Tall Truth," page 193
- They are all fictional animal characters. Kikka-tikki-tavi is a mongoose in Kipling's story of the same name. Colinus is the "Red Quail" of this issue, and White Fang is the half-wolf dog hero of Jack London's story *White Fang*.

LETTERS

SIRS:

Today I have read the most interesting story of Colinus, "The Red Quail" by George H. Hall. I would commend him on his narration and you, sirs, for your selection of such splendid material. I do hope you will have more such tales of our feathered friends.

In last month's issue, the article on bird banding was most revealing and of great interest to me and many friends who are bird lovers and bird protectors. Like Doctor Chapman and young Doctor Peterson, we enjoy shooting birds only with the camera.

When my husband and I have thoroughly perused your excellent nature magazine, it is passed on to many others. . . .

MARY L. DURYEA.

Gaylordsville, Conn.

* * *

SIRS:

I have written to you before but I don't think that is enough to show my appreciation for your superb magazine. I read this month's edition from cover to cover and found it wonderful, especially the article about the red quail. You need more stories of this kind to make your magazine a bigger success than it already is. Thank you very much.

MARTIN CHEROFF.

Lakewood, N. J.

* * *

SIRS:

. . . NATURAL HISTORY is *by far* my favorite magazine, and I hate to miss any single issue. It has always been a *real treasure*, but in recent years the improvement has been so great that it has become, in my humble opinion, the outstanding natural history publication of the world!

R. F. DECKERT.

Miami, Florida.

* * *

SIRS:

. . . I cannot refrain from commenting on the wonderful article by Donald Culross Peattie entitled "In the Days of the Giants." I read it through once, admiringly, then went back to the beginning and read it through again, pausing over each individual sentence, like one who "rolls a sweet morsel under his tongue." I have seldom read a finer, loftier, more inspiring article. The fine pictures, too, are a fitting accompaniment. . . .

ROBERT A. CLARK.

Springfield, Mass.

SIRS:

In the September, 1939, issue of NATURAL HISTORY, there appeared a chart titled "Cycle of Life."

Would you please advise me if reprints of this chart are available and the price of each?

The Science Methods Class I am teaching at present would like to obtain reprints.

DONALD DECKER.

Colorado State College of Education
Greeley, Colo.

A limited number of the charts referred to are available at 5¢ each. The chart shows graphically the period of gestation, relative weights, size of litter, etc., of a number of animals.—Ed.



SIRS:

I have called this photograph "Clutching Fingers" because it suggests a gaunt veteran thrusting its naked arms skyward.

G. FREDERICK STORK.

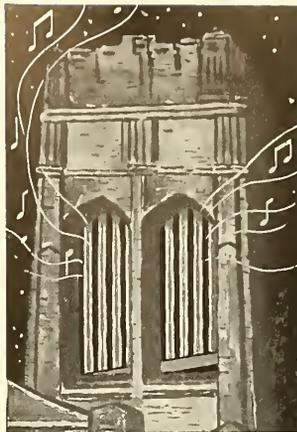
* * *

SIRS:

Your monthly magazine, NATURAL HISTORY, has been a constant source of enjoyment and education to our entire family. . . . May the work of the Museum continue to grow in scope, for the sake of all of us who are interested in what goes on in the distant places of the earth.

MRS. ROBERT FORD.

Hawthorne, N. J.



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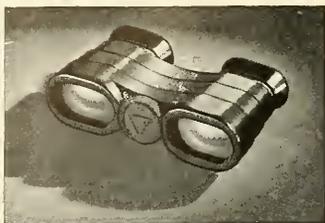
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Hitch Your Camera to a Star

By CHARLES H. COLES
*Chief Photographer,
American Museum of Natural History*

THE beauty of the changing panorama of the stars, the sun and the moon never fails to excite those who are lovers of the world that surrounds us every day. The overpowering intensity of summer sunlight, the silvery moon over a lake, or the brilliant scintillation of the stars on a frosty night are all subjects that challenge the picture taker.

The moon presents a problem in photography that is perhaps most similar to ordinary picture taking with which we are familiar. It is a sunlit object of a rather light gray color. Because of the lack of contrast between the light and dark portions of the surface, it may be advisable to use a film material that is somewhat above normal contrast. The exposure for a film like Panatomic X or Finopan will be about $f/16$ at $1/50$ th of a second. Over-exposure will veil fine surface detail. Under-exposure will cause the grain of the emulsion to be emphasized along with scratches and abrasions.

Size of image

If the moon is photographed with an ordinary camera lens, the image will turn out almost ridiculously small. The diameter of the full moon on a film will be about $1/100$ of the focal length of the lens. A miniature camera lens of two inches focal length will produce an image about $1/50$ th of an inch across. If this is to be enlarged to a half inch, a magnification of 25 diameters is required. The lens of the camera must have been in exceedingly accurate focus at infinity to form a sharp image that will stand such magnification.

To get a larger image on the negative and obtain more detail, a long focus spectacle lens may be rigged up on the front of the camera and used in place of the regular lens for lunar photography. With a miniature camera that has a focal plane shutter, or a Graflex, it is a simple matter to arrange such an outfit and obtain larger images. Portrait attachments or supplementary lenses may be used in place of the normal camera lenses as long focus lenses. It is of course necessary to determine the focus accurately.

Lunar eclipses

About once every year or so, an eclipse of the moon offers some interesting possibilities. As the moon passes into the penumbra of the earth's shadow, the surface becomes slightly darker, the portion nearest the umbra becoming dimmer than the rest of the moon. The exposure does not change appreciably during this part of the eclipse.

When the moon finally touches the umbra, a distinct dark patch appears that slowly spreads over the moon's surface. The gradual immersion of the moon in the shadow makes an interesting series of images. The camera is set up so that the long dimension of the film will be parallel to the motion of the moon. If the moon is

rising or setting, the camera is set to take a vertical picture. If the eclipse occurs within an hour or two of midnight, the camera is set up in horizontal position.

The camera is set upon a tripod and the shutter set for $1/25$ th of a second and the diaphragm to about $f/16$. One exposure is made every ten minutes without changing the film or moving the camera until the moon has moved out of the field of view. The apparent motion of the moon in the sky will move it over far enough so that the exposures will be separated by a convenient distance.

An eclipse from the air

As with all celestial phenomena, weather conditions play an important part in the observation of eclipses. A particularly favorable lunar eclipse was to have been seen on the morning of October 28th of this year. When the night of the eclipse arrived, a driving rain storm eclipsed the moon more effectively than the shadow of the earth could have. Arrangements were made at the last moment for us to try to take some pictures from an airplane that would fly above the downpour.

The plane took off and started to spiral upward rapidly. At 6,000 feet the lights of Newark began to fade in the murk and the wings glistened in the rain. Up and up through the dense clouds the plane spiraled, with the wing-tip lights growing dimmer and dimmer as the weather grew thicker and darker. At 10,000 feet I took out my reflex camera with an eleven-inch telephoto lens and set it down on the seat beside me.

The air grew thin as we neared 15,000 feet, so oxygen was supplied to us through tubes we held in our teeth. Because of the rapidly falling temperature outside, the windows were beginning to fog over with moisture.

At 18,000 feet we burst through the clouds into a sky filled with stars, sparkling as they ordinarily do only in mid-winter. The reddish colored moon in eclipse with a bright silver edge along the bottom was a thrillingly beautiful sight. Polishing the moisture off the window hurriedly, I made an exposure of $1/15$ th of a second at $f/5.6$ and quickly changed the film for another shot. Trying to polish off the moisture on the window again, I found it had frozen into ice, which I couldn't scrape off.

In the baggage compartment of the plane Major Albert Stevens of stratosphere fame was shooting through the open door. He was bundled up in heavy flying togs and wielding an aerial camera with a twenty-inch lens working at $f/4.5$ and a shutter speed of about $1/50$ th of a second.

The only image that either of us obtained was of the small bright area of the moon, that part not in the umbra. With the moon so close to totality, the bright area was very small indeed. It requires an exposure of at least one second at $f/2.8$ on the fastest of films of record the dark part of an eclipsed moon. This exposure is obviously impractical in a moving airplane, so under the circum-

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stances we did about as well as could be expected.

Barring weather trouble, however, eclipse photography can of course best be experimented with by the amateur on the ground. Another eclipse of the moon is not due to appear soon, but a partial eclipse of the sun, visible throughout the United States, will occur on April 7, 1940. And *NATURAL HISTORY* will try to acquaint the reader with sun photography in time for that event.

LAST MONTH'S COVER

Comments and inquiries about the Shell Design which appeared on the cover of November *NATURAL HISTORY* prompt acknowledgment of the fact that this cover was reproduced from four-color separation negatives made by Charles H. Coles, Chief Photographer of the American Museum of Natural History.

THE TALL TRUTH

TEMPERAMENTAL ORCHIDS

When a young man presents his lady with an expensive corsage and feeds her vanilla ice cream, he is using the orchid treatment both externally and internally.

The orchid from which vanilla extract comes is less radiant than the *Cattleya* nodding on the girl's corsage, but its reproductive process is at once a marvel of nature and a tribute to man's cleverness. In tropical America where the plant is native, the insect that pollinates it performs an operation impossible to human hands unaided, for the female element, the pistil, is enclosed. When transplanted to other regions, the plant found no insect to pollinate it and would have perished were it not for man's experimental ingenuity.

By means of a minor "surgical operation" the vanilla orchid has been made a prolific commercial plant. With the aid of a knife the operator can touch the male element (the pollen) to the female. But strangest of all, this will not produce the desired offspring unless a curious rule is observed. The "temperamental" vanilla orchid will reproduce only when pollinated during a short period very early in the morning.

Man's struggle to gain mastery of the plant world has brought him to many remarkable discoveries. But one of the strangest sights I have ever seen is that of the growers in Tahiti (where nearly half of our vanilla is produced) going about their plantations before dawn, knife in hand, performing their curious operations.

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NATURAL HISTORY

The Magazine of the American Museum of Natural History

FREDERICK TRUBEE DAVISON, President

ROY CHAPMAN ANDREWS, Sc.D., Director

VOLUME XLIV—No. 5

★ ★ ★ ★ ★ ★

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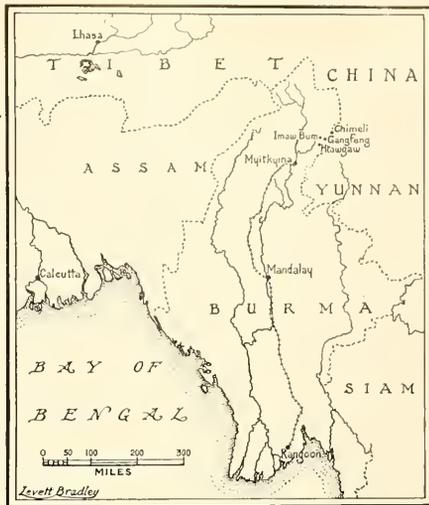
THE LISU WIFE of Lup Ting, the expedition interpreter, was usually bedecked with several pounds of beads and ornaments sewed upon her garments. These were worn not only when

she had leisure time about a village but also when she was making a long march afoot. The native women believe in showing off their trinkets

Photo by Harold E. Anthony



(Right) THE SECTION OF BURMA explored by the Vernay-Cutting Expedition was the mountainous border country near the Chinese line. From a base camp at Gangfang, adjacent country was explored in mid-winter up to heights of 12,600 feet



A WINTER IN REMOTE BURMA

By HAROLD E. ANTHONY
Curator of Mammals, American Museum

Christmas found the explorers among festive natives in a far-off corner of Burma. The story of an American Museum expedition to study animal life

WE obtained our first good view of Imaw Bum from the Rest House at Seniku, three marches from railhead at Myitkyina. A massive ridge in the blue distance, with a few patches of snow on the peaks, it was a challenge to the Vernay-Cutting Burma Expedition,* for it was one of our goals and we meant to camp as far up on its flanks as the weather would permit. It was December 15th when we could first identify it as a definite spot in the skyline. There were still many days of marching to reach our base camp and winter was definitely setting in.

Imaw Bum moved slowly toward us in the next two weeks as we trudged afoot, with our long string

*The Vernay-Cutting Burma Expedition was jointly financed and led by Arthur S. Vernay and Suydam Cutting, trustees of the American Museum, who have traveled extensively in southern Asia. Harold E. Anthony, Curator of Mammals, was the third Museum representative. The expedition included two members from England, Frank Kingdon Ward, the well-known plant explorer, and J. K. Stanford, an ornithologist.

of pack mules stretched out along the trail, winding in and out of the ravines like a long, loose-jointed serpent. New Year's Day, 1939, brought us to our base camp at Gangfang, about 5000 feet above sea-level, and the limit of our mule transport. We had left railhead with 55 mules, and additional mules had carried in supplies to the base camp prior to our arrival, so the first stage of our work, the preparation, was completed.

January 14th brought the expedition to the point of actual assault upon Imaw Bum. We had collected about Gangfang, made side trips for takin and bear, and a specimen of the small Himalayan black bear was secured, when it became "Imaw Bum or bust." The weather had been clear and settled for the past two months and might continue so for some days. But, equally, there might be storms, rain on the foothills and snow on the mountains, and we had no assurance that we could reach the camp which natives

ARTHUR S. VERNAY and his field orderly, Bum Lang, a lance corporal on detached service

SUYDAM CUTTING had Hpaonan La as orderly on the trip to the Panwa Pass

HAROLD E. ANTHONY had as orderly Si Kwy, a bright Lashi boy who loved to hunt

Photos by Arthur S. Vernay



had been sent up to build as high as practical on the mountain. There were 110 of us, white men and coolies, filing out of the little village that morning and over the sketchy pole bridge which spanned the river, to climb, descend, and climb again the succession of ridges which lay before us.

And then the rain came. We were not far from where we expected to make the first camp when the threat of a leaden, overcast sky materialized. At first, the storm was only inconvenient, but when the big drops changed to hail we became uncomfortable and there was a scramble to get coats and sweaters out of the packs. We made camp on an open hillside, where the trail began a long, zig-zag ascent of a high ridge, and the storm had ceased when we reached this spot. The natives pitched in with a will, to cut away the tall bracken which grew everywhere, to set up our tents and to improvise shelters for themselves, for the camp site was very exposed. Canvas was available for the five of us and our servants, but the coolies had brought nothing and had to use what could be found on the spot.

Two-foot rhododendron leaves

But these Burmese hill people are resourceful. They carry dahs, long brush knives, and know how to use them. Wherever bamboo can be found, and this is almost everywhere in northeastern Burma, the natives depend upon it for a great variety of purposes. A temporary shelter goes up in a matter of minutes, fashioned of a few long bamboos with one end on the ground and the other raised over cross supports to make a lean-to. Thatching may be leaves, ferns or any handy vegetation. If rain is expected the roof and sides must be constructed with more care, and a well-laid grass thatch will turn a heavy downpour. At one camp our men used the leaves of *Rhododendron magnificum* for thatching. I measured selected leaves and found them to be 24 inches long by 9 wide, and it did not take many of these natural shingles to roof a lean-to.

Our first open camp took on a communal appearance in a remarkably brief period. The small group of tents was surrounded by lean-tos which seemed to sprout out of the soil and the fern banks, with smoke curling up here and there, and brown-faced natives lounging about the entrances to their grottos like troglodytes peering out of subterranean lairs. We wished that we could photograph the native suburbs of our encampment which fitted so well into the environment that they might have been a natural growth of the vegetation, but the bad weather made photography out of the question.

From a remote quarter of the camp, a ringing call as from a trumpet or bugle reached our surprised

ears. Again and again the calls were heard and they sounded much like those heard about a military encampment. We wondered if one of the men had a bugle in his outfit, a fair assumption because soldiers are recruited from the hills and one may encounter ex-service men in any village. We were so curious about the source of these cheery sounds that a messenger was sent to summon the trumpeter of Tsonma (the district where we were camped). A grinning native reported and the mysterious trumpet was only a six-foot, hollow, plant stalk, cut about camp.

The second day of travel beyond Gangfang took us over the first high pass, 8000 feet high, not high as mountain passes go, but higher than anything we had yet encountered. We walked through a magnificent forest, composed of large trees growing close together and with practically no bare ground to be seen anywhere. Among the predominant species were oaks, a beech (*Castanopsis*), rhododendrons and magnolias, some of which were deciduous and leafless at the time we saw them but others were evergreen and afforded a great canopy of green overhead. We camped that night under some of these forest giants, and the natives could use fallen trees and great buttressed roots as part of their one-night shelters. An abundance of firewood resulted in generous campfires and a more substantial air of comfort than the night before.

Wintry trails

One more day of mountain travel and we reached the Imaw Bum camp. On this day we crossed the Nyetmaw Pass, a little more than 10,500 feet above sea-level. As we reached the 10,000 foot level the air was decidedly wintry, especially when we crossed over the pass and the trail had a northern exposure with little sunshine. The trail then pitched sharply downward to lose about 1,000 feet of altitude, and there was plenty of snow and ice to make the footing difficult. The snow concealed the trail at times and we had to cast about to make certain we were on it. This stretch was so bleak and cheerless, our hands were numb from clinging to icy bamboos to keep from sliding down in one grand rush, that we were very glad to reach the valley of the ice-bound river where, on the first suitable flat, our camp had been constructed.

The natives had put up a large hut, built mostly of bamboo, which afforded protection from the wind but not from the rain, for the roof was a mat of woven, split bamboo. We were hemmed in by high ridges on either side of the river and the sun did not strike our clearing until ten minutes after nine o'clock in the morning and departed at forty-five minutes past three in the afternoon. The mercury in

the thermometer lurked at the lower levels and overnight recorded minimums of 8° to 15° F. The altitude of this camp was a little over 9,000 feet, and as we had just come up out of the tropics—Imaw Bum is about as far north of the Tropic of Cancer as the southern tip of Florida—we felt the cold. The first night I relied on my sleeping bag to keep me warm but this was misplaced confidence. The next night I piled surplus clothing on top. By the third night I was crawling into the sleeping bag with one suit of clothes on and everything else piled on top outside.

We collected museum material from this camp as a base, running lines of traps for mammals, hunting birds and climbing up such of the ridges as were not closed to us by snow. From the divide east of camp, where we reached about 11,000 feet altitude, we had a magnificent view of the Salween Divide, which constitutes the Burma-China frontier. In the remotest haze to the north we could see a high, snow-covered peak that should have been an outlier of the Tibetan frontier.

Barefooted through the snow

Our camp on Imaw Bum was a fair sample of what we could expect from the high country for the next two months. Here we had to watch the passes lest we be snowed in and have our line of supply from the base camp cut off. At our later camps, where we worked up to 12,600 feet, in the snow, we had no high passes between us and our base. When we were driven out of the Chimeli camp, in February, by stormy weather, our coolies came up barefooted through the fresh snow, and in the same morning had dropped us down the mountains into a zone where the snow was replaced by rain. Although the five of us could hunt and trap in the snow and had clothing that would keep us comfortable, the skimmers could not keep their working quarters very warm and the native personnel were huddled about day and night in obvious discomfort. Our stay at Imaw Bum and similar high localities was not prolonged after we had secured a fair representation of mammals, birds and plants. Nevertheless, the higher mountain camps were much the most interesting and profitable places to work.

We relied upon the natives for a great deal of assistance and found them to be not only reliable and co-operative, but also possessed of interesting beliefs and customs. One of our Lisu hunters, cutting the brush and bamboo on the crest of a narrow snow-drifted ridge, from whence we hoped for a peek into the great rocky basin under the top of Imaw Bum, ended a sweep of his dah by catching the blade against his left foot. He made quite a fuss over the

accident, holding his foot in his hands, moaning a little, and looking so scared that I feared he had sliced himself badly. Plenty of blood dripping down onto the snow did not make the picture seem any more cheerful, especially since we were a long, long way from camp with a stiff descent and no trail. I set about staunching the flow of blood with handfuls of snow. I was relieved to discover that the Lisu was still in one piece and that no large artery had been cut. His big toe was deeply gashed but the blood responded promptly to the cold compress. The Lisu was fretted by the snow applications and did not want me to use them, showing this more by his reactions than by open refusal to let me doctor him.

A gauze bandage soon put his foot in order, but he gazed moodily on the bloody snow and began to dig every particle of red into the ground, using his big knife and seeing to it that not a speck was left on the surface. As nearly as we could get from him, there is a Lisu superstition that if a man leaves his blood on top of the ground he will have bad luck. This man walked back to camp with no apparent difficulty and in several days his foot had healed enough to remove the bandage.

Sign language

The hill people have a peculiar way of indicating size. Instead of holding the hands apart to show length of an animal, for example, they span an imaginary circle to show diameter. A small dog would be, not three feet long, but six inches in diameter. Girth, or diameter of an animal's body, may be just as good a size standard as length, but since we do not ordinarily think in such terms, it was necessary to adopt a different set of values and visualize objects from a new angle. I could not talk with my orderly, Si Kwy, and had to use signs. He was a bright boy and we could interchange ideas without too much difficulty, but the gestures that I sometimes made must have been not only amusing but puzzling to a stranger. I might hand a gun to Si Kwy, give him a handful of shells, and then sweep the horizon with my arm in the direction I wanted him to hunt. If I made motions with my fingers like an animal running up a tree and enclosed a three-inch circle with my thumb and index finger, he knew he was to hunt squirrels. If I flapped my arms and made an eight or nine-inch circle he looked for pheasants, and so it worked.

The natives have dogs about their villages, keeping them as pets and, in some instances, as aids in hunting. But with the Marus the dog is highly valued as an article of diet. Traders bring dogs from China, over the passes, and take great care lest any

TOWARD BURMA'S INNER BORDER

*All photos by
Harold E. Anthony*

EACH CHINESE MULE-TEER was responsible for five pack mules and their cargoes. To keep off evil spirits, a mirror mounted in red plush is fastened on the forehead of the mule. Often a tuft of red wool is fastened to hang down the nose. The mules and their fittings looked well cared for



THE NATIVE BRIDGES are usually suspension affairs built of bamboo and rattan. Suspension raises them above the level of flood water. A temporary bridge for the expedition was built of poles wedged into the rocks

(Left, middle) THE SHELTER built for the expedition at Imaw Bum near the Chinese border was capacious but not very weatherproof. Smoke from the fire built on the earth floor had to find its own way through the cracks in the roof



(Lower left) THE HEADWATERS of the Chaungmaw Ky-aung, where the expedition worked about Imaw Bum, were sealed over with ice and snow. One could walk up the middle of the stream bed in most places without breaking through



(Below) THE SALWEEN DIVIDE, a high mountain range, snow-capped in winter, serves as the boundary between Yunnan and Burma. The camp near the Chimeli Pass, which crosses the range, was not far from the peak shown in this picture, taken from Imaw Bum



CHRISTMAS WEEK at Gambkawn brought natives from far and near wearing their best finery and out for a good time. They gathered about a natural amphitheater for sports and exercises arranged to foster competition between the different mission schools

CHRISTMAS CELEBRATION

(Right) THE WOMEN brought samples of their weaving, needlework and basketry. This part of the celebration resembled a fair, for all of these samples were spread out on the ground, or displayed over the arms of their owners, and judged for excellence



At HTAWGAW, on Christmas Day, the village assembled in the school yard. Mothers brought their babies to watch the school children perform

THIS OCCASION gave the women folk of Htawgaw an opportunity to show off their elaborate costumes before a large audience

MANY OF THESE striking costumes display elaborate designs. The ornaments are of silver, sometimes rupees, or may be bright buttons





THE MULETEERS, who were always Chinese coolies, carried large, picturesque hats of woven bamboo splints. The workmanship on these hats is usually very fine, and the hat is strong but light in weight. Many of them are covered with oiled silk to protect them from rain, and they are large enough to give almost as much shelter as an umbrella. There is a strap to go under the chin in case the wind is blowing

*All photos by
Harold E. Anthony*



THE MULETEER leads his mule if he is traveling with a single animal, but in a caravan most of the animals follow in file without attention. Crossing the divide between the Moku Kha and the Ngawchang Kha, the expedition entered the home stretch to the base camp at Gangfang

(Right) THIS BLACK-FACED PUPPY, only a few days before, had been tumbling about the yard at Gangfang with his mother, brothers and sisters. At the end of each day's march he made the rounds, wagging his tail, to receive congratulations on having guided the caravan successfully into camp

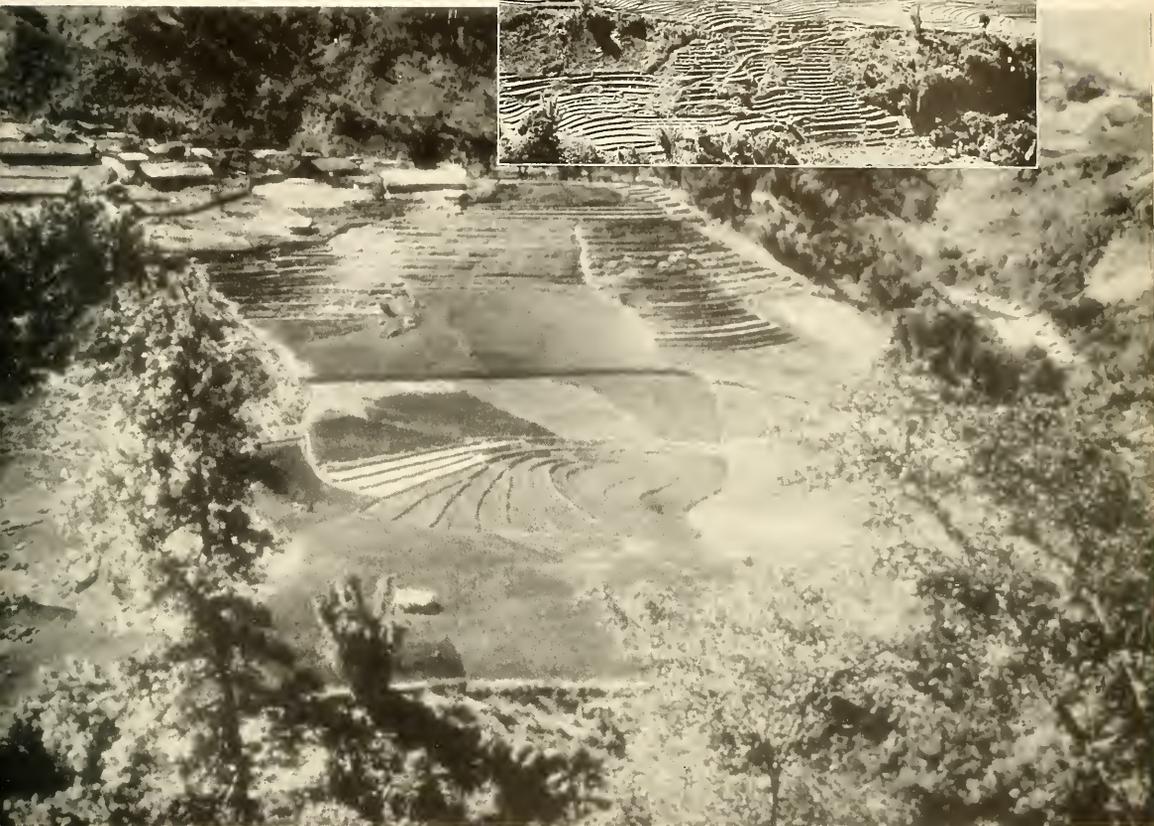


MANY HANDS made light labor of erecting a new building at Gangfang. The bamboo framework is lashed together with rattan, no nails are used. A thatching of grass completes the roof

(Below) RATTAN is easily split into thin strips for cordage. The workman uses his foot as an extra hand and grips objects with his big toe. The strips are twisted to loosen the fiber so that it will knot without breaking



(Right) THE TERRACED FIELDS of the hill peoples are marvelous landscape projects. Seen from a distance, the lines of each level look like the contours of a giant map. The soil is tenacious, with considerable clay, and the banks hold well. Without these retaining banks the forces of erosion would soon ruin the hillside for agriculture

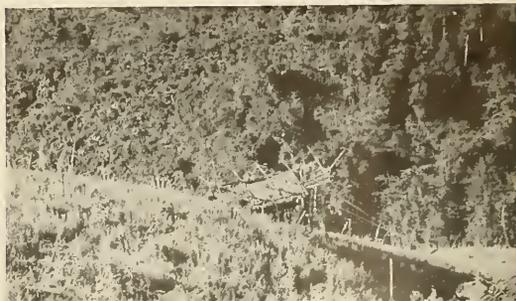


THE BANKS PINCH in on the slopes and fan out on the flats. The crop is rice, and water is retained to a depth of several inches by a low dam on the back face of each bank

(Below) WATER BUFFALO draw a crude plow. They move slowly but surely, and the black, tenacious soil curls back in even furrows. The natives take their agriculture seriously, and the whole family works hard



(Below) ONE of the world's most complicated scarecrows. Birds raid the planted fields and must be frightened off if there is to be a harvest. Long rattan strings stretch across the fields and sound wooden clappers when the watcher in the shelter pulls on them



of the dogs escape. We saw one such importation on its way to the Maru country, and the men had the dogs on individual leashes, six or seven dogs handled by one man. Evidently, the dogs could not be trusted to follow nor could they be handled at liberty like the goats, sheep and pigs we occasionally encountered. The Chinese coolies have one or two dogs always running with the pack mules, usually leading the procession and acting as if they felt a responsibility for reconnaissance. These "caravan hounds" are of medium size and often of mixed or unknown breeds, just dogs, but none the less interesting on that account. Some of the dogs with the caravans and about the villages are robust, surly brutes, and a stranger will do well to guard against a savage rush. One of our muleteers was badly bitten and a medical case for many days.

Christmas celebrations

It was December 24th when we arrived in Htawgaw where there is a mission school, a small detachment of military police, and a scattered agricultural region tributary to the village. Christmas Eve we were serenaded by several groups, singing Christmas carols, the same songs, such as "Silent Night," which we would have heard back home. The singing was quite creditable and one had no difficulty in recognizing the air, but the words were in Chinghpaw. This language, as it is written in English, has some puzzling combinations of letters.

When I first arrived in northern Burma, I tried to use a map and attempted to reconcile names used by the natives with those I found on the map, I discovered what happens to all of the *h*'s that are dropped in England. They are shipped out to Burma and stuck in front of *k*'s, *p*'s and *t*'s where they must feel at home, for they are invariably silent, at least to my ears. "Htawgaw" and "Hpare," the names of two villages, will serve as examples and sounded to me just as if they had been spelled without the *h*. The handbooks on the native language explain the presence of the *h* before these consonants as designating the "aspirate *t*" or the "aspirate *p*," as the case may be. But to this layman they seem like lost aspirations. My field orderly had a troublesome name. When he came to me I was told his name was something like "soups served" and we called him that among ourselves. Then I arrived at "Suki," to which he responded, but finally was informed that it should be "Si Kwiy."

During our first stay at Htawgaw, a team made up of expedition personnel played soccer against the local team, composed of the military police. Some of us were hardly acclimated yet, nor had we been in the mountains long enough to get our wind, so we

used this as an alibi to soothe the defeat which we received. The game afforded great amusement to everyone, and as we attempted to make willingness atone for lack of skill or practice, there was plenty of action, so much indeed that it was several weeks before the souvenirs of the game had disappeared from my shins. The Burmese natives are small and one of them would go under one of us with the ease of a greased pig. Incidentally, and for the record, we played return games when we passed through Htawgaw in March and expedition personnel was on the winning side. (P. S. We did have some of the Post personnel on our team, too.)

The really big Christmas celebration took place at Gambkawn, a day's march up the river valley from Htawgaw, where the mission had arranged for a large gathering of three or four hundred natives from all of the neighboring districts. There were to be about three days of various activities for this "poi," which is the native name for such an occasion. We hoped for photographs, both stills and motion pictures, for the natives would wear their best raiment and all of the different tribes would be represented, and we stopped over at Gambkawn.

Premature ovation

We reached the outskirts of the village where a large delegation was stationed, Messrs. Vernay, Cutting and I. The natives were expecting the arrival of a Mr. Maguiness, a government official of the Myitkyina district who would give the "poi" his official sanction, make speeches and lend dignity to the celebration. He was behind us on the trail, and apparently the assemblage at the foliage-draped village gates thought we were the government party. There was a great clamor and we were a little confused. Because our interpreters were elsewhere, we could not tell them to "hold everything." It did not help matters, either, when the guard of honor began to fire the salute, for the first blast came from just behind us and we nearly jumped out of our skins. At the side of the trail and almost concealed in the shrubbery by the gateposts, three natives with muzzle-loading muskets were doing the honors. As we came abreast of them each one, in turn, pointed his gun, waist-high, out over the landscape, held his face as far away from the gun as he could turn it and still see what he was doing, and jabbed a piece of lighted fuse down over the touch-hole. There ensued a terrific boom and a great billow of white smoke. Inasmuch as these muskets are only pieces of pipe fastened to a piece of wood, and the attitude of the musketeer indicated he would not be at all surprised if the gun burst or blew out backward, we discovered

a reason other than modesty for wishing them to hold their fire.

These people do not use guns; the crossbow is the common weapon of the hills; many of the men carry them and are very good shots. We wanted to see how well they shot at a mark and offered first, second and third prizes for the best marksmen in the Gangfang region. We had a good turn-out of the local champions on the appointed day. They shot at a narrow slip of wood, an inch or a little more in width and seven or eight inches in length, stuck upright in a bank at a distance of 35 to 40 feet. Each man released three arrows and most of the contestants hit or grazed the target with at least one arrow, and one man hit it with all three. The arrows are slender splints of bamboo about an eighth of an inch in diameter and with thin vanes of bamboo to act as feathering. The arrows fly very true and are so speedy that one can scarcely see them. They will drive into a tree so deeply that they are removed only with great difficulty. The bows, which are usually made from mulberry staves brought over from China, are so stiff that it requires great strength, as well as a knack, to draw the string back and engage it.

A lucrative trade

Gangfang is a terminus for river transport of coffin planks. The Chinese will pay a good price for planks of certain woods suitable for use in the construction of coffins. The most highly valued tree for this purpose is the *Taiwania*, a coniferous evergreen related to the junipers. It is a fine, large tree and grows today only in a comparatively restricted area near the Burma-Yunnan frontier; the genus occurs also in Formosa. A large *Taiwania* will cut from 60 to 80 coffin planks, worth an average of fifteen rupees each, delivered in China, or a maximum value for the tree of 1,200 rupees. This is very good money (one rupee equals approximately 35 cents), as business is measured in these parts, and the coffin plank contractor is able to keep a substantial part of it as profit. He pays only about 60 rupees to the natives who claim ownership of the tree; and to the Chinese crews who fell the tree and shape the planks, and to the coolies and muleteers who transport them, he pays an additional 240 rupees; total costs, 300 rupees. The planks are carried to the river and floated down as far as Gangfang, where they are pulled out and stored until a mule caravan can pick them up and move them, two planks to a mule, over the road into China.

The most stirring voice in the forests of Burma belongs to the gibbons, the long-limbed, tailless anthropoid apes which move up and down the moun-

tain slopes with the seasons. When the forests of the higher elevations are chilled in the grip of winter and there is no food for primates there, the gibbons roam the foothills; but when the warmth of spring bursts buds into green leaves and flowers, the rollicking, hallooing bands push up and are surprisingly early arrivals in regions of nine or ten thousand feet altitude, where unmelted snow may yet lie in shady nooks.

Early morning is the favorite time for calling, and in the still air the shouts of the gibbons are audible for two or three miles. The animals travel in small groups, a family or clan, comprising a dozen or more individuals of both sexes and all ages. When a locality has more than one group present they call back and forth to one another. The call of the hoolock gibbon, the species we encountered, consists of a series of ringing whoops, of clear, resonant timbre and it has an ecstatic quality about it that makes one believe the animals are expressing sheer enjoyment and have not a care in the world. Usually the outburst starts with the voice of a single animal, working up to his full capacity, when the others will pitch in with the abandon of a gang of small boys trying to see how much noise they can make.

One group of gibbons enjoying the early rays of the sun above the Pyepat trail were so engrossed in telling the mountainside what a fine morning it was that I crept along the trail to a point almost directly under them without driving them from the spot. A single, loud alarm call told me that I was seen but regarded as nothing much to worry about. The foliage was so dense that I could not see the animals very often, but I knew to within a few feet of where they were and they were not over 40 to 50 yards from me.

Reply to monkey-talk

I was greatly tempted to imitate their call, it did not sound as if it would be too difficult, and with the lot of them raising Ned I thought one or two sour notes might get by without my being discovered. But I over-estimated my ability or what I shouted was improper gibbonese, for an immediate hush followed. Apparently I spoiled their whole morning and they did not call again.

These animals have exceedingly long arms and swing from limb to limb like superacrobats. They may reach the new limb before letting go of the old one, but if the gap between limbs is long, as it frequently is, they cross with a long swoop, arms and legs flying like the man on the flying trapeze. They squat down on a limb, holding to something with one or two hands, looking down with frank curiosity at anything that has not greatly alarmed them, and



(Above) MEDICAL INSPECTION at Hpare brought most of the village, a Lashi community, about the Rest House where the government doctor was making a call on tour. The natives appear to be a reasonably healthy people and the doctor so characterized them; most of the ailments were of a minor nature



(Left) THE LASHI WOMEN seemed to be kind and attentive mothers, taking good care of their children and carrying the youngest about with them. The child may be carried in the arms or slung on the back in a sling

All photos
by Harold E.
Anthony

THE BURMESE NATIVE is seldom without his dah, the long brush knife which he uses for everything. The knife is carried in a wooden sheath, as shown at left. Not only brush and bamboo but good-sized trees are cut with the dah, and it may be employed as a hoe or a trenching tool



(Right) THE CHILDREN are a good-natured, happy lot, finding interest and amusement in all that goes on about them. Unlike some native children, they are not overburdened with adult responsibilities at a tender age, but have an opportunity to play and do childish things. Clothing is often a matter of personal choice



OCCASIONALLY one meets women on the trail, spinning cotton or wool as they walk along. This was probably more common in years gone by, for now cheap cotton cloth, commonly blue, is imported from China



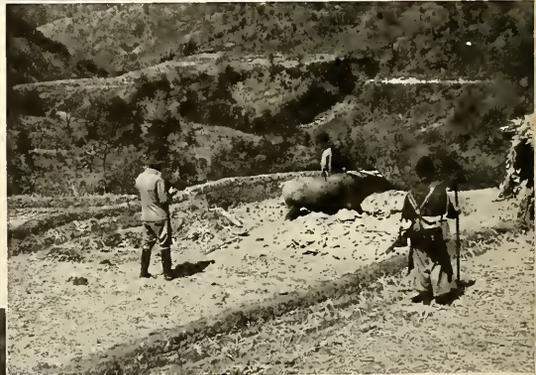
WEAVING is done on the same primitive loom seen in so many native communities throughout the world. The women are clever at working in designs, in contrasting colors

THE VILLAGE MAIDENS would always appear about the camp to see what there was of interest; if they looked worth the film, they had to face a barrage of cameras



ARTS AND CRAFTS

(Right) THE NATIVES make pottery, and one "factory" was seen in production near Hpimaw. A water buffalo was being driven around and around in a puddle of wet clay to tread it into the desired consistency. The beast was sinking knee-deep in the sticky stuff and each plodding foot emerged with a sucking pop



(Left) WITHIN A SMALL HUT a workman, using a collapsible form and a crude potter's wheel, was rapidly turning out open-ended cylinders which were carried outside to dry in the sunshine. Afterwards one end was closed to form a tight container which was intended to hold rice for storage. The kiln, in the background, was used to fire the pots after they had set sufficiently in the sunshine



THE 12,600-FOOT TRAIL over the Chimeli Pass skirts a deep gorge where the snow, in February, covered most of the landscape



THE EXPEDITION CAMP near the Chimeli Pass was visited by a snowfall before the tents could be pitched. The natives stuffed brush into every opening that would let in the cold wind



(Left) THE NATIVES were happy to shoot for prizes with their crossbows, which are their regular hunting weapons. Most of them shoot from a kneeling position and take plenty of care in sighting the arrow. There was considerable good-natured rivalry displayed

THE SLENDER ARROW is carefully straightened if the shaft is bent. Then the bowman moistens the arrow with his tongue, to make it adhere to the groove of the crossbow. Extra arrows may be stuck under the turban. Sometimes a bow string broke when the trigger was pulled and the arrow flew wide, amid shouts of laughter

All photos
by Harold E.
Anthony



(Right) *Rhododendron magnificum* grows to be a forest tree, 50 to 60 feet or more in height, and 18 inches or two feet in diameter. The flowers are huge red trusses. The leaves are especially large on the younger trees and some measured 24 inches from tip of stem to tip of leaf, and 9 inches broad



THE so-called "black barking-deer" mentioned in a sportsman's account of northeastern Burma was an expedition desideratum. A specimen brought in by the natives proved to be the Tufted Deer, not hitherto collected in Burma

(Below) A SMALL BOY blissfully suns himself while his father dams the stream to catch water shrews. After a distrustful scrutiny of the photographer, the boy decides the foreigner is not very exciting, and returns to a deep study of whatever it is that small boys dream of in Burma



take very much the same attitude as a nimble, tree-climbing boy.

Water shrews

The most interesting mammals, and the rarest, taken by the expedition are the water shrews. Shrews are insectivorous and feed on a great variety of small animal forms. The water shrews have discovered that a good living may be obtained from the water and have been playing about the streams for so many thousands of years that they have become highly specialized and differ noticeably from their terrestrial cousins. The Burmese mammal fauna is very rich in shrews, and there are two genera of water shrews which are not found away from streams and are difficult to capture. Both of these types are expert swimmers, eat only aquatic insects or small fish, and are not much interested in a baited trap set by the margin of a stream. One genus, *Chimarrogale*, was taken sparingly in small traps set at the foot of waterfalls or rapids where I guessed the shrew would have to leave the stream and cross the rocks to get upstream. Occasionally I guessed right. But the other genus, *Nectogale*, spends practically all its time in the water, cannot be tempted by any bait I know of, lives in a den with the entrance under water, and less than a dozen specimens have ever been recorded.

Accordingly, I was surprised and delighted when a native brought me, at Hpare, a splendid specimen of this web-footed water shrew, with peculiar pads on its feet, a four-sided tail, and the other conspicuous characters that identify it at a first inspection. I paid him the price of a good day's work and let the word go around that I would buy as many more as the men could bring in. My luck was in, and each day saw two or three of these brought to me. The way the natives capture them is interesting and is the same as that used for taking fish.

Two or three men, working together, would dam off part of the river at a spot where the water flowed about a small island or had two channels. Rocks were rolled across one channel, the cracks stuffed with brush and then sod tramped in on the upstream face of the dam. After several hours of work, the stream would be deflected and only a small trickle would be going down below the dam to run into the chain of pools that remained. The far end of the selected channel would be so closed by a low dam that the only escape for the greatly reduced flow of water was through one or two small gaps which had basket-work fish traps set in them. Then one of the men would take a bundle of dry aconite roots, slender, woody pieces the thickness of one's finger and a foot or eighteen inches in length, and beat them on a rock in the bed of the drained section or perhaps on a

boulder in the dam itself. A milky juice ran out and soon had found its way through the pools below.

The aquatic insects began to display symptoms of distress soon after the aconite juice was put into the water. They came to the top, dove to the bottom, then tried the top again, but finally floated helplessly. The fish also scurried about and were obviously disturbed. The men overturned rocks, poked with sticks under rocks too large to move, and gradually herded everything in the stream into some spot from which there was no escape. If the hunters were fortunate, one or two water shrews would put in an appearance during the drive and someone would capture the creatures by hand or, if the aconite had taken effect, a shrew might float into one of the wicker baskets. Or again, no water shrews might be present in the bit of river selected and the only things to show after half a day of work would be the small fish, which, however, were saved as food and seemed to please the natives. The aconite juice had a temporary effect only in the drained pools and the next high water would wash out the dams.

Earthquakes

Northwest Burma is a region of marked seismic activity; earthquakes are frequent although they are inclined to be local and the tremors are not noticed beyond a rather limited radius. A few years ago Htawgaw, which was then a military post, experienced so many earthquakes that the authorities feared loss of life if the buildings, some of which were of stone construction, were to collapse. Accordingly, the most vulnerable structures were pulled down and the men shifted to a post at Laukhaung, three marches to the south. At the time of our visit, the epicenter, or focus of earthquake activity, had shifted to the east and when we went to the Panwa district we discovered what the crust of the earth could really do when it felt uneasy.

Near the Panwa Pass, where the trail crosses the frontier into Yunnan, we stopped at the Rest House of Changyingku, a flexible "bungalow" built of poles and bamboo which trembled whenever one walked in it. We noted five or six distinct shocks a day during a week's stay and there could be no doubt that they were earthquakes. Usually the tremors were accompanied by heavy subterranean rumblings as loud as distant thunder. The floor would weave back and forth with a decidedly uncomfortable sensation. But when we were camped in heavy forests near the Hpare Pass, two marches nearer Htawgaw, we seemed to be squarely on the epicenter, for we experienced an average of about fifteen earthquakes during a day.

These were noticeably more violent than any we

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FRIEND BUFO—*Always resourceful, his ability to devour wasps and survive a Jonah-like sojourn in the belly of a snake wins new respect for the lowly toad as a likable house-pet*

By ROY L. ABBOTT

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NEVER have I heard such a bedlam of sounds as was coming from Lake Mendota that April morning, a wild confusion of high, long-drawn trills as if a thousand mad pipers were holding wassail. As, in fact, they were. Except in this case, the pipers were male toads of the common garden variety, small, compact, blackish little fellows, each with his throat ballooned to the size of a walnut and piping at the top of his voice. Also, instead of to rats, these insanely vocal males were piping to their mates, big stolid females lighter in color, silent and passive, and paunchy with eggs. But I am anticipating.

My friends of the biological laboratories had cautioned me weeks before not to miss this spring festival of the toads. "You will see more toads than you ever dreamed of," they had said. So when I heard one of them remark that the toads were in the bay, I grabbed one of the university's boats; and here I was, rowing down to Mecca, my course plainly charted by the ever-increasing volume of sound coming up the wind.

And I was not disappointed. Half a mile below the biological laboratory, the deep lake thins into shallows—wide areas of water weeds and rushes in a few inches of water, an ideal breeding place for toads. When I finally stranded my boat among the thick weeds, I could scarcely believe my eyes. Like Jerusalem of old, I was literally "compassed about with armies"—armies of toads; the water was alive with them. They were mating, and two-thirds or more of them were paired in close embrace, the little amorous males in striking contrast to the larger, lighter-colored females.

I needed toads for laboratory study, so here was my chance. With a single sweep of my dip-net, I caught six pairs; in a few minutes I had 200 or more writhing in a box or sprawling loosely over the bottom of the boat. But the mating instinct was not to be quieted by such rough handling, for even when tumbled rudely from the net, many of the pairs never broke their embrace, and an hour later, the males still sang lustily as I rowed back to the laboratory.

Eggs, too, were everywhere. They covered every stick and weed; the water was glaucous with them; like

chains of translucent beads they dragged in long festoons behind my net and draped in slimy strings over the sides of the boat.

Three weeks later when I pulled my boat into the same spot, not a toad was in sight. Each had departed to its own particular home no doubt, some near, some far, known only to the individual toads. Not all, of course, for even as I watched them that day at their mating, the herons and water snakes and pickerel were taking their toll. But those who had come safely through were doubtless now scattered far and wide, each leading its own monastic life, and each forgetting the other completely until another spring.

But the pilgrims had left something behind, for the rosary-like egg strings had sprung into life, and down there on the bottom among the water weeds I could see a host of tiny, black, chuckle-headed wrigglers, the toad tad. By July, if things went well, what was left of them would come crawling forth from the water as miniature toads to live most of their days on the dry land.

It was one of these tiny fellows, I am persuaded, that I found along that same bay nearly four months later. Or perhaps I should say that a garter snake had found him first, and it was his faint, skittering cry of protest against being swallowed that brought both him and the snake to my attention. I unhooked the snake's sharp teeth, and dropped the toad into my pocket, and forgot him completely until a chance wiggle brought him again to my attention. And that's how I found Bufo, as the Latins called him, a male garden toad, a creature that I kept and watched for several years.

When I first rescued Bufo from the snake's jaws he was scarcely an inch in body length and perhaps half an inch in width, and his slender legs seemed hardly adequate to support even such a tiny body. To look at him then, four-legged and tailless with wide mouth and extensible tongue and breathing by lungs and skin in the open air, I could scarcely imagine that six weeks before he had been a tiny fish-like creature propelling himself by a wide tailfin, rasping food with a horny-jawed mouth from water plants, and breathing at first by means of gills. Nor that a few weeks further back from that one-inch tadpole stage he had been only one of those thousands of black, minute, jelly-covered eggs—only one of the four or five thousand of them placed there in the bay

to be left and immediately forgotten by his mother who laid them and his father who fertilized them. For, of that vast embryonic host who began life with him, he was only one of the relatively few who had managed to get safely through the vicissitudes of existence in the water and the many physical changes that had come upon him—loss of tail and gills, growing of legs, and the development of lungs and eyes to fit him for life in the air.

Bufo didn't seem to mind his captivity in the least. From that first afternoon in my office when a casual wriggle on his part reminded me that I had forgotten my captive of the morning, until the end of our relationship, he never showed the slightest sign of discomfort or annoyance at his captivity, seemingly content to live out his days as I willed them.

But I was not a hard task-master. Most of the time I allowed Bufo to sit in a small vivarium containing some mossy sticks and a few inches of damp soil, digging him out only now and then to play with him or feed him. I say "digging him out" advisedly because, left to himself, he invariably wiggled and twisted and poked with his hind legs until his body sank and became largely covered by the soft earth. Sometimes, indeed, I had to look carefully to see where he was hidden. Nor did I ever unearth him without recalling my childhood surprise and astonishment on seeing my grandfather "mine" a toad in this fashion.

We were standing by a radish bed in his garden. There was a slight crust on the newly planted soil, and pointing casually to an area perhaps the size of my palm where the crust appeared broken, he suddenly asked:

"What do you suppose I'll find in there, sonny?"

My face showed no answer, so thrusting his hand nearly to the wrist in the soil, he casually brought forth a huge garden toad weighing perhaps a quarter of a pound. Her fine eyes bulged and glistened as she blinked them in the sun, but they protruded scarcely more than mine as I yelled:

"Grandfather! How'd you know that thing was in there, and aren't you 'fraid of warts?"

No, he was not afraid of warts, and experience had taught him Madam Toad's method of keeping out of the sun's heat and harm's way in the daytime.

That was my first real contact with a toad and I recall that I handled the creature rather gingerly at the time, for I had always been more or less afraid of them. But since that day I believe I have never met a toad without picking it up and playing with it for a while. I like to see its wonderful eyes, and listen to its chuckles and chirps of alarm and protest as I carry it along in my pocket—these last particu-

larly when I chance to have the toad's dearest enemy, the garter snake, in my pocket at the same time.

Bufo didn't always cover himself completely, however, for I often found him—and I have observed the same thing with other toads—merely sunken until his back was level with the earth, a position which camouflaged him perfectly and at the same time left him free to grab whatever victims came his way.

And it took a surprising amount of food to satisfy him, even that first year when his body was hardly the size of the first joint of my thumb. At first I fed him house flies. When I fished him from his den at feeding time he would sit stolidly on my desk in front of me as if hunger and food were the things farthest from his interests. But the moment I chased a disabled fly within range, something would happen so quickly that I never overcame my amazement in watching him. Usually the fly would not get closer than an inch and a half before Bufo's tongue would streak out in front of his head with a tiny whip-cracker report, and then withdraw itself so fast I could scarcely follow it with my eyes. One moment there was a fly before me, and the next moment I would be staring at the spot where the fly had been. Sometimes he would take a dozen in succession, but he always swallowed each victim before capturing another, the swallowing act being invariably accompanied by a depression or inrolling of the eyes, for the toad, in common with the frog always uses his eyes, whose sockets hang into the mouth cavity, to aid him in swallowing. When the flies were particularly bad, I often set Bufo upon my hand and held him up to the screen where he collected a meal with astonishing speed and precision, hardly ever missing a shot until he became sated. Two or three flies missed in succession usually meant that his appetite was becoming pretty well satisfied.

But house flies are probably not a common article of diet for a toad in the wild state, and Bufo gave plenty of evidence that he liked other things than flies. Cutworms, caterpillars, wireworms, sow bugs, slugs, small earthworms, grasshoppers, crickets, box-elderbugs, these, and practically every other living thing small enough to be swallowed were just so much grist to his gastronomic mill. Indeed, in the several years that I watched his feeding habits, I never saw him quit on anything except a millipede and the larva of a swallow-tail butterfly. Bufo was hungry, too, at the time, but although he had *Julus*, the millipede, half gorged, he got rid of him in a hurry, and even rubbed his jaws against the floor after ejecting him with all signs of disgust. He behaved the same with the butterfly larva, nor could I

induce him to tackle either of them at any later time.

Dickerson remarks that if a toad swallows a stag-beetle, the experience is so unpleasant it cannot be induced to swallow another one. Here, of course, the unpleasantness is probably due to the beetle's mandibles or its sharp spiny legs. But Bufo was fond of June beetles and never disgorged one of them, although their rough legs must have rubbed sharply against the soft lining of his stomach. Hence, in the case of the millipede and the caterpillar, I am inclined to believe that Bufo's ejection of them and continued refusal to have anything to do with them must have been due to a matter of taste or smell. The larva of the swallow-tail emits an almost intolerable odor, at least to me, and possibly even a toad can be nauseated by it.

Curiously enough, however, after making a meal of hornets he was not greatly bothered by internal disturbances. One day, in his third year, I placed him in an empty fish bowl and suspended the flat open nest of *Polistes*, a paper-wasp, just above his head. There were ten or more live and pugnacious wasps clinging to the underside of the nest, and as they walked above him, Bufo crouched, humped his back high, and depressed his head as if in fear. I had a pet frog once who would eat wasps even though stung entirely through the tongue by them, and I was beginning to wonder if Bufo might not lack some of the Spartan qualities of the frogs. But my doubts were not for long. Slowly his head came up, and as the agile insects caught his eye, that almost irresistible reflex to strike at a moving object asserted itself—out flashed his tongue, and down went a wasp. In a few minutes they were all inside of him, and although he occasionally shifted his position as if possibly experiencing some internal pangs, he never disgorged one of them, and for several days following, gulped the new ones as fast as they emerged from the comb.

But even when hungry, Bufo didn't always strike blindly at whatever came along. True, he would sometimes make a pass at my lead pencil when I was using it to stir up a sluggish insect or to flip him a bit of liver. But when presented with a large active earthworm, he would often crawl awkwardly along in pursuit of it, apparently trying to get at its head end before striking. Often, in fact, he would stalk it for a yard or more, seemingly as a matter of pure curiosity, twisting himself into all manner of comical attitudes as he watched. Indeed, Bufo's power of attention was considerable, for I have watched him and other toads, when separated by only a glass partition from some snakes, move along the glass and stare with seeming close attention to

the movements of the snakes for minutes on end. I must here add, however, that when Bufo was kept with several other toads in a long glass vivarium, he and the rest spent so much time striking at the flies on the outside that the whole glass wall became cloudy with the sticky secretions from their tongues. They couldn't seem to learn that these flies could not be captured. Hence, Bufo's attention to the snakes as above described may have been only a reaction to the call of his stomach.

Bufo appeared also to have some idea of height or appreciation of distance and space, for when placed on a table he would not leap blindly off, as would every frog I have placed in the same position. Instead, he would crawl up to the edge and peer over, usually turning back to waddle along and look over the side at a new place, even failing to jump altogether if the table was very high.

Can a toad show emotion? I cannot say, positively. It is so easy to make a subjective interpretation of what we see in the animal under observation. Knauer speaks of the "angry and envious glances" of a toad toward another that had been successful in the struggle for an earthworm. Certainly a toad can show attentiveness and, as I have said before, can twist its body into an attitude strongly suggestive of curiosity, but I have never observed any change in Bufo's eyes which depicted anger to me. Once I tickled him on the nose with a straw and his first reaction was to bend his head under his body and swell up. When I persisted he suddenly butted at the straw, and in response to my continued tickling he actually came crawling toward the offending object, butting as he came. This seemed to show anger, but I could detect no changes in his eyes or facial expression.

Bufo appeared to know me, and would often come quickly toward me at mealtimes and eat freely from my hand. He would also allow me to scratch him upon the back without showing the usual fear or avoidance reaction of toads in general—an arching or humping of the back and a strong inflation with air. But so far as I could observe, he paid not the slightest attention to other toads, except for a few days in the breeding season. If one of them grabbed a worm that he was trying to capture, he made no attempt to punish the successful one, but instantly turned his attention to another worm. If another toad got in his way, he trampled upon it or pushed it aside with utter indifference, seemingly without knowing that it was one of his own kind.

But in the spring, for a few days at least, he was a different creature. At that time another toad meant something to him, and he would grab at one whenever he could. His discrimination of sex, however,

appeared to be somewhat a matter of trial and error so far as his sight was concerned. He would clasp a male toad as eagerly as he would a female, but always quickly released the male when the latter began chirping as they usually will when seized. The females, however, are generally silent when clasped, especially in the breeding season, and I agree with other observers that a male toad's choice of a female hinges chiefly upon her rougher body, and her silence when clasped. Once successfully clasped to a female, he would hang on for days, digging his small hands and forearms deeply into her pudgy flanks and holding on so tenaciously that although his mate was thrice his bulk, I could pick the pair of them up and dangle them in the air by merely lifting him by the legs.

But after that short mating season, Mrs. Toad might have been only a lump of earth so far as Bufo was concerned. He paid no attention to her and she none to him. It is the way of a toad.

As a boy on the farm, I had a dog who was always cornering and barking at toads. Left to himself, he usually merely pawed and mauled the creature, but I often urged him to seize it with his jaws, whereupon he would almost immediately drop it and begin foaming at the mouth and rolling upon the ground as if very ill. I have watched many dogs give this same reaction to toads, and it must be that certain glandular secretions from a toad's skin are very nauseous to dogs. One observer states that he has never tasted anything bitterer than this secretion, but I have never been able to get a taste of it, although I have sampled or "tasted" several toads by running my tongue along their backs.

According to Dickerson, a toad does not give off this secretion unless it is hurt, but I have not seen it even when a toad was being swallowed by a snake, and to be swallowed would surely be a process that hurt. Skunks are said to wipe a toad against the ground before eating it, but this certainly cannot be true of snakes, which seize the toad and hang on until the victim is swallowed. It may be that garter snakes do not mind the "toad poison," but I once saw a large garter snake disgorge a spotted salamander which it had half-swallowed, and then proceeded to rub its open mouth against the ground with all signs of distress. The disgorged salamander was completely covered with a milky secretion, but I didn't have courage enough to taste this substance.

I have more than once removed live toads from the bodies of snakes, and it occurred to me that I might witness the whole process of swallowing and recovery of the victim by using *Bufo* as a subject. He objected strongly to being swallowed by a garter snake, puffing himself hugely and rolling over and over as if to twist his legs from the snake's mouth after the manner of a frog. But as he turned over the snake turned with him, and in ten minutes he was in the snake's middle. I didn't allow him to remain there long, however. The garter snake didn't survive the operation, but *Bufo* did, and aside from a few whitish patches on his back, due to erosion from the snake's digestive juices, seemed little the worse for his jonah-like experience.

Bufo spent his first winter deep in a pile of leaves which I had raked into a heap and covered with boards to protect some plants. I did not uncover him during the cold weather, but the temperature in the leaf-pile couldn't have been much above freezing. By the middle of March he was ready to come out, and he spent most of that year and the rest of his captivity in my basement. I could see very few living creatures in this place, but he appeared to thrive and grow rapidly, so there must have been more sow-bugs, spiders, beetles and centipedes down there than I had imagined. Sometimes when I would enter the basement he would come hopping my direction as if in greeting, but possibly this circumstance was only accidental. Yet on these occasions he always allowed me to pick him up and would sit alertly on my hand and let me rub his back as if he enjoyed it.

In the spring of his fourth year *Bufo* was full grown, a robust fellow, as male toads go, and showing strong indications of the sexual urge. He would partially inflate the sac at his throat and eagerly clutch at my fingers, clasping them strongly when I allowed him.

So I decided to give him his freedom. Accordingly, I deposited him in a shallow pond near my home, and he wasn't long in raising his voice for a mate. I watched him off and on for a few days, saw him finally in amplexus with a big female and then lost track of him altogether. But toads are said to live many years, and of a night when I hear them calling, I like to think that *Bufo* is one of the singers. And that once a year, forgetting his monastic life in the soil, he goes to the nearest pond to attend that mad orgy, the spring festival of the toads.

The Story of Coffee

By DEAN FREIDAY



Europe got its first coffee house in 1683, at Vienna

Illustrated by HENDRIK WILLEM VAN LOON

EMPIRES have fought for its control; its plottings have woven curious designs in the tapestry of statecraft. It is the aromatic climax of a millionaire's banquet, the substance of the beggar's plea, the bank clerk's morning eye-opener. Yet few of us give the romantic history of the humble cup a second thought, or consider its scientific value and tremendous potentialities.

The cup you drank this morning was prepared from a grind of roasted beans by boiling, percolating, or dripping. But if you were a citizen of some other country, it would taste different and be differently prepared; for coffee has adapted itself to the customs and tastes of the countries it has conquered.

In Sumatra, leaves rather than beans would yield the brew. The thrifty Sumatrans export the beans, and save the leaves for themselves. The leaves are gathered and roasted over bamboo or other smokeless fire, then ground to a powder and utilized in the same way we use the ground bean. While the result tastes little like our coffee, it is similar in effect, for the leaves, too, contain the stimulating caffeine. In parts of Turkey, Arabia, and Iran it is served complete with grounds and flavored with ginger, anise, cloves,

cinnamon, or other spice. There you would eat the grounds, since they contain the drink's only nourishment and these orientals regard coffee as food as well as stimulant.

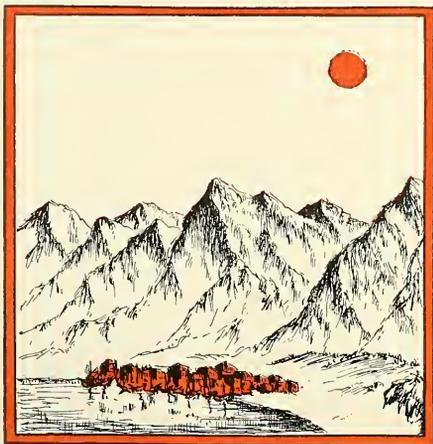
Coffee eating is fairly prevalent. Coffee pickers frequently eat the sweet pulp while working, and in parts of Africa primitive tribesmen carry coffee balls when on the march. These are made of chopped coffee beans mixed with grease to hold them together. Since coffee is native to Abyssinia, Guinea, Mozambique and the Sudan, this may well be man's oldest method of coffee consumption. But so far as we are concerned the introduction of coffee was from Arabia.

When Charles Lamb wrote his "Dissertation on Roast Pig," he might well have followed it with a "Dissertation on Roast Coffee," for the actual discovery of the drink is obscure. To make up for the lack of facts, men have been writing fables and legends ever since.

One story, of which Lamb would have been proud, can be traced back to 1700. It tells of a goatherd in southwestern Arabia faced with the bizarre problem of a flock of insomniac goats. For no apparent reason, his goats took to frisking about all night and

butting one another. After this had gone on for a number of nights, he began to get worried, for his goats were becoming a little dizzy on their feet, their eyes were bloodshot, and they were losing weight. Finally, in despair, he went to a nearby Moham-medan monastery and was advised to watch closely what the goats ate.

Several days' observation revealed that the only



From Arabia we get the coffee habit

unknown food was the little cherry-like fruit of a strange shrub that grew in one spot on the hillsides. Some of this was gathered and taken to the monastery for study. The aroma of the infusion was so delightful that the monk decided to try drinking it. After several draughts his pulse quickened, his observation sharpened, his mind became more active and he felt endowed with new vigor and mental power.

The result was so amazing that he tried the new drink on the other brethren. It dispelled the drowsiness that had made their midnight prayers such a task, and at once became popular.

When Kaffa or Kahwa, as it was apparently called, began its conquest of the world, it took its name with it. In German it became *Koffee* and *Coffee*, and finally *Kaffee*, its present form. In Russian it is *kophe*, in Spanish and French and Portuguese *cafe*, and in English it underwent all the various forms of phonetic spelling that were common before Doctor Johnson's dictionary started the standardization of English spelling. Even in the Polynesian Islands its name went with it. There it became some variant of either *kava* or *'ava*. The type names Java and

Mocha, associated with its early sources of supply, have since become nicknames for all kinds of coffee.

With the growth of the Ottoman Empire, coffee grew too, and by the 16th century was so popular with men and women alike in Turkey that it was grounds for divorce if a man refused his wife her coffee. As its use grew among the populace, and the coffee-house became an important place of social intercourse, these centers began to be politically troublesome as the starting points of popular uprisings. In 1517, the viceroy of Mecca, seeking to stamp out this menace to his realm, made coffee a religious issue in order to hide his real reasons for attempting to suppress the coffee-houses. He called together the wise men—doctors, muftis and law experts of the ulemas—to decide whether the use of coffee should be proscribed according to the doctrines of the Koran.

The ensuing argument at times became nearly as involved as Christian philosophical arguments of the Middle Ages which tried to decide how many angels could perch on the point of a needle, since angels were without physical form and hence infinitely small. In the arguments against coffee it was put forth that God intended the night for sleep, and therefore, that substances which kept people awake were improper; but this was defeated by citing the fact that opiates, which at the time were considered proper, put people to sleep in the daytime. If God intended the night for sleep, he intended the day for wakefulness. Those who favored prohibition put forth the argument that, being a stimulant, it should be classed with intoxicants. All present were true believers so did not know the effects of intoxicants, but the coffee "wets" had heard that drunkenness dulled the senses, whereas coffee quickened them, so it could not be classed with alcohol. The debate finally ended indecisively, with coffee neither approved nor forbidden but merely tolerated.

By the 18th century coffee was so popular in Turkey that it was not only served with meals but also with the friendship pipe whenever callers came. Consumption then has been estimated at no less than 20 cups a day for the average person. Curiously enough, at that time, a person who suffered from insomnia would sit up in bed and drink a cup of coffee, and then smoke until he fell asleep.

Coffee was introduced into Europe largely by accident. In the battle of Vienna in 1683, the Turks were finally routed from the gates of the city in such a hurry that they left their tents, camels, and personal effects behind. Among them were 500 sacks of dark-colored beans. In the ensuing pillage, the soldiers were on the point of throwing the sacks into the river, thinking them useless camel fodder, when

Kolshitsky appeared on the scene. Kolshitsky had been a spy for the Europeans, and in his contacts with the Turks had learned the use of coffee. For his services which had been largely responsible for the saving of the city, the Viennese had made him a citizen of Vienna, and extended him the privilege of entering any trade he might choose. When he saw the coffee he asked for it, and then petitioned for the privilege of opening a coffee-house.

At first he met with little success, for the Viennese didn't like the bitter drink with the grounds in it that made them choke. Faced with the problem of turning a liability into an asset, Kolshitsky determined to make a drink from his beans more suited to the tastes of Vienna. He strained the coffee to remove the grounds, added sugar and cream and served sweet rolls and filled doughnuts. His business became such a success that coffee-houses are still a Viennese institution of importance where people go to enter into conversation, conduct business, or read as well as to drink.

Although coffee had an early start in Vienna, it did not spread from there over Europe as might have been expected, but was rather introduced independently at other points.

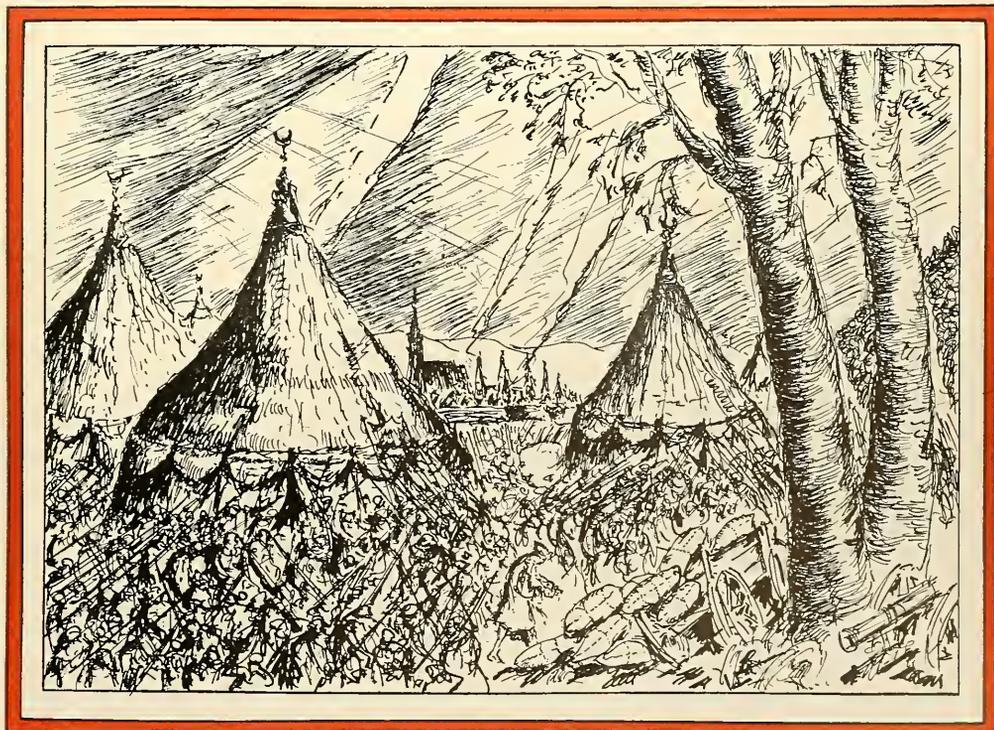
By 1660, the extensive commerce of Marseilles, which at the time far outranked Paris, had ac-

quainted the wealthy of the city with coffee, but it was considered a drug and sold in pharmacies. When this idea had been broken down, the sale of coffee became more general, and its growing popularity began to alarm the vintners and grape growers, who saw their business threatened. They began a campaign of unfavorable propaganda, not unlike that issued by present-day decaffeinated beverages. Doctors asserted that coffee was harmful, and professors from the university lectured in the town hall on the inferiority of coffee as compared with wine.

That type of propaganda was of little avail, but the body blow to coffee in Marseilles was delivered by a travel book of the period which, in describing the use of coffee in the Orient, related a story that attributed anaphrodisiac properties to the drink. From then on wine came back with a vengeance and coffee was displaced until it had been reintroduced by way of Paris. By then the fallacious information had been forgotten, and the discovery had been made that coffee needn't interfere with wine, so it met with no further opposition.

When the coffee-house was introduced into England, it became a political influence as well as a social and literary center. Each party had its particular coffee-house, and there the political bosses were consulted by the smaller fry. As in Arabia, they

The Siege of Vienna, where the retreating Turks left 500 mysterious bags of coffee



became troublesome to the government, and in 1675 the attorney-general posted an order closing the coffee-houses "because in them harm has been done to the King's Majesty and to the realm by the spreading of malicious and shameful reports." The decree met with such opposition that it was soon withdrawn, and business continued.

The wholesaling of coffee at this time was done "by the candle." When bids were opened on a lot of coffee, a candle stub was lighted, and bids were accepted as long as it burned. When it flickered out, the lot was knocked down to the highest bidder.

England was well on her way to becoming one of the greatest of coffee consumers when accident started

characterizes it. While England drank coffee, they say, English literature had a sharpness of wit and a speed which brightened it neither before nor after.

The men of arts were disagreed on coffee. Pope in his *Rape of the Lock* paid tribute to the mental stimulation coffee afforded with the lines:

Coffee, which makes the politician wise,
And see thro' all things with his half-shut eyes.

Johann Sebastian Bach was so delighted with coffee that he became one of its most ardent advocates. About 1740 he wrote his *Coffee Cantata*, which is now practically forgotten, for coffee's stimulation unfortunately could not make a trite theme and dull composition immortal.

Goethe on the other hand was opposed to coffee and, in the interest of uncovering something that might lead to its downfall, he sent a quantity of it to his chemist friend Runge. In so doing he was indirectly responsible for the discovery that the principal constituent of coffee is caffeine. Runge was the first to extract and identify the substance.

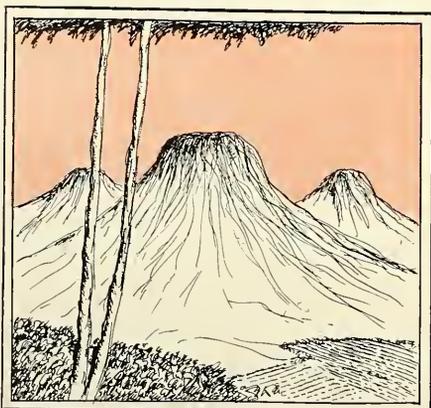
The importance of caffeine is perhaps measured by the fact that all of the popular non-alcoholic drinks, coffee, tea, cola drinks, and yerba maté (drunk by millions of South Americans) contain varying amounts of this drug. It is probably the most universal stimulant.

Unknown to most Americans, yerba maté has a sophisticated flavor combining some of the properties of tea and coffee with a distinctive touch of its own, and is slowly adding new territory to its kingdom.

In tea the chemical was first called theine, which has since been found identical with caffeine. Primitive tribes get caffeine from other sources as well. The Bushmen of South Africa use *Cyclopia* leaves, and the Amazon Indians make a paste called "guarana" from the roasted seeds of a local plant, which is also used to flavor a drink popular in Brazil. The Sudanese negroes use the cola nut.

A comparison of the caffeine content of various drinks shows that while the average drug dosage of caffeine, or its compounds, is $2\frac{1}{2}$ grains, the average per cup of coffee, although varying with the methods of roasting and brewing, is usually about 2 grains. The commercial carbonated beverages of the kola or cola class average $\frac{1}{2}$ to $\frac{3}{4}$ grains. Tea usually contains about twice as much caffeine as coffee, and commercial manufacture of caffeine drugs is from the dust and sweepings of tea leaves. Yerba maté is between coffee and tea in its caffeine content.

In addition to caffeine, coffee also contains among other constituents trimethylamine, which adds to the harmonious taste sensation but is also the predom-



The Dutch transplanted greenhouse specimens in Java

her on the path to tea. She failed in her attempt to gain control of the Netherlands' possessions in the East Indies in 1782, and with that failure lost control of the sources of coffee. England owned no coffee-producing colonies of importance, and coffee consumption had been declining for some time. The conquest of India had begun in 1730, and India was a great tea-producing country. Britain had no control over Arabia, and did not carry its products, so Empire propaganda and Empire economics turned her toward tea.

The 18th and 19th centuries were the golden age of music and literature for European civilization, and many of coffee's most ardent champions claim this to be a result of the influence of the drink. They point out that when coffee became the drink of France, French literature took on a new sparkle which still

inant substance in putrefying fish. Another compound is trigonelline, one of the main constituents of nicotinic acid.

The synthesis of these compounds into a satisfying brew of pleasing aroma is the story of skillful processing from the time the coffee is spread out to dry, through blending, roasting and packing, to the final step of preparing the drink. This is probably the weakest link in the chain, for at all other points the work is done by experts, while anyone considers himself competent to make a cup of coffee.

All the many variants of coffee are from shrubs of the genus *Coffea*, which includes 40 species, 19 of

which are of economic value. Of these, *Coffea arabica* makes up the bulk of world production. In addition to the true *Coffea arabica*, there are also nine varieties of it that are of economic significance. Several of these have been crossed with the true *Coffea arabica* to produce a hybrid that is resistant to the leaf fun-

gus, *Hemileia vastatrix*, which is the dread enemy of the coffee planter. The cultivation of the plant over a period of 600 years has brought about a considerable variation in local types as a result of climatic and soil conditions. The color of the bean, after the pulping, washing, drying, shelling, and polishing processes have been completed, may be nearly any shade of the rainbow, and variations in size and shape make it possible to differentiate commercial types by appearance. The greatest differences in the quality of the bean are produced by altitude. The greater the altitude, up to the limit of cultivatability, the milder the prod-



From Java, coffee went to the West Indies

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uct. These high altitude beans are used for blending, and in addition to their mildness usually are highly aromatic, contributing much to the pleasurable smell of the drink.

Under most circumstances, this delicate shrub must be cultivated in the shade of large trees if the

bean is to be satisfactory for use. Mahogany or Ceiba trees, and sometimes banana plants serve this purpose. An exception is found in the Hawaiian Islands where peculiar climatic conditions in the coffee region cause a mist that shades the plants during the hottest hours of sunshine.

While coffee the beverage was marching around the world, coffee the plant was doing a little independent traveling. When the legendary goats of Yemen had brought about the discovery of its use, it had already been transplanted in small quantities, by accident or intent on the part of Abyssinian tradesmen. When coffee became popular in Arabia, plant importation was undertaken on a large scale, and Arabia became the major source of supply. So it remained until nearly 1700.

The flourishing coffee-shrubs in the botanical garden at Amsterdam, which were brought as a curiosity from Arabia, suggested that they might do well in other tropical lands than Arabia. Accordingly, an experimental planting was made in Java. To everyone's amazement, they thrived as if Java had been made for them.

The shrewd Netherlanders soon had the coffee market to themselves to such an extent that they took to regulating the price by burning surpluses, a system which Brazil was to adopt 200 years later. But the natives who had done the back-breaking work to bring about the harvest didn't like the idea of burning the beans, and in fact, misunderstood the theory so thoroughly that they took to setting fire to the plantations at the wrong time. The planters therefore refused to burn any more coffee on orders from Amsterdam, and the market fluctuated wildly from year to year.

In 1714 the mayor of Amsterdam made a fatal mistake when he presented Louis XIV with a coffee-shrub. It had been planted in the royal greenhouses and forgotten by nearly everyone but the botanists, who guarded it jealously, until 1723 when Captain Desclieux of His Majesty's Infantry stationed at Martinique arrived in France. Captain Desclieux, noting the similarity of climate, soil, and vegetation between the West Indies and the East Indies, came to the conclusion that if coffee could be transplanted to Java and do so well, there should be no reason why it couldn't grow on French soil in Martinique. Convincing the king's physician of his patriotic motives, he secured—behind the backs of the botanists—a cutting of the plant and royal permission to export it.

The immigrant to the New World suffered many of the hardships of its human fellows. When the glass case in which it had been enclosed was found smashed one morning, and the precious plant broken and covered with salt spray, Desclieux muttered charges of sabotage, and guarded the plant night and day. He

kept particularly careful watch on a Hollander who happened to be aboard. When the ship was becalmed and the water had to be rationed, he divided his share with the plant, and finally, somewhat bedraggled but still alive, it arrived in Martinique.

The planting was such a success that from Martinique plantations spread on down the French Antilles to French Guiana, and from 1740 to 1790 they dominated the world market. The Haitian revolution was responsible for returning the banner to Java, for the former slaves regarded coffee as partly responsible for their servitude and refused to grow it as freemen.

Love, it is related, played a part in coffee's introduction to Brazil. Brazil had no coffee, and death was the penalty put by both neighboring countries of Dutch and French Guiana on the exportation of fertile coffee. But when a boundary dispute arose between the Guianas, an official from Brazil who was asked to arbitrate the dispute, contrived to get the plant by making love to the French governor's wife. On the night of a banquet in his honor, she presented him with a huge bouquet with a handful of the green beans hidden in the center. What the introduction into Brazil meant is so familiar that it need not be related here. With it, coffee reached the country destined to be the greatest of all the producers in its history and completed the most important part of its journey.

Coffee has always been an important home remedy for a number of ailments, and modern science bears this out in several ways. The general speeding up of body metabolism which it induces, and the elimination of fatigue products, together with the stimulating of the kidneys, are of value in many ways. The fact that caffeine is one of the few drugs which is not habit forming and whose use is not followed by a period of depression, would make it tremendously useful if individual tolerance and reaction to it did not vary so widely. A dose which might seriously harm one person barely affects another. Some people show almost a poison reaction to it, and for others it is "just what the doctor ordered." Perhaps its oldest use is that of women of the Orient to bring about menstruation when it has been delayed. Its use as a preventive of gout is almost as old, but present medical opinion is in disagreement regarding the causes and treatment of gout.

To summarize the present knowledge of the medicinal value of coffee made from freshly roasted and ground beans: it is deodorant and germicidal, and it stimulates respiration. One or two hours after administration of the drug, blood pressure usually increases (from 5 to 10 mm. of mercury), the pulse decreases (5 per minute) in some subjects and increases in

others. The effect on the pulse sometimes lasts as long as 25 hours. Simple movement (target test) is affected up to 25 hours, and the influence on acquired motor skills last several days. If used in moderation coffee aids digestion, but greatly excessive use may cause irritation of the mucous membrane. It stimulates peristalsis and is mildly laxative.

The effects on the brain are quite marked. Gunn states: "Caffeine stimulates the central nervous system, and particularly that part associated with the psychic function. Ideas become clearer, thought flows more easily and rapidly, and fatigue and drowsiness disappear. . . . If the quantity ingested is small, the results are of distinct benefit in intellectual work." The processes of customary association are facilitated by caffeine. In experiments on chess problem solving, there was a 15% improvement in problems per hour accurately solved.

Sensory perception is increased and in cases of caffeine poisoning it may be heightened to such an extent that the slightest tactile sensation causes acute pain.

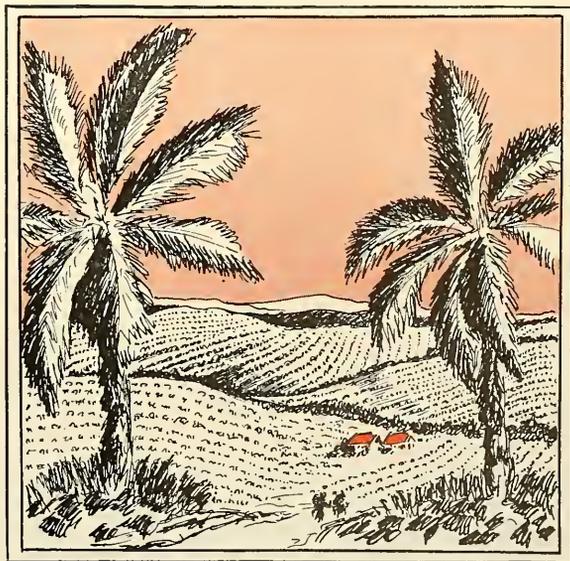
Besides the bean and leaves, both the wood and the pulp have their uses. In the interior of Africa the wood is much used for furniture because it is very durable and compact and takes a good polish. The

pulp has been used both as fodder and fertilizer. As fodder it is not altogether satisfactory, but as fertilizer it is very beneficial, and its use is increasing. Since it is richer in important soil nutrients than guano, coffee fertilizer may some day be an export commodity.

In the world of tomorrow, coffee is destined to play a great many roles now strange to it, for a method of manufacturing plastics from it has recently been perfected. You may soon drink a cup of coffee in what is literally a cup of coffee, or brush your teeth with what might have been a cup of coffee. One 132-pound bag of coffee (of which nightmare surpluses have caused Brazil to destroy 66 millions) is reported to produce 40 square feet of plastic half an inch thick and approximately 1.25 gallons of coffee oil from which various chemical and pharmaceutical products can be manufactured. As any grade of coffee may be used, it is possible that future coffee drinkers will have only the very choicest quality, for there will be no inducement to market inferior grades for beverage purposes.

It has been a long road from goats to toothbrushes, from Arabia to Brazil, and from the wild shrub to the modern breakfast table, but it looks as though we stand at the threshold of the golden age of coffee.

South America took coffee from the West Indies

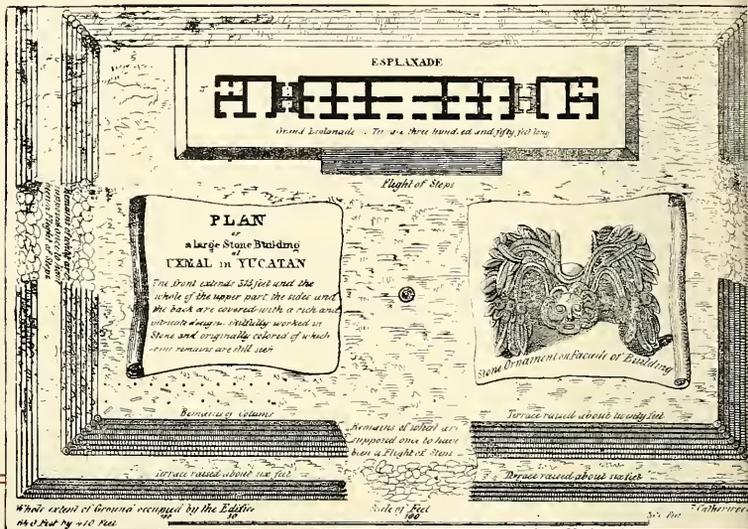




JOHN LLOYD STEPHENS, world traveler, explorer of the past, engineer, diplomat, and celebrated writer of his day. (Drawing by Edwin Earle, from an oil painting by an unknown artist.)

The Strange Story

JUST 100 YEARS AGO, John Lloyd Stephens embarked on his stirring Central American discoveries which started his famous Maya sculptures on their singular Odyssey. The thrilling tale behind an American Museum collection



IN the quiet of the exhibition hall, the carved stones of a vanished people, like wanderers too tired to talk, tell little of their travels. Yet it is largely the stories of struggle, high adventure, and even heroism lying back of these museum treasures that make them interesting to us.

As it is just one hundred years since their story began, and because it can be called finished, it is fitting to trace the strange tale of the Stephens Sculptures from the jungles of Yucatan to their place of honor in the Central American Hall of the American Museum. This brings us to their dis-

coverer, John Lloyd Stephens, gentleman adventurer, scientist, and diplomat extraordinary.

The popular excitement over this man's discoveries in Central America should be measured in comparison with the other great archaeological events of the time. The Elgin Marbles from the Acropolis had been acquired by the British Museum. The Venus de Milo had been discovered. And digging at Pompeii, Olympia, and Athens had awakened the interest of the world. John Lloyd Stephens was the first American to describe the ancient cities of the New World, and

his books were best sellers of the day, celebrated for their liveliness of style, their vigorous and dashing sketches of personal adventures, and rapid change of scene. Moreover, modern archaeological science can find little fault with his conclusions.

Glance at the yellowed pages of his *Incidents of Travel in Central America . . .* and you will seem to be reading the newest book about this part of the world. Little dictators stalk through the pages, the Nicaraguan Canal is at issue and there are signs of strained relations between the United States and Mexico.

From a Cholula vase



From a Costa Rican vase



of the Stephens Stones

By CARL C. DAUTERMAN

(Left) EXPLORER'S DRAWING of the famous ruins of Uxmal, Yucatan, where Stephens secured most of the famous sculptures. Stephens' book, from which this drawing by his friend Catherwood is taken, was a best seller in its day

(Right) MAYA HEAD-DRESS DESIGN: one of the sculptures which can now be seen in the American Museum of Natural History. Note the sketch of it decorating the plan opposite



AMNH Photo

Graduated from Harvard at 17 and from Law School at 19, it was, strangely enough, a throat ailment contracted in 1834 that turned the brilliant lawyer from Tammany Hall to a life of travel in hidden places. His first wanderings took him to the ruins of the Nile, the ancient city of Thebes, and the Holy Land, and gave him perspective for his Central American explorations.

Mystery surrounded his unsigned

writings. The AMERICAN MONTHLY MAGAZINE hinted that he was "a private gentleman, a member of the bar of New York," but rather than reveal his identity it gave the name the Bedouins had called him: Hadji Abdel Hasis. Quickly he established himself as a writer with a gift for describing the unusual, and became known as "The American Traveler." A by-product of his Egyptian travelogue was the famous Tombs Prison: the members of

the prison planning board in New York were so impressed with his portrayal of Egyptian architecture that they recommended a building on these lines. To some degree, the popularity of his writings was due to the fact that a man with serious interests could describe the purchase of the full costume of a Nubian lady "off the owner's back,"—a six-inch strip of leather cut in fringe.

Through the haze of long ago we see him turning his attention with rising energy toward the mysterious ruins of tropical America. He had had long talks in London with Fred-

(Below) MIDDLE AMERICAN DESIGNS: drawings by Constance Vaillant Tenney taken from pottery patterns, probably textile in origin

Casas Grandes, Chihuahua, Mex.



Costa Rican bowl design





MAYA—12th Century



CATHERWOOD—19th Century



JOHN HELD, JR.—20th Century

A MODERN NOTE is added to the strange story of the Stephens Sculptures by the visit of John Held, Jr., along the ancient trail of Stephens and Catherwood. Many years after the travels narrated in this article,

the well-known American artist was taken by these artistic treasures and made the right-hand sketch of this sculptured door jamb

erick Catherwood, artist and antiquarian. Should not the American Traveler write a first-hand account of these great American ruins? And why might not Frederick Catherwood be the ideal companion?

At that time, our government was interested in two Central American projects. In the first we see some of the roots of the Good Neighbor policy of today. The desire was to renew a treaty of peace, amity, and commerce with the Federation of Central America. This was intended to check British penetration. Washington had signed such a treaty; it needed only the signature of the Federation. This mission proved as difficult for John Lloyd Stephens the explorer as for the diplomatist, for as we shall see, he

had difficulty in finding the Federation. The second project concerned the feasibility of the proposed Nicaraguan canal as a financial and engineering venture. President Van Buren appointed Stephens as special agent for the two-fold mission. His official status left him free to travel regardless of the outcome.

Just one hundred years ago Stephens, accompanied by Catherwood, set sail from New York on a British brig. On the way to Guatemala City he detoured to Copan, the first of the buried cities on his itinerary. So little was known of this Honduran ruin that Stephens scarcely dared expect the wonders that were in store for him.

His first view of Copan was a wall of cut stone towering more than a

hundred feet above the shore of a river. Ascending this, he entered an acropolis of indistinct pyramids, courts, and stairways, heavily overgrown, which extended more than 600 feet along the stream. In the center of this wonderland he confronted a hulking figure of a man "solemn, stern, and well fitted to excite terror." The inscrutable stone face looked out from under a bizarre headdress of feathers which curved and cascaded over the shoulders. The back and sides retained the shape of a block, and were incised with curious characters which seemed to be a form of writing. Stephens wrote: "The sight of this unexpected monument put to rest at once and forever, in our minds, all uncertainty in regard to the character of

American antiquities, and gave us the assurance that the objects we were in search of were interesting, not only as the remains of an unknown people, but as works of art, proving . . . that the people who once occupied the Continent of America were not savages."

His enthusiasm increased, and the next day, groping through a forest so dense that he could not see more than ten yards at a time, he followed his Indians with joy as they brought to light an eye, an ear, a foot, or a hand of some sculptured piece. And when the machete rang against a chiseled stone, he pushed the men away and cleared out the loose dirt with his hands. The experience moved him to declare that, "The beauty of the sculpture, the solemn stillness of the woods, disturbed only by the scrambling of monkeys and chattering of parrots, the desolation of the city, and the mystery that hung over it, all created an interest higher, if possible, than I had ever felt among the ruins of the Old World."

It is not the lot of an archaeologist to be calm and serene while in the field; he fluctuates between the two extremes of elation and despair. So it was with Stephens. Bubbling over with enthusiasm after a brief inspection of the site, he reported to Catherwood that he had found more than 50 objects to be copied with the camera obscura. At that moment Catherwood was making a miserable failure of his first drawing for the expedition. He had set his instrument aside; his feet were buried in mud; he was wearing gloves as protection from the mosquitoes; and his discarded drawings littered the ground around him. The stone man had defied him. Here was a form of art utterly new to his experience, a florid, exotic, crowded style which he could not resolve into any intelligible pattern in the dimness of the forest.

Though in the face of these first

difficulties it seemed to Catherwood that his sketching was stopped before it started, his drawings became a valuable scientific collection. Strange to modern readers is the fact that the ruins of these self-same temples later drew the artistic talents of an artist whose work mirrors a side of modern American life which is as far from the ancient Mayas as one could well imagine. The reader may search perhaps in vain for the root of his distinctive art in the drawing accompanying this article made on the early trail of Frederick Catherwood by John Held Jr.

Stephens and Catherwood were worrying that all they might be able to take back with them was a mental picture of the magnificent things they had found, when the last straw fell. A native appeared with title papers to the land and said that no one could trespass without his permission.

Stephens' enterprising spirit soon restored their peace of mind. That night as he rolled up in his blanket he revealed to Catherwood his modest plan: he would buy Copan! He would remove the monuments to New York and establish a national museum of American antiquities. This might stimulate interest in other ruins and would show Europe that the place for ancient American art was in American museums. So, with visions of glory flitting before his eyes, he fell asleep.

Next morning things went more smoothly. Catherwood found the light on the carving just as he desired it. Stephens started negotiating for the purchase of the ruins, then resumed his explorations among the crumbling structures which he traced for more than two miles along the Copan river. One of his objects was to locate a building in which he and Catherwood could live. But there was not an intact roof at Copan, and he was obliged to be satisfied with sharing a native's corn-thatched hut during the nightly

storms when lightning flashed and thunder shook the earth.

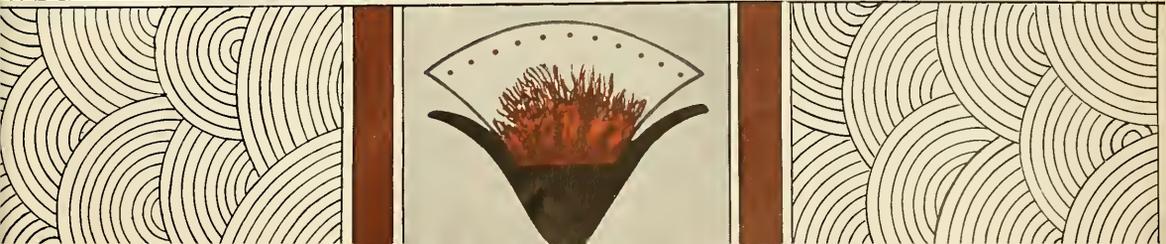
Enchanted by the heroic sculptures, The American Traveler accomplished a great deal during his short stay at Copan. Although not equipped to excavate, he explored the site with thoroughness, crystallizing all in an accurate map showing the relation of courts and pyramids to the fourteen carved monuments which gave such distinctive character to the place. He recorded with great care traces of color and the size of almost everything that caught his notice.

Everywhere his descriptions are brightened by little incidents which reveal that he did not succumb entirely to the lure of the past. For example, he tells of returning to his hut one evening to find a family who had trudged more than 30 miles to obtain the medical attention which they had heard the travelers would give; "I was attracted by the tone in which the mother spoke of the daughter, and for the first time noticed in the latter an extreme delicacy of figure and a pretty foot, with a neat shoe and clean stocking. She had a shawl drawn over her head, and on speaking to her she removed the shawl, and turned up a pair of the most dovelike eyes that mine ever met. She was the first of our patients in whom I took any interest, and I could not deny myself the physician's privilege of taking her hand in mine. While she thought we were consulting in regard to her malady, we were speaking of her interesting face; but the interest which we took in her was melancholy and painful, for we felt that she was a delicate flower, born to bloom but for a season, and, even at the moment of unfolding its beauties, doomed to die."

After a week of exploring and surveying, Stephens uncovered enough material to keep Catherwood busy for more than a month. He felt the need of pressing on to Guatemala City and

A Cholula design

Drawing by Constance Vaillant Tenney



arranged with the artist to meet him there. As he mounted his mule, his pocket bulged with a fifty-dollar lease on the defunct city of Copan.

While this was probably one of the cheapest prices ever put on a city the size of Copan, it served chiefly to let Catherwood work unmolested, for the stones that Stephens took out came chiefly from another site, Uxmal.

Conditions in Guatemala were not very favorable to Stephens. That state had withdrawn from the Federation to which his credentials were addressed and had fallen into the hands of an Indian bandit chief, Rafael Carrera. To make matters worse, news arrived that the Texans, with the support of the United States, were invading Mexico; Guatemala feared that it would be next to feel the pressure of the Colossus of the North. Naturally,

Stephens was under suspicion. The government which he sought had fled to El Salvador, and had placed a price upon Carrera's head. It was no easy matter for him to get a passport which would allow him to sail to this enemy country, but he managed it. In El Salvador he located the vice-president of the Federation of Central America, who was its only existing officer. But in view of the shattered condition of that government and the absence of a secretary of state he did not present his credentials, holding his homeland in too great regard to negotiate a treaty with such a will-o'-the-wisp.

His next destination was Costa Rica, the southernmost state of the uncertain Federation. There he had an interview with the self-appointed president and made preparations for an overland return to Guatemala.

This involved more than a thousand miles of travel, much of it through country with no accommodations for strangers and dangerous from the convulsions of civil war. But in his mind there was abundant compensation in the opportunity it would afford to explore the route of the much discussed Nicaraguan Canal.

He intended to study every foot of the way but contracted a fever at the outset which limited him to the sixteen-mile section between the Pacific Ocean and Lake Nicaragua. Nothing might have come of this experience had he not met soon afterward a British naval officer who showed him maps and drawings resulting from a two-year survey of the entire route, made for the Federation of Central America. He examined with great care the tedious listing of chains, elevations and velocities of flow, then ventured to estimate that for \$25,000,000 the two oceans could be united. His official report admitted that the country was too unsettled at that time to risk such an undertaking, but his imagination rose above the difficulties and he saw a vision of a direct water highway of nations across the Isthmus which "would make Patagonia become a land of fable and Cape Horn live only in the recollections of sailors and insurers." His notes for the day are a rhapsody on the potentialities in steam transportation for the betterment of man. Twelve years later he was to die from his devotion to that cause.

Back in Guatemala, Stephens rejoined Catherwood and prepared a report to the authorities at Washington explaining that after diligent search, the Federation could not be found.



AMNH Photo

Costa Rican pottery design

(Left) PROBABLY representing a Maya god, this carving was one of four heads decorating the quadrangle of the Nunnery at Uxmal. The face is sculptured to give the effect of turquoise mosaic

(Below) DRAWINGS OF MIDDLE AMERICAN DESIGNS by Constance Vaillant Tenney

A Cholula design



Dead cities were easier for him to find than living governments, and his next goal was the ancient city of Palenque, in Southern Mexico. Everyone advised him against going. An Indian revolt was feared, and there had been several attacks upon whites along the road to Mexico. But Stephens was not to be dissuaded. The original object of his expedition was to see these ruins. Fully aware that Palenque would have been easier to reach from New York than Guatemala City, he started out with Catherwood upon the arduous four weeks' journey, during which he visited and wrote the first descriptions of several lesser sites such as Santa Rosa Quiché and Tonala. He arrived in due course at the city of his desire: a cluster of about a dozen buildings occupying an area not larger than Battery Park, New York.

Perched on tumbling foothills and facing the Gulf of Mexico 90 miles away, the city called Palenque was perhaps the most incredible and mysterious of all the buried sites of Mexico and Central America. Here the departed architects had reached a peak in their development. Although ignorant of the true arch, they had managed to build high-roofed buildings with spacious rooms, colonnaded fronts and daring ornamental crests. They were undoubtedly the ablest modelers in stucco in the New World, and they lavished this form of decoration upon their buildings. Most important for the expedition were the great stone roofs, water-tight as the day they were built.

Stephens made his usual minute examination, noting that sculpture in the round was almost entirely lacking, while inscriptions like those at Copan existed in abundance. Notwithstanding all these features, the two travelers had a miserable month at Palenque. Every evening they were terrified by wild tropical storms. Ticks and mosquitoes made their nights unbearable. The excessive dampness spread a dis-

couraging growth of mold over their food and personal belongings. Worst of all, they were prevented from making any excavations of importance by the rains, the lack of tools, and the difficulty of procuring help from the Indians, who were busy planting corn. Nevertheless, Stephens was eminently pleased with all that he had seen of Palenque, and by the time he left he had some very definite opinions about the age and builders of that remarkable city.

It was from the last stop on his itinerary, Uxmal, in Yucatan, that Stephens collected most of the stones now in the American Museum. He had been invited to stop there by the owner of the site, an acquaintance with whom he had often dined at the Delmonico Restaurant in New York. After his strenuous journey through Central America, he reveled in the princely experience of traveling over miles of his host's estate in a litter borne by Indians. An enormous hacienda was placed at his disposal at the end of his trip. Here Catherwood rested, while Stephens sallied forth into the forest to inspect the ruins.

He suddenly emerged into a broad clearing studded with more than a dozen masonry mounds as large as natural hills and topped by limestone buildings in better condition than any he had seen. The whole area had been burned for the planting of corn, and there was nothing to obstruct the view. Every mound was as conspicuous as a volcano against the perfect flatness of the horizon.

A broad avenue separated the buildings into two groups. On one side stood a huge quadrangle and a steep pyramid supporting a narrow temple and a curious chamber which projected like a dormer window through the upper steps of a grand stairway. The most commanding building in the second group was known to the Indians as the Palace of the Governor. It rose 60 feet on a triple terrace 600 feet long at the

base. The building itself measured 320 feet along its façade. More than half its height was surfaced with an elaborate frieze of carved stones in several planes of relief, forming masks, frets, and lattices in a gigantic mosaic of 20,000 pieces. In one of the rooms Stephens found a wooden beam which had fallen out of its place over the door. He discovered with delight that it was carved with symbols like those of Copan and Palenque. Nearby was a stone death's head with an elaborate feather head-dress, which also had surmounted the doorway. He was assured that they could be sent to New York.

When Stephens described to Catherwood what he had seen he was accused of lying. The following day they went out together, and Catherwood confessed that it was even more wonderful than he had been told. But the



AMNH
Photo

From Costa Rica

(Above) ONCE an architectural decoration on a "governor's mansion": a human figure, battered and broken by time, which formed part of a facade at Uxmal



artist was in no condition for the huge job which it presented. Weakened by the strain at Palenque, he was so ill after his first day's work that Stephens became alarmed and made instant arrangements to hustle him out of the country. Thus on the 24th of June, 1840, after eight months and three weeks of exploring, the two sailed from Yucatan.

The lure of Uxmal was so great, and the sale of Stephens' book so good, that the travelers returned after a year to make a detailed study, using a daguerreotype camera. It was then that the majority of the stones which were to become celebrated as the Stephens Sculptures started their strange travels. The collection was painstakingly carried out of the jungle on the backs of natives. Particularly the valuable carved wood, vases, and idols had to be handled with great care. They made the trip successfully, but misfortune was in store for them after their arrival. Many perishable pieces were shown in a panoramic exhibit arranged by Catherwood in New York. This exhibit, which included other treasures from Egypt, was burned, and the only Central American objects that escaped were the now famous carvings which had not yet arrived by steamer. These were destined to serve as strange a use as any relics that were ever rescued from the jungle.

Mr. John Church Cruger of New York had an estate on Cruger's Island in the Hudson River near Barrytown, New York. Here in a glade he built an "ancient ruin," and here a scant 100 miles from New York City, the Stephens Stones took up their ancient vigil.

The greatest value of Stephens' work was his formulation of a point of view which contradicted the prevailing European ideas on the age and origin of the ruins which he had seen. The discoveries in Egypt, Greece, and Italy had created a fascinating field for speculation, and all sorts of imaginary relationships were hinted between the arts of the Old World and the New. Stephens took the stand that the ruins on this side of the Atlantic were of thoroughly American origin, independent of Old World influence.

Because there was "nothing in Europe like them," he dismissed any discussion of the Greek or Roman origin of these cities. He ruled out Chinese and Japanese influences because of the paucity of material available for comparison. As for the Asiatic Indians, he argued that they frequently cut their temples into the rock; while the Amer-

ican builders, who could have, did not. Furthermore, nothing like the distorted Hindu sculpture with its multiple heads and limbs existed in America. Egypt was the only other source left, and he proceeded to refute that. Taking pyramids as the strongest point of resemblance, he showed that in America they have no interior chambers, so were not used for burial; also that, being truncated, they are not complete pyramids at all, only lofty foundations for buildings. "The pyramidal form," he argued, "is one which suggests itself to human intelligence in every country. . . ."

On his way to Palenque an old priest had told Stephens that by adding ten days to his trip he could visit a high peak looking out upon the Gulf of Mexico, which would bring within view a large stone city where Indians lived in the same manner as before the discovery of America. The inhabitants allegedly spoke the Maya language and murdered every white man who attempted to enter their territory. Though Stephens did not find such a city, it is significant that he was willing to believe that one might exist containing Maya-speaking Indians who were the living custodians of the ancient culture. For he stoutly insisted that all he had seen was derived not from the Old World but from America "without models or masters, a distinct, separate, independent existence; like the plants and fruits of the soil, indigenous."

He was even more to the point in regard to the age of his ruined cities. Answering Dupaix, who argued that the figures in the courtyard at Palenque had been partially covered by the biblical flood, he showed that in the 30 years which elapsed since Dupaix cleared away the earth the accumulation had again reached its former level. He affirmed that if the figures were entirely buried, "one Irishman, with the national weapon that has done such service in our canals, would in three hours remove the whole antediluvian deposit."

Stephens believed that Copan was older than Palenque. As for Uxmal, the survival of wooden beams made him suspect that this was an existing and inhabited city at the time of the arrival of the Spaniards. He had studied the accounts of Herrera, Cortes, and Bernal Diaz, which told how the natives' temples were thrown down, their idols burned, their leaders enslaved, and "all the mementoes of their ancestors . . . made odious to their

eyes." He saw no reason why the cities he had visited could not have been at various times living parts of the same nation or civilization which the Spaniards found and destroyed: a florescence of the American Indian. It is to his credit that his century-old conclusions are still valid in the study of American archaeology. The eight ruined cities of which he wrote are now recognized as vestiges of a single culture, the Maya.

For twelve years after he brought these relics out of Yucatan, John Lloyd Stephens was active in public life and as a pioneer in the development of world transportation. When the discovery of gold in California necessitated a railroad across the Isthmus of Panama, he rose to his highest achievement. He organized the Panama Railroad Company and with J. L. Baldwin explored the entire route, discovering a pass only 300 feet above sea level which removed all fear of impassable grades.

He was made president of the company within a short time, but the man who had discovered lost cities was not one to sit behind a mahogany desk, and he spent several seasons at the Isthmus.

During one season he lived on an over-crowded boat where every night meant choosing between the mosquito-infested interior and the rain-swept deck. Quinine was not known as a specific for malaria, and he frequently battled fever while managing the work. America lost a prominent writer, builder, and pioneer in science when he died suddenly in New York on October 12, 1852.

Over half a century passed before the Stephens Sculptures left their weird setting on Cruger's Island. In 1919 Dr. Herbert J. Spinden negotiated with the daughters of John Cruger for their transfer to the American Museum of Natural History, where they are doubtless looked upon by more persons than ever they were since the many centuries ago when they were sacred to eyes of the Mayas.

Thus ends the story of the Stephens Sculptures. Their vicissitudes have been many. Though they are forever linked with the name of a man who lived his life for them, when you gaze at them you will know that they hold yet greater secrets of a forgotten race. Their handiwork speaks softly of ancient hopes and fears that may have been meant to last forever. And by its very strangeness the last chapter of their story seems to bring them to a fitting climax.

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DO NOT MISS

MEET MR. PORPOISE: once a land creature like ourselves, he still resembles us in many ways. Though normally friendly and playful, he experiences profound grief at the death of a loved one, shows extreme jealousy, and—he simply must have his sleep. See this illustrated article soon in *NATURAL HISTORY* Magazine.

Navajo legend told of a sacred cave—the **PLACE OF THE GODS**. A medicine man spoke of “buffalo tracks” in stone. And a vacation-bound doctor detoured into an adventure that carried him to the scene of ancient mysteries never before visited by anyone not of the Navajo tribe.

Anyone sharing the popular misconception that the Eskimo is “dumb” will find many quite surprising and thoroughly amusing incidents in Philip H. Godsell’s **THE ESKIMO IN LIGHTER VEIN**, which should force the most skeptical to eat his words.

In **CONFESSIONS OF A HUNTER**, Roy L. Abbott, whose warm understanding of animals is well known to readers of *NATURAL HISTORY*, will tell why you should know an animal before you raise your gun.

Despite the notorious **TRAP-DOOR SPIDER’S** gift for wily toils and stratagems, he has manufactured no defense against *Ocnaea smithi*, a tiny parasite which grows within his anatomy. *Ocnaea’s* amazing career in the spider’s body and out, will soon appear in *NATURAL HISTORY* in a dramatic photo series by George Elwood Jenks.

A forthcoming issue of *NATURAL HISTORY* will reveal how the **VENUS’-FLYTRAP** plant, one of the great wonders of the botanical world, lures flies and other insects to their death. Equipped with “trigger-like” bait, the trap closes its spiked jaws on the victim within one-thousandth of a second—and digests it!

The story of **THE TIGER OF JAVA HEAD** will be told by William Lord Smith. The animal was bigger than those on the mainland, they said, and fiercer. His capture came only after a long campaign planned in an isolated hut in the steaming tropical wilderness.

PHOTOGRAPHIC FEATURES

The amazing **FUNNEL-WEB SPIDER**: another Lee Passmore picture biography soon to appear in *NATURAL HISTORY*.

REARING A FAMILY OF THIEVES—extraordinary close-ups of magpie life from the first moment through the first month.

TRAIL SIGNS OF THE AMERICAN INDIAN. The signs are not only still with us, but growing bigger all the time!

The lordly **SPOONBILL**, a sensitive bird, is rigidly protected even from photographers. But the Audubon Society made an exception to allow Karl Maslowski to film the exclusive story of a rare creature.

☆ ☆ ☆

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A WINTER IN REMOTE
BURMA

Continued from page 276

had felt before, the rumbling was louder, and dead limbs would be broken from the trees. Our tents were pitched on a soft meadow sod and our cots would buck and shudder as if in the grip of a strong hand. The quakes were of brief duration, as a rule, but there might be several in sequence, and one always had the feeling that something worse was just on the verge of happening.

Our visit to Burma was timed to avoid

the unpleasant features of the rainy season, wet camps, leeches, sand flies, *et cetera*, and we concluded our work in April just as these were due. The material results were some one thousand specimens of mammals, fifteen hundred birds and two thousand five hundred of plants. But in addition to these we brought back many pleasant recollections of splendid mountain ranges, magnificent forests, beautiful flowers, and picturesque, interesting, likable native peoples. It was one of the rare spots on the earth which did not know a war was pending.

INFORMATION TEST

A few informational high spots that may be gleaned from this month's NATURAL HISTORY

Score 5 points for each correct answer. Correct answers on page 316

1. The phrase "by the candle" suggests
(a) Witchcraft
(b) Blasphemy
(c) Auctioning

2. A toad may be said to "swallow with his eyes."
True..... False.....

3. The culture of Central America is
(a) Chinese
(b) 100% American
(c) Egyptian

4. An orchid provides what common flavoring found at any soda fountain?

5. The habit of drinking coffee originated in
(a) Java
(b) Arabia
(c) Brazil

6. When frightened, toads excrete a protective substance which causes warts.
True..... False.....

7. The giant Watussis in Africa are descended, according to legend, from
(a) The ancient Egyptians
(b) A detachment of crusaders
(c) Early Arabian coffee merchants

8. Man is one of the few creatures who never eats his food alive.
True..... False.....

9. Alcoholic beverages are prohibited to what group of 209 million people?

10. Is it possible to get a photograph of the moon during its total eclipse?

11. In the future it is possible that everyone will drink only the choicest grades of coffee because
(a) The inferior grades are distinctly harmful

- (b) Using soil-less culture, the best coffee can be raised in one's own cellar

- (c) The poorer grades will be used for manufacturing plastics

12. The ruins of an ancient Mayan city were once situated on an island in the Hudson River.
True..... False.....

13. The unofficial high-jumping champions of the world are
(a) The Lisus of Burma
(b) A team of exiled German athletes
(c) The Watussi of Africa

14. The Stephens Stones are
(a) Recently discovered diamond-like gems
(b) Ancient Mayan sculptures
(c) Dinosaur-shaped granite, the basis of last year's fossil hoax

15. What is the caffeine beverage drunk by several million South Americans and comparatively unknown in this country?

16. Of what use are the wooden clappers hung on strings across Burmese fields?

17. Who is probably the world's tallest king?

18. Which of the following creatures breathes with its skin as well as its lungs?
(a) The beaver
(b) The dog
(c) The toad

19. Coffee makes a man a better chess player.
True..... False.....

20. Tea contains more caffeine than coffee.
True..... False.....

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RECEPTION IN

A veteran globe-trotter's account of his visit to Africa's modern country of giants, where King Rudahigwa, "the Reformer," stages a royal welcome including record-breaking high-jumps and a thrilling savage dance festival

(Below) SOARING well above the head of the author, who stands 5 feet 10 $\frac{3}{4}$ inches, this Watussi nobleman unknowingly puts Olympic high-jumpers to shame. While the author stood his ground, one after another of these tall natives demonstrated that they could top the official world's record of 6 feet 9 $\frac{3}{4}$ inches with plenty to spare

EVERY traveler in Uganda has heard of the unique and attractive Hotel Kiwali, built by an enterprising Englishman and his wife on the top of a hill near Masaka. It commands a magnificent view of the surrounding region as far as Lake Victoria to the east, and if one could forget the strange country through which one must pass to reach it, one might well imagine it to be a corner of England.

Tea is served on enchanting lawns bordered by flowers. The putting greens and tennis courts are protected from high winds by trimmed hedges. The pleasantly decorated rooms are filled with comfortable English furniture and are gay with bright chintzes. Everything is immaculate and has been done with taste and a feeling for real comfort. There are even tame martins nesting under the eaves; but instead of singing robins and sparrows, one sees chattering weaver birds, green doves and impudent, elegant wagtails. These tropical birds failed to break



RUANDA

By MARTIN BIRNBAUM



MEN, NOT WOMEN are the coiffure addicts among the Watussi. Vain of their headdress, they spend many hours in the "beauty parlor" to achieve a design that adds to their already impressive height. Note how closely the faces resemble the sculptured pharaohs carved in ancient Egyptian monuments, from whom they may be descended

the English spell, but the tropical storm in which we were hurriedly obliged to leave Uganda for the native kingdom of Ruanda, certainly did.

This was no rainfall. It was a deluge—a solid wall of water reaching to the sky, lit up by continual lightning flashes. The noise of hissing waters was drowned by such cracking thunder that we thought the hill would be rent in pieces. No one could be heard in the tumult, and we doubted the wisdom of leaving the hotel, for the valley below would surely be flooded. When there was a lull in the fierce, beating rain, the heat of the rising sun raised clouds of mist through which we caught glimpses of antelope and small zebra herds staring at us in surprise from the meadow and looking for all the world like Japanese wood blocks with shadowy borders. A sweet musty smell rose from the steaming earth, and the road ahead looked new and smooth.

Suddenly we skidded and down went our overloaded car through the treacherous soft mud into a deep ditch. All our efforts to budge it were fruitless,

although we removed all our luggage and packing cases to lighten the car's weight. The tempest had transformed the road into a pool of red slush into which one would sink knee-deep. Our hope of reaching Ruanda that day vanished like the rising mist, but just when we began to despair, a safari of some 60 half-naked Bantu negroes came marching along, each man with his few belongings on his head. They were on their way to seek work in Uganda. Upon seeing our plight, they stopped and in a short time they had gathered bunches of grass from the roadside to pile under the wheels to prevent slipping. Fortunately we lost only a little more than an hour and Paul, our skillful Azande negro chauffeur, was again speeding through the valley of the Kagera River, which empties into Lake Victoria, one of the sources of the Nile.

The mimosa and euphorbia gave way to treeless, grass-covered hills where long-horned Ankole herds were grazing. Birds were plentiful: partridges, shrikes, hawks, and brilliant plantain eaters. The placid waters of Lake Mohasi reflected the setting

sun, and we saw many aquatic birds before our climb over a dangerous, narrow, serpentine road brought us to the Plateau Hotel.

It was almost as beautifully situated as the Kiwali, but there the comparison ended. We were not expected, and I slept uncomfortably in the car, preferring it to the room allotted to me. As usual my discomforts were forgotten when we reached Astrida (named after the ill-fated Belgian Queen). The polite Belgian administrator of the district announced that the native ruler of this Belgian protectorate would receive us in the neighboring town of Nyanza. Astrida itself was remarkable for its magnificent missions, schools and churches, in some cases built by a single missionary aided by his pupils. The surrounding highlands offer fine vistas of undulating hilltops, capped by fleecy clouds. Thousands of

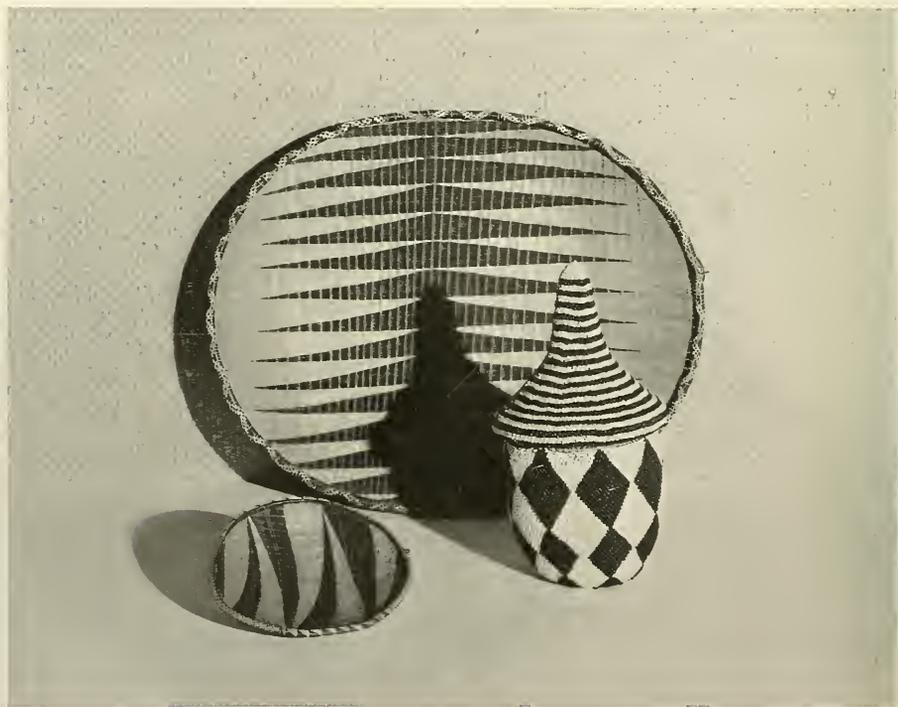
eucalyptus, mimosa and other trees have been planted by the Belgians, in an attempt to influence the rainfall, and the roads are, therefore, pleasantly shaded.

Nyanza, the scene of our reception, was only a few kilometers distant, and when we reached it, we felt more or less like the Lilliputians in *Gulliver's Travels* when they first saw the hero who seemed so gigantic to them. For here we were presented to a king well over seven feet tall and all his grave, courteous statesmen who stood around him were at least six and a half feet tall. Some of them had short beards, and the cast of their countenances was decidedly Semitic. They were called Watussi, or Mutudzi, the word being spelled differently by almost every traveler.

Rudahigwa, the young ruler, is one of the tallest men in his realm, and the surprising way in which

(Below) THESE WOVEN VESSELS are unique and unexcelled examples of native art. They are greatly prized and guarded by the royal family, who refuse to sell them. The author, however, managed to secure

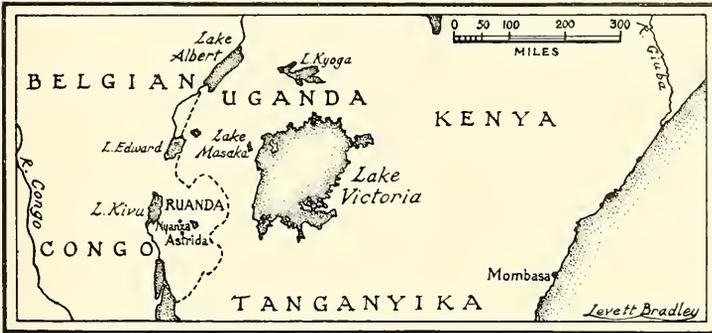
a fine collection for The American Museum through an exchange of gifts with his royal host. His own present was a valuable ring of 5th century B.C. Grecian origin



he and the other Watussi aristocrats dress their hair, adds to their incredible stature. The outstanding thick tufts have a quality like the Fiji Islanders', but they are built up into curving, crested puffs and divided into deep ridges by curious diagonal partings. It takes many hours to arrange a coiffure. Only the vain, handsome males take such trouble and pride in

enemies to be savagely tortured in her presence while she was enjoying her breakfast.

The present king, Mutara Rudahigwa, which means "Rudahigwa the Reformer," seems a very gentle ruler indeed. He speaks and writes good French, drives his own car, and has introduced many radical European ideas into his kingdom. He is under



The giant Watussis, whom tradition links with the ancient Egyptians, inhabit the region of Ruanda, near the headwaters of the Nile

their hairdressing. Most of the ladies have very little hair to dress, for their skulls are almost always closely cropped. Now and then one sees a noble lady, reclining like a modern Cleopatra, on a covered litter which is carried along the road by a group of negro retainers or dependents. And sometimes at great functions or dances, a few slender, willowy princesses appear, their short hair decorated with curious long ornaments suggesting a bird of paradise; but one might stay in Ruanda for weeks and never see a Watussi maid, unless fortunate enough to arrive on a festive occasion. My only excuse for speaking authoritatively about their hairdressing fashions is the fact that I had the honor of meeting the young queen, Nyiramasuka, whose hair couldn't well be any shorter and she undoubtedly sets the fashion for all the closely guarded ladies of Ruanda. I only regret that the meeting took place in a modern brick "palace" instead of the king's native compound under a round conical thatched roof.

The feature of the reception room was the fireplace which was decorated with reliefs of crested cranes, these graceful, native birds being the royal emblem. I was even permitted to fondle the tiny royal Princess Elizabeth, the queen's only child. It was a relief to find Her Highness such a gracious sweet-tempered lady, for I had heard on good authority that the king's grandmother, his deposed and banished father's mother, was a cruel, domineering woman who would without hesitation order her

the protection of Belgium, and when I paid my visit he was preparing to become a Christian. For that reason he had only one wife, but even so, he was having his troubles. His tall Watussi ministers are often polygamous; and because the queen has not given the king a son, they claim the ancient right to insist on a royal divorce. No Christian ruler, of course, could secure a divorce on such grounds alone, and so the missionaries are hoping that a prince may soon be born to settle the question of a permanent Christian union. The king's marriage with the present queen would then be religiously sealed, he could be safely received into the Christian Church, and all parties would be satisfied.

Ruanda is not a nudist colony, like the innocent Cameroons where one can still see men and women without even a fig leaf on. The Watussi are resplendent in long, gracefully draped togas of gleaming white silk, on which here and there a huge crimson blossom or a circular, geometrical design in vivid green or black and orange, is artistically stamped.

The question of the origin of this strange race has not been conclusively settled, but the legends, as handed down, are probably correct. According to tradition, many generations ago, Egyptian tribes wandered south with their flocks to the plateaus beyond the sources of the Nile, conquered the negro tribes living about two degrees south of the equator, and adopted the language of the subjugated blacks without intermarrying with them. In Ruanda one



(Above) BUTARE, giant Watussi dance-leader of the pygmies and son of a royal minister, twirls his neck like a pinwheel while his retinue cavorts in the rear. Gorgeously arrayed, with white monkey-fur headdresses, they disported themselves handsomely in honor of the author's visit. The pygmies are not slaves of the Watussi, but a caste of "migratory workers." Economically they are strictly hunters living in the jungle, whence they are free to trade their game wherever it will bring the best return. Under this arrangement they accept a low but not dishonorable position in the fairly rigid Watussi caste system



(Left) SEVEN FEET PLUS and every inch a king: Mutara Rudahigwa holding the infant princess whose name, Elizabeth, is significant of the many European changes which have earned this monarch the title "the Reformer." In family affairs also, his predicament parallels that of some Western royalty. Though monogamous himself and shortly to become a Christian, his ministers are often many-wived. They claim the ancient right to require him to divorce the queen unless she bears a son. Rudahigwa speaks and writes French. His country is a Belgian protectorate



(Above) PYGMIES DANCING. They are excellent entertainers, gyrating, shooting out their arms, and stamp-

ing with such fierce energy to the savage music that a huge cloud of dust rises over the field



(Left) A PYGMY "CHEER-LEADER." His function is to encourage his compatriots to an ever more frenzied performance of their art



(Right) NATIVE MUSIC-MAKERS whose barbaric chants and throbbing drums were supported by blasts on curving oxen horns, which are gaily decorated with red and white tassels

RECEPTION IN RUANDA



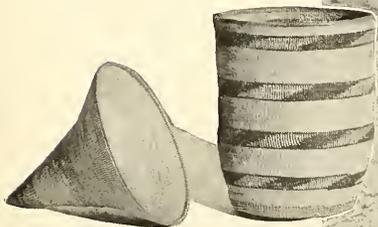
(Above) A SWEEPING panorama of Belgian Africa, which the author traversed to reach Ruanda



(Left and below) WATUSSI NOBLEMEN resplendent in their long, graceful togas of gleaming white silk. These garments are artistically stamped with huge crimson blossoms or geometrical figures of vivid green, orange and black



(Right) A PARTY of natives encountered by the author during his travels through the country of the Watussi. Note the woven box and cover held in the girl's hand. These articles are extremely rare and the author counts himself fortunate to have brought back a representative collection, secured from the king's own collection



(Above) A CLOSE-UP of a Watussi box. It was beautifully woven of colored vegetable fibre by the queen and her ladies-in-waiting. Note other examples of this fine workmanship illustrated on page 300



(Above) JAVELIN THROWING was also featured in the royal entertainment. Here, too, the Watussi excel, adding further speculation as to the results of sending a Ruanda team to the Olympic Games. Used to awkward clothing, their performance under proper training might be even more spectacular



can see today living images of the ancient Egyptian pharaohs, closely resembling the mummies preserved in the Cairo Museum.

The ancient immigrants brought their great horned oxen south with them, and they were undoubtedly the same breed which were so exquisitely carved in low relief on the stone walls of the tombs in the Valley of the Kings near Luxor. The present living herds are as amazing as their tall owners or caretakers. No animals in the world today can compete with them in the length of their horns, which often total twelve feet along the curve. In Ruanda there are about 10,000 of these superb cattle. All are sacred and belong to the king, and they are never sold or killed. Ordinary Ankole cattle are not even permitted to graze on the sacred meadows preserved for them. The whole country is, so to speak, cattle-minded, and the Watussi sportsmen spend their spare time talking about the points and pedigrees of a beautiful cow, just as we discuss the winner of the Kentucky Derby. When King Rudahigwa wants to honor one of his noblemen, or more rarely, some negro subject who has rendered the country some distinguished service, he does not pin a jewelled order on the man's chest and dub him knight, but he entrusts a sacred cow to the honored man's loving care. On a feast day when their gigantic horns and necks are garlanded with festoons of flowers, the sleek royal herd is a sight worth going many miles to see.

Even such sights do not begin to exhaust the marvels of Ruanda. One cannot claim to know the secrets of the private lives of the people, for they are proud aristocrats who keep you at a respectful distance; but their giant ruler, Rudahigwa, is as hospitable in a royal way as he is tall, and when he prepares a princely reception, it is an unforgettable experience.

Giants and pygmies

A caste system exists among the Watussi reminding one of India, although it is not as rigid. At the top of the social ladder are, of course, the Watussi ruling classes. Then come the descendants of the conquered negroes, who often try to look like Watussi and sometimes show unmistakable signs of Watussi blood in their veins. Finally, on the lowest scale of the social ladder, are the fascinating pygmies, a totally different and distinct race, ranging from four to four and a half feet in height. They are wonderful hunters, and catch game for their overlords, and dance and act to entertain them.

Some travelers have said that these pygmies are slaves of the negroes, but that is not quite true. They are very primitive, wandering forest folk who never settle down to cultivate the soil, and make hardly

anything but poisoned wooden arrows and a rude bark or tappa cloth; their women build temporary hemispherical shelters of bent twigs covered with phrynium leaves. They usually attach themselves to a negro chief and his tribe, in order to exchange their game for salt, tobacco, metal arrowheads, or cultivated vegetables. If they are not satisfied with the treatment they receive, they simply disappear into the jungle and in due course begin to work for some other tribal chieftain. In Rudahigwa's domain, many of the pygmies were dancers and their antics in the war games were very strange and exciting. They were divided into little groups depending on the colors of their ornaments, and their leader was a colossal seven-foot Watussi youth, named Butare, who was the son of a royal minister. His height was increased by a headdress of white monkey fur, and the same fur was used by the little dancers on their wrists and around their waists. The whole troupe wore leather bracelets and anklets, to which many crude jingling metal bells were attached. Each of their muscles was trained to move independently of all others, and their necks—especially the tall leader's—could twirl like a swift pinwheel between the shoulders while they made strange gyrations and contortions, shot out their arms, and stamped with such fierce energy that a huge cloud of dust arose from the dancing field. Often their movements were wildly applauded and were accompanied in their frenzy by musicians chanting loudly, beating long hand drums, or tooting with barbarous rhythm on oxen horns decorated with red and white tassels. There was one functionary whose duty it was to encourage the dancers to more and more violent efforts. The interest never lagged for an instant, and the scene presented a picture of African savagery which took one's breath away. But during the short rest intervals their gleaming eyes and dazzling teeth would grin good-naturedly at us. Obviously they were pleased and satisfied with our astonishment.

Spectacular high-jumpers

When the dancing was over, the tall young Watussi bucks showed their skill as short distance runners, or with javelin hurling, or shooting with bows and arrows; and as a fitting climax Rudahigwa would call upon his young warriors to honor us with their special greeting. They were standing at a distance of about 40 feet from me, and one after another they ran swiftly forward, in spite of their long robes, and leaped high over me, although I stood erect with my big sun helmet on. It was always a high jump of between seven and eight feet, as the camera snapshots can prove. This means simply that in Ruanda, there are a number of young men, any one of whom

can beat the all-time official world record of six feet nine and three-quarters inches, which is several inches higher than the Olympic record. It is true that their style and technique differ from ours. They make a small hard mound two or three inches high to mark the point from which they leap swiftly into the air and over you. When they reach the highest point, their long bodies, legs and arms, are outstretched horizontally almost parallel to the ground where they land gracefully on their feet. Even subtracting the take-off mound, which they say is only to stop them at the jump, the Watussis could exceed the established records. What a sensation they would make at the Olympic Games if King Rudahigwa and a few of his champion athletes could be persuaded to come to Europe and compete!

Rudahigwa's hospitality did not end with these games and dances, for he even showered gifts on our party, in the shape of curious boxes with conical covers, and platters beautifully woven of colored

vegetable fibre by the queen and her ladies in waiting. For quality, these examples of exquisite craftsmanship can rank with the fine mats of the Polynesians. When I praised them and asked Rudahigwa if I could purchase any from native merchants, the king, like a polite Spanish grandee, informed me that they could not be bought but he would be pleased to present them to me. His embarrassing gesture was at first reluctantly refused by me but I finally retaliated by offering him my Greek ring in friendly exchange. It was set with an ancient Athenian coin showing an archaic head of the Goddess of Wisdom, on one side and the emblematic owl on the reverse, and Rudahigwa had shown marked interest in it. The ring fitted his long slender finger exactly and he accepted it with obvious pleasure. The specimens of Ruanda weaving which I took away from his palace are now in the American Museum of Natural History and will always remind me of this memorable reception in Ruanda.

REMEMBER

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FOOD THE WORLD OVER

By D. R. BARTON
Illustrated by IRWIN WEILL



THERE was a very bold boy named Walter in our class at school. The teachers all said he was a devil. The girls said about the same thing and, I feel sure, Walter liked this reputation. At any rate, he did everything he could to keep it.

Walter was the sort of person one can start off on a train of action knowing he will exhaust all its possibilities, or at least most of them. We discovered this shortly after daring him to eat a piece of chalk. He would always take a dare and he took this one as eagerly as any other, with the result that he began a dreadful career of dietary exhibitionism.

Next to chalk, Walter seemed to like flies best. And he drank ink. Not much of course. Just enough to give a rich blueberry pie look to his mouth when he gaped, which was something he liked to do, unexpectedly, at the girls. I don't think he cared much for the ink. But he insisted the flies tasted like bananas. He often caught, trimmed and devoured upward of three a day in season. It seemed reasonable to us that Walter would die of them, not because of germs, which were little more than a name to us, but simply of flies. We watched him for symptoms. But he always remained his exuberant self, and the last time I ever saw Walter, he was engaged in, and winning, a fist fight.

What finally happened about the flies concerns a little girl in the class, whose name I don't remember. Most of the girls simply squealed when Walter started off on a chalk-ink-fly meal in their presence. But this particular little girl got an intense reaction of some sort which brought on a low, mournful screaming—I can still hear it—and, if Walter persisted, ill-

BAMBOO WINE
CHINOIS

KOUMIS A LA
TARTARE '00
(Fermented
Mare's Milk)

PALM WINE
POLYNÉSIE

RICE WINE
JAPONAIS
(served warm)

MENU Of the World

PUNCH
*Rumfustian Colonial Style**
(Contains ½ pt. gin, 1 qt. beer, 1 bot. sherry, 1 doz. egg yokes, sugar, nutmeg)
Canapés Australiens et Chinois
(Roast spiders, salted earthworms, toasted water beetles)

POTAGES
Bird's Nest Soup Chinois

POISSON
Putrefying salmon Eskimo

ENTREES
Broiled Monkeys Sudanese aux jambes croissées on toast
Hippopotamus Steak *Boiled Alligator*

LEGUMES
Mashed Acorns *Boiled Tiger Lily Bulbs*
(Grated Yam, taro, curdled coconut milk, baked in leaves)
Combinaison Milanésienne

ENTREMETS
Fried Tadpoles Japonais *Chopped Bear Paws*
Roast Parrot au Mexique *Chinois*
Stewed Iguana Sudanese *Broiled Elephant's Hoof*
Baked Snake Australien *Livingston ***

SALADE
Chopped Wild Clover and Nettle Leaves—
Candlefish Oil Dressing

DESSERT
Dried Locust *Petits Fours de*
Crushed caterpillar *Watermelon and sunflower seeds*
Demi tasse de Maté *Smoked Sea-Worms*
Metheglin Cordial (fermented honey)

*A great favorite among our hardy colonial forefathers.
**The famous African explorer-missionary, David Livingston, found them delicious.

ness. The latter was Walter's undoing. The teacher found out about his digestive experiments and was horrified. She marched Walter to the Principal and he was horrified. The Principal called in Walter's parents and they were horrified. As nearly as I can recall, the germ part was the least of it. They converged on him with all manner of dark prophecies and recrimina-

tions. In the end, I think even Walter was a little horrified.

Looking back on this episode, it seems to point some sort of moral. Actually all Walter had eaten was a little calcium (the chalk), in a form not greatly different from those tablets prescribed for expectant mothers and rickety children. Ink in the amounts Walter drank probably contained no more tannin than a strong cup of tea.

There was also, it is true, some ferrous sulphate, and therefore, the potion should not have been taken except under a physician's direction.* As to flies, he should have cooked them. They do carry typhus, T. B. and other bacteria. But *per se*, flies are a fair source

clude all the forebears within his memory among those invited. We can't see these ancestral guests, but we do notice something a little queer going on as the meal gets under way. When Yasha dropped the half-gnawed mutton chop we overlooked it as an accident.

shores. In the flickering light they seem actors in a huge natural shadow play as they reap a great harvest of these annelids. When caught, the worms are dried, smoked over a fire and strung up like sausages prior to their consumption as relishes. Yams are



Man has eaten the earth itself and nearly everything that grows, runs, crawls or flies above it. Yet he seeks more than mere nourishment: for the earliest cave drawing and the latest advertising poster spell the same word—magic



of protein. The fact is, that although Walter didn't need to resort to such sources of nourishment, he had an excellent psychological conditioning to survive under adverse circumstances. Far better than the squeamish little girl. From this standpoint the dressing-down he received from his immediate superiors was, like most tirades based on emotional outrage, ill-advised. But there is no gainsaying that any lusty juvenile who chooses to emulate Walter's dietary stunts in our particular culture will surely invite the same outraged retaliation. We are highly prejudiced in this respect, and by way of reviewing Walter's case in a more impartial light, we might do well to drop in on a number of people who live rather differently from ourselves.

To accomplish these widely scattered visits as conveniently and comfortably as possible, suppose we draw our chairs around the rotating globe in the library. For our purposes, this will have to be not exactly a globe, nor quite a seer's crystal, but something in between the two, since most of the things we shall see happened a varyingly long while ago.

At this particular moment in history we are probably keeping an eye on the Balkans anyway, so let's begin with a remote Slavic village on that peninsula, which is separated by several generations from the present "spheres of influence."

Entering this village we look in at the lowly dwelling of one Yasha who is enjoying Christmas dinner with his family. Christianity has not penetrated unscathed in Yasha's country and he has been careful, we are told, to in-

clude all the forebears within his memory among those invited. We can't see these ancestral guests, but we do notice something a little queer going on as the meal gets under way. When Yasha dropped the half-gnawed mutton chop we overlooked it as an accident.

But there goes a dish of barley. Mrs. Yasha stoops to strew a few plums under the table and Yasha Junior solemnly spills a generous dram of wine which drains away into the earth floor. This scene tells us a little something about the variability of table manners. And it certainly tells a good deal about *Homo sapiens*. The proper study of mankind may be man. But a naturalist who specializes in nocturnal field mice is apt to learn considerable about owls, and by the same token an examination of the things we eat and the ways we eat them, should give us an unusual and illuminating method of introspection. Such an examination is, however, a large order. We bring with us an astonishing array of equipment every time we sit down to table—the molars of a plant eater, a rodent's incisors, canines for meat rendering, an alimentary system equipped with a remarkably complete battery of chemical solvents and designed to accommodate and properly eliminate a tremendous variety of intake. These internal adaptations open up a range of food possibilities attainable by no other creature. Worms may eat men as well as earth. But we can subsist on all three *if* we have a mind to. The mental attitude is very important.

Speaking of worms, most of us will recall the giggling that spread throughout the class in European history at first mention of the august Diet of Worms. If we really want to see that standard school boy pun come to life all we need do is give our clairvoyant globe a spin and we have left the Balkans for the South Seas. Here the seaworm (*palolo viridis*) is emerging in great numbers from underwater coral crevices to breed its kind. The islanders, torches in hand, swarm about the

the almost exclusive staple hereabouts, and the natives so appreciate this "worm sauce" that they have built numerous religious ceremonies to celebrate the "worm harvest." The rites often have to do with male puberty, doubtless suggested by the phallic character of the worm at the time of propagation.

While our globe is turned to the Pacific, we might glance in at a Filipino house boy who is stewing up an odd, garlic-flavored mash for himself and his brother servants. The mash was made entirely of beetles, which the house boy caught while they fluttered about the street lamps of modern Manila. This house boy speaks, reads, and writes English, can do simple sums, and is expert at cooking a fine American dinner, but such superficial varnish has not obliterated his native preferences in food.

For a real taste of strange comestibles there is no more fruitful spot than the African jungle. To allay hunger some natives there have been known to eat as much as two pounds of soap-stone clay. And the Bushman will devour almost anything that runs, flies, creeps, or crawls—others, anything that grows except full-sized trees and plain poison. But a hurried call in Ceylon convinces us that Man can also eat trees. In small pieces, of course, and thoroughly rotten. The Vedda add honey for flavoring, which apparently makes it a palatable *Ersatz* dish during hard times. Thus wood, ants, snakes, bugs and whole live baby field mice are all grist to man's marvelously adaptable mill.

Meanwhile, revolving back to our own hemisphere we find Man coming perilously close to a diet of even poison. Focusing on a village of the Boro tribe in the Upper Amazon, we observe a

* Proper quantities of both tannin and ferrous sulphate, the principal ingredients of most ink, have been medicinally prescribed.

housewife operating what amounts to a crude orange-squeezer with a seven-foot lever. It is late afternoon, and preparing dinner appears to be quite an athletic undertaking. The housewife repeatedly bounces her full weight on the free end of the lever. With each bounce a splatter of juice runs down into a drip pan. But in this case it is the "rind" that is kept, the juice thrown away. And with good reason for the juice of the manioc or tapioca plant is largely prussic acid, that indispensable ingredient of so many American murder stories. Since her family subsists very largely on manioc, we can expect fastidious care in its preparation, and we see that after a final bounce the housewife squats on the ground to pound the pulp into a cake flour. This in turn is boiled to drive off as much lingering poison as possible, but their hardy systems will have to withstand any chemical traces that remain. The leaves of the manioc are eaten from a pot where they have been mixed with any available fish, worms, and insects. In fact, there is no formal meal till sundown although the family pot simmers all the day long. From its contents the Boros nibble haphazardly, endeavoring to maintain a "balanced budget" by tossing in as many sundry items picked up along the way as they remove for their periodic snacks. These items incidentally, include wood-grubs and animal offal. A hard life? Perhaps. But among the neighboring Guato Indians the words for head-louse and honey are identical, which would seem to indicate a tolerable contentment. Then, from time to time, we may observe the Boro shaking a bit of powder into his mouth from a bark pouch. This powder consists of pulverized cocoa leaves mixed with clay-dust and is the Boro's "pause that refreshes," since it yields a fair dose of cocaine. Generations of use are said to have so adjusted the Boro to this drug that given sufficient quantity, he can go several days without food, sleep or drink.

In the course of a quick trip northward into primitive America, we glimpse a number of quaint delicacies at various tables. It has been a hard season and the Apaches are going in for rats, frogs and lizards. Further along we note that the Ceris are fond of the prickly pear—so fond, in fact, that they seek the undigested seeds in their own excrement to plant next year's crop. The Navajos dote on sunflower seeds, while more easterly tribes specialize in cakes of tree bark. Lower Californians eat rats and snakes. And

in the San Jacinto Valley, acorns are a favorite. The Kwakwilt Indians of British Columbia make a kind of salad of seaweed dressed with candlefish oil. And they love wild clover; each housewife fences in a patch as her "vegetable garden."

Reaching the far north, we find Man partial to the half-digested contents of reindeer stomachs and even their dung. Also we discover that the Eskimo has an excellent appetite. While he is stretched out openmouthed on his bed-platform, his wife pops in toothsome gobs of raw meat in staggering quantity. If we stay long enough, we shall see him lose all desire to carry on "table" conversation, or even move.

It would be interesting to pit him against some of our Northwest Indians in an eating contest. Fourteen pounds of cold raw salmon are reported as a mere mid-day snack for them. Whisking across the Bering Straits we discover that northern Asia boasts some hearty eaters of its own. Frozen horse-meat is a staple of many Tartar tribes, wherein twenty pounds of it at one sitting is reputed to be not at all beyond the capacity of a single individual. Fortunately theirs is a simple economy. No one need worry about the butcher's bill.

After a passing glance at these alimentary feats we must surely feel a new respect for our race. The feats were largely accomplished, remember, without recourse to alkalizers, liver pills, or any of a hundred other forms of digestive life-belts that are flung to us in this soft and hypochondriacal age. My school friend Walter drank a modicum of ferrous sulphate, but countless Boro youths have probably tossed off in comparable quantities and with impunity, compounds of cyanide and cocaine. Walter ate bits of relatively clean white chalk, but many a pregnant primitive has stuffed down handfuls of black loam. As to the insects, we have seen how rapturously they are consumed in many parts of the world. Nor can it be explained away on racial lines. Science has discovered little difference in the digestive capacities of the different races, and the most recent investigations indicate that men can be healthy on almost any assimilable substance in which a sufficiency of the basic food values occurs; that is, an all meat, all vegetable, or mixed diet.*

*Readers interested in such investigations are referred to a series of articles, "Adventures in Diet" by Vilhjalmur Stefansson, which appeared in *Harper's Magazine*, November, December 1935, and January 1936.

It seems clear, then, that Walter's complete faith in the rugged qualities of his digestive system are fully justified. "The human body," Doctor Stefansson has said, "is a sounder and more competent job than we usually give it credit for." No doubt Walter's parents and pedagogues had his best interests at heart when they impressed upon him the error of his way. But the error was psychological rather than physiological. Though his innards might well have remained intact, persistence in his dietary experiments would certainly have resulted in social difficulties. The squeamish little girl is an obvious case in point, and there could be no better description of her ailment than "cultural nausea." Despite our penchant for French restaurants with their frog-legs and snails, we may think we couldn't "stomach" any of the things we've seen on our flying world tour. But the fault would be, to paraphrase the Bard, not in our stomachs but in our minds. We might finally force them down and still experience nausea. But this, too, would be a "cultural nausea," and in time we should grow accustomed to outlandish foods, as numerous intrepid explorers have proved. These words are not written to suggest a lowering of hygienic standards or to advocate the encouragement of ink-drinking in our schoolrooms. On the other hand, our particular brand of humanity is too frequently the prey of silly food fads or neurotic stomachaches, and a good-humored mental house-cleaning should go a long way toward diminishing if not eradicating both evils.

The culinary arts

If we have been at all observant in our globe-spinning travels, we ought to have gained an inkling of the startling variety of custom in the preparation of Man's meals. It might, however, be worth pointing to a few methods which were not represented in any of the several national restaurants at the recent World's Fair—and with good reason.

Those who like their beef rare may sympathize with the Abyssinians who drive a cow to the kitchen door, truss it up, and cut large strips of flesh from the unhappily still living animal. The strips are then downed on the spot rolled in chunks of pasty bread called *teff*. The Chinese who steadfastly kept cattle for centuries without ever discovering dairy products, prefer to sever the jugular vein, plug up the wound,

then beat the cow to death. The procedure requires about an hour, but it yields an exceedingly rare steak. This is in line with an old Germanic custom of whipping pigs to death as a means of increasing their succulence, while history reports the Roman habit of trampling the abdomen and mammary glands of a sow about to farrow—a preliminary activity which, the Romans claimed, increased the flavor immeasurably. Certain African tribes prepared an ostrich by binding a fatal wound and causing the bird to bleed to death internally and the Araucanians of South America have received a

before she is dead. . . . It is mighty pleasant to behold.”

Many similar stomach-tossing recipes could be selected from as many localities, but the above are sufficient to indicate that Man can be at least as cruel to his prey as any other predatory animal.

“Stupendous”

Modern Hollywood and ancient Rome have many conscious and unconscious affinities, and it should surprise no one that the most “super-colossal” refinements of the culinary art burgeoned in the shadow of the Palatine

remedy his forgetfulness in public, which . . . he proceeds to do, when, from the first incisions, hogs puddings and sausages bound out in all directions. The servants compliment their master with loud acclamations on the success of this farce, and the cook who had so cleverly performed his part receives a silver garland and the honor of drinking a goblet with the company. Then follows a boiled calf; and while the guests were engaged in dispatching him, the whole triclinium trembles, the ceiling cracks and while the affrighted company are rising in consternation, a vast hoop descends through the open-



degree of notoriety for their national dish, *nachi*. Directions, for those who would like to try it, follow: hang a sheep by the forelegs. Slash its throat and proceed to stuff cayenne pepper and salt down the windpipe. Sever the jugular vein, inserting one end of it into the windpipe so that the blood forces the pepper and salt down into the lungs causing suffocation. The lungs are then removed and eaten at body temperature.

Lest we lay to heathenism such violations of the S. P. C. A. code, it might be well to include here an excerpt from a cook book in use among thoroughly Christian Europeans during the 17th Century:

“Take a goose, pull off the feathers, make a fire about her, not too close for smoke to choke her, or burn her too soon, nor too far off so she may escape. Put small cups of water with salt and honey, also dishes of apple sauce. Baste goose with butter. She will drink water to relieve thirst, eat apples to cleanse her and empty her of dung. Keep her head and heart wet with a sponge. When she gets giddy from running and begins to stumble, she is roasted enough. Take her up, set her before guests, she will cry as you cut off any part and will be almost eaten

hill. As instances of this, a few selections from the Feast of Trimalchio chronicled by the contemporary satirist Petronius* will bear repetition here.

“Next followed an enormous wild sow, out of which flew a flock of wild thrushes. She was surrounded by a litter of little pigs made from some kind of cake-paste. When this course was removed, three pigs of different ages, decorated with handsome bells, muzzles and halters, were marched into the banquet hall. Trimalchio . . . selected the largest, it was carried off to be killed, and reappeared cooked in as short a time as it would have taken an ordinary cook to prepare a fowl. But it is remarked that this pig is larger than the wild sow that had been previously served, and Trimalchio, observing it intently, discovers that it had not been opened. Whereupon he sends in a towering passion for the cook, who arrives in fear and trembling and pleads as an excusable oversight that he had forgotten to eviscerate the animal. . . . [While] Trimalchio’s cook is being marched off between two torturers, the company intercedes for him, and the courteous host pardoning him at their request, orders him to

ing with garlands and pear-shaped boxes of perfumes attached to it. . . . Then followed an after course (*epidipnis*) brought in on fresh tables containing some curious specimens of culinary achievements. Thrushes stuffed with a peculiarly light kind of wheat (*siligo*) flour, raisins, and nuts of some kind, probably walnuts. Quinces stuck full of prickles, to resemble sea-urchins, similar to that well-known ornament of our own refined supper tables—a sponge cake hedgehog sprinkled with cut almonds. These are accompanied by a goose, various fish, and many kinds of birds—all of which Trimalchio assures his astonished guests are made out of pork by his skillful cook. . . . Just as Trimalchio is delivering a ‘won’t go home until morning sentiment,’ he is interrupted by the crowing of a cock, which is instantly caught and cooked.”

Food magic

It is rather significant to note that the Romans regarded food so highly that they could think of no greater compliment than naming their children after vegetables. Thus, the general, Fabius Cunctator, whose name has come down to us in the celebrated “Fabian” society, was really called

*Quoted from C. F. Furnas in his *Man, Bread and Destiny*.

YOUR NEW BOOKS

VAILLANT'S EXCELLENT STUDY OF THE RED MAN'S ART
OUR BIG GAME • ANIMAL STORIES OF THE WILD
TRAVELS IN HAWAII • HEILNER ON DUCK SHOOTING

NORTH AMERICAN BIG GAME

A Book of the Boone & Crockett Club compiled by the Committee on Records of North American Big Game

----- Alfred Ely, Chairman,
H. E. Anthony, R. R. M. Carpenter
Charles Scribner's Sons, \$7.50

WHEN the late Prentiss N. Gray conceived the idea of tabulating the measurements of outstanding trophies of American game, the finished work, in 1932, appeared in book form under the title *Records of North American Big Game*. Now, as a continuation of this work, there comes to us a new book *North American Big Game*. And while the new book contains all of the records of the old one, using these as a foundation and background, these records have been revised and greatly enlarged—and then tucked away in the last 93 pages of the book, where those who are interested in record trophies will pore over them with the certainty of being well repaid with a vast amount of new material. But it is the hunter, who goes afield either with rifle or camera, and those of us interested in the game itself, its habits and natural history, who will enjoy to the full the other 436 pages.

It is evident the editors are determined to do a thorough job of this, for the opening chapter is on Big Game of the Pleistocene which in all conscience is far back for most hunters. There is an article on vanished game and one on conservation. Horns and antlers is an outstanding and authoritative chapter by Dr. H. E. Anthony. Grancel Fitz has a very worthwhile chapter on the rating of trophies and their measurements. While he does not settle the matter of a rating formula, it is a step in the right direction. There are also chapters on rifles, photography, hunting with bow and arrow, as well as two chapters by James L. Clark on the care of trophies in the field and at home.

When it comes to actual hunting, habits and natural history, each species of North American game is handled by an expert in his own line, of which the bear is a good example. Here, C. Hart Merriam covers description and distribution; hunting is dealt with by Andy Simons (Alaska Brown), Ned W. Frost (Grizzly), F. H. Riggall (Black) and Captain Bob Bartlett (Polar)—each an outstanding authority.

The illustrations are generous in number and of excellent quality.

Altogether, this book marks a new high point in out-of-door literature on Big Game. The Boone and Crockett Club, the

National Collection of Heads and Horns of the New York Zoological Society and the American Museum of Natural History who stand as its sponsors, may well be proud of it.

WILLIAM MONYPENY NEWSOM.

WILD ANIMALS. GREAT WILD ANIMAL STORIES OF OUR DAY

--- Compiled by Frances E. Clarke
Macmillan, \$2.50

HERE is a collection of twenty-five stories beginning with one by William Beebe, *raconteur par excellence*. The second is "Beaver, Builder of Empire," by William H. Carr, a fine story reprinted from *NATURAL HISTORY MAGAZINE*. There is another beaver story by Grey Owl, the American Indian. The collection includes an excellent article on conservation of wild life by Jay N. Darling; another on the same subject by James Oliver Cur-

wood, but rather too emotional and illogical; a third on practically the same subject, entitled "The Wild Life Sanctuary," by Dallas Lore Sharp, in his characteristic fine style; and a most interesting chapter entitled "Our Disappearing Fur-Bearers," by Edward A. Preble, of the U. S. Biological Survey. "How to Hunt the Fox," by Edgar Wilson Nye (Bill Nye), is very amusing. There are stories about the lion, the mole, the koala, the skunk, the grizzly, the black bear, the fox, the elephant, the coyote, and others, many of them by our younger naturalists.

In a collection of "Great Wild Animal Stories of Our Day," as indicated by the sub-title, one might expect to find one by Ernest Thompson Seton, who is perhaps our best writer of such stories. Neither *The Trail of the Sandhill Stag*, nor *The Biography of a Grizzly*, nor any other of his is here. None of Ernest Harold Baynes' fascinating stories is included, not even *The Sprite, the Story of a Red Fox*, or *Jimmie, the Story of a Black Bear Cub*. There is nothing from Kipling, not even *Rikki-Tikki-Tavi*.

No doubt one of the chief difficulties in compiling a book of this kind is the superabundance of material. In spite of an overwhelming number of wild animal stories, the compiler has succeeded in selecting and bringing together in this volume some worth-while stories and essays.

CLYDE FISHER.

HAWAII

----- with Sydney A. Clark
Prentice-Hall, Inc., \$3.50

THE Hawaiian Islands have been richly publicized; each year they entertain fifty thousand "visitors" who spend ten million dollars there. For these temporary residents of Hawaii Mr. Clark has written a guide such as he looked for when planning a trip to Hawaii but was unable to find. He tells you how to get there, how much to tip, where to stay and what to see and answers the innumerable questions which generally occur to travelers. But to these practical details he has added a brief sketch of the history, the economics and the life of the islands. While these essays do not pretend to satisfy the student of Hawaiian affairs, they serve to paint a background against which each traveler's own observations may become more significant. Mr. Clark assumes that the reader is visiting Hawaii to enjoy himself and not to carry on sociological investigations.

This guide may be recommended. It is pleasantly written and, as far as my recollections go after eight years, accurate.

H. L. SHAPIRO.

North American Big Game

A Book of the Boone and Crockett Club published under the Auspices of The National Collection of Heads and Horns of the New York Zoological Society



The most voluminous and comprehensive book ever published on this subject—contains complete, authoritative information on all big game found in this country; extinct game; rifles and ammunition; conservation; hunting with bow and arrow and with camera; treatment of trophies; and measurements of over 2000 of the world's largest heads. Illustrated from photographs, paintings, and drawings. 533 pages. \$7.50

at bookstores

Charles Scribner's Sons, New York

INDIAN ARTS IN NORTH AMERICA

----- by George C. Vaillant

Harper and Brothers, \$5.00

THE intrinsic merit of American Indian art has waited a long time for its just appreciation. The first wave of enthusiasm for the primitive which swept over France a generation ago had a limited range. It washed the shores of Africa but neglected the products of American aborigines. For a time primitive art and Africa became synonymous, but fortunately this overemphasis arising from priority of discovery has abated and other areas equally worthy of respect for their vigorous esthetic expression are beginning to receive the attention they merit. Among primitive artists few have achieved greater variety or approached as closely to the most rigorous standards as have the American Indians. And at last a monument worthy of the distinction of our aboriginal art has been created in Doctor Vaillant's admirable *Indian Arts in North America*.

If any of our native arts have received heretofore a modest acclaim, they have generally been the products of the highest cultures known on this hemisphere. Such examples as the classic beauty of a Copan head from Honduras, or the technical excellence of a Peruvian textile have long been familiar axioms to a limited circle of connoisseurs, but the charming plasticity of a "Mound" figurine from Ohio or the perfect proportions of a diorite bowl from Alabama have lain unnoticed in our archaeological museums. From these repositories Doctor Vaillant and his assistants have selected with exquisite taste a series of examples which they have placed in the light they have long needed. One has only to finger the pages of this book to realize the amazing gifts of our native artists and to understand the enthusiasm and insight which prompted Doctor Vaillant to introduce them to a wider public than they have enjoyed. But the book does not stop here.

Recognizing that art does not exist *in vacuo* but represents the expression of the artist in his cultural milieu, the author has admirably arranged his selections to illuminate the interaction of artist and environment. This method and the accompanying text heighten the cultural meaning of the various forms into which the esthetic impulse was released and serves to integrate artist, medium and subject matter. The buffalo skin painting, for example, practiced by the Plains Indians, becomes more than a work of art. It reflects the nature of the nomadic culture which gave rise to it and becomes a synthesis of the esthetic impulse plus the limitations and opportunities afforded by life on the plains.

Doctor Vaillant richly deserves our gratitude for his splendid contribution to American Indian art. His wide experience with Indian cultures combined with a faultless taste exceptionally qualifies him for this task which he has discharged with great distinction. This cultural and artistic insight is equally evident in his lucid text and skilful selection of plates.

H. L. SHAPIRO.

A BOOK ON DUCK SHOOTING

----- by Van Campen Heilner

*Paintings and drawings by
Lynn Bogue Hunt.*

Penn Publishing Co., Philadelphia, \$7.50

THIS is a book on duck hunting written by a duck hunter for duck hunters. They will like what he says and they will love the way he says it.

His pen may not be mightier than his gun but it runs a good second and he succeeds in communicating his joy and enthusiasm to those who are in sympathy with his desires. Discomforts, hardships, dangers are welcomed cheerfully if only they promise to lead to ducks. No trail is too difficult to follow if there is a duck at the end of it. And the incidental adventures are told graphically with an animation and appreciation which shares them with those who can accompany him only on the printed page.

We will not be with him long before we discover that he is really not so bloody minded as his successes afield indicate. In truth, it is sport not ducks he is after. Writing of some over tame wigeon he says: "I only shot a pair because they were so trusting." Indeed, reading between the lines, we seem to make the further discovery that our author is inspired primarily by love of the wild to which wildfowl give such ardent expression. The lines

"Voices of wild geese

Over the sea—over my heart

A sudden peace"

were not used as a chapter heading by a man who sees wildfowl only over a gun barrel.

Other quotations from the poets are equally revealing. As eminently appropriate he might include Florence Jaques' tribute to the fascination of ducks (*The Geese Fly High*, p. 87).

While this is avowedly a book of "duck shooting stories" (duck hunting would be better) descriptive of the author's experiences, we learn much of the habits of the birds he pursues, from the sportsman's viewpoint, and also much of the ways of the duck hunters of the lands he visited.

The illustrations, by Lynn Bogue Hunt, himself a duck hunter, include 16 full-page colored plates and many line cuts. When we say that they are eminently worthy of the text, we pay a high compliment to both artist and author. The numerous photographs are also in keeping with the spirit of the book.

FRANK M. CHAPMAN.

HAWKS IN THE HAND

----- by Frank and John Craighead

Houghton Mifflin Company, \$3.50

BIRDS of prey are either hated or loved, depending on how little or how much one knows about them. So widely do their feeding habits differ that if their treatment is to be placed on a purely economic basis every hunter must learn to distinguish the various species. But the more one learns about these "predators" the more one is inclined to spare them all.

Good books about them are thus to be

"...No book on waterfowl shooting now exists that can match this one in scope, writing or excellence of illustration."

NEW YORK TIMES.

A BOOK ON DUCK SHOOTING

By VAN CAMPEN HEILNER

Illustrated with sixteen color plates and many black and whites by Lynn Bogue Hunt.

Introduction by Dr. Robert Cushman Murphy.

Dr. Murphy and Mr. Heilner, both of whom are members of the staff of the American Museum of Natural History, bring to this book all the authority of the scientist and sportsman.

\$7.50

at all bookstores

THE PENN PUBLISHING COMPANY
931 Filbert Street, Philadelphia

By Donald Culross PEATTIE

Poet-Scientist of Nature

Author of
"AN ALMANAC FOR MODERNS"

FLOWERING EARTH



"FLOWERING EARTH does for the plant world what Carrel has done for medical research... with something very close to genius." —NORMAN TAYLOR

in *Saturday Review of Literature*

"Dignified, majestic, soul-stirring... for the intelligent, the eager, the mentally hungry of the world; for people who are refreshed by any sort of emancipation from the trivial; who like to view past ages, the present, and the future impersonally, objectively, but with an understanding eye. *Flowering Earth* is for every one."

—GEORGE MIKSCH SUTTON
in *N. Y. Herald Tribune "Books"*

WITH WOOD ENGRAVINGS
BY PAUL LANDACRE

\$2.50 G. P. PUTNAM'S SONS
2 W. 45th Street, New York

welcomed, and the Craighead brothers have produced an excellent one. In boyhood they became fond of these courageous birds, and went on to pursue their hobby much farther than usual, risking their necks on cliffs and great trees in order to secure a splendid collection of photographs, and sometimes bringing home young birds to be trained for hunting. Many were given their liberty again after they had grown up, and the tales of their development and their individual traits make up a fine part of this most readable book. The tendency to credit them with human qualities is hard to resist.

The brief title does not suggest that six species of owls are discussed as well as the raven, in addition to a dozen of the best-known diurnal birds of prey in North America. The amount of information imparted is exceptional, and it is presented in the form of personal adventure all the way from the coast of Virginia to the far West.

The 57 beautiful plates are all grouped in an unusual place—at the front of the book. Those of the duck hawks, bald eagles, and goshawks at their nests are masterpieces.

JAMES P. CHAPIN.

FINDING NEW SUBJECTS FOR YOUR CAMERA

----- by Jacob Deschin

Whittlesey House, \$2.50

"There is nothing new except what is forgotten."—MLLE. BERTIN.

THE amateur photographer who has laid his camera on the shelf for lack of ideas must hasten to remove it. The advanced pictorialist who needs a re-birth of ideas will now have that experience. Mr. Jacob Deschin has prepared a book presenting subject material for the camera user. The material is not entirely new. He mentions every-day things and happenings which are forever a source of pleasure: home-life incidents, the fair grounds, reflections—simple and complex, street activities and bed-time stories. So greatly have they become a part of our daily existence that we seldom observe them. To some, the book will introduce new fields to conquer; to others, it will recall long-forgotten ideas.

The author states, "the ability to 'see' is not the gift of the few." Such a statement covers more ground than we would realize on a first reading. Subjects which are photographed for pictorial arrangement, or even as records, must necessarily interest us to some extent. Should we investigate the potential salon print composition to a further degree and ask a few questions about it, we are developing our ability to recognize good material. What other aspects are there? Does one viewpoint convey the whole story, if any, or should more exposures be made? Can you improve on Mother Nature's arrangement? When we instinctively question ourselves, we are on the road to success.

Finding New Subjects for Your Camera is primarily a guide-book for the beginner lacking the necessary training or imagination to recognize a picture. Should the salon print maker wish to re-explore subject

ideas, he will find it interesting to thumb over a copy. When this book is weighed alongside *New Ways in Photography*, it is very evident that the author has created a companion piece to supplement his former work.

THANE L. BIERWERT.

MODERN MIRACLE MEN

----- by J. D. Ratcliff

Dodd, Mead & Co., \$3.00

FOR those who desire to be brought up to date in various fields of medical, biological and agricultural science, I can heartily recommend *Modern Miracle Men* by J. D. Ratcliff. Not sacrificing truth for fiction, Mr. Ratcliff has presented his subject matter in a most interesting and readable fashion. He has not resorted to that over-spectacular style which, in my opinion, marred several less recent books considering similar material.

In Mr. Ratcliff's book we find up-to-date information on many subjects: the virus causing influenza; sulphanilamide, the drug which is aiding in the treatment of pneumonia; respirators and what they can accomplish; the "serum bank" of the New York City Health Department; the newer aspects of typhus fever and many others. I was glad to note that the author has taken pains to give ample credit to the personnel and activities of the U. S. Public Health Service for the splendid work which has been accomplished by them. This is too little known by many.

There are several interesting observations on the more recent types of agriculture including the unknown potentials of growing bountiful crops without soil. One of the chapters I found most interesting was that entitled "91 Billion Acre Farm." This deals with the spectacular, valuable and romantic activities of the U. S. Bureau of Fisheries and the Oceanographic Commissions. *Modern Miracle Men* is a book worth while with many interesting illustrations.

MORTON C. KAHN.

WOODCRAFT

----- by Bernard S. Mason

New York: A. S. Barnes and Company, \$2.75

HERE is a comprehensive book on woodcraft and campercraft which deserves a place with such classics on the subject as *Camping and Woodcraft*, by Horace Kephart, and *The Book of Woodcraft and The Woodcraft Manuals*, by Ernest Thompson Seton.

The author divides his book into three parts, namely, Campercraft, Woodcraft, and Crafts of the Woods. The contents of Part I are well indicated by the brief titles of the eight chapters of which it is made up—Shelters for the Trail, Tepees of the Plains, Bark Wigwams and Shelters, Permanent Tomahawk Shelters, Beds and Duffel, Fire-craft, Campfire Gadgets and Axmanship.

The other two parts of the book are each made up of eight chapters, treating of everything from making hunting knives, war-bonnets, rattles, drums, and council rings to calumets, peace-pipes and totem poles.

CLYDE FISHER.

HORSES AND AMERICANS

----- by Phil Stong

Frederick A. Stokes Co., \$5.00

IN this imposing volume, with its many well chosen illustrations, Mr. Stong gives us the result of his amazing amount of research, historical, scientific, philosophical, sociologic, and along other lines pertaining to his broad subject.

His account of four centuries of frontier life gives us a vivid picture of the life of the people from the early pioneers to the present day, the importance of the horse in the opening of the West, and its continued high role in our civilization.

The author tells in picturesque style of the development of the West, "The Pony Express stitched Eastern America to the West Coast and the goldfields. Locomotives fumbled at the idea, belatedly, but the horses made the way across the plains."

His description of colonial life in the East is most interesting and enlightening, as contrasted with that of today. He speaks of the early Postal Service on horseback between Boston and New York. Ebenezer Hurd, one of the faithful riders who served the good cause for forty-eight years, put our modern Parcel Post to shame when one of his commissions was the delivery of a yoke of oxen.

In Chapter IV there are several minor errors in his description of the succession of footfalls in equine progressive movement. However, these points are so extremely minute and technical, possibly criticism is hardly warranted. These movements are almost universally believed to be pretty much as Mr. Strong has described them but this belief is not technically correct.

His contention that the horse is not being deposed by gasoline seems well taken. He does not share the often expressed prediction that horses will some day become extinct, for aside from all practical value, man's admiration or even affection for such a noble animal will never permit its extermination.

S. HARMSTED CHUBB.

THOREAU

----- by Henry Seidel Canby

Houghton Mifflin Company, \$3.75

AFTER many years of intensive study,

Doctor Canby has given us a superb biography of a great literary naturalist. One is impressed with the enormous amount of work that has gone into the book, which is divided into two parts, "Adventurer in Life" and "Naturalist and Nature Writer." Thoreau, the man, receives more adequate treatment than Thoreau, the naturalist. "The poet-naturalist Thoreau has been amply recorded by his first biographers, Channing and F. B. Sanborn, whose books are indispensable for knowledge of his career; but the would-be lover, the home-bred philosopher, the dynamic individualist, escape from this too narrow classification."

Doctor Canby has brought together much new material—dependable evidence that Thoreau was a tender, lovable, human man. Although he never married, two or three women came into his life in a

very real way, one of whom was Lidian, the second wife of Emerson—a Transcendental relationship. In this biography we have a new Thoreau, whom we have not before known.

Thoreau's books have lived not because of their contribution to natural history, but on account of their value as literature. Doctor Canby says, "The final and most important cause of Thoreau's lasting success is his power over words. At his best he is a superb writer, one of those shapers of language who give age-old ideas their final form. Thanks to this, his sentences and paragraphs escape from the dead hands of time." And again, "Thoreau's best nature studies are good not on account of their science, but because of the flowing garment of words."

In his *Journal*, Thoreau writes, "Sentences which suggest far more than they say, which have an atmosphere about them, which do not merely report an old, but make a new, impression . . . to frame these, that is the art of writing." Again, "It is vain to write on chosen themes. We must wait till they have kindled a flame in our minds." . . . "We cannot write well or truly but what we write with gusto."

Doctor Canby's book is fascinating from beginning to end, and after one has read it, he will turn again to re-read *Excursions*, and *Walden*.

CLYDE FISHER.

* * *

In view of the recent literary wave of interest in Thoreau, it seems pertinent to append mention of Max Lerner's current *Ideas Are Weapons* (Viking, \$3.50) in which the early American Nature writer is examined from the unusual standpoint of his considerable place in the developing social thought of our country. Readers attracted by this aspect will find stimulating Mr. Lerner's important symposium of thoughts.

CARIBBEAN TREASURE

----- by Ivan T. Sanderson

Viking Press, \$3.00

CARIBBEAN TREASURE is a companion volume to *Animal Treasure*, that dramatic account of a naturalist's sojourn in West Africa. Those readers who enjoyed the fast-moving action of Sanderson's first book will find an equal interest in his second, for something is happening in every chapter. *Caribbean Treasure* continues the career of Sanderson as a "climax" naturalist. The author has a pleasing literary style, he has considerable artistic ability which provides the book with attractive illustrations, and he selects for his field work localities which have a rich and interesting fauna and flora. He has unusual experiences because he is in environments where such things can happen, and he reacts to every stimulus. Certainly, it would be captious to deny him a sympathetic hearing because he can transmit his daily thrills through the medium of a graphic text to an equally thrilled reader. This reviewer found much of interest in the book and he believes the lay public will enjoy it. But, with a background of personal experience in tropical jungles, he believes that overemphasis creates impressions

which are not true to facts as most people would get them.

I read *Caribbean Treasure* as an exhibit of what a primitive jungle environment could produce from the sensitive and perceptive nature of a journalist-artist-naturalist, and I should judge that the success of his accomplishments rank in the order of the capacities as I have given them. There are a great many interesting first-hand observations on animals put on record by Sanderson, some of them for the first time, but if the book has a large sale it will not be because of this fact. Rather it will be because the author has the reader tingling in sympathy over the successful dramatization of unusual episodes.

The specialized readers of *Caribbean Treasure*, who speak the scientific language used by Sanderson, will be able to dismiss some mis-statements as understandable errors made by a naturalist working in a new region. The parts that may puzzle Sanderson's technical readers will be his records of natural history made under pressure, as when he falls down a cliff, tangling himself in vines, to have a tête-à-tête with a venomous snake, is joined by a peccary, and gives a blow by blow account of each round. The reader may well wonder if the excitement of the moment has influenced the conclusions.

H. E. A.

SEVEN GRASS HUTS

----- by Cecile Hulst Matschat

Farrar and Rinehart, \$3.00

WHEN Cecile Matschat married an engineer whose duty led him to uninhabited regions of South America, she packed a trunk of feminine koicknacks including her grandmother's small clock and some prized New England teaspoons and sailed away.

Seven Grass Huts is her story. It should interest men as well as women for she followed her husband from one end of South America to the other, and wherever they traveled she examined with the keen eyes of an artist the wealth of fauna and flora which she describes so vividly.

Unlike the average bride whose home is built along conventional patterns containing familiar objects, her first house was made of grass as were the six which followed. Knowing she could not change her mind after she left a camp a thousand miles from Sao Paulo, she said goodbye to the civilized world and struck out with her husband and his assistant, a huge Paraguayan gaucho who watched over "Senhora Boss" with devoted kindness, even though he was frank in his criticism that she was a "damn skinny woman."

Because of her interest in drawing she began a study of orchids which led to a fantastic meeting in the jungle with a madman who was an orchid fancier. Her escape from him, her encounter with a seventeen foot giboya which she killed, a jaguar hunt in the Chaco, and a Voodoo ceremony in Rio keeps the reader following her with sustained interest from Brazil to Patagonia and back to Central America, ending with a domestic touch of grass but cookery as the last chapter of the book. The *Riñonito al Vino* sounds good enough for any meal. GLADYS LYNWALL PRATT.

BIRDS

----- by Gayle Pickwell

Whittlesey House, \$3.50

"THERE is always room for another bird book," said the publisher to the author, "provided your bird book is different."

Doctor Pickwell's book is "different." It is a large, green-covered volume containing sixty-eight full-page illustrations. Identification is not the keynote. The Bird itself holds the center of the stage with a first chapter heading of, "Why Know Birds" and a sub-heading, "To Grant They Have Interest and A Right To Live." We read of, "Bird Food And How Birds Get It," of "Bird Feathers," and "Bird Travels."

The author is an excellent nature lore interpreter who is not only a thorough ornithologist but is also well grounded in requirements leading to "reader appeal." The subject of bird conservation rears its bloody but unbowed head here and there with warnings to evildoers who stalk the fields with shotgun and rifle.

The numerous photographs are outstanding and are well reproduced. Time, care and years of experience have gone into this book. The author's patience has been well rewarded and the reader will have his reward, too. WILLIAM H. CARR.

* * *

Doctor Pickwell has also compiled a beautifully illustrated treatment of *Weather*, in all its ramifications from fractocumulus clouds, highs and lows, to "dust-devils," erosion and cyclone tunnels.

THE ESKIMO AND HIS REINDEER IN ALASKA

----- by Clarence L. Andrews

Caxton Printers, \$3.50

THE author describes the introduction of reindeer into Alaska as "the greatest and most practical plan ever put into practice for the well-being of a native people of the United States." In view of the long and varied relations of our government with its natives, the results of this experiment are of interest. If his presentation of the case is an impartial one, as there seems reason to believe, the results of this reindeer introduction have been a disappointment. As soon as it became evident that there might be a profit in reindeer, white citizens, in spite of the law, seized control of the industry. An attempt has recently been made to remedy this situation but what the outcome may be is not indicated.

It should be emphasized that this is not a textbook. The data on reindeer is included in an interesting and entertaining collection of incidents in the lives of the Eskimo of northwestern Alaska, based on the author's observations—principally during the years 1923 to 1929—and an otherwise extensive experience in the country. It ought to accomplish just what he has hoped for by giving his readers a better and more sympathetic understanding of the people he portrays. Anyone who has been in that section will read about it with a touch of nostalgia. JUNIUS BIRD.

after the bean (*faba*). The illustrious Cicero, moreover, can be traced to a perhaps (for us) even more deflating source—the chick-pea (*Cicer arietinum*). But there is more to this than appears on the surface, since we know that beans were once consecrated to the dead, and that the Greek mathematician Pythagoras wouldn't touch them. He believed in the transmigration of souls and lived in constant dread that he might be munching an ancestor.

A disbelief in or at any rate a confusion about, the duality of matter and spirit is at the basis of most human cannibalism. More often than not, anthropologists have found that a man ate his fellow creature to gain certain desirable mental and physical qualities of the victim, which he expected to be transferred in the process of digestion. No better example of this can be cited than the story of the white African trader who discovered that bits of brain matter taken from the tribe's recent dead had been slipped into his food. When he asked the reason, the culprits confessed that it was their belief the white man would thus be possessed by the spirit of the tribe which would give their native chief a tremendous advantage in driving a good bargain.

Magical virtues of a less philosophical nature have been attributed throughout the length and breadth of human history. In the 13th century, river crabs pounded in asses' milk benefited consumptives. Rice cooked with almonds generated blood. And beans caused gross and impure dreams. Furthermore, onion juice snuffed into the nostrils cleared the head "excellently" which is memorable in view of the fact that onions were used in treating colds up to our own grandmother's day. These medievals on the other hand, were quite correct in regarding liver as a good blood builder.

As recently as the 18th century, mushrooms were conceived to "work violently upwards and downwards" and cause palsy and apoplexy. "If use be made of them," one writer admonished, "it ought to be done with much moderation and it is necessary to drink a good wine upon them." Eggs were believed to "make the voice loud and pretty." Ginger improved the memory, peaches helped "a stinking breath," while oil of almonds mixed with honey cleared the vision and rid the head of dandruff.

But haven't these beliefs a familiar ring? It is no accident that Man's earliest artistic expressions on cave walls were largely directed by an impulse to gain magical control over his game animals. The pictorial art of our posters and advertising remains to this day in the category of magic. We are shown radiantly rugged gentlemen who have conjured their brimming health from a certain package of bran—one of our less nourishing grains; beautiful girls have found the holy grail of glamour, not in a dish of peaches but in some scarcely more relevant preparation. Our small sons are led to assume that regular consumption of a particular breakfast cereal will transform them into professional baseball stars. The latter are paid to support the correlation of a home-run in the afternoon with this same cereal in the morning. Other breakfast foods hint at trips to Mars or supply, as premiums, "death-ray guns" which assist the child's vicarious participation in wholly magical happenings from which he probably will never quite recover. However jestingly, Popeye the Sailor derives titanic strength from a handful of spinach. And every commodity from cow's cream to cold creams ("skin-food") raises the siren song of vitamins.

Now the average person understands vitamins no better than he does his telephone or his radio. Our culture, naturally, contains a number of cautious specialists who do. But for the majority, vitamins are fully as magical as any witch-doctor's potion. If we can accept broad generalizations, it might be said that nearly all advertised food products are urged upon the public more or less as supernatural wonderworkers. In fact, it may be quite possible that Man has more magic mixed up in his food, here and now, than he ever had before.

Whether this state of affairs is desirable or representative of progress is a matter for dispute elsewhere. But we can say this much with reasonable safety: Man has a top-notch digestive apparatus—one of the best in the entire animal kingdom. Wherever he lives he always finds plenty of things that agree with him, and it is a fair assumption that the contemporary American has available the best range of choice in all history. As the wise physician might say: enjoy it by all means. Don't be afraid of the new and different. And, above all, keep your mind off your stomach.

Recent Museum Publications

NOVITATES

- No. 1040. The Species of *Temnostoma* Related to *Bombylans* Linné (Syrphidae, Diptera). By C. H. Curran.
1041. New Neotropical *Baccha* Fabricius (Syrphidae: Diptera). By C. H. Curran.
1042. Studies of Peruvian Birds. No. XXX. Notes on the Genera *Contopus*, *Empidonax*, *Terenotriccus* and *Myiobius*. By John T. Zimmer.
1043. Studies of Peruvian Birds. No. XXXI. Notes on the Genera *Mjotriccus*, *Pyrrhomys*, *Myiophobus*, *Onychorhynchus*, *Platyrinchus*, *Cnipodectes*, *Sayornis* and *Nuttallornis*. By John T. Zimmer.
1044. Studies of Peruvian Birds. No. XXXII. The Genus *Scytalopus*. By John T. Zimmer.
1045. Studies of Peruvian Birds. No. XXXIII. The Genera *Talmonmys* and *Rhynchocyclus* with Further Notes on *Ramphotrigon*. By John T. Zimmer.
1046. A New Bee of the Genus *Pasiptae* from Peru. By T. D. A. Cockerell.

Answers to Questions on page 297

- (c) Auctioning. See page 284
- True. See page 278
- (b) 100% American. See page 294
- Vanilla. See *The Tall Truth*, page 259
- (b) Arabia. See page 281
- False. The idea that handling a toad causes warts is a myth. For real use of protective secretion, see page 280
- (a) The ancient Egyptians. See page 301
- False. The Abyssinians ate steak from the living cow (see page 310), and a 17th century European cook book contained instructions for eating a live goose (see page 311)
- The Mohammedans. See page 282
- Yes. The part of the moon in eclipse is exceedingly dark, but a long photographic exposure will record it. See page 258
- (c) The poorer grades will be used for manufacturing plastics. See page 287
- True. See page 294
- (c) The Watussi of Africa. See page 307
- (b) Ancient Maya sculptures. See page 288
- Yerbe maté. See page 284
- They are "scarecrows." A watcher pulls on the strings when birds swoop down. See page 269
- Rudahigwa, King of the Watussi. See page 300
- (c) The toad. See page 277
- True. See page 287
- True. See page 284

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