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MARY CYNTHIA DICKERSON, *Editor*

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Photo by Barnum Brown

FOSSIL TREE FROM RED DEER RIVER, ALBERTA

This petrified tree trunk, now on exhibition in the dinosaur hall of the American Museum, is forty-five feet long. It is in a fine state of preservation. Many fossilized trees, chiefly cone-bearers, are found associated with dinosaur skeletons on the Red Deer River. They are carbonized and jet black. When found they are surrounded with a thin layer of lignite, which soon disintegrates under exposure, while the central silicified stem bleaches to a reddish buff color

—See note regarding its excavation, page 78

The "Ostrich" Dinosaur and the "Tyrant" Dinosaur

By HENRY FAIRFIELD OSBORN

This article illustrates some of the methods as well as the "perils" of the restoration of extinct animals from their more or less complete skeletons. A restoration presents the author's theory of the habits of the animal, how it moved, how it fed, how it attacked its prey or escaped from enemies, also the environment in which it lived. In the present instance a dinosaur which was restored and named by the author as an habitual "bird robber" has proved through our discovery of one of its descendants to have followed a less destructive calling. This descendant is known as the "ostrich dinosaur," in relation to a theory of its habits which may in turn prove untenable.—THE AUTHOR.

ONE of the American Museum expeditions of 1902 was hunting dinosaurs in the great geological deposit known as the "Bone-Cabin Quarry" in central Wyoming, not

far north of the old line of the Union Pacific Railway. Among the remains of hundreds of skeletons of large forms which we found crowded into this quarry, we discovered one very small,



Ornitholestes, the "Bird Robber," and *Archæopteryx*.—Original restoration, by Osborn and Knight, of *Ornitholestes* as a bird robber, capturing an *Archæopteryx*. Now regarded as an improbable interpretation of the habits of this animal

delicate skeleton of a swift-running type of dinosaur, with long, slender limbs, a very long tail, a hand provided with long, very slender fingers terminating in sharply recurved claws, a small, delicately formed head with pointed, recurved teeth.

On its arrival at the Museum this skeleton was very carefully studied by the present writer, who reached the conclusion that this little dinosaur was

same family of swift runners as the supposed "bird robber," although it cannot be regarded as a direct descendant. The first remains of this more recent animal, one of the most extraordinary dinosaurs ever discovered, were found near Denver, Colorado, in 1889, and came into the hands of Professor O. C. Marsh, of Yale University, for description. This specimen consisted of the bones of the hind foot, which were



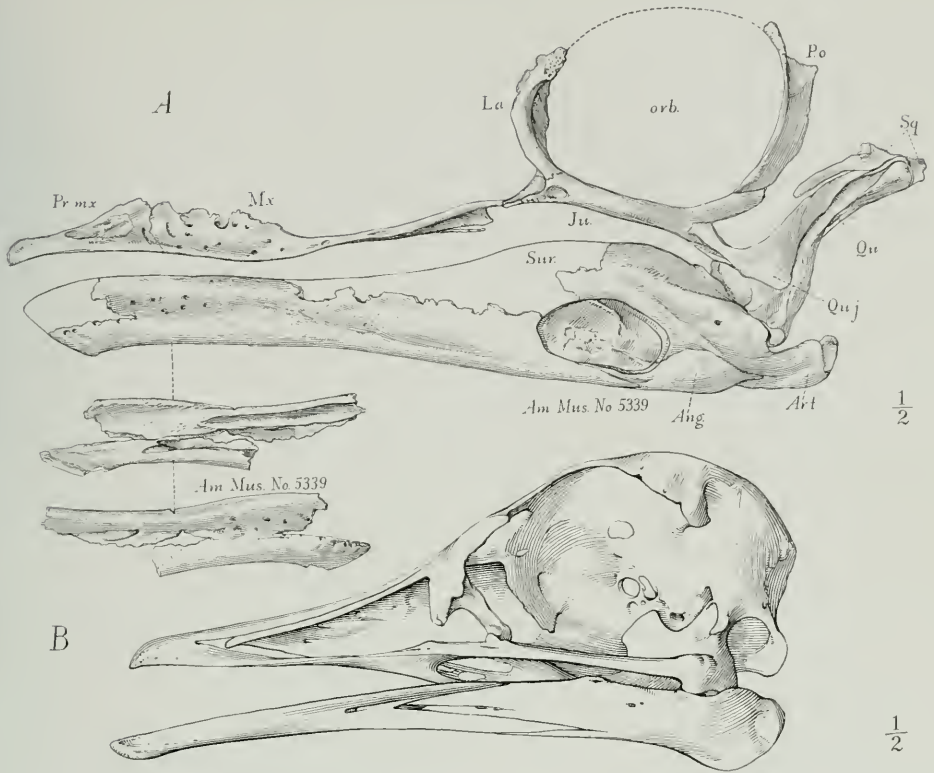
This complete skeleton of the "ostrich mimic" dinosaur, *Struthiomimus* (of much more recent geologic age than *Ornitholestes*), was discovered by an American Museum expedition in 1914, after a search prolonged through a dozen years in the Upper Cretaceous dinosaur fields of northern Montana and southern Alberta. Only parts of skeletons had been found previously, and the skull and fore limb had never been seen. Study of these threw an entirely new light on the life habits of this type of dinosaur, and made untenable the old theory regarding the bird-robbing propensities of *Ornitholestes*. The skeleton was brought from Alberta to New York in the solid block of sandstone in which it had lain embedded through the ages

a carnivore and preyed upon the primitive contemporary birds, in which the powers of flight were only partially developed, and the animal was consequently given the name *Ornitholestes*, "the bird robber." The theory was that by great speed and very alert movements *Ornitholestes* was able to overtake and capture its prey.

It is an interesting instance of how one discovery in science affects another that this theory of the habits of the ancient "bird robber" has become untenable through the subsequent discovery of another dinosaur, of much more recent geologic age, belonging to the

placed in a manner so closely similar to that in some of the large existing birds, such as the ostriches and rheas, that the animal received the very appropriate name *Ornithomimus*, "the bird mimic." In fact, the foot so closely resembles that of a bird that if it had been found in a period before dinosaurs were known to science, it would certainly have been described as belonging to an ancient type of bird.

Little more was known of this type of dinosaur until 1902 when a collection of limb bones belonging to similar forms was secured through explorations along the banks of the Belly River,



A Dinosaur Skull and a Bird Skull.—A—Skull of the "ostrich mimic" dinosaur. Bones of the back and lower jaw, and bony ring surrounding the eye socket (*orb.*). B—Skull of the existing ostrich (*Struthio*), to the same scale of size.

Comparison shows that the "ostrich mimic" dinosaur was not carnivorous, but that the jaws had been converted into a narrow, horny beak, not unlike that of the present-day ostrich, for eating some kind of soft food

Alberta, Canada. This type was named *Ornithomimus altus*, "the tall bird mimic," by Lambe, of the Canadian Survey. The geologic formation in which these supposed "bird-mimic" limb bones were found is considerably more ancient than the Denver Basin in which Marsh's type was discovered.

In 1902 the American Museum exploring parties entered this rich field of Upper Cretaceous dinosaur life in northern Montana and in 1909 in southern Alberta. Remains of the "bird mimics" proved to be extremely rare; but year after year the trying search was kept up in the hope of discovering a complete skeleton and of finally solving thereby the riddle

of the life habits of this remarkable family of dinosaurs. Barnum Brown who was in charge of the field parties observed that these bones are almost invariably found in ancient shore deposits, indicated by wave ripple marks in the sandstones, mingled with remains of mollusks and of various forms of shore-living plant life, which affords evidence that these "bird mimics" lived along the seashores and subsisted on the animals exposed by the rising and falling tides. Finally, in 1914, the prolonged search was rewarded by the discovery of a complete skeleton of one of these animals. The specimen was exhumed with the greatest care and brought to the Museum in

the heavy block of solid sandstone in which it had lain embedded through the ages.

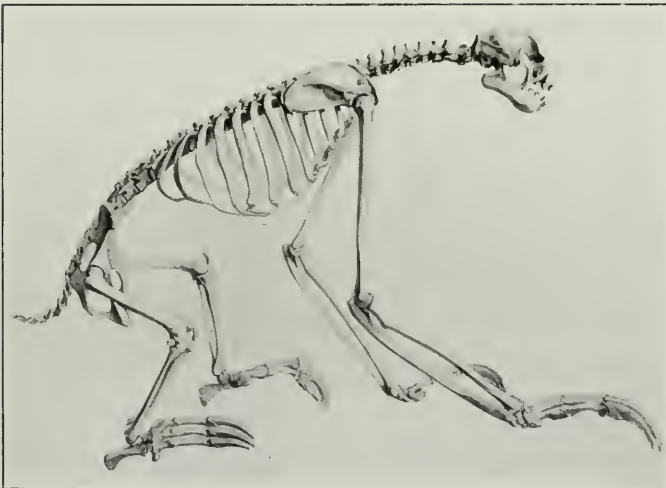
At the time of death the animal was entombed in the position shown, with the neck bent sharply backward so that the back of the skull rested upon the top of the hip girdle; as the rock was gradually removed from the bones in the Museum laboratory the animal was found to be in exactly the posture shown in the accompanying photograph except the limbs, which we found it necessary to alter slightly in order to expose the two sides. In the restoration the arms were outstretched in front and the legs placed in a similar bent posture as if in motion.

The discovery of this skull and fore limb occasioned one of the greatest surprises in the whole history of the science of vertebrate palæontology. It had confidently been predicted that these "bird mimics" were flesh eaters, and the present writer, at least, expected to find the skull provided with sharply pointed, recurved teeth, adapted to seizing and holding a

swiftly moving and struggling prey. Consistent with this theory, it was anticipated that the fore limb and the hand would be specialized as grasping organs adapted to snatching and holding a struggling bird or small reptile, as in the theory of the ancestral "bird robber" dinosaur. On the contrary, the "ostrich mimic" dinosaur proves both in its head and in its limb structure to be not raptorial at all but probably a comparatively harmless, inoffensive creature.

The extremely small head and slender jaws, which are entirely toothless, most nearly resemble those of the living ostrich. Unlike any dinosaur yet discovered there is a total absence of teeth and the indications are that the jaws had been converted into narrow horny beaks somewhat similar to those of the ostriches of today. The head as a whole is one third longer than in the present-day ostriches, although the tail and backbone combined are more than thirteen feet in length. The jaws are relatively deeper and more powerful than those of the ostrich, but all the areas of

muscular attachment are much slighter than in any of the carnivorous dinosaurs, indicating that this animal had long since lost all the flesh-eating adaptations of the skull, and had become fitted for the consumption of some variety of relatively soft and tender food. The neck is long and extremely flexible, reminding one of



To illustrate the tree-climbing fore limb of the three-toed sloth, *Bradypus*, which in some respects resembles the fore limb of the "ostrich" dinosaur, *Struthiomimus*. After De Blainville

that of the ostriches, and of the Cretaceous diving bird known as "*Hesperornis*." Such a long, slender neck is in widest contrast to that of the giant carnivorous dinosaur *Tyrannosaurus*.

This ancient type, the "bird mimic."

new and consistent theory of adaptation—namely, that this animal had actually come to mimic the ostriches both in its structure and in its browsing habits, were it not for the very peculiar and unique structure of the fore



A



B

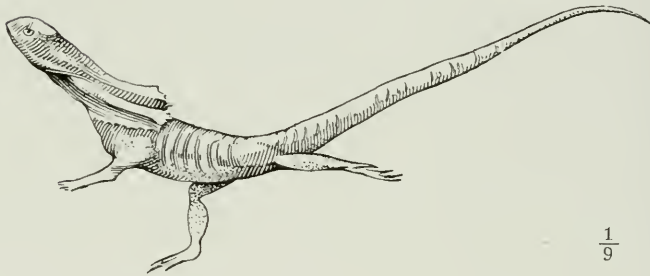
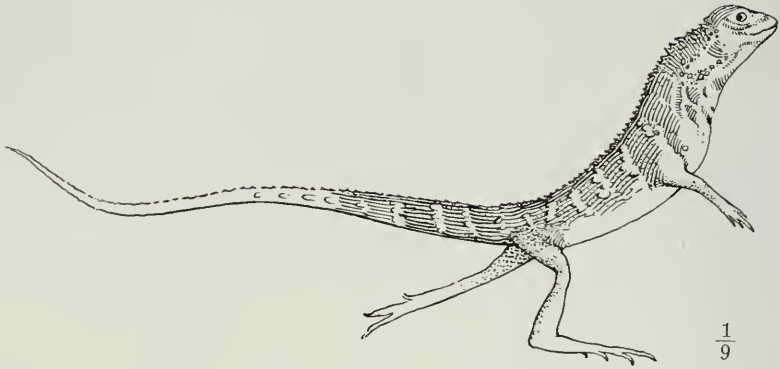
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The "Ostrich Mimic" Dinosaur, *Struthiomimus*.— A—Theory of the running pose based upon the flight of modern lizards. B—Theory of the anthill-attacking pose

is found to possess in the hind feet portions of an additional toe, which is not present in the original *Ornithomimus* specimen, and in view of the close resemblances which the animal presents in its skull, neck, and hind limbs to the existing ostriches, rheas, and other struthious birds, the author decided to name it the "ostrich mimic," *Struthiomimus*.

The way would be quite clear for a

limb and hand, which are almost as much unlike those of the carnivorous dinosaurs as they are unlike the wing of the ostrich. It resembles, on the contrary, in some respects the fore limb of the peaceful herbivorous tree sloths of South America, such as the three-toed sloth *Bradypus*, or the two-toed sloth *Choloepus*. The arm and forearm are long and relatively slender, as in the three-toed sloth, while the hand



From instantaneous photographs of the Australian water lizard (upper) and the frilled lizard (lower), showing the manner in which it is believed that the small primitive, two-legged dinosaur ran. The tail acts as a balancer to the fore part of the body.

consists of three digits of nearly equal length, the thumb being set off from the other fingers apparently for grasping purposes while the second and third fingers are quite closely appressed side by side as in the hand of the two-fingered sloth. The terminal bones of the fingers were provided with long, partially recurved claws adapted for grasping the limbs of trees, as in the climbing sloths, but not adapted in any way either for digging in any hard substance or for seizing an active prey. This unique combination of characters has led to a very lively discussion as to the life habits of *Struthiomimus*. All agree to abandon the idea that it was a carnivorous animal, but opinion varies between a purely herbivorous and a carnivorous interpretation.

First, as to the running motions of

the animal, it is agreed that the "ostrich mimic" is certainly the swiftest reptile which has ever been discovered. It nearly rivals the modern ostriches in its powers of speed. As the fore part of the body was balanced by a long, slender, and very rigid tail, in which the vertebræ are closely articulated, it is apparent that it depended upon the balanced mode of running, similar to that which is seen in the swift bipedal movements in several of the modern lizards, such as the Australian water lizard or the frilled lizard. The habit in lizards of running upon the hind legs with the body reared upward in front has been observed among representatives of three families—namely, the Old World Agamas, and the New World Iguanids, and Tegus or race runners. In each of these forms the



"Ostrich Mimic" Dinosaur *Struthiomimus* in Flight.—Theory of the "ostrich mimic" dinosaur at full speed, with the tail balancing the body, partly assisted by a thin membrane (or patagium) on the fore limb, aiding flight as a parachute or air plane



C



D

Two Additional Theories of Habit to account for the Structure of the "Ostrich Mimic" Dinosaur.—C—Tree-browsing theory. The fore limbs are used as supports. D—Shore-living theory. The fore limbs are scratching in the sand for small Crustacea and Mollusca

running habit has evolved independently. The habit has been observed among large tree-living species as well as among lizards of diminutive size, several of the latter frequenting the deserts. The lizard appears incapable of rearing unless moving at a high rate of speed. The bipedal trait may be indicated immediately after the beginning of the dash over the ground or the lizard may rear upward after it has run a considerable distance. As observed also by the herpetologist, Raymond L. Ditmars, during the reared, running pose the front limbs appear to droop voluntarily and not to be used as balancers, but the position of the tail indicates the marked importance of this organ in balancing and there is a voluntary curving upward of the tip of the tail in order to keep the body upright. From these studies of modern lizards we may picture the running gait of the "ostrich" dinosaurs, in which the rod-like tail balances the anterior half of the body, the tail being somewhat longer than the backbone in front of it. The hind limbs are relatively longer than in any of the running lizards but relatively shorter than in the ostriches, so that we are not justified in believing that these animals quite attained the remarkable speed of the modern ostrich, which outruns the swiftest horse. The toes of the hind feet of *Struthiomimus* are purely of the running type and not adapted for scratching or digging.

Influenced by the fact that the remains of these "ostrich mimics" are invariably found in deposits which had formed ancient seashores, in conjunction with the peculiar structure of the neck and the fore limb, Barnum Brown has suggested that the animal was a wader which fed upon small crustaceans and mollusks, using its long

anterior claws partly to scrape the sand away and partly to seize the shore-frequenting animals. There are three objections to this theory: first, neither the beak nor the ends of the fingers are adapted for seizing an actively moving crustacean prey of any kind, although they may have been capable of securing the sessile mollusks, which may have been swallowed whole; also neither the structure of the beak nor of the toes is analogous to that of the shore-living birds (Gallatores), which partly live upon small invertebrates.

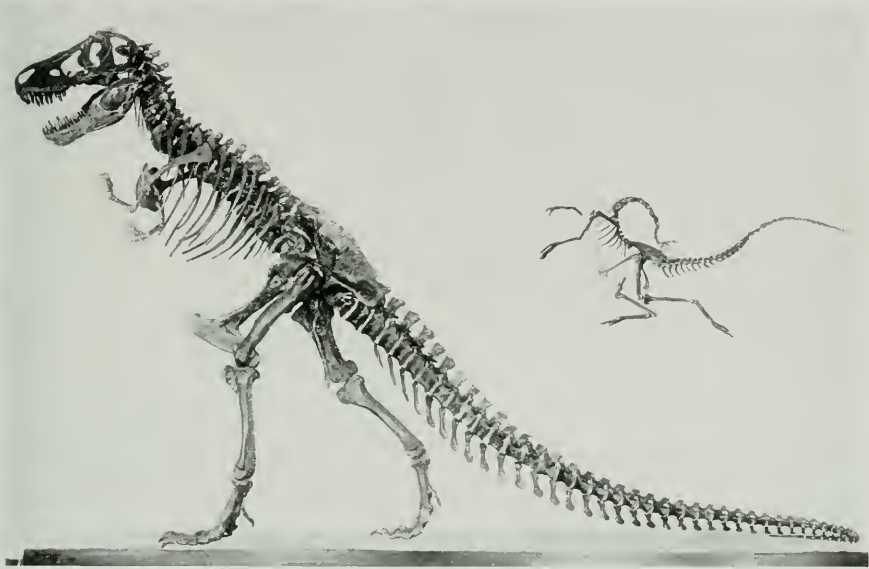
Another theory is that suggested by the ornithologist, C. William Beebe, that the fore limbs of the "ostrich mimics," feeble as they were, may have been adequate for attacking sandy and gravelly anthills. The difficulty with this theory is that the terminal bones in both the fore and hind feet do not afford evidence of powers for scratching or digging, nor do the upper bones of the fore limb give evidence of accommodating digging muscles.

The theory which, on the whole, seems the most probable one is that the "ostrich" dinosaurs were adapted chiefly for an herbivorous browsing pose either among low shrubs or the lower branches of trees. In balancing the body by means of the smaller branches of trees and in drawing down the limbs of trees toward the mouth, the long, sloth-like hands may have been used as the tree sloths use theirs. While the fore limb is quite powerful, it was certainly not adapted to quick movements such as are essential to the capture of an active prey. It must be admitted that no thoroughly satisfactory explanation of this limb has yet been suggested; it is evident that it was ideally adapted for some particular function or habit which had already been assumed in part in the remote an-

cestral form, the "bird catcher" of Jurassic time, *Ornitholestes*.

Thus the theories of several expert anatomists who have coöperated with the author in attempting to solve the riddle of this "ostrich mimic" indicate very great diversity of opinion and of

less, descended from similar ancestors: *Tyrannosaurus* extremely large-headed, with powerful teeth, very short neck, and short, powerfully clawed fore limbs and enormous hind limbs provided with very powerful recurved claws; *Struthiomimus* extremely small-headed, the



The "Ostrich Mimic" Dinosaur, *Struthiomimus*, and the "Tyrant" Dinosaur, *Tyrannosaurus*.—To illustrate the wide contrasts between the skeleton of the "ostrich mimic" dinosaur (right upper) and that of the "tyrant" dinosaur (left lower), animals which, notwithstanding their extreme unlikeness in adaptation to habits, descended from similar ancestors. Photographed to the same scale

interpretation. It is agreed only, first, that the animal was a very swift runner, and, secondly, that it was in all probability herbivorous and that perhaps the hand was adapted for searching out and grasping some particular form of shrub or fruit.

The contrast which this animal presents to *Tyrannosaurus* gives us one of the greatest extremes known to science of two types adapted to most widely different habits which have, neverthe-

less, descended from similar ancestors: *Tyrannosaurus* extremely large-headed, with powerful teeth, very short neck, and short, powerfully clawed fore limbs and enormous hind limbs provided with very powerful recurved claws; *Struthiomimus* extremely small-headed, the toothless jaws sheathed in horn, the neck elongated and highly flexible, neither the fore nor the hind limbs adapted for seizing a live prey. In both animals the hind limbs are adapted to very rapid progression. In the case of *Tyrannosaurus* this is designed to overtake the prey, while in *Struthiomimus* this length of limb was doubtless to enable the animal to escape from enemies, among which may have been the *Tyrannosaurus* itself.



IN THE HEART OF THE VENEZUELAN ANDES

Coming down into the valley of the Rio Chama. Picturesque wheat farms occupy the shelves of the mountains up to an elevation of about eleven thousand feet

Travel Notes in Western Venezuela

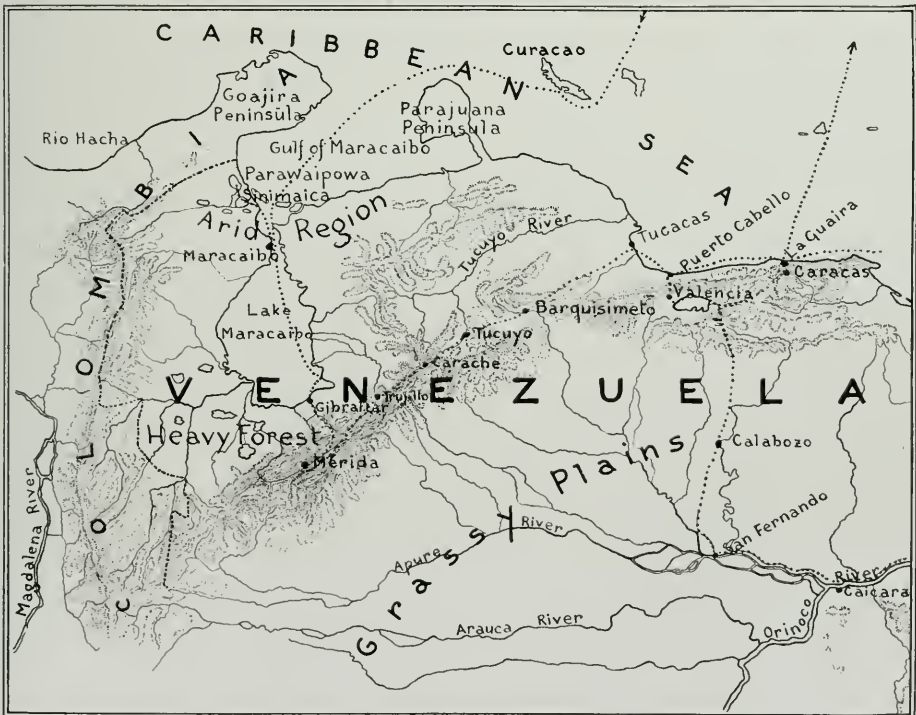
By HERBERT J. SPINDEN

Illustrations from photographs by the Author

IT is a time-honored story that relates the origin of the name Venezuela and one more to be credited than the majority of place name anecdotes. When Alonzo de Ojeda, accompanied by the illustrious geographer, Amerigo Vespucci, entered the Gulf of Maracaibo in 1499 he found villages raised on piles above the water. From this circumstance he gave the name "Gulf of Venice" to the shallow sea enclosed between the arid peninsulas of Goajira and Parajuaña. Those were days of flowery speech and fervid imagination: the comparison between Venice the Magnificent and the homes of humble fishing Indians in the New

World struck the popular fancy and soon the whole land was known as Venezuela—Little Venice. The surviving pile-built villages north of the city of Maracaibo are still of great interest to the ethnologist and to the traveler with an eye for the picturesque.

Slipping out of Maracaibo at nightfall in a *bongo* manned by Parajuaño Indians we arrived at the lagoon of Sinimaica at ten o'clock next morning. The *bongo* is a flat-bottomed boat propelled by sails or poles and fit for navigating shallow waters. The lagoon of Sinimaica is the largest of a series of small brackish lakes connected by natural canals called *caños*. There are three



Map of western Venezuela showing a portion of the route covered by the American Museum archaeological reconnaissance of this part of northern South America



Among the lake dwellers in Venezuela there are considerable differences in wealth. The poorer people live in picturesque poverty in an outer line of houses



The pile-built villages in the lagoon of Sinimaica are survivals of the ancient villages of the Indians from which the name Venezuela—Little Venice—was derived. All traffic is by boat and you step from the wobbly dugout upon ladders rising from the water and find yourself on a shaky platform of small poles. Within the house you sit on your heels and eat toasted plantains and boiled manioc, while beneath you little scavenger fishes watch eagerly for crumbs that may fall through the latticed floor

villages of Parajuano Indians in this lagoon bearing the Spanish names La Boquita, La Boca del Caño, and El Barro. All are of the same character, being composed of detached clusters of houses well out from the low shore. Mangrove thickets fringe the open water where they have not been cleared away for coconut walks. There is a tide of perhaps two feet in the lagoon and the houses rise two or three feet above the high-water mark. All traffic is by canoe and you step from the wobbly dugout upon ladders rising from the water and find yourself on a shaky platform of small poles. You are courteously invited to enter. The rectangular houses have light frames and roofs of heavy thatch. Mats enclose the sides and cover portions of the floor. The fireplace is a box filled with earth. While you sit on your heels and eat toasted plantains and boiled manioc, you see through the latticed floor the upturned faces of little scavenger fishes eager to catch the crumbs that fall.

Freedom from the insect life that makes the shores unbearable may account for the custom of building houses out over the water. But it is an interesting fact that these lake dwellers also have houses upon the arid plain well back from the thicket-covered shores. The plain is a dreary stretch sparsely covered with acacias and other desert shrubs. The most conspicuous of these is the *divi-divi* from the seeds of which a valuable dye and tanning substance is extracted. The houses in the desert are mere roofs upon poles and as often as not the hammocks are swung under an unusually large tree. The natives take evident delight in keeping open house and in living *al fresco*.

The dress affected by the women at the present time is a voluminous gown resembling a partially deflated balloon.

In ancient times the dress was doubtless much simpler and it is interesting to note that bandoleers and belts made of long strings of beads are now worn under these generous garments. Tattooing is seen upon the arms while the face is ordinarily painted with a large circle upon each cheek connected by a line across the nose. The men are sometimes seen in their ancient attire which consists of a belt and breechcloth and sometimes a poncho. Artificial wigs are worn by the leading men, and sandals with tasseled latches.

The Goajiro Indians live mostly in the interior of the desert peninsula that bears their name and their warlike habits have kept the white man from their territory. In two places they have come in contact with civilization, one at the Catholic mission of Rio Hacha in Colombia and the other at the lagoon of Parawaipowa where the Venezuelan government maintains a border garrison. The mountain range west of Lake Maracaibo (the Sierra de Perihá) is controlled by the wild and little known Motilones.

In Venezuelan histories one reads dark tales of Sir Walter Raleigh, L'Olonais, Sir Henry Morgan, and the lesser buccaneers who ravaged the Spanish Main for the glory of England and their own immediate fortune. Maracaibo was sacked again and again. Even the strongly defended Gibraltar at the southern end of Lake Maracaibo was destroyed. Today one sees at the latter site a few modern huts built round the old plaza. Paved streets can be traced out into the bush and ruined walls enter the waters of the encroaching lake. Only a graceful bell tower remains intact from former times.

Lake Maracaibo is surrounded by a coastal plain extremely dry in the north



On the arid plains back from the lakes a large divi-divi tree often serves as the sole shelter of a family, and the hammocks are swung in the shade

Weaving with cotton is still practiced by the Goajiro Indians. The products of the loom include sashes, ponchos, and hammocks

and given over to cactus and thorny shrubs, but humid in the south and clothed in heavy forest. The sierras rise abruptly from the edge of this plain and to great heights. From the southern end of the lake the Andes seem an impassable wall with their forested slopes and fogbound crests. And indeed the trails that sidewind deep gorges and climb lofty ridges, only to drop again to the roaring stream, find passes in the barren paramo some fourteen thousand feet above the sea. The transitions from one type of environment to another are sudden and startling.

A direct but little used trail for Mérida leaves the unhealthy lake port of Bobures, passes through small savannahs and stretches of dripping forest to Torondoy, a coffee center, and then ascends the Torondoy River to its very source in the paramo of Mucumpate. In the coffee region the mountain-sides have been cleared of forest and only the widespreading bucarí trees retained as shade for the tender shrubs. In February these bucarí trees are masses of vermilion blossoms.

Leaving Torondoy we soon find that the valley has become too dry for coffee, perhaps because the high ridges to seaward rob the winds of their rain. Small huts of mud and thatch cling to the steep slopes, and irregular fields of maize differing in age and condition make an odd patchwork of dull colors on the mountain-sides. The brighter green of plantains



Open house is kept in the desert by the Parajuano and Goajiro Indians. The peninsulas that flank the Gulf of Maracaibo are exceedingly arid. The Goajiro Indians inhabit the western one, and those groups living in the interior are almost untouched by civilization. The Parajuano Indians may once have inhabited the eastern peninsula. The old man wears the apron of olden times. He belongs to the Parajuano tribe



The Parajuano woman seated in the hammock has her face painted in a fashion peculiar to this tribe. The hammock is native of South America, and is in common use throughout Venezuela

shows itself in moist ravines. At Mucumpis Below we are not able to wheedle a noonday meal from Mrs. Sanchez who keeps the posada. After a brief rest we climb in a dizzy zigzag to Mucumpis Above where half a dozen Indian huts are clustered in a hanging valley. We now enter a second zone of humidity and soon the forest closes in about us. While the trees are not of great size the growth is very dense, with vines, canes, and ferns competing for the scanty spaces between trunks and branches. One sees the familiar plants of New England gardens in begonias that bank the trail, in fuchsias, geraniums, and the purplish Wandering Jew. Out of the blue the afternoon fog creates itself in wisps and shreds and soon the world is lost to sight. The forest opens, for we are nearing its upper limit and the trail feels its way in the white dusk along the edge of things. Mossy trees are like vanishing ghosts but reality comes in the roar of the stream a thousand feet below.

At Samuro, a rambling mud-walled structure with smoke-blackened thatch, we found a number of shivering Indians in striped ponchos. The earthen floor of the common sleeping-room was wet and the chill fog penetrated everything. Kindliness and good humor flourish but cleanliness is an unknown virtue in the mountain inns of Venezuela. One may easily picture some starving disciple of Hygeia shutting his eyes and praying while he eats, but to a peripatetic anthropologist after a hard day on the trail the earthy smell of the small greenish potatoes is grateful and comforting. Then there is a savory but uncertain stew and perhaps an egg sprinkled with the rusty salt that the government sells. On special occasions a mediæval boar's head may be brought in on a charger.

The paramo is the barren land above the timber line. In the Venezuelan Andes it begins at about ten thousand feet elevation. The transition from the upper forest zone is fairly abrupt and is marked by the dwindling of the trees and by the increase in size of the plant most characteristic of the paramo—namely, the *Espeletia*. This curious perennial, with its leafy crown felted with cotton against the cold, its awkward flower stocks set with yellow blossoms, and its thick trunk made of the dead and blackened leaves of former years, is called the *Frailejon del Paramo*—the Great Friar of the Paramo. It grows to the height of six or seven feet and in the distance is not unlike a human figure in white cowl and black cloak. Another plant of the paramo has small leaves braided along the close-growing stems. It might be mistaken for juniper were it not for the pink and yellow blossoms. A common bush resembles the huckleberry and is often heavily fruited.

From the divide one gains a splendid view of the Sierra Nevada de Mérida across the deep valley of the Chama River. This range boasts five peaks rising into the zone of perpetual snow. The highest one, La Corona, is given by latest measurements an altitude of 5002 meters (16,411 feet). The trail drops down through a valley showing signs of ancient glaciation and after two hours' travel we come to a region where wheat is raised. The little irregular fields are as stony as those of the New Hampshire hills. At Mucuchies, a town of some size with a population largely Indian, our trail joins with the better traveled one running from Valéra to Mérida.

The valley of the Chama below Mucuchies grows drier and hotter as we go down it but before Mérida is reached



Photo by Dr. Alfredo Jahn, Caracas

Highland type of Indian woman, from the region of Mérida. The native population of the Venezuelan Andes was divided into many tribes speaking different dialects. Little now remains of the ancient culture



Lowland type, from the Guajira Peninsula. These Indians are sturdy and independent; in fact the warlike habits of the men have effectually kept the white man from their territory. The women in recent times have adopted a voluminous gown resembling a partially deflated balloon. They still tattoo the arms, however, and wear, under the gown, their long strings of beads



The Andes rise as a great wall at the southern end of Lake Maracaibo and during the winter are often wrapped in fog. The trails sidewind deep gorges, and houses are often perched on steep hillsides. In the lower zone the climate is humid and the vegetation rank and tropical. Coffee is grown on the steep mountain sides under a cover of larger trees. The plantain—a coarse banana—is often cut green and toasted in thin slices as a substitute for bread



The principal plant of the paramo of the Andes—the land above timber line, beginning at ten thousand feet elevation—is the *Espeletia*, with leaves heavily felted against the cold with down that resembles cotton

conditions change for the better. Mérida is an old-fashioned city and a natural fortress, placed on a sloping bench between two streams. The University of the Andes is situated here. Coffee of superior quality is grown as well as a variety of other tropical products.

From Mérida one may travel by mule

on the dry soil is agriculture possible.

The archaeological explorations were extended into northern Venezuela. Next a journey was made southward across the llanos or grassy plains to Cabalozo and San Fernando de Apure.

As a purely scientific result of the expedition, it now seems clear that the earliest pottery art of Mexico and Cen-

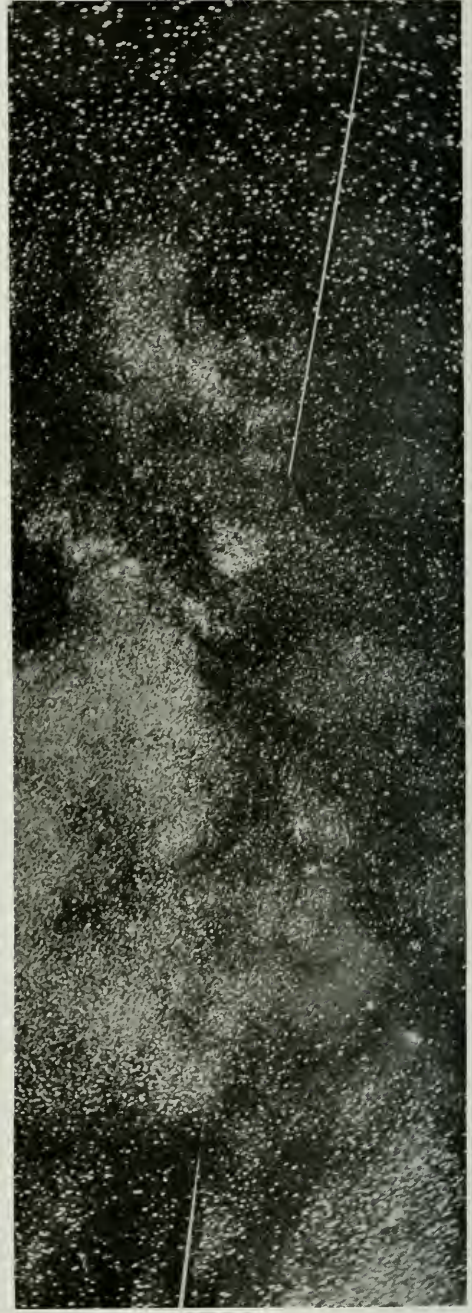
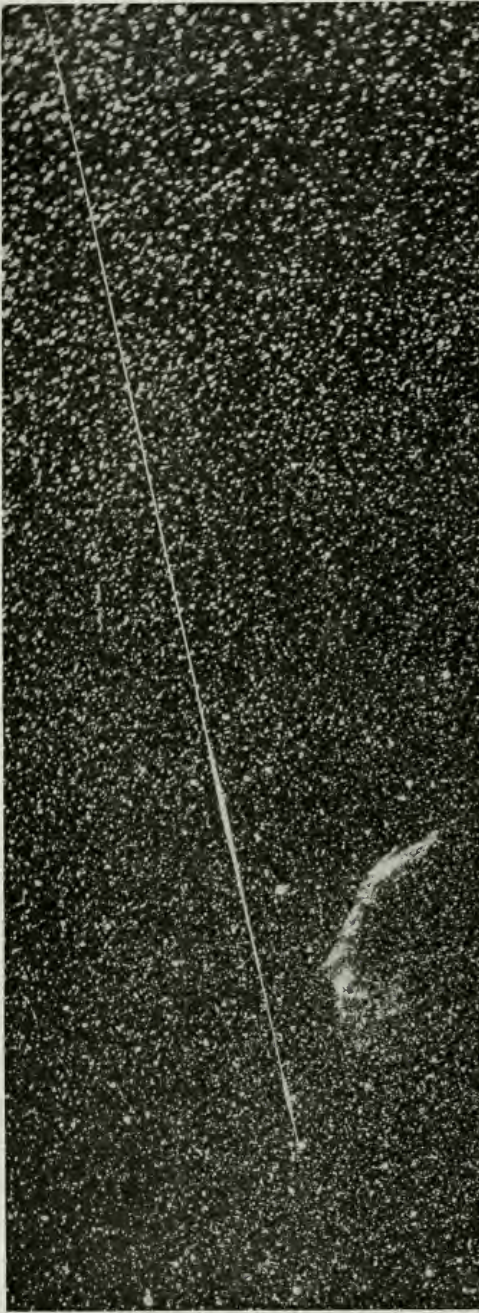


Photo by Dr. Alfredo Jahn, Caracas

Street scene in Mérida. Five snowy peaks rise directly opposite this city and afford a brilliant contrast of tropical and arctic life

to Valéra, Trujillo, Carache, and Tucuyo in a general northeasterly direction. The Andes decrease in elevation but some of the passes are ten thousand feet or more above the sea. There are narrow forest belts as well as short stretches of true paramo. The lower country is hot and dry and when we come to the broad plain in which lie Tucuyo and Barquisimeto we find forests of cactus trees made almost impenetrable by underbrush of smaller cactus. Only where water can be put

tral America, belonging on what is known as the "archaic horizon," was extended in ancient times across northern South America possibly to the mouth of the Amazon. The trail, marked by clay figurines of a peculiar style, is of greatest interest because the spread of this pottery art was associated with the first spread of agriculture, and with the historic development of plants, such as maize and beans, that are of the utmost importance in our own day and civilization.



Photos by E. E. Barnard,
Yerkes Observatory, Wisconsin

METEORS IN FLIGHT

The meteors are within our atmosphere, the many stars are millions of miles away. *Reproduced from transparencies in the American Museum.*

A rapidly moving meteor is hot only in a thin skin on the surface which takes fire and is blown away in the onrush as fast as it burns, trailing behind as a stream of light. Iron meteors are so combustible that they may burn like tinder in the oxygen compressed to high heat in front of them. Thus it is that small iron masses, moving rapidly, may burn entirely away and no fraction of them reach the ground

The Flight of a Meteor

STORY OF THE FLIGHT OF STONE AND IRON METEORS THROUGH THE AIR. THEIR DIRECTION AND IMPACT WITH THE EARTH.—EXPLANATION OF THE TRAIL OF FIRE OF A "SHOOTING STAR"

By ELIHU THOMSON

At this time, when the application of science to national defense and to internal industrial development has been forced into an importance that centers the world's attention on its scientific men, any word from an American like Elihu Thomson is of especial note. While the following article concerns pure science rather than applied science, Elihu Thomson stands to Americans chiefly as an exponent of applied science. His contributions to electrical engineering have yielded him some five hundred patents, among them the very great discovery of electrical welding. He is in fact one of the few men of today whose personal achievement is having a large effect upon industrial progress. In addition he has given his coöperation to others working in applied science to such an extent that President Maclaurin, of the Massachusetts Institute of Technology, recently bestowing upon Dr. Thomson the Fritz medal of that institution, pronounced him one of the greatest teachers of his generation. With this in mind it is an unusual pleasure to read the following clear explanation of an astronomical matter which for most of us has heretofore been enveloped in vagueness.

The collections of meteorites in the American Museum of Natural History are unusually large and important, and also are unusually well arranged for study by the visitor. In a brief paper following the present article Dr. Chester A. Reeds, assistant curator of geology and invertebrate palæontology in the American Museum, has suggested a few of the collections and specimens which particularly illustrate the points made by Dr. Thomson.—THE EDITOR.

THE following may assist to a proper understanding of the physical and chemical actions which occur during the passage of a meteor into our atmosphere. Outside of our air a mass of matter such as constitutes a meteor or shooting star would necessarily be very cold. Its velocity on entering our air will be its velocity in space compounded with the earth's motion or velocity around the sun, according to the direction of its motion in relation to that of the earth. When the velocity relatively to the earth is high, the earth's gravitational force can modify the motion but slightly. In such cases, the earth's atmosphere acts so effectively as a protective sheath, that only a few of the very numerous bodies variously known as shooting stars, meteors, aërolites, and siderites ever reach the earth's surface. If the velocity is as high as thirty or forty

miles per second in entering our air the crushing strains brought upon it by air resistance in its path may be great enough to break it into fragments. while the high temperature of the compressed air in front of it and opposing its motion melts or vaporizes the materials of which it is composed. Stony meteors resembling pieces of rock would naturally yield to fracture and dissemination more readily than masses of solid iron. This may account for so large a proportion of the bodies which reach the ground being composed of iron, known as meteoric iron.

Rock masses are, however, occasionally found and have perhaps survived because they were moving, in a general sense, along with the earth in its orbit, and would thus have a lower velocity in entering our air. But the iron meteors are so strong as to resist enormous crushing strains and remain intact, or

they become broken into a few pieces only, which survive further crushing.

Metallic iron is however so freely combustible that when exposed to a blast of hot, compressed oxygen, it is burned into fused iron oxide very rapidly. That is what happens to iron meteors in their flight. The air in front of them is like a blast of highly compressed gas so rich in oxygen, and so heated by compression, as to cause the iron to burn like tinder. The survival of a stony meteor or aërolite for such a time that it may reach the ground, must consequently result from its having entered our outer air at a comparatively low velocity—or upon its having had a long flight almost horizontally in the thinnest outer air, so that much of its initial speed was lost before it fell into the denser air below. On the other hand, the survival of an iron meteorite or siderite depends on its velocity being insufficient to develop crushing strains great enough to fracture it into small pieces, and upon the size of the meteoric mass itself, or of its fragments, if fractured. A small iron mass of high velocity will burn away so rapidly in the dense oxygen in front of it that the whole mass will be consumed and dissipated before any of it reaches the ground. Moreover, the energy of motion converted into heat by air resistance will not heat the body internally. The heat will be in the fused outer skin of oxide and will go into the trail or train left behind in the meteor's path. Indeed, the fused iron oxide as soon as formed on the outer surface is blown off and left behind in the hot luminous trail which marks the course of the body through the air.

If, however, the iron mass or fragment is large and the velocity has been reduced so that no further crushing or breaking can occur, then although rap-

idly burning on its surface, the time of flight being short, a considerable fraction of it may reach the ground or the sea surface while still moving with considerable velocity. On the land it may bury itself to a depth more or less great. In the case of an iron meteorite just considered, there will then be two sources of heat energy giving rise to luminosity. The air in front will be highly compressed and luminous while the wastage by combustion of the iron on the outer surface will result in high luminosity and a train of sparks or fire with a more ruddy light back of the meteor.

The recent industrial use of the acetylene blowpipe with excess of compressed oxygen in cutting heavy iron and steel masses, such as thick plates, is an evidence of the effectiveness of the combustion of iron in removing material. The product is of course magnetic oxide, a black oxide of iron in a fused state which is blown away as fast as it is formed, thus continually exposing unoxidized metal to continue the burning. Melted pear-shaped drops have indeed been observed falling out of the track or train left by an iron meteor in its course through the air. These are probably composed of iron cinder or melted oxide.

The flight of a meteor is so short in time that although its surface is highly heated, it has not sufficient heat conductivity to allow heat to pass from its outer surface to the interior. It enters the air in a very cold state and at no time possesses more than a thin skin of heated metal, which at once burns, liquefies, and is torn off. It can only possess, as it were, a thin layer in which the temperature gradient is very sharp or steep. The temperature limit of this layer or skin is the melting point of the oxide or of the iron itself, for, as

we have said, it is blown away just as soon as fusion occurs.

Let us turn a hot blast or even a very hot flame upon a piece of ice. Water forms rapidly and is blown off the ice but what remains is none the less ice to the end of the process. Ice is not combustible. Let us then subject a ball of wax to a forcible oxygen jet at high temperature. The wax will burn outside, melt rapidly, and as soon as melted, blow away, leaving a rapidly diminishing body of wax to the last.

An instantaneous vaporization of the whole mass of a large iron meteor is therefore not possible. Such a meteor, on entering our thin upper air, will condense the gases immediately in front of it, increasing their temperature and bringing the oxygen to a density at which the combustion of the outer skin of the moving mass begins.

If the initial velocity be extremely high, the resistance as it reaches the denser air may rise sufficiently to crush or fracture the mass. The smaller fragments will now burn and the rate of wastage by combustion be greatly increased by the fracturing, exposing a much more extended surface to burning or oxidation. If the flight is long enough, most, if not all, of the fragments may be consumed before reaching ground. But if the velocity is not high enough to cause such extensive and complete fracturing the mass may not break at all—or the fracturing soon ceases and the remaining mass is merely diminished by combustion and fusion with the continual cleansing of the surface of fused products due to the rush of gas past the meteor. When the mass has a size sufficient, it may endure the rapid waste by oxidation and a considerable fraction of it reach the earth in a solid and comparatively cold condition, embedding itself in the ground.

Many fall into the sea. It would seem that a mass which has so survived will, in reaching the ground, have lost so much velocity that its striking speed will not necessarily be high as compared with that of a projectile from a high-powered gun. It will not be hot except as to a thin layer on its outer surface. Meteors rarely descend in vertical paths. Passing in a course more or less horizontal or much inclined to the vertical, they traverse many miles of dense air, and their form being usually very irregular, they meet with an enormous retardation as compared with the flight of a well-shaped cannon shot. When fragments are broken off they are poor projectiles and are retarded rapidly.

Iron meteors of round or nearly spherical outline are more likely to be gradually retarded than to undergo fracture unless their velocities are extreme.

The slower moving iron meteorites of any considerable size are almost sure to survive their flight and fall to earth, having undergone a wastage by combustion, not, however, constituting a high percentage of the total mass.

The greater number of the meteors reaching our air are naturally small, and are disintegrated or burned completely during flight. Others much larger have in many cases come to earth either entire or in fragments. There is no limit to their possible size so far as known, but evidently meteors weighing many tons are very rare. The great crater known as the "Meteor Crater," formerly Coon Butte in Arizona, a few miles west of Winslow, is by far the largest excavation known as attributable to the fall of a meteorite, or perhaps a cluster of them.

It is about forty-five hundred feet in diameter and six hundred feet deep. It

is surrounded by an upcast ridge from one hundred and fifty to two hundred feet above the surrounding plain, and fragments of meteoric iron are numerous in the slopes of this ridge and on the plain outside. At some time in the past a huge meteoric mass fell and excavated this enormous hole.

The similarity of form and proportions between the Arizona Meteor Crater and lunar craters is very striking and is strongly suggestive of the

idea that the craters on the moon are the unobliterated records of innumerable giant impacts of meteoric masses; unobliterated because, though formed millions, if not billions, of years ago, the moon's surface is not subject to erosion, as the moon has no atmosphere—it never had an atmosphere, being too small to retain one. Consequently it preserves a record of all that has happened to scar it during countless ages of past time.

COLLECTIONS OF METEORITES IN THE AMERICAN MUSEUM

THE collection of meteorites in the American Museum is large and varied, and exhibits in a considerable number of specimens various features of which Dr. Thomson speaks in his paper.

In one of the alcove windows on the east side of the hall of geology and invertebrate palaeontology of the Museum, there are a number of transparencies taken from photographs of meteors in flight. These were made by Dr. E. E. Barnard at the Yerkes Observatory, Williams Bay, Wisconsin. The meteors are represented by long white

streaks of light. In looking at these particular photographs one should not lose sight of the fact that the meteor trail is within our atmosphere and that the multitudes of stars which are also in evidence are millions upon millions of miles away. It is also interesting to note that the light streaks are not of a uniform width throughout. Instead of being spindle-shaped in outline as we might at first suppose, they are more like a series of elongated spindles or darts joined by attenuated bands of light. Does this imply that the elements of the air



The iron meteorite has a very thin black crust, of metallic luster. The texture within remains unaltered by the fiery journey through the sky. On some iron meteorites peculiar crosslines, "Widmanstätten lines," may be etched with a weak solution of nitric acid

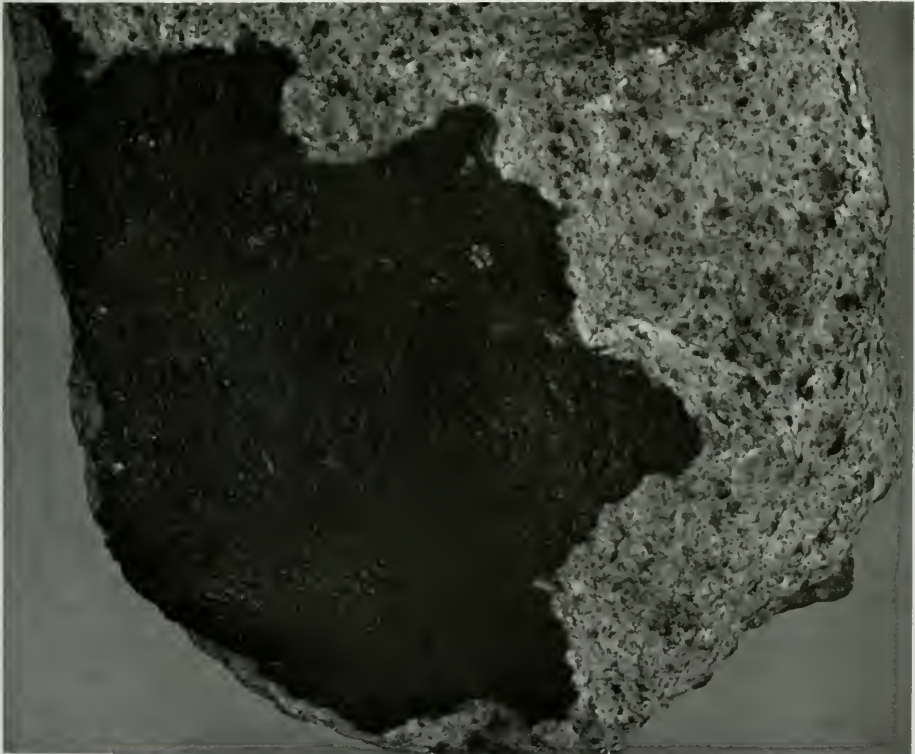
are unevenly mixed, that the oxygen is negligible or absent in places, and that there are "holes" in the upper atmosphere such as the aviators have experienced in the lower atmosphere? Perhaps there are a series of "crushing" stages throughout the flight of the meteor, which develop a larger number of smaller fragments and greatly increased rate of wastage by combustion (see Dr. Thomson's article, page 27). This would explain the enlargements in the meteor trail, but it does not meet the objection raised by the total disappearance of the light streak and its renewal subsequently as seen in one of the photographs.

The Museum collection contains a large number of stone meteorites (aërolites), as well as of iron meteorites (siderites), and a representative lot of the intermediate group of siderolites, which, speaking broadly, are part stone and part iron. The large stone and iron meteorites in the Museum collection are in Memorial Hall at the entrance to the Museum. The smaller stone, iron, and

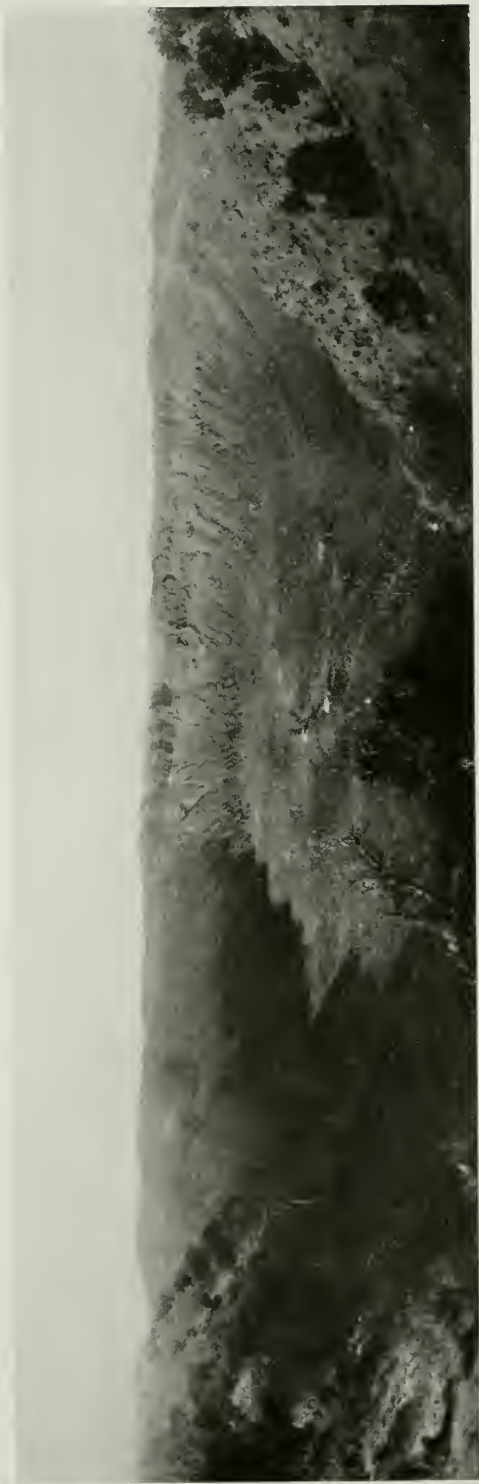
siderolite specimens are in alcove cases on the east side of the hall of geology and invertebrate palæontology, fourth floor, central wing.

The exterior of a stone meteorite is covered with a black crust about one thirty-second of an inch thick or less. The interior of such a specimen is unaltered, and on recently broken surfaces is usually of a light gray color. Where the aërolite has lain on or just beneath the earth's surface for a long time, both the exterior crust and chipped surfaces may be dulled by weathering, for even stone meteorites oftentimes contain considerable iron-bearing minerals which oxidize, thus discoloring the surface.

The Selma aërolite, from Selma, Alabama, in Memorial Hall, is the largest stone meteorite ever found in this country and one of the largest in the world. Several cracks are in evidence in this meteorite, but owing to the absence of a crust within the cracks, it is supposed that they developed after it reached the earth by alternate ex-



The stone meteorite has a black crust one thirty-second of an inch thick or less, and on freshly broken surfaces is light gray in color. Stone meteors, of course, break and scatter during flight much more readily than iron meteors



A HUGE HOLE MADE BY A FALLING METEORITE

Meteor Crater, formerly Coon Butte, in Arizona, is by far the largest excavation known which can be attributed to the fall of a meteorite. It measures 4500 feet in diameter, 600 feet deep, and is surrounded by an upcast ridge 150 to 200 feet high. Fragments of meteoric iron are numerous in the slopes and on the plain outside. A very comprehensive exhibit of photographs and specimens illustrative of Meteor Crater, Arizona, has been loaned to the American Museum through the courtesy of Princeton University and of Mr. D. M. Barringer, of Philadelphia. The exhibit is in one of the east alcoves of the hall of geology and invertebrate paleontology.

pansion and contraction of the mass just as joint planes are developed in rocks of the earth's crust, or, that they were developed at the time of the fall by impact.

The iron meteorites have a thinner crust or skin than the stone meteorites. The iron skin has a metallic luster and is not so black as the crust of the aërolite. The interior of these specimens, like the aërolites, was not affected by their passage through the zone of fire, the atmosphere, for their texture is unaltered up to the very skin. In some iron meteorites peculiar crosslines known as "Widmanstätten" or "Neumann lines" may be etched on a polished surface by a weak solution of nitric acid. For some time it was supposed that this was a sure way of identifying meteorites, but there are a number of siderite meteorites in the collection which cannot be etched. Their outer surfaces may be chiseled into a nose, rounded, or pitted, depending upon whether they turned over in their rapid flight. The most striking instance in the Museum of a protuberance shaped in this manner by the compressed oxygen flame on a siderite, is the large Willamette, Oregon, specimen. The back side of the specimen is rough and deeply scarred, while the front has a rounded, pitted, and fluted surface.

There is also in another one of the alcove

cases on the east side of the hall of geology and invertebrate paleontology one of the three collections of material which have been gathered from Meteor Crater. This exhibit has been placed here through the courtesy of Princeton University, and of Mr. D. M. Barringer, of Philadelphia. Another exhibit is at the United States National Museum, Washington, and a third one at the Crater itself, in Coconino County, Arizona.

Some years ago a company was organized under the direction of Mr. Barringer, which surveyed the site and sank drill holes in the bottom of the Crater to depths greater than five hundred feet. The products of the drilling, samples of the sedimentary rock, metamorphosed sandstone, shale balls, Canyon Diablo meteorites, and ejected rock fragments are on exhibition. A booklet written by Mr. Barringer containing a number of maps, photographs, and descriptive text accompanies the exhibit.

On an average of once a week the Museum is called upon to examine supposed meteoritic material, but in most instances we are obliged to tell the expectant visitor that his specimen is some other kind of rock. It should be noted that if the thin metallic skin or black crust is absent, the specimen is in all probability not a meteorite.

CHESTER A. REEDS.



Rear view of the Willamette meteorite to show the effects of the flames, whipped backward in the speed of the flight and the fierceness of the burning. This meteorite, now in Memorial Hall of the American Museum, was found in Willamette Valley, near Oregon City, Oregon, November 9, 1906. [See the back of the cover for another view of this meteorite]



A SEPTEMBER MIGRATION ON LONG BEACH, LONG ISLAND

When the wind is strong from the north or northwest, many of the insects travel westward along the south side of the boardwalk. "Monarch" butterflies are in the majority, with occasional violet tips, the hunter's butterfly, peacock butterflies, and other species.

The author, through eight years' observations, has discovered for the "monarch" a route nearly one hundred miles long on the southern coast of Long Island. This is thought to be a part of the extensive coastwise route for this butterfly from Canada into the Southern States. This butterfly migrates northward also in the spring

Autumn Migrations of Butterflies¹

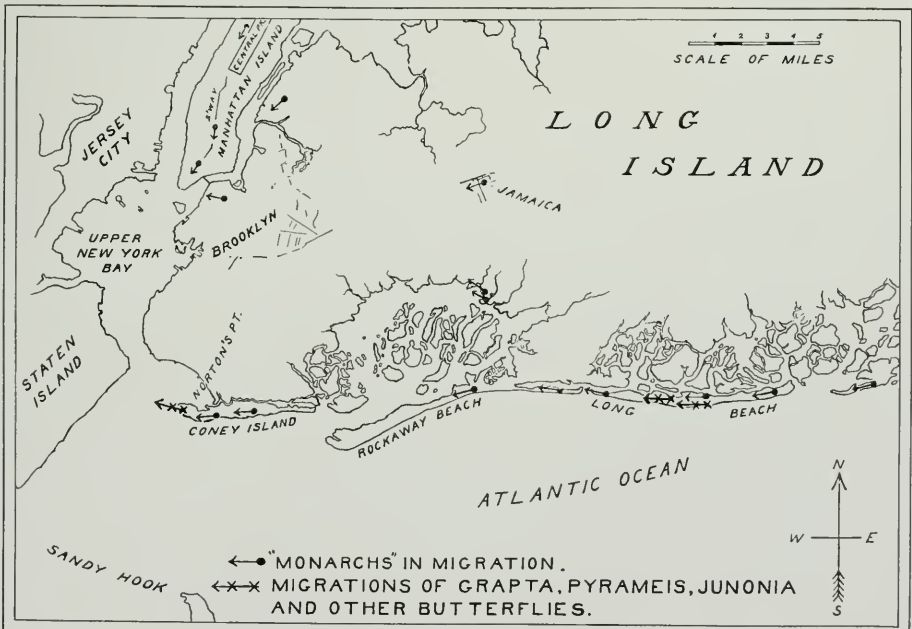
By HOWARD J. SHANNON

With records made on Long Island during August and September, 1916

SYSTEMATIC studies of the seasonal migrations of insects have always been attended by difficulties which are sufficiently obvious. The elusiveness, when in full flight, of the subjects themselves, the difficulty of distinguishing a merely local movement from an extensive advance, as well as the wide geographical range of various species which may be considered migratory, so that it is impossible to distinguish incoming travelers from the resident population—all these are drawbacks which have stood in the way of more definite information. Therefore it is not surprising that we have such fragmentary knowledge of the species which do migrate, as well as of

the laws which govern them in their annual behavior.

In fact, there is a large and impressive body of opinion which questions whether butterflies take part in seasonal movements with any real constancy and regularity in temperate North America, except in the case of the "monarch" (*Anosia plexippus*), and the "great sulphur" (*Catopsilia eubule*), which certainly move south in autumn and north in spring. In addition to these, of course, there are the dispersal movements from the south involving certain butterflies and, more particularly, moths like the cotton moth (*Aletia argillacea*) and the velvet bean moth (*Anticarsia gemmatilis*), which



Autumn migrations of butterflies on Long Island. Fluctuation in numbers of migrating butterflies from day to day is apparently due to changes in wind direction, so largely also a controlling factor in the migration of birds. Migration is much more profuse along the Long Island coast on days when the wind is north or northwest

¹ Article and illustrations copyrighted, 1917, by Howard J. Shannon.

arrive so late in the north as to perish with the approach of winter.

This body of negative opinion as regards the regularity of seasonal movement, seems to be especially strong among European entomologists and in connection with the insect life of that continent. Yet, for reasons which need not be elaborated here, and on account of the larger number of detailed records which have been made, one would expect an opposite conclusion. In the year 1898, Mr. J. W. Tutt, the British lepidopterist, reviewed the scientific literature in an exhaustive paper and concluded that, "although nothing would have given us greater satisfaction than to have discovered in our inquiries into this subject an analogy between the migrations of insects and the migrations of birds, we can find none. The latter is regular, systematic, purposeful: the former appears to be spasmodic, irregular, uncertain, and undertaken solely on account of the absolute necessities of the time." Yet, as the writer has tried to show in a recent article,¹ a review of the literature of dragon fly migrations throughout Europe shows a constancy of direction, of season, and of route, for all the countries where records have been made.

An attempt in this review will be made to show, first—the principles of behavior governing autumn butterfly migrations on Long Island, and second—the species of butterflies which have been found migrating in observations carried out with these principles in mind.

As a result of eight years of personal observation on the southern coast of Long Island, a route of travel has been definitely established for the "monarch" butterfly. The movement begins about mid-August and lasts

through September, with stragglers appearing even into late October. This route of nearly a hundred miles is believed to represent only one part of the coastwise highway leading from the Canadian territory and extending into the Southern States—an assumption which seems justified by a constantly growing mass of data in the writer's possession. It is a question, however, how many insects cross Long Island Sound—whatever may be the habit of the birds. It is probable that the insect migrants which follow the southern Long Island coast in autumn are drawn, in very large measure, from the island itself. In any case, it is evident that the travelers coming down from the north will be so deflected sideways by the east-and-west-lying ocean shore as to cause a crowded movement there—a contracted procession composed of many insects traveling side by side in company. Thus Long Beach on southern Long Island, a sandy, barren land unobscured by trees, has been chosen for these observations.

Another assisting factor has been found in the discovery that the fluctuation from day to day, and as pronounced as it is in the case of birds, is apparently due to the same cause, a change in wind direction—although the temperature change, often accompanying the shift in wind direction, doubtless acts as an important factor. Mr. C. C. Trowbridge found that when the wind was from the northeast the hawk migration along the Connecticut and Long Island shores was comparatively slight, while with the wind from the southern quarter, the movement became still less, or ceased entirely. But when the wind shifted to the north or northwest, many birds were urged southeastward into Massachusetts, Rhode Island, and into eastern Connecticut, as well as

¹ Do Insects Migrate Like Birds? *Harper's Magazine*, September, 1915.



"MONARCHS" RESTING DURING A STRONG NORTHWEST WIND

On Long Beach, Long Island, and at Coney Island, the "red-winged monarchs" have been observed during gales clustering in characteristic bunches and adding a touch of color to garden shrubs and shade trees

into southeastern Long Island. This resulted in a far more profuse migration along these shores, as the birds struggled westward against the wind on their way to the more direct flightway down the Atlantic shore. Identical behavior has been repeatedly noted in the case of the butterflies and dragon flies. So, although many observations have been made with a great variety of wind direction prevailing, days of north or northwest wind have been intentionally chosen owing to the greater opportunities they offer for the observation of less common, and in some cases, so far as the writer knows, the hitherto unnoted autumn butterfly migrants of Long Island.

Still another local feature should be noted: the fifty-foot-wide board walk that, supported on concrete pillars, extends for several miles along the beach in close proximity to the ocean. For when the winds are especially severe from the northern quarter, many butterflies travel in the protective trough or valley formed by the dune slopes and the northern side of the walk; while many are even driven beyond this barrier between them and the ocean, and in its southern lee, work their way steadily west in the measure of protection it affords.

The detailed records which follow include observations of the year 1916, and were made in the immediate vicinity of this walk. For although butterfly migrants other than "monarchs" have been noted in previous years, both here and in Connecticut, only recently have they been clearly identified by repeated capture of nearly all the species concerned. These notes were made, of course, from a fixed station, and represent only a small part of the butterflies which were doubtless traversing the beach some distance away.

AUGUST 12, 1916. *Wind northwest.*

The flightway at Long Beach is visited at 2.20 P.M.

A profuse migration of dragon flies is in progress including a greater number of species than the writer has ever before observed at one time. *Epiaschna heros*, *Libellula pulchella*, *Tramea lacerata* and *Anax junius* are in the majority with a greater number of *Epiaschna heros* than any other species. A less number of *Celithemis elisa*, *Libellula semifasciata*, *Pachydiplax longipennis*, *Erythrodiplax berenice* and *Sympetrum rubicundulum* are also present. All alike are traveling steadily west along the south side of the board walk, until they reach the obstructing buildings to the west when they turn diagonally northwest against the wind and pass through the streets of Long Beach. This divergent path is followed throughout the migratory season, although some individuals fly directly west without diverging. "Monarchs" are present but not in great numbers, flying side by side with the dragon flies. At 4.30 P.M. two dark-winged butterflies, almost certainly *Fanessa antiopa*, pass west and are followed by one *Basilarchia dissippus*.

AUGUST 15. *Faint breeze from the south.*

10.20 A.M. A scattered procession of "monarchs" is passing steadily west. (In all following records the westward direction of flight will be understood unless another point of the compass is indicated.)

10.21. *Libellula pulchella* passes.

10.22. *Libellula pulchella* passes.

10.35. *Epiaschna heros* passes.

10.37. *Libellula pulchella* passes and is followed by *Fanessa antiopa*.

10.43. *Libellula pulchella* passes.

10.45. *Pyrameis huntera*.

11.30. *Pyrameis huntera*.

11.31. *Pyrameis huntera*.

11.35. *Epiaschna heros*.

2.35. *Pyrameis huntera*.

From 2.35 until 4.20 only one more *Libellula pulchella* and another *Pyrameis* pass. A day of sparse migration, as not one "monarch" is seen during the latter part of the afternoon.

AUGUST 20. *Wind southeast.*

11.30. *Fanessa antiopa*.

11.35. *Anosia plaxippus*.

11.55. *Basilarchia dissippus*.

From 12.15 until 6 P.M. no "monarchs" are seen.

SEPTEMBER 3. *Moderate wind from the northwest.*

10.15 A.M. Many thousands of "monarchs" are in migration. Dozens of *Grapta interrogationis* var. *fabricii*, *Colias philodice* and *Pyrameis huntera* are also passing.

10.30. *Catopsilia eubule* passes east.

From this time until 12 M. three *Junonia cenia* and one *Grapta* pass west.

1 P.M. Two *Grapta* pass, then three *Junonias* and several *Colias philodice*. *Catopsilia eubule* passes east.

1.25. *Fanessa antiopa*.

- 2.10. *Grapta interrogationis* var. *fabricii*.
 2.15. A humming bird.
 3.45. *Grapta*.
 3.46. *Pyrameis huntera*.
 3.55. *Grapta*.

The remainder of the afternoon is spent in study of the resting "monarchs" on bayberry bushes bordering the marsh.

SEPTEMBER 4. *Wind northwest.*

8.20 A.M. Scattered procession of "monarchs."
 9.05. *Vanessa antiopa*.

From this time until 10.45 six *Pieris rapae* pass west, also one *Vanessa antiopa* and one *Grapta*.

The wind shifts, becoming south at noon when *Pieris* travels more indiscriminately here and there over the dunes.

SEPTEMBER 8. *Wind southwest.*

11.10 A.M. Scattered procession of *Epiaschna heros*, *Tramea laccrata* and *Libellula pulchella* passes.

11.45. *Pieris rapae* passes in scattered groups steadily east. Fifteen or eighteen are in view at a time.

11.46. *Junonia cænia*.

11.56. A "monarch" passes with *Grapta*.

12.35. During the last fifty minutes, *Pieris* has continued to stream steadily east in procession.

12.40. A "monarch."

12.41. *Grapta*.

12.55. *Grapta*.

Dragon flies of the three species noted have continued to pass west.

12.56. *Catopsilia eubule* passes east.

1.10. *Catopsilia eubule* passes east.

A moment afterward *Catopsilia* passes me, going west.

2.30. *Catopsilia eubule* passes east.

2.45. Dragon fly movement diminishing.

3.45. A storm gathers in the northwest and a pouring rain, accompanied by a gale from the west, sweeps over the shore. The beach is hidden by flying clouds of sand; all migration is obscured.

SEPTEMBER 9. *Wind northwest.* Clear weather, a drop in temperature to 68° in central Long Island.

10 A.M. Many thousands of "monarchs" are passing west with a lesser number of *Epiaschna heros*.

10.15. *Colias philodice*.

Several *Graptas*.

Later in the morning other *Graptas* pass, with *Colias philodice* and a number of *Pyrameis huntera*.

4.45. A humming bird.

4.50. *Pyrameis atalanta* passes.

SEPTEMBER 16. *Wind north.*

From 11.10 A.M. until 12 M. steady streams of "monarchs" pass in thousands, also a few *Colias philodice*, dozens of *Pieris rapae*, one *Basilarchia disippus*, several *Graptas* and a few dragon flies, mostly *Epiaschna heros* and *Anax junius*.

12.10. *Libellula pulchella* and *Catopsilia eubule* pass west.

12.25. A humming bird, many "monarchs" and *Pieris rapae*.

1.10. A humming bird.

Hundreds of "monarchs" pass, also some *Graptas*, *Libellula pulchella*, *Tramea laccrata* and a few *Epiaschna heros* and *Colias philodice*.

2.15. A humming bird.

2.45. A humming bird, also *Grapta*.

3.30. A humming bird. Occasionally *Junonia cænia* passes with a few small dragon flies. *Thecla melinus* passes in a scattered procession of considerable extent. The small red dragon flies *Sympetrum rubicundulum* pass.

4.10. A humming bird.

A day of profuse migration. "Monarchs" in the majority, then *Grapta* (forty or more), an equal number of *Pieris rapae*, as many *Colias philodice* and a dozen or more *Junonia cænia*.

SEPTEMBER 24. *A strong wind from the northwest.*

10.45. Thousands of "monarchs" stream west, with dozens of *Graptas*, *Colias philodice*, *Pieris rapae* and a less number of *Junonia cænia*. Few dragon flies are present, mostly *Anax junius*, *Libellula pulchella* and *Epiaschna heros*. The small red dragon fly *Sympetrum rubicundulum* occasionally passes.

Later in the day several dozen *Junonia cænia* pass, *Pyrameis huntera* is frequent, *Graptas* not so common. A few hawks pass.¹

From these records it seems fair to conclude that the following butterflies are habitual westward autumn migrants on Long Island: *Anoxia plexippus*, *Pyrameis huntera*, *Vanessa antiopa*, *Grapta interrogationis* var. *fabricii*, *Colias philodice*, *Pieris rapae*, *Junonia cænia* and probably *Basilarchia disippus*, *Pyrameis atalanta* and *Thecla melinus*, although the records for these last three species are much less complete than the others.

When we consider this concourse of insects traveling steadily westward along southern Long Island the question naturally arises as to their exact future course, and more particularly, how and where they leave the island. To determine this point a number of later visits were made to Norton Point which is the western tip of Coney Island and

¹ Bird migrants have not been particularly noted in these records except the humming birds, which are sufficiently rare to be worthy of notice.

the extreme southwestern corner of Long Island.

SEPTEMBER 22. Southwest wind of considerable strength.

1 P.M. A "monarch" is flying about the western edge of the Point, and traveling southwest. Two others are floating here and there above the dunes. A *Junonia* flies from the grasses and travels southwest. *Colias philodice* flies here and there above the sand hills. Some *Pieris rapae* rest among the grasses, one *Libellula pulchella* hawks back and forth, a *Tramea laeocrata* flies south along the western edge of the shore. *Papilio asterias* rests on the lee side of a dune. No constant direction of migratory movement is noticeable.

SEPTEMBER 30. A storm on the previous day is followed by clearing, a drop in temperature, and a powerful northwest wind which becomes a gale at the shore. Upon leaving the train at Coney Island a procession of "monarchs" is seen to be traveling down Atlantic Avenue toward the west. Seven are seen within a space of fifteen feet about the station exit, others come from the east in scattered flights of a dozen or more. This procession continues westward all the way to the Point.

Here the gale sweeps so powerfully down the Narrows and across the bay as to keep the butterflies in shelter. The lee side of a clipped hedge surrounding the house which fronts the immediate Point, is spotted with the red wings of "monarchs." Others cluster in characteristic bunches on the ornamental shrubbery of gardens or even on the shade trees of the avenues. *Grapta* also rests on the hedge with *Colias philodice*. Other specimens of *Colias* shelter themselves in the grasses where *Junonia* is found.

Swallows flocking from the east breast the wind, fly high or low, then dip lower still, and by skimming just above the waves are able to leave the shore and find their way across the bay toward Staten Island. Hawks appear from the east beyond the lighthouse, strongly breast the wind, are blown back to land, only again to attempt the water passage. They try one air level, then another, and finally work their way out of sight across the bay.

"Monarchs" occasionally leave their shrubbery shelters, fly west toward the shore, feel the full force of the wind, and are blown back to land. A *Junonia* flies against the wind and is blown back like the hawks. It tries again, is once more cast landward; then mounts higher still and flies fully fifty feet over the water, only, once more, to feel the full strength of the wind which carries it back to the beach where it is lost to sight among the bushes.

Farther to the east a few *Anax junius* and one *Tramea laeocrata* are traveling toward the Point.

OCTOBER 1. It is milder than yesterday and the wind has abated its force, but is still from the northwest.

3.30 P.M. While the train halts in the Coney Island Railroad yards, two "monarchs" and two *Anax junius* come from the east, fly over the train, and continue west. A scattered procession is moving down the avenue.

At the Point itself, a great migration of thousands of the small dragon fly, *Sympetrum rubicundulum*, is in progress along the shore and toward the extreme tip of the land. "Monarchs" follow the same course. Some fly



Hunter's butterfly resting while on migration. This species (*Pyraemeis huntera*) is a quite common autumn traveler on Long Beach

directly to the Point and travel westward out of sight, others follow the curve of the shore for a short distance northward and leave the land at this point. *Epiaschna*, in considerable numbers, and the smaller dragon flies behave in the same way, although the powerful *Epiaschna* follows the direct flightway out over the Point more often than do the others. *Grupta* and *Junonia* show the same behavior. All alike leave this shore, and against a wind that is still quite strong, beat their way west across the bay and toward Staten Island until they are lost to sight.

What is the significance of this quite constant and consistent movement which begins at a definite date, follows a definite course, and persists for so long a period? Additional studies of the same character conducted along the Jersey coast should cast further light upon the problem, for favorable conditions should show a southward movement there; or possibly a trend toward the interior for some species. Moreover, a greater number of species should be present than we find in these Long Island movements.

A few suggestions, however, seem unavoidable. It is evident at once that, omitting *Anosia*, the "monarch" (which undoubtedly travels far south and returns in spring), the greater number of these butterfly migrants are winter

hibernators in the north. This is true of *Grupta*, *Pyrameis huntera*, *Pyrameis atalanta*, *Vanessa antiopa* and *Junonia cania*. So they may combine migration with hibernation in which case they would show a partial analogy with some of our winter resident birds. For although certain species are with us

throughout the year, some of those individuals which spend the winter about New York come from a region somewhat farther north, just as some of our summer individuals shift southward as autumn deepens into winter. Naturally these records are far from complete. The red admiral, for instance, was seen only once. Yet it has been reported by Mr. William T. Davis as flying west over Moriches Bay near Fire Island, on September 9, 1912, in a flock that contained at least ninety-two speci-



Migrants leaving Norton Point, the extreme southwestern corner of Long Island. The peacock butterfly (*Junonia cania*), accompanied by "monarchs," other species of butterflies, and dragon flies, travels westward over the waters of New York Bay apparently bound for a more southern station

mens.¹ Moreover, a recent report in *The Entomologist* describes a single-file procession of this species traveling southeast from the British Isles and toward the Continent, a further indication of its southward, autumn migra-

¹ *Journal N. Y. Entomological Society*, Vol. XX, p. 293, December, 1912.

tion. Then, too, only three *Basilarchia disippus* were discovered, but certain other migrants, almost certainly another species of *Basilarchia*, would seem to indicate that the presence of *disippus* was not accidental. Moreover, although *Thecla* was clearly identified only on September 16, it was certainly present on one or two other occasions.

It is highly significant, too, that the winter phase of the common "clouded sulphur" (*Colias philodice*) is so little noted. This is probably accounted for by the fact that this phase, whatever its nature, is passed, in many cases, in some region outside our immediate latitude. The presence of the common cabbage butterfly (*Pieris rapæ*), also, is very interesting, for, being a European importation, it recalls the many reports which exist in Old World literature regarding the extensive migrations of its close relative, the larger cabbage butterfly, *Pieris brassicae*. In some cases the numbers involved have been so great as to give the appearance of a drifting snowstorm blowing over the water or moving steadily in one direction over the land. Indeed, one writer has noted that these butterflies seem able to alight on the water surface for a moment to rest, and then to rise again and pursue their interrupted flight in the same general direction as before.

The "great sulphur" (*Catopsilia eubule*) in eastward flight is somewhat puzzling, as is the record also of *Pieris rapæ* on September 8. For that this eastward flight of *Catopsilia* is quite habitual at Long Beach, seems evident

from an earlier observation on this same beach, October 19, 1915, when a single individual passed east. Yet its habitual course along the Connecticut shore is west, as shown by an extensive flight during September 22, 23, and 24, 1894, and by recent September observations by the writer. In addition to this movement, however, Mr. William T. Davis believes there is a late summer movement from the south, which would account for these eastward flights on Long Island.

Finally, after considering various explanations which might be offered, it is difficult to avoid the conclusion that, whatever their outcome, many of these flights are as truly seasonal and migratory as are those of birds. It is an interesting fact, moreover, that all of these species of butterflies and dragon flies have a wide distribution into the Southern States, so there is no impossibility in the conception of a prolonged movement for some species other than the "monarch." The exact limits of travel for each, however, and the question of a spring return for certain of the longer-lived species, can be determined only by experiments of marking the butterflies as they pass and tracing them in their later course along the coast.

Our records give certain evidence that such interesting secrets exist, and that some region or regions to the south of us undoubtedly contain the answer to problems, hitherto neglected, in the lives of some of our commonest, most familiar butterflies.

WINTER PHOTOGRAPHS FROM THE WOODS AND
FIELDS OF MASSACHUSETTS WITH QUOTATIONS
SELECTED FROM THOREAU'S JOURNAL
ON *WINTER*¹ IN MASSACHUSETTS

BY MARY CYNTHIA DICKERSON



TRACK OF A DEER MOUSE IN THE WOODS

"A single track stretching away . . . is very handsome, like a chain of a new pattern. . . . There is a still life in America that is little observed or dreamed of. . . . How snug they are somewhere under the snow now, not to be thought of, if it were not for these pretty tracks. For a week, or fortnight even, of pretty still weather, the tracks will remain to tell of the nocturnal adventures of a tiny mouse. . . . So it was so many thousands of years before Gutenberg invented printing with *his* types, and so it will be so many thousands of years after his types are forgotten perchance. The deer mouse will be printing in the snow . . . to be read by a new race of men. (*Jan. 15*) . . . The winter was not given to us for no purpose. . . . Because the fruits of the earth are already ripe, we are not to suppose there is no fruit left for winter to ripen. . . . Then is the great harvest of the year, the harvest of thought. All previous harvests are stubble to this, mere fodder and green crop. (*Jan. 30*) . . . A fact must be the vehicle of some humanity in order to interest us. Otherwise it is like giving a man a stone when he asks for bread. . . . It must be warm, incarnated, have been breathed on at least. A man has not seen a thing who has not felt it." (*Feb. 23*)—THOREAU

¹Quotations used through courtesy of Houghton, Mifflin Co.



BIRD AND SQUIRREL TRAILS IN THE CORNFIELD

"... A strong wind from the northwest is getting the snow into picturesque drifts. . . . Take long walks in stormy weather, through deep snows in the fields and woods, if you would keep your spirits up. . . . Be cold and hungry and weary. (*Dec. 25*) . . . If you are sick and despairing, go forth in winter and see the red alder catkins dangling at the extremity of the twigs all in the wintry air. . . . promising a new spring. . . . (*Jan. 10*) . . . Staying in the house breeds a sort of insanity always. . . . (*Dec. 29*) . . . It is surprising to go into a New England town in midwinter and find its five thousand inhabitants . . . confined. . . . Scarcely here and there has a citizen stepped aside one foot to let a sled pass. And about as circumscribed is their summer life, going out from house to shop, and back to house again. . . . It is as if some vigilance committee had given notice that if any should transgress these narrow limits, he should be outlawed and his blood should be upon his own head. (*Feb. 3*) . . . To insure health, a man's relation to nature must come very near to a personal one. He must be conscious of a friendliness in her. When human friends fail or die, she must stand in the gap to him." (*Jan. 23*) — THOREAU



THROUGH THE BLUEBERRY PASTURE

“ . . . There is but little life and the objects are few, it is true. We are reduced to admire buds, even like to partridges, and bark, like the rabbits and mice, the great red and forward looking buds of the azalea, the plump red ones of the blueberry. . . . (Jan. 10) . . . The stems [of the blueberry] rise up in a winding and zigzag manner. . . . Judging from those whose rings I have counted, the largest of those stems must be about sixty years old. (Dec. 24) . . . To such an excess have our civilization and division of labor come that A., a professional huckleberry picker, has hired B. s field, . . . C., a professed cook, is superintending the cooking of a pudding made of some of the berries, while Professor D., for whom the pudding is intended, sits in his library writing a book, a work on the Vaccinieae, of course. And now the result of this downward course will be seen in that book. . . . There will be none of the spirit of the huckleberry in it. The reading of it will be a weariness to the flesh. . . . I believe in a different kind of division of labor, and that Professor D. should divide himself between the library and the huckleberry field.” (Dec. 26) —THOREAU



THE SILENCE OF WINTER

"Some three inches of snow fell last night and this morning, concluding with a fine rain, which produced a slight glaze, the first of the winter. This gives the woods a hoary aspect, and increases the stillness by making the leaves immovable even in a considerable wind. (*Dec. 24*)

. . . What are threescore years and ten hurriedly and coarsely lived to moments of divine leisure, in which your life is coincident with the life of the universe. We live too fast and coarsely. . . . We consult our will and our understanding and the expectation of men, not our genius. . . . Our moment of life costs many hours, hours not of business, but of preparation and invitation. . . . That aim in life is highest which requires the highest and finest discipline." (*Dec. 28*)—THOREAU



A WET AND HEAVY SNOW

"You glance up these paths, closely embraced by bent trees, as through the side aisles of a cathedral, and expect to hear a choir chanting from their depths. (*Jan. 30*) . . . What a comment on our life is the least strain of music! It lifts me above all the dust and mire of the universe. . . . Almost all, perhaps all, our life is, speaking comparatively, a stereotyped despair, *i.e.*, we never at any time realize the full grandeur of our destiny. We habitually, forever and ever, underrate our fate. (*Jan. 13*) . . . There are in music such strains as far surpass any faith which man ever had in the loftiness of his destiny. He must be very sad before he can comprehend them. . . . Music hath caught a higher pace than any virtue that I know. It is the arch reformer. It hastens the sun to his setting. It invites him to his rising. It is the sweetest reproach, a measured satire. (*Jan. 8*) . . . When we are so poor that the howling of the wind shall have a music in it . . ." (*Jan. 18*)—THOREAU



A COMPANIONABLE COUNTRY

"Skated up the river . . . in spite of the snow and wind. . . . We went up . . . and came down . . . again with the wind and snow dust, spreading our coat tails, like birds, though somewhat at the risk of our necks, if we had struck a foul place. I found that I could sail on a tack pretty well. . . . Sometimes we had to jump suddenly over some obstacle, which the snow had concealed, to save our necks. It was worth the while for one to look back against the sun and wind, and see the other sixty rods off. . . . In the midst of . . . curling snow steam, he sweeps and surges this way and that, and comes on like the spirit of the whirlwind. At Lee's Cliff we made a fire, kindling with white pine cones. . . . Then cast on some creeping juniper wreaths and hemlock boughs to hear them crackle." (Feb. 3)—THOREAU



NEW ENGLAND BOG AND MEADOW

"In severe winters the quails venture out of the woods, and join the poultry of the farmer's yard. . . . It is remarkable that this bird, which thus half domesticates itself, should not be found wholly domesticated before this. (Feb. 7) . . . I am glad to find that our New England life has a genuine human core to it; that inside, after all, there is so little pretense and brag. . . . The middle-aged son . . . helps his old mother about her work when the field does not require him. (Dec. 26) . . . If there are any who think that I am vainglorious, that I set myself up above others, and crow over their low estate, let me say that I could tell a pitiful story . . . if my spirits held out to do it. I could encourage them with a sufficient list of failures. . . . I think worse of myself than they can possibly think of me, being better acquainted with the man." (Feb. 10)—THOREAU



THOROUGHWORT TO THE MIND

It is bitter cold with a cutting northwest wind. . . . There is nothing so sanative . . . as a walk . . . alone in distant woods or fields, in unpretending sproutlands, or pastures tracked by rabbits, even in a bleak, and, to most, cheerless day like this. . . . This cold and solitude are friends of mine. . . . I come to my solitary woodland walk as the homesick go home. . . . I enter some glade in the woods perchance, where a few weeds and dry leaves alone lift themselves above the surface of the snow, and it is as if I had come to an open window. I see out and around myself. . . . This stillness, solitude, wildness of nature, is a kind of thoroughwort or boneset to my intellect. This is what I go out to seek. . . ." (Jan. 7) — THOREAU



FOOTPRINTS IN THE WOODS—COTTONTAIL RABBITS

"The snow is the great betrayer. It not only shows the tracks of mice, otter, etc., etc., which else we should rarely, if ever, see, but the tree sparrows are more plainly seen against its white ground, and they in turn are attracted by the dark weeds it reveals. . . . We might expect to find in the snow the footprint of a life superior to our own, of which no zoology takes cognizance. Is there no trace of a nobler life? . . . Why do the vast snow-plains give us pleasure, the twilight of the bent and half-buried woods? Is not all there consonant with virtue, justice, purity, courage, magnanimity; and does not all this amount to the track of a higher life than the other's—a life which has not gone by and left a footprint merely, but is there with its beauty, its music, its perfume, its sweetness, to exhilarate and re-create us!" (Jan. 1)—THOREAU



A WINTER GOOD NIGHT

“ . . . Stood within a rod of a downy woodpecker on an apple tree. How curious and exciting the blood-red spot on its hind head! I ask why it is there, but no answer is rendered by these snow-clad fields. . . . It looks . . . as if it had a black cassock open behind and showing a white undergarment. . . . It is briskly and incessantly tapping all round the dead limbs, but hardly twice in a place, as if to sound the tree, and so see if it has any worm in it. . . . How briskly he glides up or drops himself down a limb, creeping round and round, and hopping from limb to limb, and now flitting with a rippling sound of his wings to another tree. (*Jan. 8*) . . . The snow buntings and the tree sparrows are the true spirits of the snowstorm. They are the animated beings that ride upon it and have their life in it. (*Jan. 1*) . . . You hear the lispings music of chickadees from time to time, and the unrelenting, steel-cold scream of a jay, unmelted, that never flows into a song, a sort of wintry trumpet, screaming cold, hard, tense, frozen music. . . .” (*Feb. 12*)—THOREAU



YELLOW WITCH-HAZEL FLOWERS OF MIDWINTER

"Perhaps what most moves us in winter is some reminiscence of far-off summer. (*Jan. 12*)

My difficulties with my friends are such as no frankness will settle. . . . Explanation is not what is wanted. Friendship is the unspeakable joy and blessing that result to two or more individuals who from constitution sympathize. Such natures are liable to no mistakes, but will know each other through thick and thin. . . . Who are the estranged? Two friends explaining. (*Dec. 21*) . . . O Happiness, what is the stuff thou art made of?—Is it not gossamer and floating spider's webs? a crumpled sunbeam—a coiled dew-line settling on some flower? What moments will not supply the reel from which thou mayst be wound off? Thou art as subtle as the pollen of flowers and the sporules of the fungi." (*Jan. 20*)—THOREAU



A SPRING WITH GREEN CRESS

"Is this not the plant which most, or most conspicuously, preserves its greenness in the winter? . . . It is as green as ever, and waving in the stream as in summer. (Dec. 22) . . . When I break off a twig of green-barked sassafras, as I am going through the woods now, and smell it, I am startled to find it fragrant as in summer. It is an importation of all the spices of Oriental summers . . . very foreign to the snow and the oak leaves. (Feb. 9) . . . I listen to the sharp, dry rustle of the withered oak leaves. This is the voice of the wood now. . . . It sounds like the roar of the sea, and is inspiring like that, suggesting how all the land is seacoast to the aerial ocean. (Jan. 2) . . . Sound and still youthful senses, not enervated by luxury, hear music in the wind and rain and running water. One would think, from reading the critics, that music was intermittent, . . . dependent on some Deceased or Mesopotamian, but music is perpetual and only hearing is intermittent." (Feb. 8) — THOREAU



THE WOODLAND IN JANUARY

“ . . . Such things are beautiful, they have a high use which dollars and cents never represent. . . . Such things educate far more than any hired teachers, preachers, or any system of school education. . . . If we have the biggest howler in the country, then it should not belong to an individual nor be made into a doorstep . . . natural objects of rare beauty should belong to the public. Not only the channel, but both banks of every river should be a public highway. . . . (Jan. 3) . . . When, as now, in January a south wind melts the snow, and the bare ground appears . . . a perfume seems to exhale from the earth itself . . . I derive a real vigor from the scent of the gale wafted over the naked ground, as from strong meats, and realize again how man is a pensioner of nature.” (Jan. 8) —THOREAU



A WOODLAND PATH

"The snow has fallen so gently that it forms an upright wall on the slenderest twig. The agreeable maze which the branches make is more obvious than ever, and every twig thus laden is as still as the hillside itself. . . . The sight of the pure and trackless road . . . would tempt us to begin life again. (*Dec. 26*) . . . I sometimes think that I may go forth and walk hard and earnestly, and live a more substantial life, get a glorious experience, be much abroad in heat and cold, day and night, live more, expend more atmospheres, be weary often. . . . But then swiftly the thought comes to me, Go not so far out of your way for a truer life, keep strictly onward in that path alone which your genius points out, do the things which lie nearest to you, but which are difficult to do, live a purer, a more thoughtful and laborious life, more true to your friends. . . ." (*Jan. 12*)—THOREAU



EVEN SPROUTLANDS INCREDIBLY FAIR

“ . . . In certain places, standing on their snowiest side, the woods were incredibly fair, white as alabaster. Indeed, the young pines reminded you of the purest statuary, and the stately, full-grown ones, towering around, affected you as if you stood in a Titanic sculptor's studio. . . . How new all things seem! . . . It is like the beginning of the world. . . . The world is not only new to the eye, but is still as at creation. Every blade and leaf is hushed, not a bird or insect is heard. . . . (Jan. 20) . . . Such is beauty ever, neither here nor there, now nor then, neither in Rome nor in Athens, but wherever there is a soul to admire. If I seek her elsewhere because I do not find her at home, my search will be a fruitless one. (Jan. 21) . . . I would be as clean as ye, O Woods.” (Dec. 29)—THOREAU



A SUNSET SKY

"The man is blessed who every day is permitted to behold anything so pure and serene as the western sky at sunset, while revolutions vex the world. There is no winter necessarily in the sky, though snow covers the earth. The sky is always ready to answer our moods. We can see summer there or winter. (*Dec. 27*) . . . Whatever we see without is a symbol of something within. . . . The lover of contemplation, accordingly, will gaze much into the sky. Fair thoughts and a serene mind make fair days. (*Jan. 17*) . . . I witness a beauty in the form and coloring of the clouds which addresses itself to my imagination, . . . excites me, stirs my blood, makes my thoughts flow. . . . If there is not something mystical in your explanation, . . . it is quite insufficient. . . . What sort of science is that which enriches the understanding, but robs the imagination? . . . If we knew all things mechanically merely, should we know anything really?" (*Dec. 25*)

—THOREAU

The Telephoto Lens in Cinematography

WITH ESPECIAL REFERENCE TO ITS APPLICATION
IN THE PROBLEMS OF BIRD PHOTOGRAPHY

By NORMAN McCLINTOCK

Illustrations from the Author's motion picture films taken with regular lens and telephoto

THE application of the telephoto lens to still photography is well known. Those who have ever tried telephoto work are, of course, thoroughly familiar with the well-known law, that the increase in the exposure required is directly proportional to the square of the magnification used. This law is based upon the assumption that the diameter of the positive element of the telephoto system is constant. When the telephoto lens is applied to cinematography all of the difficulties encountered in still photography are present, with the addition of new problems. For instance, it is generally impossible materially to increase the duration of the exposure in cinematographic work, in order to conform with the above-mentioned law, for the reason that sixteen pictures per second must be made and the longest permissible exposure for each picture is about one thirty-second of one second. In view of this exposure limitation, it will be obvious that the only alternative in motion picture work is to employ a telephoto combination having larger glass cells than commonly used in still photography, so that sufficient light can be had to make exposures of not less than one thirty-second of a second duration. This will explain why it is advisable in cinematographic telephoto work to make each telephoto lens complete in itself and not consisting of a negative element which is to be added to the regular positive lens.

The cinematographic telephotos have their diaphragm stops graduated on the lens mounts, as on all ordinary lenses, and accordingly no special calculations for the exposures are required.

Another, and all important, problem in cinematograph telephotography is accurate focusing. Owing to the great magnification on the screen of the motion picture positive film, which is sometimes as much as, or even more than, three hundred diameters, the greatest care in focusing is necessary. And,

on the other hand, the longer the focal length of the lens used the greater is the difficulty, by reason of the rapid decrease in the so-called depth of field with the increase in the magnification. In the telephoto bird work which I have done, I have used an auxiliary magnifying lens for the sharp focusing of objects on the ground glass.

The most serious difficulty, however, to be met with in making telephoto motion pictures is the question of vibration. Vibration is an ever-present enemy of the field cinematographer, which has to be constantly fought, even with the use of regular lenses, and when telephotos are used the problem is far harder, for not only is the desired image enlarged by the use of a telephoto lens but any vibrations present are correspondingly magnified.

It is the act of grinding the camera combined with the necessity of having a combination of interior moving parts that is apt to set up vibrations, which may be most disastrous as far as satisfactory screen results are concerned. I use the term "screen results" advisedly, for one may secure a perfect series of individual still pictures on a motion picture film and yet show a most disagreeable and prohibitive relative vibration between the positions on the screen of the separate pictures when projected. This question of vibration is, of course, a mechanical and not an optical problem.

In my bird work I use a heavy camera, a heavy tripod, and brace the telephoto lenses. Even then, I am often troubled with vibration, especially when using my largest telephoto lens, which has an equivalent focus of seventeen inches and a maximum speed of F6. This lens gives a magnification of eight and one half diameters, in comparison with the standard two-inch lens.

In order to make a comparison with still photography, to show the relative size of this particular telephoto lens to the size of the picture secured, it will be interesting to



*From motion picture film
by Norman McClintock*

COMPARISON BETWEEN 3" LENS AND 12" TELEPHOTO

Both photographs show a swinging food shelf for birds on the estate of the Honorable George Shiras, Ormond Beach, Florida, and were taken from the same standpoint. The upper picture was made with a 3" motion picture lens, the lower with a 12" telephoto



*From motion picture film
by Norman McClintock*

ROBIN IN A BIRD BATH: A TELEPHOTO TRIUMPH

With ordinary apparatus it is well-nigh impossible to get near enough to photograph the adult robin without the use of a blind. With the 17" telephoto lens at twenty-five feet one can secure an image of the same film size as with the standard 2" lens at three feet. No song bird is fonder of bathing than the robin.



*From motion picture film
by Norman McClintock*

LOUISIANA HERON AND YOUNG AT NEST

Above, Louisiana heron and several nests; below, the bird and one of the nests shown by telephoto. With the telephoto lens one can, without intrusion, be on intimate terms with the home life of the birds. These photographs were made on the preserve of Mr. E. A. McIlhenny, at Avery Island, Louisiana



*From motion picture film
by Norman McClintock*

LOUISIANA HERON AT CLOSE RANGE

Consecutive sections of a bird film taken with a 12" telephoto lens. The parent utilizes the time while guarding the nest, in preening her feathers

note that, to produce a 4"×5" still picture on the same basis as I do the 1"×¾" motion picture with this 17" lens, it would be necessary to use a lens of about 13" diameter. This comparison will give an idea of how the question of speed is met in producing telephoto lenses for cinematography. Owing to the difficulties described, cinematographers have so far but little used telephoto lenses of a longer focus than eight inches.

Several years ago I realized the possibilities for usefulness of telephoto lenses of long foci when applied to bird work. I therefore secured the two most powerful cinematograph telephotos I could find and I will now confess it was without a full comprehension of the difficulties I had in store for me. But, as "necessity is the mother of invention," the problems were gradually met.

Having worked for many years at bird still photography, I observed that individual song birds would permit me openly to approach them to within a more or less definite distance, which was rather constant. This distance I term the critical distance and it could be determined for each individual bird.

It then occurred to me that if I could work on birds outside their critical distance and still secure photographic images of a satisfactory size, a new, and, as far as I was aware, an unused field would be opened up to me. This reasoning combined with some simple mathematical calculations led to the procuring of the cinematograph telephotos already mentioned.

As a concrete example of this type of bird photography I will say that it is manifestly an impossibility, without the use of a blind, to approach and photograph the average adult robin at a distance of three feet. And yet by employing my seventeen-inch lens and working at a distance of twenty-five feet, which is thoroughly practical, and which is outside the generally accepted robin critical distance, I can secure an image of the same identical size on the film as I would be able to do with the standard two-inch lens at a distance of three feet.

I often have recourse to blinds for bird work and they are many times essential, but I must confess it is a source of still greater pleasure to me to meet song birds in the open and to be able with their full know-

ledge and consent to secure motion pictures¹ which occasionally depict interesting and characteristic habits.

It will be noted that in what I have written so far the application of the telephoto lens has been confined to comparatively close work. The photographing through the cinematographic telephoto lens of larger animal life at a distance from the camera, often introduces the additional problem of the light rays passing through air strata of different and varying densities, with the consequent fluctuating distortions of the objects. This defect can only be met by selecting a suitable time for making the pictures. The best time for such distant work is in the early morning and the late afternoon, when the heat radiation from the earth is less than it is during the middle of the day.

Telephoto work through great aerial distances, such as distant mountain views, presents a problem that cannot usually be successfully met, except with special tools, which must be intelligently employed. Those who have ever tried to make distant still telephotos know the unsatisfactory flat and foggy negatives that usually result, irrespective of the exposure and development. This objectionable quality of negative is due to the action of violet and ultra-violet rays which are present to an excessive degree between the lens and distant objects. This defect, to a small extent, can be and should be reduced by employing a light shield in front of the telephoto lens for cutting off all extraneous light rays.

Investigations in this subject by such expert scientists as the Belgian worker, M. André Collier, and Dr. C. E. K. Mees, of the Eastman Company, seem to indicate that the suspended particles of water vapor, which are present in the atmosphere, especially near the earth's surface, are transparent for the longer waves of light, which compose the red end of the spectrum. Therefore, as the human vision is more affected by the red end of the spectrum than is the standard photographic emulsion, our vision is not materially affected by the intervening presence of water vapor in a landscape view, unless present to an excessive degree. On the other hand, it is supposed that the passage of even moderate

¹ Of the bird pictures which I have shown at the American Museum of Natural History, one entire reel, as well as parts of other reels, was made in the manner described.

amounts of water vapor offers a turbid medium to the passage of violet and ultra-violet light waves, scattering them and producing upon the photographic emulsion, which is supersensitive to these rays, much the effect that would be seen by viewing a landscape through a sheet of finely ground glass. This scattering effect of water vapor is at a maximum in the ultra-violet rays, to which the human eye is not very sensitive, and decreases toward the red end of the spectrum. In addition to this, when the sky is blue the distant mist reflects this light also and thus makes matters worse for the photographer.

In order to remove these obstacles, due to the presence of ultra-violet light, the special tools to be used are the modern panchromatic film and a deep yellow filter, scientifically selected and adjusted for absorbing all of the harmful ultra-violet rays mentioned. Indeed, so great is the latitude with these new tools that it is possible, if desired, to eliminate the entire appearance of atmosphere in distant views.

The end to be sought for, however, is that in which the resulting picture will as closely as possible represent the view as seen in nature by the eye.



*From motion picture film
by Norman McClintock*

Snowy egret nesting. Avery Island, Louisiana, regular 3" lens. While the young wear the natal down, the guarding parent spends much time brooding



*By courtesy of the United States
Geological Survey*

OPEN CUT IN HIMALAYA MINE, CALIFORNIA

The pegmatite veins are coarsely developed granites wherein the three constituents of that rock, mica, feldspar, and quartz, are strongly individualized. Pegmatite forms the matrix of the tourmalines which, developed in it in highly colored crystals, form wonderful mineral aggregates with the limpid quartz and opaline feldspars, wherein, more rarely, the lilac kunzite is discovered



*By courtesy of the United States
Geological Survey*

The gem-bearing region in San Diego County, California, possesses to the eye no attractions, unless its sterile slopes and cactus-invaded valleys, in some lights, offer picturesquely desolate vistas. The prospector's zeal, however, has broken through the arid crust of rock, and uncovered a dazzling wealth that has made this inhospitable country a mineral Golconda

Gem Mining in the United States — Tourmaline and Turquoise

By L. P. GRATACAP

IF, as an ancient connoisseur and historian of "Precious Stones" with quiet confidence affirms, "the climate fittest for the production of stones of excellent beauty are such as do lie nearest the Tropicks," the expectant prospector in our own country, guided by so grave a dictum, might too quickly relinquish his pursuit of these mineral rarities. Nature has not blessed the United States very plenteously with gem stones, but neither has she been too niggardly in bestowing, here and there, in the long ranges of our mineralized belts, very stimulating stores of such treasures. Her discrimination in being more lavish to us in her gifts of rich economic deposits of earths and ores, was commendable. For although gems may have been, as quaint Thomas Nicols pompously assures us, "generated of an

humour which containeth in itself purest terrestrial portions," yet the disillusionizing experience of commerce pretty clearly shows them inferior to the more homely coal, clay, metallic oxides, and salts.

As a matter of fact the United States cannot qualify, at present, as a gem producer of any large commercial importance. In only four important regions have rewards for the gem hunter attained for it a somewhat secondary place among the great gem marts of the world. Nevertheless, in the sporadic development of gems, consequent upon the chemico-crystallographic agencies at work in the formation of large crystalline areas of rock, the United States offers a wide and instructive, if not always profitable, field for exploration.

Within a few years a quite astonishing

discovery of a new mineral and a new gem in San Benito County, California, revealed an unsuspected hidden pocket of interesting mineral associations, instructive to the mineralogist, but, alas, delusive to the gem hunter. A new gem was indeed revealed, but it had, so to speak, a most tantalizing brevity of life, disappearing almost as soon as found. The mercantile epigram, current some twenty years ago, that a day's yield of coal or iron, or a week's work in a granite quarry, would exceed the money worth of an entire year's output of precious stones from the United States, might be slightly modified in view of the phenomenal developments in southern California. Yet, allowing to these latter every possible weight, the qualification would turn out to be scarcely more than an academic correction. Even the diamond discoveries in Arkansas have proved to be rather sensational and promissory hints, than practically valid assets.

The important localities of precious stones in the United States, as at present best recognized, are the tourmaline properties of Maine, the tourmaline veins of southern California, the turquoise diggings of Arizona, New Mexico, and Nevada, and the sapphire quarries of Montana. Of course this is doing scant justice to the wide prevalence of a host of lesser gems, which, throughout the crystalline belts, momentarily illuminate with glimpses of color and brilliancy the prosaic work of mining. There are incidental revelations of handsome gems in the granite beds from time to time, which appear only to vanish in a miscellaneous assembly of worthless companions. Among these gems may be mentioned the beryls of North Carolina and elsewhere, sometimes graduating into unmistakable emerald, the topazes of Texas, the opals of the West, the wonderful kunzite of California, and the not infrequent garnets and amethysts everywhere. A painstaking empiricism has also involved—we think rather spuriously—a great number of less truly gemlike minerals within the aristocracy of gems, and they are all well represented in the United States. But they have really effected a purely parasitic association with the invincible precious stones of the world.

The specimens of gem tourmaline, found at Mt. Mica, Maine, ushered the United States upon the gem exchange of the world, since its products rivaled the best tourmalines

found anywhere. The discovery, now a well-rehearsed tale, was made by Elijah L. Hamlin and Ezekiel Holmes, both of them enthusiastic mineral hunters, and both boys. They had started upon one of those familiar tours among the hills with hammer and chisel, which so often reward the devotee with little more than the exercise. Young Hamlin picked up a crystal—it was during an autumn snowstorm—which had separated from the roots of a fallen tree, dislodged perhaps from its mineral setting by the intruding roots. A little further investigation brought the overjoyed collector thirty more beautiful crystals. All but one of these were subsequently lost, and then, according to a malicious rumor, reappeared in the Imperial Cabinet at Vienna.

The locality of Mt. Mica, after the announcement of its wonderful contents, was visited by many mineralogists, and upon more disclosures, a mining company with Dr. Augustus Hamlin as its president, was organized in 1881. This company has prosecuted the work of mining the gems ever since, with varying success. There have been taken out from the Mt. Mica mine, and from the neighboring localities of Auburn, Hebron, and Norway, some superb green stones, flawless and delicately dichroic with yellow tints; also some remarkable dark blue crystals exhibiting the familiar zonal colorations from end to end, and with rubellite centers framed in green borders.

The region in which the tourmalines occur is formed of coarse granite veins, piercing mica schist, and these pegmatitic invading masses are banded. The coarser elements, that is the portions in which the quartz, feldspar, and mica attain a larger individual development, encase the gems. The mother vein contracts and then again spreads, as though in its upward flow through the country rock, it had paused, expanding like an arrested stream and continued its penetrating course through constricted openings, while within, slowly crystallizing, the gem tourmalines shaped themselves. The zonal character is revealed in the rude alignment of a feldspar strip against a garnet-bearing ribbon of rock, with a lower granitic underwall. The lithia mica (lepidolite)—so constant an associate of the precious tourmalines both in California and in Madagascar—is blended with common mica (muscovite), and everywhere the vein is most capriciously

provided with the tourmalines. On opening the rock the veins are found to be widely and variously altered by decomposition, resulting from the infiltration of water, with the inevitable change of the feldspar into a soft discolored clay. The tourmalines are uncovered in pockets—usually detached—lying on the clay beneath them. Secondary crystallization has ensued through these interior changes, and in the so-called "live pockets" (a not unreasonable designation when one sees the activity their presence entails among the workers) the quartz crystals are themselves coated with a thin crust of tiny tourmalines, which are absent in the "dead pockets."

At Mt. Apatite, some four miles from the town of Auburn, similar, but differently conditioned, relations occur. The Pulsifer and Keith Mine on the southwest side of the mountain has been worked for gems in a small way for forty years, and in 1907—as Mr. Pulsifer informs me—it was first worked for feldspar, in conjunction with the intermittent search for the gems. Here the signs which indicate the neighborhood of the gem matter are a lamellar form of the feldspar, albite (cleavelandite) and the lithia mica, embedded in the coarse granite. In June, 1916, Mr. Pulsifer secured at one point, six thousand carats of blue-green tourmaline, and encountered in the vicinity several pockets of the mineral herderite, a beryllium salt, and justly eminent as a mineralogical prize.

A further survey of tourmaline mining in the United States transports us to southern California—a region where tourmalines, kunzite, and the many lithia compounds, flashed their hues and displayed their massive development, not so many years ago, to an amazed and almost incredulous world, repeating, as everyone soon discovered, the mineral phenomena of central Madagascar. The region in California which, some twenty or more years ago, began to yield to explorers these uncommon crystals, lies almost wholly in San Diego County. The localities of Pala, Pala Chief, Mesa Grande, and Ramona practically furnished the largest part of the commercial output of tourmaline, a gem finding one of its best markets in China, whose merchants exult in its richness of color and its impressiveness of size.

In San Diego County there may be seen a series of moderately high mountain ridges,

culminating in elevations of over five thousand feet, which overlook the plainlike expanses at their feet. These inauspicious elevations are the lithic pediments of large igneous outflows, and have themselves undergone, under the repeated invasions of later lava-like masses (now recorded in the traversing granite veins), extensive metamorphic alterations. Throughout the invading magmas of granitic lavas the processes of mineralization have generated the extraordinary gem contents of the decomposed hosts, assisted by intensely active chemical agencies, in the boron, hot silica baths, and varying proportions of lithia-bearing waters.

Here, in pockets, in seams, and in druses, a most remarkable retinue of minerals has been crystallized, in some cases showing a rude stratified segregation, the whole transpiring probably, in long continued and successively reinforced periods of digestion and change. Here the gem stones, tourmaline and kunzite have formed, the commercially valuable lithia-containing lepidolite, and amblygonite, with a clustering association of many-colored quartzes, potash and soda feldspars, beryls, garnet, epidote, and micas with later derivatives, and were perhaps preceded by original emanations of sulphides and native metallic sublimates.

A mineral individuality is discoverable in these marvelous belts of mineral profusion, so that the lithia mica with its splashes of radiating red tourmaline, and with amblygonite, prevails in one region, the big diversely colored tourmalines in another, kunzite, in the loveliest shades of gentian and lilac, in still a third, and garnet and topaz in a fourth. Scant justice can be done in words to this prodigality, and while the collectors revel in the abundance of color and species, the crystallographer is no less astonished at the local peculiarities of formal development in the crystals.

The tourmalines and kunzites have, of course, given the region its fame as a gem-producing locality, and the size and color of the former have momentarily eclipsed the claims of all other localities. In the Morgan Gem Collection in the American Museum of Natural History are to be seen the cut rubellite—beautifully zoned gems, with red at one end of the polished cabochon and green at the other, while in a wall case are grouped the colossal crystals of rubellite, inserted in the sides of yellow-white crystal-

lized quartz, and near them the stupendous crystals of kunzite in mimic cliffs of purest rose-lilac.

Up to 1905 the Mesa Grande locality yielded a gross output of \$200,000 in gems, in which total the singular cat's-eyes are to be noted, whose refractive phenomenon is caused by thread inclusions, or by symmetrically disposed hollows. The colorless stones (achroits) decline into absolute unimportance by the side of their gorgeous companions, whose extreme length often measures eight inches.

If the reader will stop in the Morgan gem hall and examine the case of kunzite, he will see some of the finest examples of this seductive and quite indescribable gem. It is a gem spodumene with a high percentage of lithia—an element which seems to confer color in an unusual degree upon its compounds—and which, before these discoveries in California, was little more than suspected, although small colored fragments had been found in colorless spodumene. Dr. George F. Kunz—gem expert with Tiffany and Company and associate curator of gems in the American Museum of Natural History—recognized the mineral when the first large crystal from California was shown to him. Later, after a critical examination by Prof. Charles Baskerville, of the College of the City of New York, the newcomer—for new in all legitimate senses it was—was named after Dr. Kunz. A unique pocket yielded five enormous crystals of this paragon of gems, and two of these now astonish the connoisseur in the gem hall of the American Museum.

In its appeal both to scientific and æsthetic interest, the tourmaline justly ranks high among minerals. As a natural salt its composition is difficult to enclose exactly in a formula, since it varies in its chemical constituents, and reflects these variations in its appearance and properties. As a mineral occurrence it presents interesting circumstances of genesis and association; as a gem it is a "chameleon" in its inconstancy, and yet attains the most attractive grades of gem beauty, while in optical properties, in crystallographic development, and in electrical reactions, it offers an inviting field for experiment and study. As a gem its finest developments are found in the clear, limpid, and solid greens of Maine, but in California it is remarkable for its mineral growth and

coloring, its variety, size, and combination.

It is worthy of note that the California rubellite greatly surpasses its congener from the tourmaline mines of Madagascar.

A closing note of interest is to be recorded in the occurrence of pink beryl. These delicately tinted crystals have much charm, from peculiarities in their crystallization, but to the gem hunter they appeal by reason of the promise they half fulfill, that they may somewhere, some day, attain the gem quality of the famous morganite (vorobyevite) of Madagascar, a princely gem with which Nature has enriched the mountains of that island. These pink beryls have appeared in San Diego County, associated with yellow, green, and even blue varieties, but they have not yet been found possessing the tone depth and richness of the Madagascar stone.

An observation of interest to be made upon these gem occurrences of tourmaline, wherever they have produced gem material in quantity, is the striking resemblance the geognostic features present in every instance—the coarse granites, the abundant evidence of lithia, the commingled development of the same minerals, some peculiarities of crystallization—as in the beryls—a closely approximated succession in the mineral generation, the prevalence of the soda feldspar (albite), and the very generous association of quartz.

Leaving California, we descend into Arizona, among the turquoise mines. Centuries ago turquoise was mined by the Indian in a part of New Mexico savagely placed amid decomposed and crumbling mountains. Today his excavations tunnel the cliffs, deserted and valueless, and pits two hundred and three hundred feet deep, exhibit a vast removal of waste, where he searched the tufaceous rock for the bits of prized gem. The old channels and galleries of the Aztecs in the Burro Mountains have become filled with detritus now hardened into a refractory mass only penetrable by extended blasting. The stones found in the workings show many shades of color but enclose white centers, and green shades prevail, making poor showing against the robin's-egg-blue, or azure of the higher grades of the gem.

In Mohave County, Arizona, well-organized explorations continue for this valuable mineral, and the present activity, with the incentive of expanding markets, almost bestows upon turquoise mining the leader-

ship among American gem industries. It appears to be a product of alteration, and is invariably symptomatic of igneous intrusions, with consequent decomposition, followed in many fields by a later saturation of the corroded rocks by quartz. This last invasion has cemented the whole complex into rugged refractory strata. The turquoise, exhibiting the widest range of quality, occurs as nuggets and balls, and in veins and seams with interspersed incrustations.

The demand for this gem is not easily satisfied, and the output in 1908 was appraised at \$150,000, to which yield Nevada, Colorado, New Mexico, Arizona, and California contributed. Turquoise is not regarded with unstinted admiration by the gem collector; it has too often repaid his confidence with disappointment by its loss of color. Not admitted into the first rank of gems it is classed among the second and even third-class stones, because of this tendency to deterioration. But in its most perfect state the soft blue of the turquoise, rendered precious in fine examples by its durability, rivals the other gems. At any rate it has been cherished by connoisseurs for many centuries, and its popularity today is unmistakable. Dr. Berthold Laufer of the Field Museum, Chicago, says that in the eyes of the Tibetans the turquoise had a sacred character that lifted it above the ordinary category of stones; "to call a turquoise a stone, to the Tibetan, is offensive, and his indignant remonstrance *DI YA RE, DO MA RE*, informs the astonished visitor that it is a turquoise and not a stone."

Mohave County in Arizona has monopolized the turquoise product of the state. One approaches a group of hills which are the more or less isolated elevations distinguishing the west side of the Cerbat Range and included in the general geographic designation of Mineral Park. The lithological conditions embrace a preëxistent Pre-Cambrian rock, invaded by later granites and porphyries. The gem stones are found in these intrusions, which, weathered and eroded, assume a high relief, the rigidity of outline being maintained by saturation of the mass by quartz.

Processes of alteration succeeding one another in more or less defined order, have been accompanied by circulating solutions depositing or forming turquoise. Dark stains of iron oxide blotch the seams of quartz or turquoise, and the variegation of color is heightened by copper stains of blue and green smearing the kaolin with vivid or dull, faded streaks, like the droppings from a paint brush. The turquoise is found irregularly developed in veinlets of rock crevices, with rarely a tendency to form a nuggety mixture, from which sizeable gems may be extracted.

In almost all the workings, here and elsewhere, the turquoise is a secondary occurrence, consequent upon the initial decomposition of the matrix, and the later entrance into the jointed mass of phosphate solutions, with the final "setting" of the gem itself in favorable nuclei of concentration and along narrow ribbons of interstitial quartz. In some workings veins six to eight inches in thickness are encountered, while elsewhere the turquoise penetrates its host in threads, or appears in patches, rather haphazardly yielding pure turquoise, semi-turquoise, and green soft kaolin. The finest quality of stone is not common, and the sorting—which is very exhaustively done—separates out the greenish pale varieties and the soft turquoise, both of which are worthless for commercial purposes.

A picturesque situation has been developed by the Arizona Turquoise Company. This company has attacked the steep slope of Ithica Peak, one of the Mineral Park summits, and entered the mountain-side by an open cut. The operation involves the formation of a series of terraces, each twelve to fifteen feet high. Drill holes are sunk and great masses of rock dislodged by blasting. Hundreds of tons of rock are thus brought under the sledge, and from the broken and crushed fragments the turquoise is picked out. There is an eager scrutiny for the fine-colored stones, which are afterward more tenderly extracted with smaller implements, and some solicitude. The stimulated interest in turquoise urgently requires for its satisfaction new developments of the pure blue and permanent mineral.



THE JACK RABBIT, SANTA CLARA VALLEY, CALIFORNIA

The "rabbit drive" no longer occurs in California. Irrigation and the resulting increased occupation and cultivation of the land have effectually reduced the ranks of the previous hordes in the state and driven the remnant to a restricted range among the foothills. The largest rabbit drive known to have taken place in California was that of 1896 at Fresno, when eight thousand people participated and twenty thousand rabbits were killed



The Jack Rabbit in California

By MARY CYNTHIA DICKERSON

Illustrations from photographs by the Author

This brief study of the developing jack rabbit was written in California, at Stanford University, from notes accumulated during the daily care and observation of a pair of young rabbits, from the time of their birth, February 26, until they were three months old. During the first six weeks of this period they took kindly to a diet of cow's milk administered through a small opening in a pipette rubber attached to a small vial, as I had found by previous experience other young mammals will do—skunks, woodchucks, cottontail rabbits. As far as known, nothing has been published heretofore on this development of the jack rabbit. The interest lies especially in observations made on their developing instincts—namely, that certain actions, such as washing the face, are not learned by imitation of the parent or through experience, but are instinctive from the moment of birth; that a generalized fear instinct arises soon after birth and becomes specific through experience, a valuable safeguard for the race in its definite environment; and that the play instinct develops those activities—digging, listening, leaping, running, nest building—which are to prove necessary for the life of the adult.—THE AUTHOR.

THE snow was still on the mountains of the Coast Range but the foothills were green, buttercups and mustard were beginning to make the fields yellow, and an occasional poppy of the hosts to appear later was showing along the roadside or in the oat field—in other words, it was February in the Santa Clara Valley.

I had been tramping the foothills, where the most conspicuous evidence of life is furnished by the jack rabbit. Now and again the gray forms had started up from the

shelter of rocks or small bushes, or sometimes had appeared suddenly as if materialized from empty air, to speed away with incredible swiftness.

Now I was at my desk in the University laboratory, my back to the window with its view of mountains and foothills. Suddenly there was shouting, and a rush of feet on the campus outside. Three laborers were chasing and stoning a jack rabbit. Soon they had it cornered in an angle of the buildings and were about to use a club. It was the

work of but an instant to reach the door and by a bribe change the intention of the man with the club. So the rabbit was caught unhurt (not without the expense of numerous long scratches on the hands and arms of the captor), and was soon in a rabbit house improvised from a packing box. She did not give up her freedom without further struggle, but between the periods of bewildering activity and thunder of hind feet on the wood of the box, she looked out from her temporary prison with large, gentle eyes.

The next morning (February 26), on entering the laboratory, I chanced to observe a small brown oval patch in a corner of the room. Bending down over it, I saw two large, luminous eyes gazing mildly at me. It was a baby jack rabbit, so small that it could be held, I found, and partly covered in one hand. Diligent search of the room disclosed one other baby in the farthest corner under the radiator—a family of two. Both together could be held securely on one palm and they showed little fear and no desire to leave the spot.

The California jack rabbit (*Lepus californicus* Gray) is born in an unusually advanced condition. The young rabbit is covered with fur, his white teeth are cut, and his eyes are wide open. His coat is brown with accents of yellow and black, much richer in coloring than the grayish fur of his mother; and he is labeled a very young baby jack rabbit by a light gray area which surrounds his mouth and his brown wiggling nose—like a round bib tucked above his chin instead of below.

On comparison he scarcely seems the son of his mother. His ears are not half the length of his head, whereas hers exceed the head in length by two inches. Also his muzzle is short and broad instead of long and pointed like hers—in fact, his face is ludicrously flat below the eyes as though he were really as soft and plastic as he looks and had received a gentle but convincing blow on the nose. And thirdly, his short, stocky legs would certainly classify him as the offspring of some other rabbit than a jack.

But these are all items of his immaturity. By the tenth day the ears and legs begin to lengthen out of proportion to the increase in growth elsewhere, and his muzzle also begins to lengthen and narrow. The changes in the shape of the muzzle and in the length of the legs are gradual, but the growth of the ears

from this time on is astonishingly rapid. At the fifteenth day they equal the head in length; soon they outstrip it, until at the close of the fourth week they are four inches long and at the end of the fifth week measure four and a half inches, whereas the head is then only two and three fourths inches in length. It is amusing to see Baby Jack take advantage of this increased length of his ears to haul them down and wash them conveniently in his mouth—he has the instinct to wash his face from the first morning of his life.

During the first days jack rabbits have a generalized sense of fear, squatting with lowered ears at any sound or movement; also they have a bravado not possessed later, turning and jumping at the enemy in pugilistic fashion while expostulating in a harsh, low-pitched voice. Later their fear becomes very definite and vivid, yielding not a jot to months of care and captivity.

One of the most conspicuous signs of a jack rabbit's babyhood lies in his inability to gauge perpendicular distances. For the first few days his instinct keeps him pretty closely to the ground nest, otherwise he would try to walk down hill as though it were level or would unwittingly walk off any rock or hillock and so might get many a tumble. It is not until the third day that he begins to be cognizant of the ups and downs of his world. His development is rapid, however, and twenty-four hours later he stops and studies every situation.

On the fourth day he begins digging, and from this time until he is five weeks old spends much time in this employment. Serious-eyed and absorbed he works very hard—like all young mammals he is "dead in earnest."

Jack rabbits have the play instinct from the first day. In this case observed, play activity increased steadily from the fourth day to a maximum at the close of two weeks, then continued, apparently without change, except as influenced by increasing muscular strength. Playing rabbits are intensely alert. When facing away from each other, suddenly, with what seems simultaneous leaps a foot or more in air, they are turned about touching noses. They bound away in devious curving and zigzag courses, moving with indescribable lightness and stopping with startling abruptness. One jumps at the other "pell-mell," he in turn shoots straight up into the air, dropping to a listening position with long ears held far forward, very



A very young baby jack rabbit. He scarcely seems the son of his mother, for his fur is rich brown in color instead of gray, his muzzle is short and broad instead of long and pointed, his legs are stocky, and his ears are very short. He is not yet so afraid as his mother and will face about and jump bravely at any enemy that appears, while scolding in a harsh, low-pitched voice



The ears of a jack rabbit two weeks old have grown to be as long as his head, but from this time on they increase in length at an astonishingly rapid rate. He has the instinct to wash his face from the first morning of his life; on the third day he begins to gauge perpendicular distances; the digging instinct develops on the fourth day

deer-like. Again, they take to following the leader: one jumps over a stone, the other follows; the first leaps a chasm two feet wide, the second is at his heels; they crouch in the shadow of a stone, then dash out into the light capering, then peer out from the shadow again where they remain, momentarily interested in washing each other's faces. Soon they are playing boisterously again, one bounding into air without any preliminary hint of such an intention, the other shaking his head until his long ear-

tiliginous ears snap together. Finally one of them sees something that stimulates his curiosity. He watches eagerly, his ears straight forward and widely opened. He progresses a little, he drops one ear, he moves slightly to the right, to the left, he stretches slowly forward, investigation written plainly in eyes, ears and tense muscles. Ah! it's only a shadow after all and Bunny Jack races away, lowering his tail so that it is like a little black streak between his flying hind legs.

The most surprising thing about young jack rabbits in the light of the fact that they are so highly developed when born, is their continued dependence on a milk diet as the weeks pass. On March 2 (sixth day), they showed the first recognition of the possession of teeth by chewing at the nest material. When two weeks old (March 10), they gained their first interest in grass, sniffing at it with noses a-wiggle and little red tongues thrust out at right or left, but refusing to eat more than one or two of the grass ribbons. The three weeks' limit was reached (March 17), four weeks were gone (March 24), five weeks (March 31), and the situation seemed astounding. Six weeks (April 7), at last they showed willingness to eat clover and grass. During the seventh week they were weaned from their improvised "bottle"—most unwillingly on their part—and with the change in diet became increasingly wild.

This long period of dependence on the mother jack rabbit is an interesting fact for the gardener as well as for the naturalist. It is likely that in this relatively northern part of California the jack rabbit breeds only three or four times a season, the months of October, November, December, and January constituting a definite winter season. Therefore the best time for reducing the ranks of these rabbits is during the winter months, before March—provided the ranks ever again need reducing.

For in California rabbits for the most part no longer devastate the crops. This is owing to a constant



A very serious and determined young rabbit (four weeks old), but ready for play at any moment. Jack rabbits have the play instinct from the first day, but play activity increases from the fourth day to a maximum at the close of two weeks, continuing unchanged thereafter except as influenced by increased muscular strength

warfare against them since 1875, and also because of the continually greater occupation and cultivation of the country. The rabbit drive, one of the unique and picturesque features of early life in the West, no longer occurs in California. This is certainly well; for those days of special holiday, of closed schools, of general rejoicings and barbecues, when men, women, and children gathered from miles about, driving the rabbits into a corral, where as many of the people present as desired competed in the work of clubbing the helpless, screaming creatures to silence and death—those days must have been indelible lessons in cruelty. We remember that the number of rabbits killed in a single drive ranged from a few hundreds to twenty thousand; that in 1888, rabbit driving having reached its height, newspapers estimated that 40,000 rabbits had been killed in Fresno County during the spring, and 70,000 in Kern and Tulare counties, respectively; that the total number of drives in California up to 1898 was more than two hundred, with half a million rabbits destroyed.

Today, only twenty years after the largest rabbit drive California ever knew—1896, Fresno, 8000 people, 20,000 rabbits killed—the custom is becoming a forgotten thing of the past. Those parts of California where the greater number of drives took place have changed in aspect. San Joaquin County, for instance, from being the leading county in the production of wheat, barley, rye, and hay, with fewer than two thousand farms (a third of these containing more than five hundred acres each), has become noted for its irrigation projects and its success in intensive farming. The farms now number several thousand and are relatively small.

Grain fields have given place today to orchards and vineyards, market gardens and dairies.

And the jack rabbit? He had most picturesquely held sway over the fertile valleys and plains as well as over the drier foothills before the arrival of the settlers from the East. Breeding rapidly, and each individual having a life probably eight or nine years long, the hosts had grown strong, maintaining their numbers despite the inroads of natural enemies and disease, despite the attacks of the Indian, whose greatest pride was his blanket woven of twisted strips of rabbit fur. But, like the Indian, the jack rabbit has been driven from his dominion. The great army of the fleet-footed has been routed and the remnants forced back to the strongholds of infertile foothills. He is now becoming only an unnoticed part of the state's wild life, of its small game, no longer important enough to carry a bounty on each pair of the long ears.

So as we tramp the foothills and see an occasional jack bound into air and race away, its lithe body superbly built for grace and speed, we forget that it has known anything but the relatively peaceful life it led in past ages and now leads among the rocks and dry slopes of the foothills. Here the adult today yields to few enemies outside of the coyote. Its speed distances any dog, and the slow badger has no chance in the chase. It is likely that many young rabbits succumb to these enemies as well as to skunks and weasels, to say nothing of the barn owl, the western red-tailed hawk and the marsh hawk. But other young rabbits, those who survive, reach maturity equipped with the fleetness and with the great wariness of their ancestors.

Museum Notes

SINCE the last issue of the JOURNAL, the following persons have become members of the Museum:

Life Members, Mrs. WARNER M. VAN NORDEN, and MESSRS. AMOS P. BROWN, GEORGE BULLOCK, HENRY C. DRAYTON, COLEMAN DU PONT, OTTO M. EIDLITZ, CHAS. H. LOUIS, DWIGHT W. MORROW, A. PERRY OSBORN, H. FAIRFIELD OSBORN, JR., WALTER C. WITHERBEE, and F. W. WOOLWORTH.

Sustaining Members, Mrs. M. GOLDFRANK, Mrs. PIERPONT MORGAN, and Mrs. FRIDA ZINSSER.

Annual Members, Mrs. A. H. ALKER, Mrs. E. FARRAR BATESON, Mrs. FRANKLIN Q. BROWN, Mrs. JAMES BYRNE, Mrs. GILBERT COLGATE, Mrs. F. DALZIEL, Mrs. MABEL LANGENBERGER-JONES, Mrs. J. L. MOTT, Mrs. JAMES BRONSON REYNOLDS, Mrs. GEORGE S. RUNK, Mrs. VICTOR SORCHAN, Mrs. EDW. R. STETTINIUS, Mrs. JOHN N. TONNELÉ, Mrs. F. A. VANDERLIP, Mrs. D. B. VAN EMBURGH, Mrs. VANDERBILT WEBB, Mrs. ELI WHITNEY, Mrs. A. M. WITTENBERG, and Miss E. H. WISNER, the Hon. WILLIAM McADOO, and the Hon. JAMES W. WADSWORTH, JR., Dr. MILLER REESE HUTCHISON, Dr. MORTON R. PECK, Dr. HERMAN SCHWARZ, and MESSRS. MORTIMER C. ADLER, JOHN G. AGAR, PERCY S. ALDEN, DARWIN R. ALDRIDGE, JAMES W. ALKER, WM. HALL ALLEN, CHARLES LANIER APPLETON, GEORGE T. BROKAW, EDWIN BURKHORN, EVERLY M. DAVIS, FRANK G. DOELGER, EDGAR M. DOUGHTY, GEO. SIMPSON EDDY, WILLIAM L. HIERNSTADT, SAM A. LEWISOHN, NORVIN R. LINDHEIM, WILLIAM J. MILLARD, G. M. P. MURPHY, SAMUEL RAISLER, CHARLES F. SWAN, JOHN RUSSELL TABER, SAMUEL A. THOMPSON, F. T. VAN BEUREN, JR., MARTIN VOGEL, MAX WATERMAN, ANDREW GRAY WEEKS, J. S. WILEY, LOUIS WILEY, WILLIAM H. WILLIAMS, BARKLEY WYCKOFF, EDWARD GUILD WYCKOFF, CHARLES ZIMMERMANN, and Mr. GEORGE L. JEWETT in memoriam.

THE chemical preparedness exhibit which was arranged at the American Museum under the auspices of the American Chemical Society, the Electrochemical Society, the Society of Chemical Industry, the American Museum of Natural History, and the Museum of the Peaceful Arts, in honor of the

meetings of the American Association for the Advancement of Science, will be continued until February 1. There are on display specimens of seventy-four of the eighty-five elements, the largest number ever grouped in this country. One group of nineteen contains all the elements found in nature in uncombined state. Through the courtesy of Lady Ramsay there is exhibited the original group of elements—helium, xenon, krypton, and neon—discovered by the late Sir William Ramsay. There are also relics from the work of Joseph Priestley, the discoverer of oxygen. The progress made by this country in industrial chemistry since the beginning of the European war is illustrated by cases of coal tar products including dyes and medicinal preparations. Products of the electrical furnace and those obtained by the fixation of atmospheric nitrogen are also exhibited.

With the chemical exhibit is a case prepared by the department of public health of the American Museum, showing certain phases of the life and works of Louis Pasteur. Pasteur was by training a chemist and his contributions to chemistry were valuable. He found time, however, for other and varied activities; in his younger days he did portrait painting that has been saved to us; when the silk industry was on the verge of destruction because of the spread of disease among the silkworms, he came forward with a cure; and it was he who first showed that fermentation was due to microorganisms of the air. His greatest service to the world was the demonstration of the use of vaccines in diseases of man and animals, particularly in cases of anthrax, rabies, and fowl cholera.

AMONG those who attended the meetings of the vertebrate section of the Paleontological Society held at the American Museum, December 28–29, were Dr. J. C. Merriam, of the University of California; Dr. E. H. Sellards, state geologist of Florida; Dr. O. P. Hay and Mr. C. W. Gilmore, of the National Museum; Professor R. S. Lull, of Yale University; Dr. W. J. Sinclair, of Princeton; and Dr. F. B. Loomis, of Amherst.

MR. ALESSANDRO FABBRI exhibited at the annual meeting of the New York Zoölogical

Society on January 9, a remarkable series of motion pictures made last summer at Bar Harbor. An explanation of the film was given by Mr. Roy W. Miner. Through the aid of the most improved apparatus and a carefully developed technique, Mr. Fabbri has succeeded in reproducing on the screen on a greatly magnified scale many small and microscopic animals. Various species of Protozoa, including the *Amœba*, and many small Crustacea like *Cyclops*, *Evadne*, *Prodon*, and *Caprella*, were among the forms shown. The presentation of the last was especially interesting, as not only was the entire animal shown, but also, by further enlargement, details of the head and internal structure, and the circulation of the blood. The beating of the heart of an embryo fish within the egg was brought out especially well. The fresh-water *Hydra* of stagnant pools, which is only about one thirty-second of an inch in length, was magnified upon the screen about six thousand diameters; certain species of the most delicate of marine hydroids were magnified to a like scale. Mr. Fabbri's work opens new vistas to the teachers of zoölogy who can introduce such pictures in their classes, and will be of great value to those who are engaged in research on the anatomy and habits of such minute forms.

MR. N. C. NELSON returned late in December from a field trip which included a systematic survey of the glazed pottery area of the Southwest, and also an examination of caves and rock shelters in Kentucky. In the Southwest the territory reconnoitered comprised a broad belt from Aztec to Albuquerque on the Rio Grande, and thence southwest to St. Johns and Springerville in Arizona. During this journey, which involved traveling by wagon, in the saddle, and on foot, over more than two thousand miles, and occupied about four months, about four hundred ruins were examined and the more important were roughly mapped, described, and photographed. Wherever ash heaps occurred, stops were made to obtain the stratigraphy of the deposit.

In Kentucky examination was made of a series of caves and rock shelters along the Kentucky River, and of a larger series along Green River near Mammoth Cave. Several sites were tried out by excavation. Few of these yielded results of importance, save a

small rock shelter opposite Boardcut Island, and Mammoth Cave itself. In the entrance to the latter was found a partly buried floor deposit of refuse belonging to a hunting period of culture antedating the introduction of fine polished stone implements and pottery, while in the former were found traces of refuse and a stone cist burial containing fragments of pottery, all clearly belonging to a relatively late period of Indian occupancy of the middle Mississippi region.

THE opening session of the sixty-ninth meeting of the American Association for the Advancement of Science was held in the auditorium of the American Museum of Natural History on the evening of December 26. The retiring president, Dr. William Wallace Campbell, director of Lick Observatory, gave an address, "The Nebulæ." Following the address, the Honorary Committee which had been appointed by Henry Fairfield Osborn, president of the American Museum, entertained the visiting scientists at a reception in the new hall of the age of man. Mr. Charles R. Knight's mural painting, "The Age of Reindeer and Mammoths," was unveiled at this time. The orchestral program, under direction of Naham Franko, included the whole range of nature music from Handel to Strauss.

AT a recent meeting of the trustees of the American Museum a special grant was voted to the 312 officers and employees of the institution, in view of increased demands made upon them and in consideration of the advanced cost of living. The grant, which equaled ten per cent of the salaries of 1916, was largely provided through personal subscriptions by the trustees.

MR. BARRINGTON MOORE has been appointed associate curator in the department of woods and forestry. Mr. Moore is a graduate of the School of Forestry, Yale University. In 1908-1909 he studied representative forest regions in Germany, France, India, Japan, and the Philippines. From 1909-1914 he was in the Forest Service of the United States, where he had wide experience in field problems and editorial work. Since 1914, when he left the government service, he has devoted himself to research work in silvics and silviculture. He is the author of numerous papers on forestry problems.

AMONG the specimens brought back by Mr. Barnum Brown from his expedition to the Red Deer River, Alberta, in 1915, were two petrified tree trunks, finely preserved and nearly complete. One of these, forty-five feet in length, two and one half feet wide at the butt, and tapering to a slender tip, has been placed on exhibition in the dinosaur hall of the Museum. These tree trunks are from the Belly River formation of Cretaceous age, and were associated with skeletons of dinosaurs. Together with various leaves and other plant remains found in the same beds, they serve to illustrate the kinds of vegetation that prevailed where these dinosaurs lived. The trunk now on exhibition is not that of a tree which grew tall and spindling in a dense forest, but is the type that would grow in an open glade, branching strongly all the way up. When the specimen was unearthed, the branches were all attached, but could not be preserved as they were completely turned to lignite. An interesting circumstance in the preservation of these petrified tree trunks is that the outer layer, above and below, is converted into lignite (carbonized), and the inside of the trunk is partly converted into agate (silicified), the cells of the wood being filled with siliceous deposit, while their framework is still preserved in lignite. Some of the trunks are round, but they are usually flattened, partly as a result of compression. The lignite varies in thickness over different parts of the tree, but if compression is disregarded, the difference in vertical and horizontal diameters shows a conversion of approximately four inches of wood to one inch of lignite. Some of this lignite has been preserved on the trunk now on exhibition, although it was not practicable to preserve the entire coating.

DR. EDGAR ALEXANDER MEARNS, who died in Washington, D. C., near the close of the year 1916, was one of the first of the many men of science who have participated in the work of the American Museum. He was born at Highland Falls, N. Y., September 11, 1856, studied medicine at Columbia University, and in 1883 entered the army with the grade of First Lieutenant Assistant Surgeon. At the time of his death he held the rank of Lieutenant Colonel, Medical Corps. His greatest military service was during the Spanish-American War, when he served as

Brigade Major in Cuba and later organized the hospital camp at Chattanooga.

His connection with the American Museum began in 1883, when he donated a series of skins and eggs of North American and European birds, the former to remain unmounted as the basis of a study collection. At this time he was engaged to identify, label, and catalogue the collection of European birds, then larger than that of the North American birds. His first comprehensive paper, on birds of the Hudson Highlands, published in 1878, was based on material found about his home at Highland Falls; from that time onward, wherever he chanced to be, he found scientific work to do. His appointment as surgeon to the Mexican Boundary Commission of 1892-1894, resulted in his publishing *Mammals of the Mexican Boundary of the United States*, and while stationed in the Philippines, in spite of poor health, he made important ornithological and botanical collections. He was a member of the Roosevelt African expedition in 1909, where his enthusiastic work as a collector won for him from the natives the title, "The Man Who Never Sleeps." Colonel Roosevelt states that he was by far the best shot of the party. On this expedition he secured large and important collections of birds and mammals, and of botanical material. He also accompanied Mr. Childs Frick to Africa, where again he made extensive collections of birds and small mammals. He was emphatically a field naturalist. Although his published papers number more than a hundred, they were largely based upon material personally collected. At the time of his death, he was engaged in the study of the large African collections he had brought together.

For his many services to the American Museum he was elected a Patron in 1890. He was a prominent member of the Linnean Society of New York, one of the founders of the American Ornithologists' Union, and of the National Geographic Society. In his early years Dr. Mearns was one of the group of young, enthusiastic, and energetic naturalists which included Merriam and Fisher, men whose work was not only important in itself, but did much to stimulate others to undertake zoölogical work. His death is a decided loss to science. Ever kindly and helpful, never a harsh critic, and always ready to aid with word or act, he will be sadly missed.

THE department of anthropology has recently received from Mrs. E. H. Harriman a brown sable parka from Alaska, and by gift of Justice Nathan Bijur a fine moosehide war shirt from the Tlingit of Alaska. The department has purchased from C. O. Sachs a number of specimens of Indian material, relics of the battle of Sand Creek in 1864, and of the famous chiefs Gaul, Rain-in-the-face, Spotted Tail, and White Antelope.

THE Museum has recently received as a gift from the Hon. Francis B. Harrison, of Manila, the skin and skull of a timarau from the Philippine Islands. Other recent gifts are five hundred bird skins collected in Ecuador by Mr. William B. Richardson; and birds and the skeletons of a giraffe and a kangaroo presented by the New York Zoölogical Society.

MRS. PAUL MORTON has made gifts to the Museum of baskets from the Northwest, a valuable Navajo blanket, and a bronze statuette, "The Moqui's Prayer for Rain," by H. A. MacNeal. This last represents one of the participants in the snake dance speeding away after the ceremony, bearing in his hands numerous snakes which he is to set free in the open country.

DR. MALCOLM A. SMITH, of Bangkok, Siam, has made a unique and valuable addition to the Museum's herpetological resources in the gift of twenty-two snakes, four burrowing salamanders, and sixteen frogs, all from Siam. Several of the specimens are new to the Museum collection as to species, and some as to genus. Mr. Mahoto Nishimura has presented thirty-six specimens from Manchuria, representing thirteen species new to the collections.

MR. LEO E. MILLER has returned to the Museum after two years spent as leader of an expedition to South America. He and his associate, Mr. Howarth S. Boyle, left October 21, 1914, for Puerto Colombia. From this point they went up the Magdalena River to Puerto Berrio, and thence overland to the highlands of Antioquia, where they spent approximately five months. One excursion, an exploration of the Paramillo region, has already been described in the JOURNAL—November, 1915. Other excursions were to the Atrato River drainage on the west coast of Colombia, and to the Lower Cauca River

where, at Puerto Valdivia, large collections were made.

On completing the work in Colombia, the party went to Panama, crossed to the Pacific side, and took a steamer to Peru. Landing at Mollendo, they proceeded by train to Lake Titicaca, which they crossed by steamer, and went on to La Paz for a brief stay. Headquarters for a number of months were made at Cochabamba. From this point excursions were undertaken to the Beni district: large collections were made on the Chimoré and Chaparé rivers. The explorers worked for a month at the Mission among the Ura-care Indians. The high country between Cochabamba and the Beni was also explored. The men next journeyed to Sucre by way of the Santa Cruz trail, and explored the country about the Upper Pilcomayo River, after which they proceeded overland to the Argentine Republic, covering the more than three hundred miles on muleback. This is all high arid country where the temperature varies one hundred degrees Fahrenheit every twenty-four hours.

About nine months were spent in the Argentine, in which time many of the northern provinces of the country were visited. Excursions were undertaken from the high Andean peaks in the west to the sweltering *chaco* of the east. The desert regions of Santiago del Estero were also visited. The last work was done in the lake region near San Juan, where large collections of waterfowl were made. Altogether the expedition, during its two years spent in the field, collected between eight thousand and nine thousand birds, about fifteen hundred mammals, made hundreds of photographs, and recorded a number of volumes of data concerning the life histories of animals, types of country, faunal zones, and people.

A SPECIAL exhibition of the motion picture film entitled "How Life Begins" was given in the American Museum auditorium on Saturday morning, January 20, for the teachers of the public schools of Greater New York. The pictures were made by Mr. George E. Stone in collaboration with Dr. J. A. Long, of the University of California, and were shown through the courtesy of the Exhibitors' Booking Agency of New York. They illustrate the story of how plants and animals come into existence. The film consists of the proper combination of actual

photographs of the essential stages in the development of plants and animals, and of carefully labeled diagrams, thus making a complex subject remarkably clear. Following this film there was exhibited another showing the growth of the house fly and its relation to disease.

MR. H. E. ANTHONY will spend the spring months in Cuba, in an effort to secure fossil mammal material for comparison with the specimens recently brought back from Porto Rico. The unexpected discovery of a rather extensive fossil mammalian fauna in Porto Rico points suggestively to the possibility of similar faunas on the adjacent islands, and of important results that might come from correlating the island faunas. It is probable that most of the work in Cuba will be done on the eastern end of the island.

MISS ANN E. THOMAS represented the American Museum of Natural History at the meeting of the New York State Science Teachers' Association at Syracuse, December 27-29. She addressed the biology section on the coöperation that exists between the American Museum and the public schools of New York City in the teaching of natural science.

UNDER the terms of the will of James Gaunt, an annual member of the American Museum of Natural History, the institution is designated as residuary legatee of one half of his estate.

DURING the session of the American Association for the Advancement of Science recently held in New York City, the meetings of the Section of Anthropology and Psychology convened at the American Museum, also those of the American Anthropological Association, the American Folk-Lore Society, the Vertebrate Section of the Palæontological Society, and the Entomological Society. On December 27, Professor T. D. A. Cockerell, retiring president of the Entomological Society of America, gave an address at the Museum on "Fossil Insects." On December 28, Dr. A. A. Noyes, of the Massachusetts Institute of Technology, addressed a meeting of the American Chemical Association in the auditorium of the Museum on "Nitrogen

and Preparedness." Following this address a reception was held in the hall of the age of man by the various chemical societies represented at the meetings. On December 29, Professor Frederic P. Gay gave an address on "Specialization and Research in the Medical Sciences" before the Section of Physiology and Experimental Medicine and the Society of American Bacteriologists. There was also held a symposium on cancer and its control.

DURING January Dr. Robert H. Lowie gave four lectures on ethnology at the Museum. The object of the course was to define culture. The subjects considered at the successive lectures were "Culture and Psychology," "Culture and Race," "Culture and Environment," and "Determinants of Culture."

THE American Scenic and Historic Preservation Society, jointly with the American Museum of Natural History, on January 10, held exercises signaling the establishment of the National Park Service of the United States. The speaker of the evening was the Honorable Robert Sterling Yard, of the National Park Service, Department of the Interior, who gave an illustrated address on our national parks and national monuments.

THE supervisors of the national parks of the United States, who had been called from the West for a conference in Washington, visited New York City January 9 and 10. They were entertained at luncheon at the American Museum of Natural History, by Professor Henry Fairfield Osborn, January 10. Following the luncheon, they made a tour of the Museum, paying particular attention to the habitat groups, the halls of vertebrate palæontology, and the hall of forestry. Arrangements were made for securing from the supervisors a series of tree portraits representative of the national parks. Those present were Major Amos Alfred Fries, Yellowstone Park; Mr. Walter Fry, Sequoia and General Grant parks; Mr. George Estyn Goodwin, Crater Lake Park; Mr. Washington B. Lewis, Yosemite Park; Mr. S. F. Ralston, Glacier Park; Mr. Thomas Rickner, Mesa Verde Park; Mr. L. Claude Way, Estes Park; and Mr. W. A. Welch, engineer of the Palisades Interstate Park Commission.

The American Museum of Natural History

Its Work, Membership, and Publications

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

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

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

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

The educational work of the Museum is also carried on by numerous lectures to children, special series of lectures to the blind, provided for by the Thorne Memorial Fund, and the issue to public schools of collections and lantern slides illustrating various branches of nature study. The following are the statistics for the year:

Visitors at the Museum	847,675
Lectures to School Children	81,798
Lectures to Members	5,089
Lectures to Children of Members	9,465
Lantern Slides Sent out for Use in Schools	38,912

There are in addition special series of evening lectures for Members in the fall and spring of each year, and on Saturday mornings lectures for the children of Members. Among those who have appeared in these lecture courses are Admiral Peary, Dean Worcester, Sir John Murray, Vilhjálmur Stefánsson, the Prince of Monaco, and Theodore Roosevelt.

Membership

For the purchase or collection of specimens and their preparation, for research, publication and additions to the library, the Museum is dependent on its endowment fund and its friends. The latter contribute either by direct subscriptions or through the fund derived from the dues of Members, and this Membership Fund is of particular importance from the fact that it may be devoted to such purposes as the Trustees may deem most important, including the publication of

the JOURNAL. There are now more than four thousand Members of the Museum who are contributing to this work. If you believe that the Museum is doing a useful service to science and to education, the Trustees invite you to lend your support by becoming a Member.

The various Classes of Resident Membership are as follows:

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

They have the following privileges:

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

Associate Membership

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

- Current issues of the AMERICAN MUSEUM JOURNAL—a popular illustrated magazine of science, travel, exploration and discovery, published monthly from October to May (eight numbers annually), the volume beginning in January
- A complimentary copy of the President's Annual Report, giving a complete list of all Members
- An Annual Pass admitting to the Members' Room. This large tower room on the third floor of the building, open every day in the year, is given over exclusively to Members, and is equipped with every comfort for rest, reading, and correspondence
- Two complimentary tickets admitting to the Members' Room for distribution by Members to their friends
- The services of an Instructor for guidance when visiting the Museum

Publications of the Museum

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

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

All classes of Members receive the *JOURNAL*, which is a popular illustrated magazine, primarily issued to keep members in touch with the activities of the Museum as depicted by pen and camera; also to furnish Members with reliable information of the most recent developments in the field of natural science. It takes the reader into every part of the world with great explorers; it contains authoritative and popular articles by men who are actually doing the work of exploration and research, and articles of current interest by men who are distinguished among scientists of the day. It takes the reader behind the scenes in the Museum to see sculptors and preparators modeling some jungle beast or creating a panorama of animal life. It shows how the results of these discoveries and labors are presented to the million public school children through the Museum Extension System. In brief it is a medium for the dissemination of the idea to which the Museum itself is dedicated—namely, that without deepening appreciation of nature, no people can attain to the highest grades of knowledge and worth.

In addition to the *JOURNAL*, publications in the way of *Handbooks* and *Leaflets* are issued from time to time in which various subjects embraced in the work of the Museum are treated in a nontechnical way.

The following list gives some of the popular publications; complete lists, of both scientific and popular publications, may be obtained from the Librarian.

POPULAR SCIENTIFIC PUBLICATIONS

— HANDBOOKS

- NORTH AMERICAN INDIANS OF THE PLAINS**
 BY CLARK WISSLER, PH.D. Paper, 25 cents; cloth, 50 cents
- INDIANS OF THE SOUTHWEST**
 BY PLINY EARLE GODDARD, PH.D. Paper, 25 cents; cloth, 50 cents
- ANIMALS OF THE PAST**
 BY FREDERIC A. LUCAS, SC.D. Paper, 35 cents
- DINOSAURS**
 BY W. D. MATHEW, PH.D. Price, 25 cents
- TEACHERS' HANDBOOK, PART I, THE NORTH AMERICAN INDIAN COLLECTION**
 BY ANN E. THOMAS, PH.B. Price, 10 cents
- TREES AND FORESTRY**
 BY MARY CYNTHIA DICKERSON
 A new edition in course of preparation.

ILLUSTRATED GUIDE LEAFLETS

- THE COLLECTION OF MINERALS**
 BY LOUIS P. GRATACAP, A.M. Price, 5 cents
- NORTH AMERICAN RUMINANTS**
 BY J. A. ALLEN, PH.D. Price, 10 cents
- THE ANCIENT BASKET MAKERS OF SOUTHEASTERN UTAH**
 BY GEORGE H. PEPPER Price, 10 cents
- THE MUSICAL INSTRUMENTS OF THE INCAS**
 BY CHARLES W. MEAD Price, 10 cents

THE SAGINAW VALLEY COLLECTION By HARLAN I. SMITH	Price, 10 cents
PERUVIAN MUMMIES By CHARLES W. MEAD	Price, 10 cents
THE METEORITES IN THE FOYER OF THE AMERICAN MUSEUM OF NATURAL HISTORY By EDMUND OTIS HOVEY, PH.D.	Price, 10 cents
THE HABITAT GROUPS OF NORTH AMERICAN BIRDS By FRANK M. CHAPMAN, SC.D. Second edition issued May, 1916.	Price, 25 cents
THE INDIANS OF MANHATTAN ISLAND AND VICINITY By ALANSON SKINNER	Price, 20 cents
THE BATRACHIANS OF THE VICINITY OF NEW YORK CITY By RAYMOND L. DITMARS	Price, 15 cents
PLANT FORMS IN WAX By E. C. B. FASSETT	Price, 10 cents
THE EVOLUTION OF THE HORSE By W. D. MATTHEW, PH.D.	Price, 20 cents
MAMMOTHS AND MASTODONS By W. D. MATTHEW, PH.D.	Price, 10 cents
HOW TO COLLECT AND PRESERVE INSECTS By FRANK E. LUTZ, PH.D.	Price, 10 cents
OUR COMMON BUTTERFLIES By FRANK E. LUTZ, PH.D., AND F. E. WATSON	Price, 15 cents
THE BIG TREE AND ITS STORY	Price, 10 cents
THE INSECT GALLS OF THE VICINITY OF NEW YORK CITY By WILLIAM BEUTENMÜLLER	Price, 15 cents

SOME REPRINTS

THE GROUND SLOTH GROUP By W. D. MATTHEW, PH.D.	Price, 5 cents
THE WHARF PILE GROUP By ROY W. MINER, A.B.	Price, 5 cents
THE SEA WORM GROUP By ROY W. MINER, A.B.	Price, 10 cents
THE ANCESTRY OF THE EDENTATES By W. D. MATTHEW, PH.D.	Price, 5 cents
HEREDITY AND SEX By FRANK E. LUTZ, PH.D.	Price, 10 cents
THE STORY OF MUSEUM GROUPS By FREDERIC A. LUCAS, SC.D.	Price, 10 cents
THE NEW AFRICAN HALL By CARL E. AKELEY	Price, 5 cents

ILLUSTRATED GUIDE TO THE COLLECTIONS

New edition issued August, 1916, 136 pages, 75 illustrations, many full page.
Price, 25 cents

KEY TO BUILDING AND COLLECTIONS Price, 5 cents

SOUVENIR STAMP ALBUM

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



Willamette meteorite near locality where discovered. Side view to show protuberance (above) produced during flight. The shape of a meteorite depends largely on whether or not it turns over during its journey. If it does not turn over, it is likely to be chiseled by the flames into a nose in front

—See "The Flight of a Meteor," by Elihu Thomson, page 25

THE
AMERICAN MUSEUM
JOURNAL



EXCAVATION OF THE AZTEC RUIN

CAMP LIFE IN NEW MEXICO

HORNED DINOSAUR — MUSIC OF BIRDS

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MARY CYNTHIA DICKERSON, *Editor*

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Photograph by Herbert J. Spinden

A STRONGHOLD OF THE ANCIENT CLIFF DWELLERS

Looking up the cañon of the Rito de los Frijoles, New Mexico, from a ceremonial cave in the cliff. The streams flowing into the Rio Grande from the west have cut deep gorges through the yellow tufa. The cliffs on the north side of the stream are very steep, and in them are found artificial caves made by ancient peoples

THE AMERICAN MUSEUM JOURNAL

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FEBRUARY, 1917

NUMBER 2

Excavation of the Aztec Ruin

By N. C. NELSON

THE AMERICAN MUSEUM began last summer the complete excavation and reparation of one of the finest and best preserved examples of prehistoric Pueblo architecture in the Southwest. This ruin is located in the Animas Valley, in northwestern New Mexico, a few miles below the Colorado boundary and directly across the river from the town of Aztec. The town, it may be explained parenthetically, takes its name from the ruin which, according to erroneous but persisting popular notion, was built, not by the "Indians," but by members of the Aztec tribes whose habitat since before the Columbian discovery has been confined to Middle America. A resident of Aztec, Mr. H. D. Abrams, is the owner, and he has generously given the Museum a concession to clear out and investigate the entire ruin. It is the largest single piece of scientific work of the kind ever undertaken within the limits of the United States. The first season's excavation was provided for through the generous assistance of Mr. J. P. Morgan. Mr. Archer M. Huntington has generously contributed funds for the continuation and completion of the work.—THE AUTHOR.

THE Aztec ruin is the principal member of a large group of more or less ancient houses and villages localized within a short radius. If not the last of this group to be inhabited, it appears at any rate to embody the highest development of architectural ideas attained by the Pueblo Indians in that section of the Southwest. The site is of more than usual scientific importance, partly because of its relatively excellent state of preservation but more especially because of the fact that the owner has for many years guarded it against vandalism. Other ruins of the identical type exist for a hundred miles or so around, and although far less accessible than the Aztec pueblo, they have been for the most part systematically looted. The investigation of the ruin involves two things: first and foremost, the collection of every available particle of in-

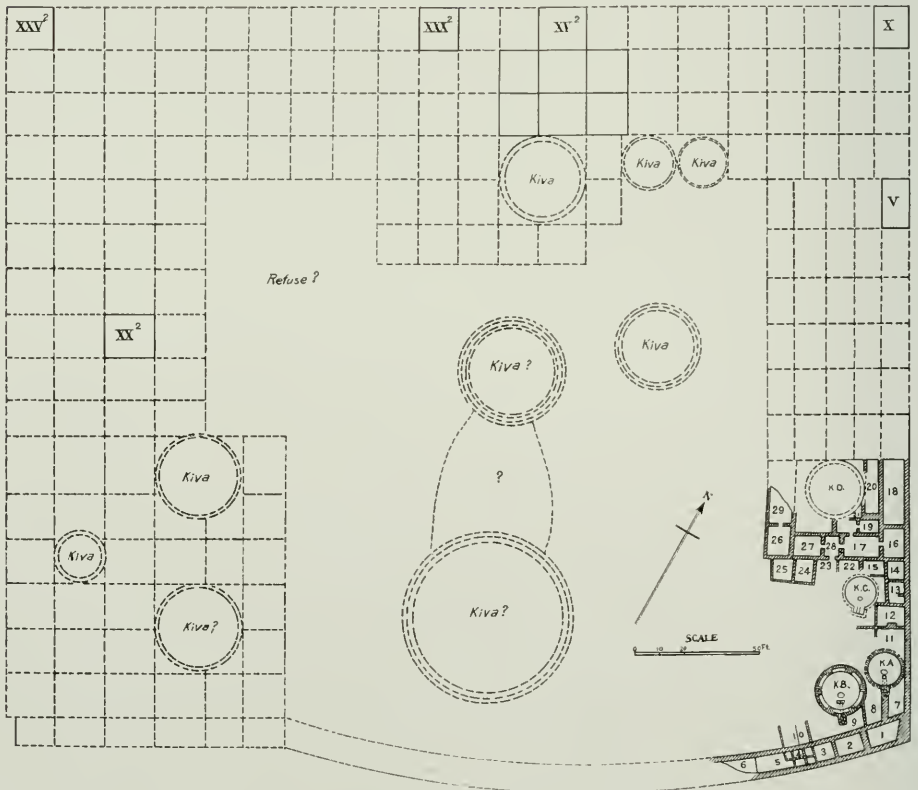
formation that may serve to throw light on the habits and attainments of the builders; and second, the repair (not the restoration) of the standing portions of the structure, making it at once a monument to the Indian and an attraction to the more and more interested public.

The Aztec ruin represents what was at once a great house and a village. That is to say, it was something like a large modern American apartment house in size, but different from it in that its inhabitants constituted a closely organized community. The basic principle of this organic group was coöperation. How the Indian came to adopt this coöperative plan we cannot precisely tell. It may be that it grew out of economic necessity. Thus to insure good crops even in the beautiful Animas Valley he was obliged to resort to artificial watering, and nothing short

of coöperation in digging and maintaining irrigation ditches would have been practicable. Again, the Pueblos may have been hard pressed by encroaching nomads, and in that way compelled to group together for mutual protection and to build villages that were in reality great fortresses of no mean order.

An examination of the accompanying illustrations will perhaps give a better general idea of the essential nature of these fortresses than any amount of verbal description. The ground plan and the restoration are especially illu-

minating. Stated in the simplest terms, the Aztec pueblo consists of three buildings joined in such a way as to enclose three sides of a rectangular court. This court faces approximately south and is enclosed by a curving wall, which in this particular case has been expanded so as to accommodate a row of small rooms. The only entrance to the fortress, as far as we at present know, led through a door in this wall and was presumably closed and barred at night as well as in time of trouble. The guard, or at any rate the defenders, we may imagine to have mounted this wall



Ground plan of the Aztec ruin as apparent before excavations were begun in July, 1916. The numbered rooms with shaded or solid walls are those cleared by the Museum Expedition. It may be noted that the long walls of the west wing and the cross walls of the north wing join exactly, as if this portion of the village had been planned and built at the same time. The east wing, on the other hand, shows irregularities in that its long partition walls do not meet the cross walls of the north wing, and also in that this building does not appear to have been completed at the south end. This last peculiarity was probably due to the presence at this spot of an older house which was partially incorporated in the great pueblo

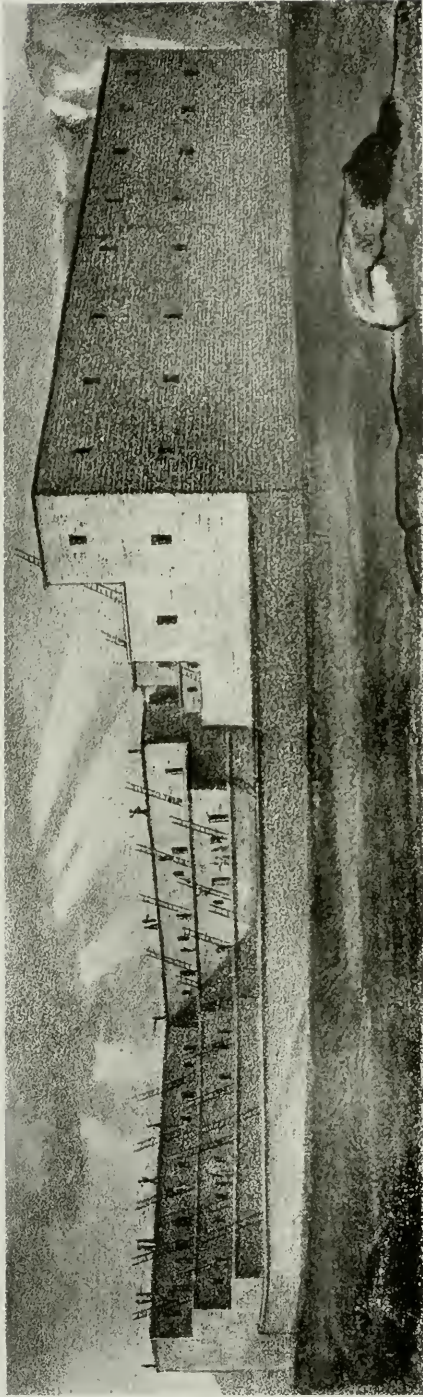
and to have fought from behind a parapet. At all events, the initial attack would have to be delivered against this wall, because it affords the only means of access to the village, the strong outer walls of the pueblo buildings proper being a sheer three or four stories high and provided with no apertures large enough to admit a man. Even if the enemy succeeded in reaching the court of the village, his victory was less than half assured, because there were no entrances leading directly from the court to the houses. As may be observed in the restoration, the three buildings on the sides facing the court rose by receding steps, each normally one story high and one room wide. These separate levels of rooms were reached not by interior stairways but by outside ladders which could always be drawn up, thus placing the attacking foe at a succession of disadvantages. Of particular importance was the fact that while each of the upper tiers of rooms was entered by a door through the front wall in the normal way, the ground floor rooms were entered only through trapdoors in the roof. The enemy, to get into the building at all (to set fire to it, let us say), was therefore obliged first to scale the lower story. To do this he would have to bring his own ladders and expose himself in a more or less weaponless condition. From these brief details it will be apparent that as a military contrivance this type of village could scarcely be improved upon.

One very interesting fact about this type of pueblo, is that the builders must have planned it out in full before beginning construction, because the village, once completed, was relatively difficult to modify or enlarge. This implies that the builders must have taken something like a census of the originally dispersed members of the com-

munity and have built on a scale to suit demands. Limited modifications and enlargements could be made, however, and are indicated perhaps in the Aztec pueblo by the addition of a series of rooms on the court side of the west wing. There is also the suggestion of a building projecting into the court from the center of the main wing. This center wing is very unevenly developed in observed ruins of the type, and may, therefore, be a deliberately chosen method of accommodating an increasing population.

The Aztec ruin lies on the smooth but gently sloping valley floor, perhaps five hundred yards from the right bank of the Animas River and about two hundred yards from the base of the barren gravelly uplands. Within a stone's throw there are no fewer than eight additional ruins (one, at least, being apparently incorporated in the pueblo), and within a mile or less there might at one time have been counted certainly all of one hundred ruins, some situated in the valley and some on the terraces above. The greater number of these ruins are of small or medium size, representing houses of both angular and curvilinear ground plans, and built, as a rule, of easily procured cobblestones or river boulders, laid in mud. Some are built entirely of mud or adobe. Occasional ruins, however, were constructed more or less completely of dressed sandstone blocks, as is the main pueblo itself. In other words, we have here, probably, the remains of a long-lived community, the members of which at first lived in scattered houses but gradually united into larger and larger groups until finally, perhaps, they were all gathered within the walls of the fortress-like pueblo.

The great Aztec pueblo contained about five hundred rooms and may



After Jackson

RESTORATION OF A PUEBLO OF THE "AZTEC" TYPE

Such pueblos were at once great fortified houses and villages, and are comparable, in the number of people sheltered, to the modern American apartment house, although different from it in that the principle of the pueblo was close communal cooperation. The buildings were so joined as to enclose three sides of a rectangular court, whose fourth side was protected by a low, outcurving wall. Only one entrance led through the outer wall into the pueblo, which was, therefore, easily defended. The three buildings, rising sheer from the ground on the outside with very small windows, rose within the court, by receding steps, each a story high. Interior stairways were not in use, access being gained to upper levels by movable ladders. As a military contrivance, this plan could hardly have been improved upon, since an enemy would be forced to make not one, but a series of attacks, to get possession of the building.

The illustration, which is based on the ruins of "Huncho Pavie" in the Chaco Cañon, a fortified village similar to that at Aztec, gives a tolerably correct idea of façades and elevation, of the low, outcurving front wall enclosing the court, and of the mode of entrance by outside ladders, but it fails to indicate any doorway through the front wall, and pictures as too large the windows in the outer walls of the upper stories

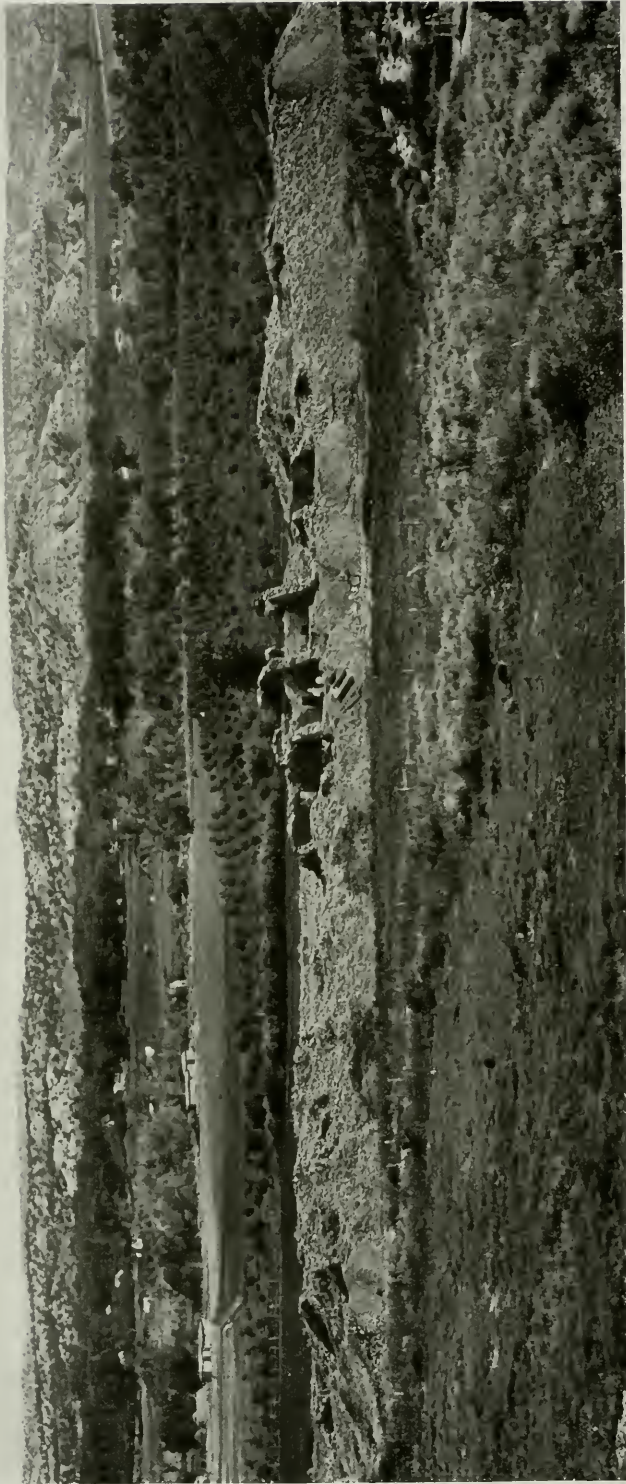


Photograph by E. H. Morris

THE AZTEC PUEBLO RUIN

Upper view, as seen from the front or south side before the brush was cleared away. Behind the ruin rise the barren gravelly uplands which enclose the Animas Valley.

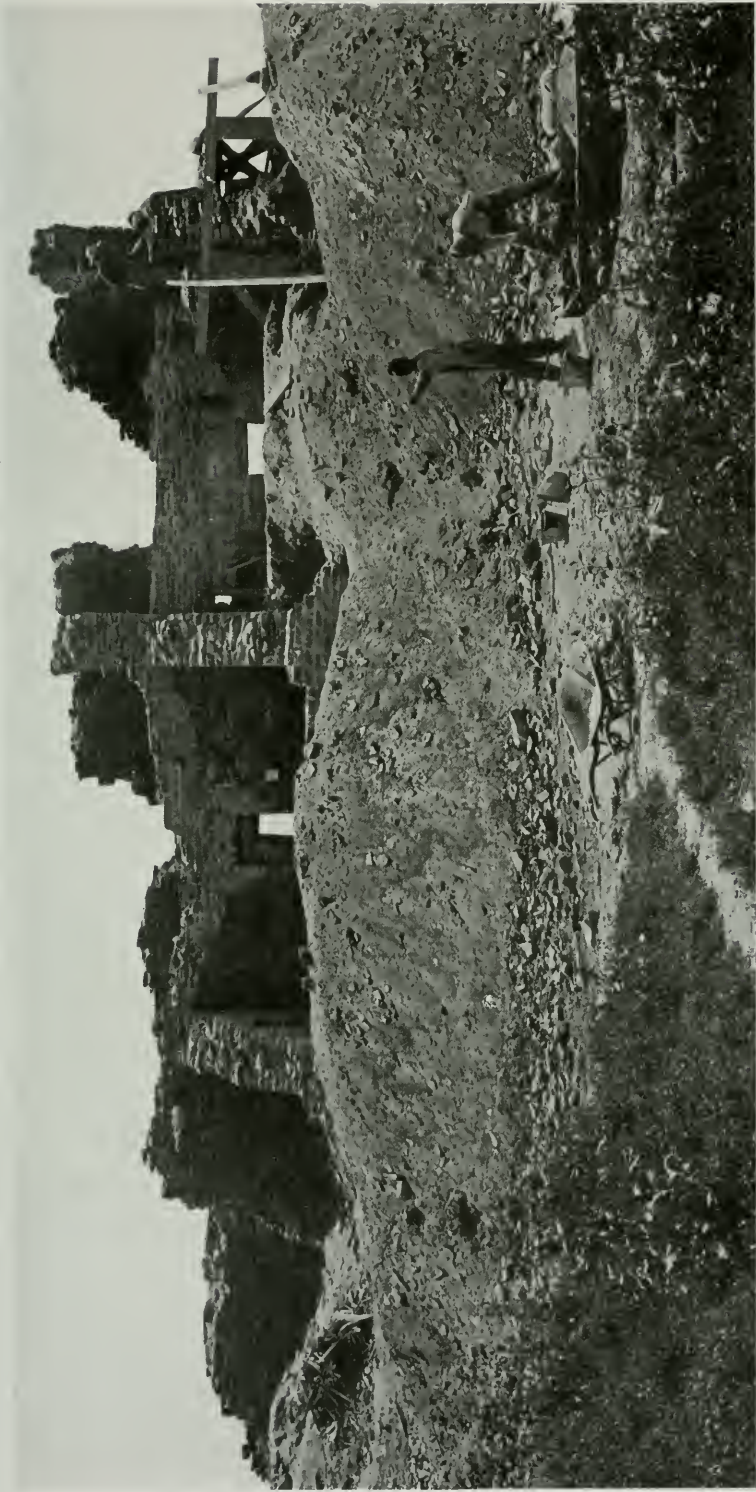
The lower view shows the burning of the brush at night after it had been cut and thrown into large piles



Photograph by E. H. Morris

THE MAIN PUEBLO RUIN AT AZTEC AND ITS SURROUNDINGS

After it was cleared of brush, the great ruin stood out in full view for the first time in many centuries. The total length of the main facade here shown is 359 feet and the debris at the extremities rises fully twenty feet, *i. e.*, to the top of the second story; while the standing walls in the center reach a height of about twenty-seven feet. The village was built on a growing alluvial fan, however, so that the lower story is at present partly buried in fluvial deposit. Beyond the orchard, following the broken line of timber, runs the swift and often noisy Animas River, and in the grove, between the river and the sparsely covered hills, hides the peaceful little town of Aztec.



Photograph by E. H. Morris

THE MAIN WING AT AZTEC

Central section of the main wing seen from the north while in process of repair. This is the best-preserved portion of the ruin, rising as it does well up on to the third story, or in all about twenty-seven feet, the first floor being several feet below the level of the foreground. In the left of the two rooms showing doorways intact, were found about two wagonloads of rubbish, mixed with which were discarded specimens of matting, sandals, coarse and fine string, raw and tanned hide, numerous beads of turquoise, and many other objects of interest to the archaeologist



Photograph by E. H. Morris

In order to discover as many as possible of the small and fragmentary artifacts, such as beads, in the floor débris, it is necessary to run this through one or more screens. Beyond the screen (in the photograph), running toward the Animas River, may be seen the expedition's winding tramway grade. In the distance rise the Knickerbocker Mountains



Photograph by N. C. Nelson

The excavation of Aztec was begun at the southeast corner of the ruin, the débris being taken to a distance by means of a tramway



Photograph by N. C. Nelson

Portion of the floor and wall of the circular and subterranean kiva, or ceremonial chamber, marked KA on the ground plan, page 86. In the immediate foreground is the fire pit, and beyond it the fresh air intake shaft, the smoke having to escape through the entrance in the roof directly above the fire. On the left may be seen the uncovered burial of a wolf, the precise significance of which in the ceremonial chamber is unknown at present



Photograph by N. C. Nelson

Many ceilings in the rooms of the lower story of the Aztec ruin are as perfect in all respects as the day they were constructed, probably some five or six hundred years ago. The beams are of spruce or pine, measuring up to twelve inches in diameter; transversely over these lie secondary timbers two to three inches thick, usually of cottonwood, spaced evenly or by threes; above these again is a layer of split rails, cedar bark, and twigs, the whole being finally covered with a four to six inch coat of clay (adobe), which constitutes the floor for the dweller in the story above. The same general method of ceiling construction is still used by the Pueblo Indians, and in fact by the Mexicans or Spanish Americans as well, but seldom with such neatness and skill

easily have housed the same number of people. Its main building is 359 feet in length, the east and west wings respectively 282 and 281 feet, but the actual space occupied by the village is somewhat larger, owing to the out-curving wall which encloses the court. Each of the building wings is from four to six rooms wide, and was three, and in some places possibly four, stories high. The walls, which are a little over three feet thick in the lower story, still rise to a height of twenty-seven feet. The secular rooms, which are always rectangular, vary somewhat in size, the smaller ones measured being only a trifle over nine feet square and the largest as much as twelve and one half by twenty-three and one half feet. The height of some of these rooms from floor to ceiling ranges from nine to eleven feet. The doors average a little over two by four feet and usually require one to stoop for passage. The windows or ventilating apertures that open out through the rear wall are all in the neighborhood of one foot square.

Of ceremonial rooms, which are circular in outline and more or less subterranean, there may be as many as thirteen in the pueblo. The greater number are incorporated in the buildings proper, but three at least are situated out in the open court. These "kivas," as they are called, differ greatly in size, the largest being apparently all of sixty feet in diameter while the smallest so far excavated is only about twelve feet. They also vary somewhat in details of construction.

The amount of labor involved in erecting such a village seems enormous when we consider that these people possessed no burden-bearing animals and no tools except such as were made of stone, bone, and wood. We are still more impressed on finding that in this

particular instance the building stone used was quarried in the hills some four or five miles away. Likewise the great timbers employed, some of them measuring twelve inches or more in diameter, were felled on the mountain-sides, probably far up the valley, and transported at least in part by sheer human strength. The proverbially "lazy" Indian would seem to be a myth. And yet the Indian performed his task, we believe, as a free man, and not as the slave of royal taskmasters as in the case of those who built cities and monuments in Egypt and Mesopotamia.

How much of an enterprise it really was to erect such a fortified town, it would be impossible to convey to the reader at this time. The fact would hardly be appreciated even by a visit to the site. But in the course of the four or five years of future work planned for the complete excavation and reparation of the ruin, we may expect that the enormity of the enterprise will become tolerably clear.

When we reached the Aztec ruin in the latter part of July, we found what appeared to be an immense heap of debris, almost entirely covered with a heavy growth of "chico" brush. By early September, the place looked very different. The brush had been cut and burnt, so that the ruin itself stood out in full view. The walls that rose above the general level of fallen masonry had been repaired, and from thirty to forty rooms, mostly in the east wing, had been cleared. It was merely a beginning, however—an experimentation, as it were—in ways and means. During the coming season we may hope for considerable progress. The task set is one calling not only for infinite patience with regard to scientific details but also for practical tact in dealing with men (even the visiting public is a problem),

as well as for mechanical resourcefulness. No work of quite the same character has been done before in the Southwest, so that it has been necessary to try out different methods to determine the quickest and best.

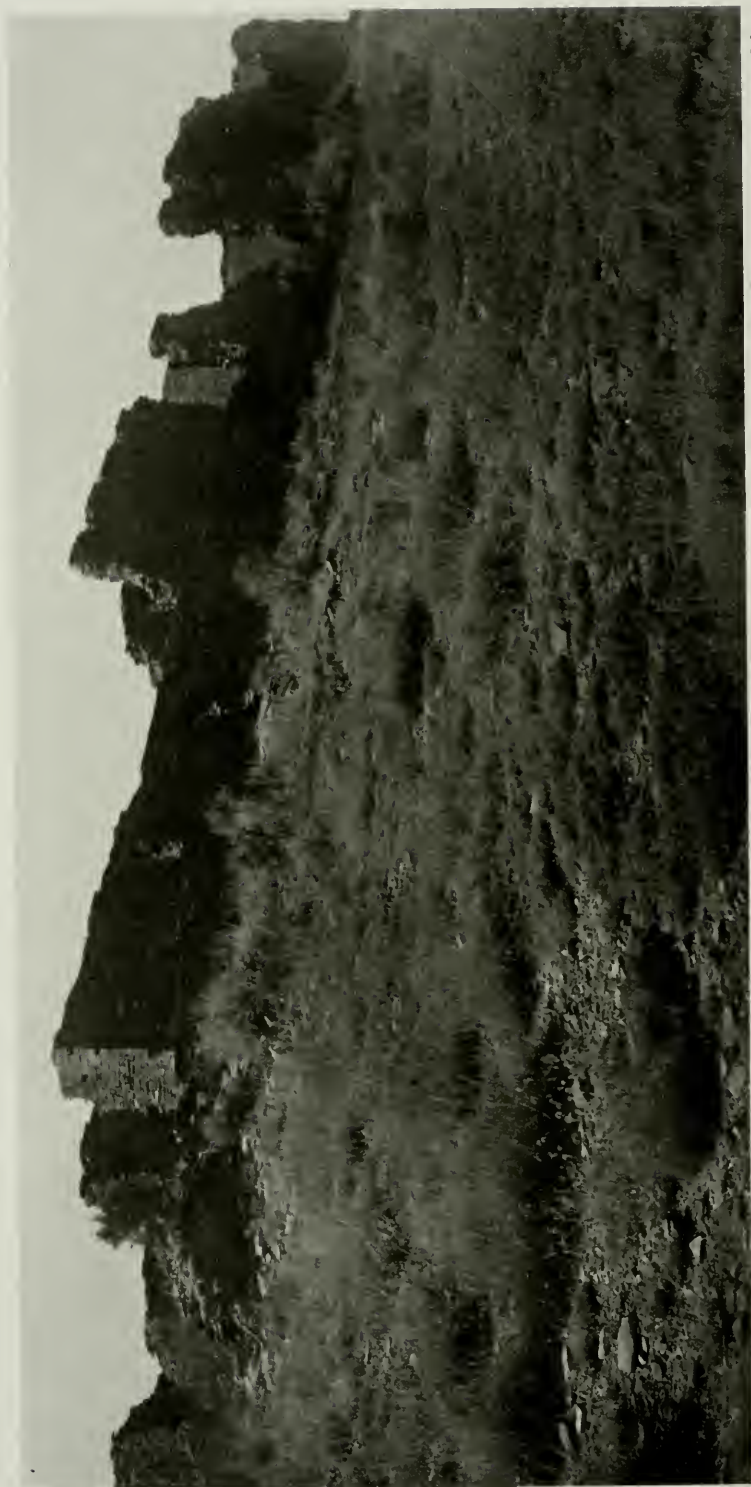
The work itself looks like ordinary labor, and may very easily degenerate into such. All scientific pursuits involve more or less of routine and drudgery, and this is especially true for those who are trying to reconstruct the life and history of prehistoric peoples. To wield the pen to any purpose, the spade must be handled first. But it is difficult indeed, amid dust and débris, through alternating periods of heat, cold, rainstorm, and desert dryness—the mind all the while occupied with purely practical problems—to maintain always the nicely balanced scholarly attitude. And there is no eight-hour law in archaeology even for those who do not love their work. On the other hand, archaeological field work, like other branches of research, offers its moments of exultation. In a way the excavation of ruins is like prospecting for ore—you always expect a strike and you are reasonably sure of getting it. But here again lies a real danger. My early notion of an archaeologist was that of a bewhiskered individual gone mildly fanatic over something or other antiquated—perhaps arrowpoints. This tendency to find complete satisfaction in the object unearthed is always present, and the moment it takes full possession the archaeologist is dead.

Possibly the reader may ask, "What then is the ultimate purpose of archaeological research? Why all this expenditure of time and money if not primarily to recover relics of the past ages?" I have had to ask myself these questions more than once when hardships and difficulties arose which made

it for the moment doubtful whether the game was really worth the candle. This period of doubt came about the time the mere novelty of the occupation had worn off, when the specimens found were no longer "curiosities." The conclusion reached was—and it is now an article of faith, so to speak—that of course the immediate purpose of excavation is to obtain "specimens," but that specimens after all are nothing but means to an end. The real mission of archaeology is to make the unknown past live again or, in other words, to write history.

Some may question the possibility of stating anything of permanent historical value about the times lying beyond the invention of writing, or concerning any people who have not left us some written records. But if history is to be essentially a record of the general organic life and growth of the world's inhabitants, then archaeology is in a position of vantage. A stone axe or a necklace of sea shells is an incontrovertible document, in certain respects worth more than any written document whatsoever. A proper interpretation of a complete array of archaeological data from any given quarter of the world will be a far safer guide than any book of travels of the Mandeville type or any rhapsodical history of the Carlylean order. The most sober historian is never completely unbiased, so that even admitting his sources to be infallible, his interpretation at its best will be only an approximation to the truth. Therefore a history based on documents other than those of the written sort has, within its own limits, genuine merit, and archaeological research is amply vindicated.¹

¹ The results of the work in the way of specimens found, will be considered in a later issue of the *JOURNAL* by Mr. Earl H. Morris, who is in immediate charge of the Aztec excavations.



Photograph by N. C. Nelson

PUEBLO PINTADO, OR PAINTED VILLAGE

This ruin is the easternmost of the group of fortified towns of Chaco Cañon (New Mexico) and is of the same general architectural type as the Aztec ruin. It is known locally as "Pueblo Alto," due perhaps to the fact that it stands in an exposed place on the continental divide and can be seen for many miles around. The north façade here shown measures about two hundred feet in length



Photograph by N. C. Nelson

PUEBLO WIJEGI, CHACO CAÑON, NEW MEXICO

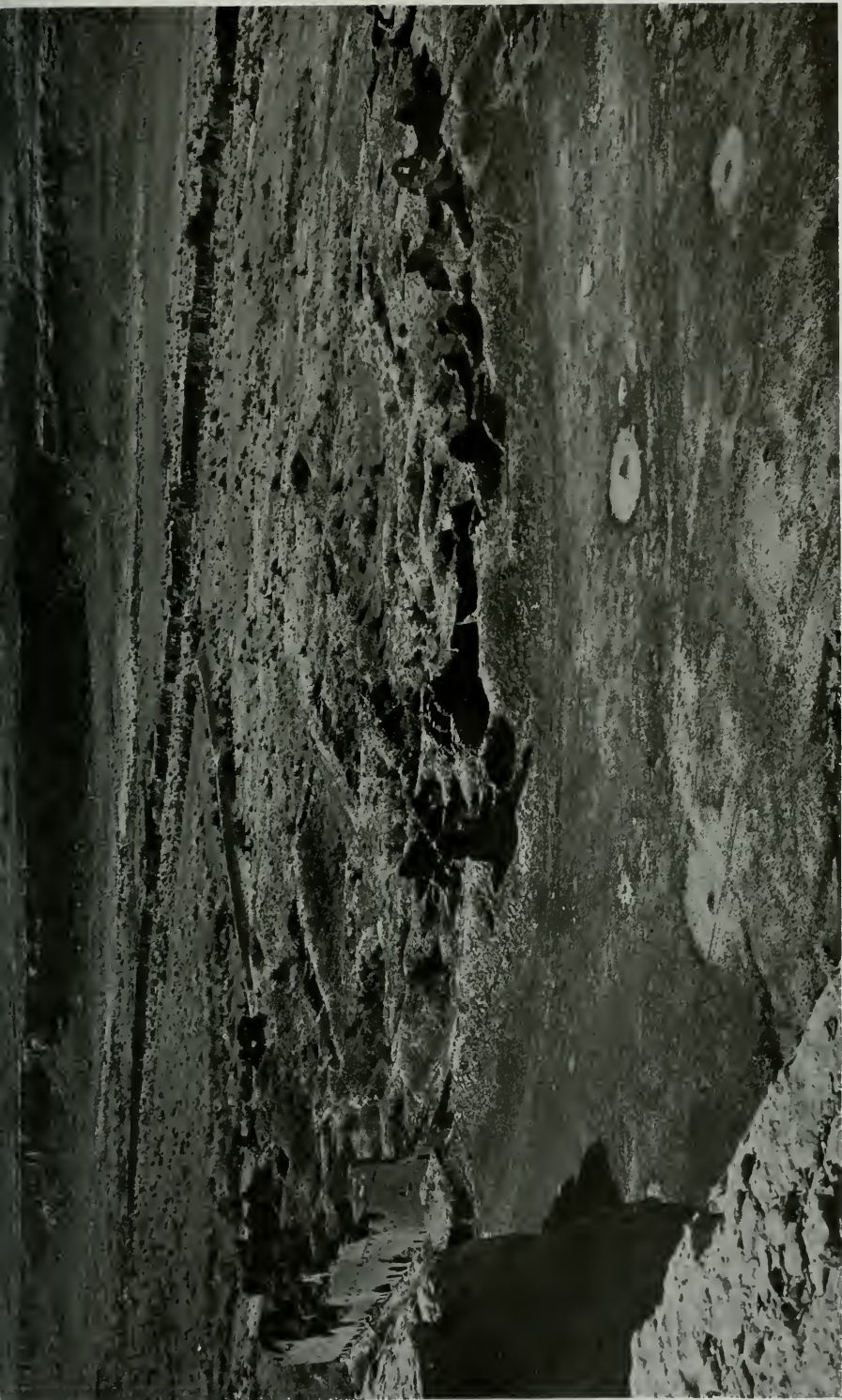
This rather small but well-preserved ruin is of the same general architectural type as the ruin at Aztec. Its dimensions are about 120 by 225 feet and the masonry rises to about twenty-five feet. The semicircular wall, which ordinarily encloses the court in this type of village, is missing; this fact, together with the absence of any refuse heap, makes it seem probable that the place was not only never inhabited but never finished. The view shows the full width of the Chaco Cañon just below the point where it boxes up



Photograph by N. C. Nelson

PUEBLO CHETTRO KETTLE, CHACO CAÑON, NEW MEXICO

Except that it covers a larger area, this ruin resembles quite closely the one under investigation at Aztec, some sixty miles to the north. The ground plan is E-shaped, with a semicircular wall connecting the two extreme wings so as to enclose the south-facing court. In spite of apparent reduction, the buried lower story of this structure is largely intact. The main building, of which the rear wall still shows, is about 450 feet long. View taken from the north wall of the cañon looking southeast or upstream



Photograph by N. C. Nelson

PUEBLO BONITO, CHACO CAÑON, NEW MEXICO

This well-known ruin is the largest and probably also the longest occupied of the type of communal habitation to which the ruin at Aztec belongs. Bonito appears roughly semicircular in ground plan, but unlike other villages of its class and age, it has suffered enlargement and modification at different times so that the archaeologist is unable at present to say what the original structure looked like. In places the rear walls are seen still to rise to the fourth story, but they are in imminent danger of falling owing mainly to the fact that the timbers have been ruthlessly torn out for modern building purposes. Valuable unpublished collections of pottery and other relics from this site are in possession of the American Museum as a result of extensive excavations begun in 1896 by the Hyde Exploring Expedition, and last summer the writer made preliminary chronological investigations in the large refuse heaps lying in front of the ruin. The view shows the full width of the Chaco Cañon, its perpendicular walls and central arroyo, and also gives a fair idea of the general bareness of the entire region.

The New Archæology

By CLARK WISSLER

THERE was a time when being an archæologist meant being a mere collector of curious and expensive objects once used by man. Such an archæology could make no just claim to a place in anthropology, the science of man. Its devotees vied with one another to possess the greatest number of unique objects, and under the stimulus of these interests the whole of North and South America has been ransacked to fill collectors' cabinets. But, while these activities have added something to our knowledge of man in the New World, they are impotent to answer the very questions we are all interested in; namely, how long has man been in America, whence did he come, and what has been his history since his arrival?

Geology finds in the earth the story of the world's origin and subsequent career, and in an analogous fashion the archæologist finds in the ground the story of man and his achievements. The new, or the real archæology is the study of these traces and the formulation of the story they tell. The fundamental questions we have enumerated above are not only very real problems, but very difficult ones. They are quite comparable to the tasks faced by the geologists. No mere collecting of curios, however fine or expensive they may be held to be, can in the least meet the exacting conditions encountered by the archæologist. He must actually dissect section after section of our old Mother Earth for the empirical data upon which to base his answers. It is not merely the finding of things that counts; it is the conditions and inter-associations that really tell the story.

This is well illustrated in the case of a famous Chaco ruin called Bonito, a pueblo quite similar to the "Aztec" ruin. A good many years ago Bonito was dug into, and many fine pieces of pottery and other relics found there were brought to this Museum, where the choicest are now on view; but to the questions, "how old is Bonito, how long occupied," these fine curios can give no answer. Last summer, Mr. Nelson, the American Museum's veteran archæologist, worked several weeks on what was left of Bonito. He found that the ash heap, or dump, had always been in the same place, and by patiently dissecting a vertical section of this refuse he got the story of the ruin. We now know that the builders of this pueblo came to the site in a body and left again within a few hundred years. We know, also, that there were no important changes in their arts and industries while residing there. Such are the results of the real, or new archæology, as a part of the science of anthropology.

There is no mystery about such work. It is largely toil; but toil under the direction of a scientific mind. In the same way, Mr. Nelson and his associates have worked out the status of more than a hundred ruins in New Mexico and Arizona. It can now be told at what relative date each of these was built, which is one of the first great advances toward the story of prehistoric man in the United States.

It is not alone among the ruins of the Southwest, however, that the true archæological method is applicable. Long ago traces of man were noted in the Delaware Valley, particularly at

Trenton. They were found deep down in sand and gravel, suggesting great age. For many years these facts had been debated and discussed without definite result; but two years ago, Mr. Leslie Spier turned his attention to the Trenton sand deposits, dissecting them through and through with the same infinite patience. The outcome of this study is that we now know that the stone tools of man are found at one general level in the Trenton sand, and that they are a part of the pebble series for the same. In short, it is beyond dispute that the history of the pebbles in the sand is also the history of the stone tools. Yet, this sand deposit is below the soil and so situated as to indicate its formation at a time when the climatic conditions of New Jersey were quite unlike what they are to-day. Here again progress has been made toward the first step in the solution of man's origin in the New World.

Very much the same can be said of the question as to whether our North American caves were occupied by man at an early period. A good many years ago, when the first discoveries were made in Europe leading to the theory that there was a time when man's culture could be truly characterized by the term "cave dwellers," our archaeologists examined many of the now famous caves of Kentucky and Virginia. They found that prehistoric man had entered these caves, but had left behind nowhere such clear-cut evidences of his successive appearances as in Europe. It was concluded, therefore, that all these

traces of man belong to a very recent period. Last autumn, however, Mr. Nelson made a careful study of Mammoth Cave. He made careful vertical sections in the accumulated deposits near the entrance to the cavern, and by the minute dissection of these, found a definite difference between the cultures represented here and those of the historic Indians. There is now every reason to believe that the culture of the Indians found in Kentucky by our first explorers was not the initial culture of that area. There is every hope that the use of proper methods of research will give us a chronological series for the whole Ohio drainage.

We cannot here describe the new methods that were used to get these results. They belong to the technique of the subject, but we should not forget that every field excursion of an archaeologist will bring him face to face with a case a little different from anything he has encountered before. The new situation must be analyzed and dealt with as its nature requires. So, in short, the real equipment of an archaeologist is a scientific mind. As soon as archaeology ceases to strive for the mere collection of fine objects or curios, and turns to problems, it makes discoveries. We may justly take pride in the appearance of this new science, partly because our own Museum has played a conspicuous part in its inception, and partly because it will hasten the day when our archaeological exhibits can be made to tell the true story of man's career in the New World.



HUMAN SWALLOWS' NESTS IN THE CLIFF

This term seems the best description for those small, rounded rooms, made by human hands long ago in the volcanic tufa of the cliff. They formed the homes of the Pueblo Indians in such places as Puyé and the Rito de los Frijoles (see page 110). One needs almost to have wings to gain access to some of them, for long, shaky ladders (like that in the center of this picture) are far from reassuring. In past times when wooden shelters, long since fallen to decay, were reared on beams projecting from the small holes about the openings of the cliff rooms, the Indian women, gaily dressed like their sisters of today, and less like swallows than tropical birds, darted in and out of doorways or climbed the ladders with jars of painted pottery on their heads



In the vicinity of Mount Taylor, between Cabezon and San Mateo, a most striking sky line is formed by volcanic peaks of varied shapes. Here we see the "Alesna," or "awl," so called, no doubt, on account of the sharp point it presents

Camp Life in New Mexico

THE ENCHANTMENT OF WANDERINGS AND STUDY AMONG ANCIENT
INDIAN RUINS IN THE AMERICAN SOUTHWEST

By ETHELYN G. NELSON

IT is now more than four years since I began to follow in the wake of an archaeological expedition to New Mexico. I confess it was with considerable trepidation that I first embraced the idea. The picture brought to mind by the mere mention of this corner of our country was one in which heat, sand and drought were the main features. What a change has been wrought in my opinion by these five years' experience may be judged by the fact that I now look forward with the greatest eagerness to the early spring days when we may again start forth on our wanderings through this land of enchantment.

Truly a land of enchantment! There is a spell in the deep blue of the sky, an exhilaration as of wine in the air, and a charm in the very immensity of the

unpeopled spaces, in this little-known section of the United States. Here, too, the romance of olden times is still maintained, for the cowboy rides the range, and the trapper and the treasure hunter are frequently met with. Weird and wonderful are some of the tales told by these natives as they visit with us around our evening camp fire, and we listen, interested and credulous as we might not be elsewhere, for the spell is upon us.

My first summer of camp life in New Mexico began in the vicinity of the picturesque village of Galisteo. I well remember my introduction to it. After a walk of some three miles from the desolate little railroad station, whose newly appointed agent seemed scarcely aware of the existence of the near town, we came suddenly to the edge of a rise



Camp at Mesita de la Tapia, on the Río Puerco.—Around the base of the high rock are traces of about ninety small villages, while the round hump on top indicates the ruin of a village of some size, to which the valley dwellers probably retreated in time of trouble. Access to the top is fairly difficult and could easily be barred. The only spring for miles around is situated just to the left of the tents

of ground and looked over on what appeared as an oasis in the desert. A little white church stood in the midst of a group of adobe houses, while apple orchards and great cottonwoods shaded the whole. Just beyond, the new bridge spanned the stream that winds its way through the town. We hastened on our way, and were soon resting in a room in the cool depths of the rambling adobe structure where Señora Davis, mother-in-law of the only English-speaking resident of the place, the merchant, puts up chance wayfarers. From this vantage point we began to explore the surrounding country for ruins, being ably assisted by a Mexican driver whose name, Anaya, soon became twisted into Ananias on account of the casual way in which he used the truth when an extra five dollars for a day's work was in sight.

Mrs. Davis' hospitable abode was soon afterward exchanged for the open-air existence which was followed until the snows fell. Sometimes the twelve by sixteen foot tent was our complete apartment, forming sleeping and living rooms as well as kitchen and dining rooms; while at other places we made use of rock shelters, green-covered arbors, or real caves, to supplement or entirely supplant it. From using a two-burner gasoline stove in cooking during our first summer, we were reduced to the open camp fire in the last expedition, where the nightly change of camping site made it necessary to do away with everything but actual necessities. Sleeping cots were discarded for the ground, and a board on a box replaced the usual camp table—demonstrating the uselessness of too great luxury.



Our camps have ranged through all varieties of scene, from the flat, sandy, desert abomination, to the beautiful sheltered spot with towering cliffs of varicolored sandstone overshadowing it. There have been springs and streams of water in places, and drought has been our lot in others. I am reminded of a time when we had more water than we needed. It was one evening when we were moving camp. The day had been fine, but as we were loading the last of our things on the wagon, there came up one of those sudden thunder storms common to the region in summer and fall. Soon the pitchy darkness was relieved only by the continual sheets of lightning. By the time we reached our destination, a rock-shelter camp, most of us were drenched to the skin. The usually dry arroyo between the rock shelter and the place where a careless driver had dumped our belongings, had become an impassable torrent, so that we were obliged to huddle in the cave

until midnight, before our bedding (fortunately protected by heavy canvas) could be rescued.

The first summer the work of the expedition was carried on along lines that necessitated camps of a more or less permanent nature, as compared with those of the season just closed. The rock-shelter kitchen at San Cristobal—which Senator Pankey, the owner of the “81,000 acre ranch” on which it was situated, persisted somewhat to our confusion in dubbing “Honeymoon Camp”—became quite like home before it was finally abandoned. Our workmen, all Mexicans, soon became old friends and we found them waiting for our return the next season to resume work for us. Most of them spoke no English and were a happy-go-lucky set, being quite content apparently with today’s frijoles and black coffee, with no thought for the morrow. They no doubt had their opinion of folks who would spend so much time and money digging holes in the ground and collecting worthless bits of bone and pottery, but they were polite enough to keep it to themselves. Old “Socrates” was so named by the head of the expedition because of his great knowledge of everything on earth or in the heavens above. No question could be put to him that he was not prepared to answer, and he had a name and a use for every plant that grew in the vicinity. All this past summer we drank a wild tea recommended by him and found it good. He had stories of buried treasure, supposed to be well guarded by the Indians: and he wanted a chance to dig in the old church ruin at San Marcos, but when there later on, his natural aversion to hard labor overcame his greed for gold. One young fellow brought into camp his wife (a mere girl of about fifteen years) and baby, with all their personal



In archaeological field work there are few holidays. When the excavation is not actually in progress, there are always plotting, mapping, and cataloging to keep one busy

This rock shelter, formed by one immense boulder tipped against another, was once an Indian abode. A little excavating and a few yards of mosquito netting transformed it into a very acceptable dining room and kitchen during the hot months

The water near the camp was often too alkaline for use. At San Cristobal it was necessary to bring water by wagon from Galisteo, six miles away. Sometimes the saddle pony was requisitioned to bring water from a near spring

belongings even to the kitten—which was unfortunately captured by an owl. Another workman brought his newly made bride for a honeymoon trip. He, it was said, had been the victim of the folly of the higher education. Having been at school and therefore qualified to act as postmaster, he had tried to defraud the government, for which

horses; and families near our camps were sure to make similar requests.

As I glance back over this last wonderful summer, with its kaleidoscopic changes, my mind is crowded with varied images. With scarcely any pause in our daily travel from the last of May until the last of October, except for the month at Aztec, new scenes kept



Measuring the rooms and taking an inventory of the contents occupy a large part of the time when excavation is in full swing. In the background of this picture, taken at San Cristobal, may be seen the remains of a church built by the Spaniards some three hundred years ago

he had spent one year in the "pen." Apparently, however, this experience had not detracted in the least from his own or his bride's admiration for himself. Before leaving camp he begged that their pictures might be taken as souvenirs of their happy time there. This matter of having pictures taken, by the way, was something that greatly fascinated the natives, even the Indian boys sometimes requesting it. A group of cowboys one day held us up for a half hour while they posed on their

unfolding before us. Towering cliffs, weathered into all sorts of fantastic and beautiful shapes, melted into vast plains of sagebrush-covered sand, again to be replaced by piñon and cedar-timbered hills carpeted with many kinds of wild flowers.

Little Mexican towns are tucked away in the most unexpected places, the low adobe houses so blending with the general landscape that if it were not for the relief afforded by strings of scarlet peppers and by a few fruit and

cottonwood trees, they might almost pass unnoticed, or be thought merely a part of the adjacent cliff. They remind one of scenes in Palestine, and the solitary shepherd surrounded by his sheep on the bare hillside, or the old woman going to the stream with her water jug, serves to enhance the illusion. It strikes the newcomer oddly to find that English is seldom spoken in these towns, the Mexican language prevailing everywhere except in the larger centers.

The Indian villages, however, so often perched on the tops of inaccessible mesas, are much more strikingly picturesque, while the Indian women are like birds of bright-colored plumage as they dart in and out of their doorways or climb the ladders with jars of painted pottery on their heads. Their love of brilliant hues in their dress contrasts with the taste in garb shown by the Mexican woman, who is usually clad in somber black with a shawl of the same color thrown over her head. One's imagination tries to picture the old life of these Indian women when they occupied the rows of caves or the cliff dwellings which line the walls of

the Frijoles Cañon near Santa Fé. I still see that ceremonial chamber high up in the cliff, with its three long shaky ladders, where I confess that my courage failed me ere I reached the top.

Ruined villages, the search for which led us all over northwestern New Mexico, seem in great part at least to be

situated in the most picturesque localities: so while the Indian may have selected his dwelling place with many other things in view, I for one am convinced that he had an eye for the beauty of his surroundings. I feel grateful to him for this, since in this way we also were brought to these spots. From a place called the "Point of Mal Pais," we traveled for miles through the Angostura, a nar-



This ancient Indian guardhouse, built under an overhanging ledge high up in the cliff, is not so easy of access as it would appear from the picture. In fact, I almost gave up trying to reach it across the steep face of the rock. It is neatly finished inside, but is too small to have been used as a dwelling

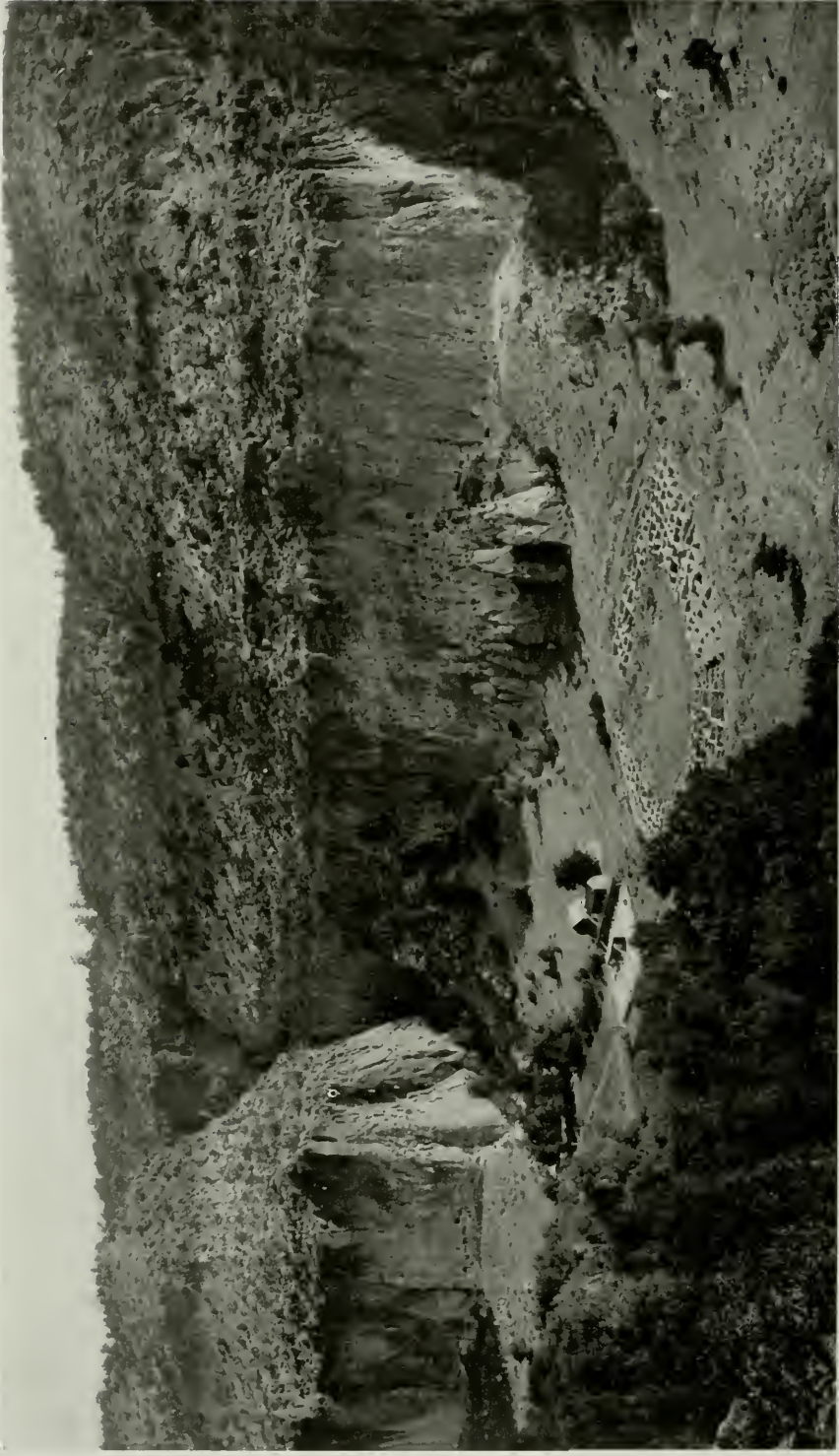
row rocky cañon with stupendous cliffs on one side and the black lava flow on the other, to emerge at evening into a beautiful meadow where we found a spring of water and luscious grass for the horses. We camped in a sheltered *rincon* near a natural sandstone bridge of great beauty. Opposite, across the valley, was another wonderful rock formation resembling a great cathedral. As the sun sank be-

hind this rock we vowed that we would again return to enjoy this charming spot at our leisure. Before noon of the next day we were at the ruin on the high mesa overlooking all this valley land and the black lava country beyond. In the sides of the rock were little cliff houses where the guard for the crops was no doubt posted in those olden days. We were loath to leave. That evening we had a memorable horseback ride up the cañon to another even more picturesquely situated ruin, where a little stream of water from a spring came tumbling down the hillside. It was dark when we galloped back into camp, where a roaring fire had been prepared to light our return.

It was in October, I think, that we came one evening near the Indian village of Santa Ana, and it was raining. We had passed through the more sheltered wooded section of that part of the country to the sandy wastes opposite Santa Ana, hoping to cross the stream into the town to procure feed for the horses. The river had been rising, however, and we were obliged to turn back after crossing part way. We shall none of us soon forget that experience. The rain was descending in torrents, the wind blowing a gale, and there was no shelter. The little sleeping tents were hastily set up on a sand hill, and after drinking a cup of coffee made over the flame from a burning packing box, we took refuge in our beds. The poor horses had a sorry time, with no feed and only such slight protection as the shelter of the wagon might afford.

From this time on until we arrived again at Aztec, our experiences were somewhat checkered. At Jemez Springs, a truly beautiful place, where the hot sulphur water bubbles joyously from the ground and a fine stream of water tears madly down the narrow cañon, we

rested a day while the sun shone, to dry our belongings and take advantage of the baths. This was in a forested region at an elevation of nearly eight thousand feet. Now if it hadn't been for the kindness of heart of the head of the expedition, who decided that we stay another day for the benefit of the horses, possibly he would not have lost himself on top of the mesa in the bitter cold, and perhaps our little saddle pony, Daisy, would not have become lamed in some mysterious manner. On that fateful morning—it was Friday, the thirteenth—the leader of the expedition (after deciding that we remain the additional day for the sake of the horses) concluded that good time must not be wasted and that therefore he would take this occasion to locate definitely the ruins said to lie on the mesa opposite camp. He decided thus, in spite of the fact that the sun was again sulking behind the clouds and there was every indication of rain—for an explorer must often take chances if he is to gain results. He shouldered his knapsack soon after breakfast and set forth. When it began to rain later on, we thought he would surely return. He did not come. The situation of our camp, so pleasing in the sunshine of the day before, now had all that dreariness of aspect which a cold, drizzling rain and wet soggy ground can produce. I retired to the tent and tried to keep warm by a lantern, while I read or sewed. The day dragged away and when darkness began to descend I became seriously alarmed, especially as we found that the footbridge across the stream had been washed away by the rising current. Visions arose of all sorts of calamities which might befall one who was wandering alone in the forest without shelter or food. Little sleep came that night, and great was the

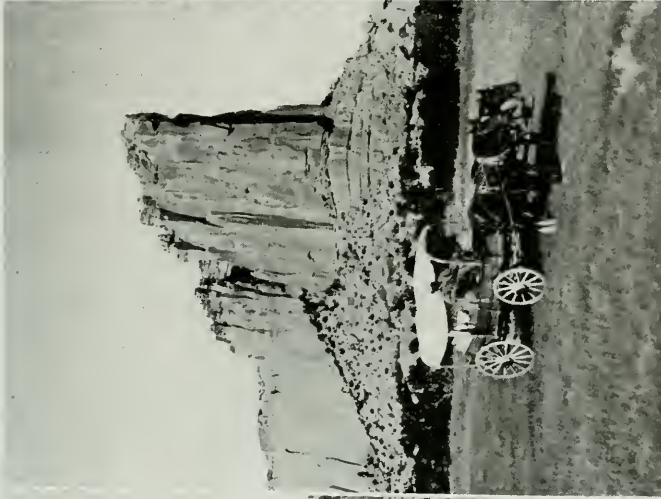


THE RITO DE LOS FRIJOLES

Here in a narrow cañon some thirty miles from Santa Fé, the former homes of the Pueblo Indians are represented by ruins on the valley floor, as well as by many cave dwellings in the vertical face of the cliffs. The bottom of the cañon is reached only by a very steep trail. The ruined villages of New Mexico are frequently situated in most picturesque places, as if the Indians appreciated not only the convenience and defensibility of their homesteads, but the beauty of the landscape as well.



A group of friends — A common feature of the landscape in New Mexico is the weathering of the sandstone cliffs into all sorts of quaint shapes, often requiring but little imagination to transform them into faces, animal forms, or more imposing architectural designs



According to legend this well-known rock, the Mesa Encantada, was the home of the ancestral race of Acoma Indians. It is now practically inaccessible, only a few adventurous explorers ever having reached the top. The cliff is nearly 450 feet high



One of our most picturesque camping spots was at this natural bridge near Cebolilita. Small Indian ruins are on the flat just below, and much larger ones on the mesa top near by

relief soon after daybreak to learn that the "padron" had been sighted on the opposite bank near a Mexican house. Soon he was in camp, reciting adventures of a compass gone wrong because of water in it, of a lost trail, and, after continual wandering through the day and into the night, an uncomfortable

seemed to have about all they could pull. There was snow on this mountain, too; and while I will not say that I walked barefooted over it, as some one has intimated, yet I must admit that my worn footgear by this time was not such as to yield much protection.

It was not many days before we were



Digging for spoils.—Work with pick and shovel is not ordinarily considered attractive, but there is a fascination about delving in a buried house with the hope of unearthing a choice piece of pottery, that makes one forget the labor involved

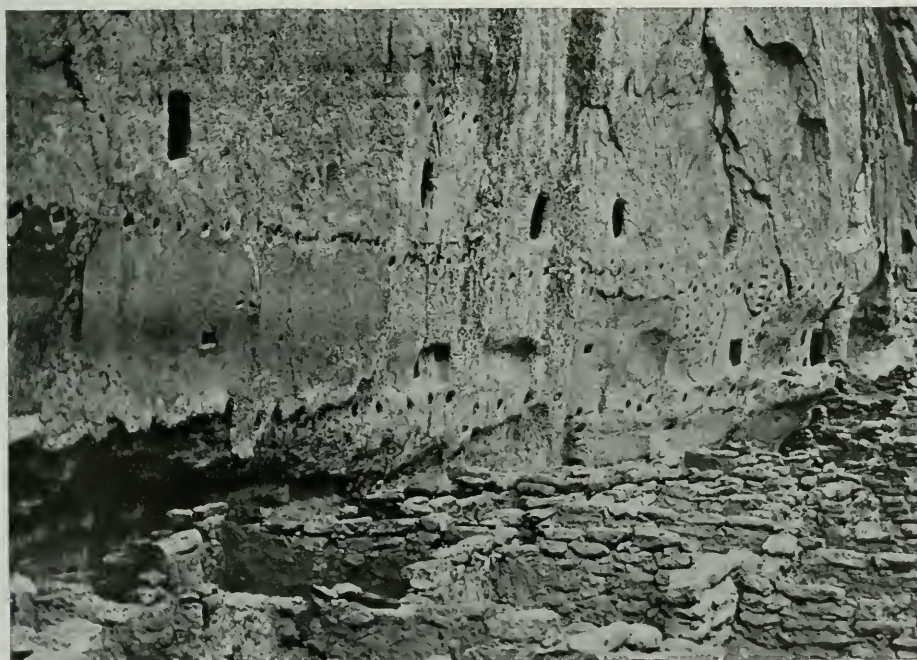
time passed in an adobe hut trying to dodge leaks in the broken roof.

Hot baths and sunshine soon effaced the memory of this disaster, and it was not until we were ready to resume our travels and found poor Daisy disabled that we began to wonder if our good luck had left us. But the walking over the rocky road was not bad and we trudged gaily onward. Of course there was the wagon, but the horses always

obliged to leave the lamed pony along the way with a Mexican friend of the driver's, since from lack of proper attention, combined with having to travel every day, her injury had grown worse instead of better. As a final disaster, the kingbolt of the wagon broke off short as we were crossing a deep gully one day, with no blacksmith shop inside of thirty miles. Having by this time grown somewhat philosophical, we sat



This November camp on the edge of the forested region at Arroya Hunga near Santa Fé, elevation seven thousand feet, is a vivid contrast to the rock shelters or green-covered arbors which sometimes were our stopping places. It is this variety of experience which gives zest to the freedom of the gypsy life



The back wall of this ruined pueblo was formed by a cliff in which may be traced rows of holes chiseled out for the ceiling timbers of the rooms whose walls appear in the foreground. Although this was a two-story building, indications of a lone room to a third story may also be seen. The larger openings were entrances to chambers probably used for granaries because of their secure position and protection from rain

calmly down by the roadside and waited while a messenger returned to the settlement we had last passed through and borrowed a new bolster for the wagon. In a way this last accident was providential, for the fact that the bolster had either to be returned within a certain time or paid for, tended to hasten on the expedition. In about two weeks from the day we left Jemez Springs, we arrived at Aztec, having walked nearly every step of the distance, something over two hundred miles.

It has been suggested that we use an automobile on these trips instead of a prairie schooner. I can only say that I wish any one who thinks this, might be set down on a certain piece of road over which we traveled after leaving Jemez Springs. Twice we unloaded the wagon and transported the goods piecemeal, before we reached a comparatively good track. It took considerable imagination to call those stretches of rocky hillside and gully roads, and although it was possible to get over them with a wagon I think an automobile could scarcely have made the trip.

Even difficult experiences and disas-

ters, however, cannot dampen the enthusiasm of those who love the gypsy life with all its freedom. We find real joy in rising at five o'clock on a summer's morning—to eat a breakfast that would astonish the jaded appetite of a New Yorker. Then, hustling the camp equipment into the wagon, we are off at seven, walking perhaps ten or twelve miles before the noon halt is made. The sun may be hot, but the air is so invigorating that it matters not. We reach a ruin where, perhaps, I am seized with a desire to probe into the refuse heap for buried treasures, while the archaeologist is taking his measurements and pictures. One forenoon I unearthed seven pieces of pottery in this way, before it was necessary for the expedition to move on.

But no! I am sure that it is quite impossible to make any one realize the charm of an existence like this, by merely telling about it. One must be there and do things and get the "feel of the country" into his blood, and then, unless he be tied too firmly to life's conventionalities, he will return again and yet again.



In the high altitudes of the Southwest we always had a camp fire, even on a summer's evening, but in desert regions firewood is not to be had. Often very weird and wonderful were the stories told by cowboy, trapper, and treasure hunter, as they visited with us about the fire at night

REPRODUCTIONS IN DUOTONE OF PHOTOGRAPHS
FROM THE AMERICAN SOUTHWEST

BY HERBERT J. SPINDEN AND EDWARD S. CURTIS



From the copyrighted photograph by E. S. Curtis

MÓSA, A MOHAVE WOMAN

The Mohave inhabit the very hot lands along the lower course of the Colorado River. Although their country is commonly accounted a desert, the Colorado in that region, like the Egyptian Nile, has seasonal overflows, making possible the raising of corn. The people paint themselves with mud and take pleasure in mud baths. Although less advanced in the arts than the Pueblo and Piman tribes, they are an interesting people, and especially notable for their splendid physique



Photograph by Herbert J. Spinden

AN ACROPOLIS OF THE SOUTHWEST

The Hopi village of Walpi is situated upon the tip of a sandstone mesa that rises eight hundred feet above the arid plain. This site appears to have been chosen in early Spanish times for its defensive situation. Nevertheless the architecture is purely Indian. The inhabitants show in their customs the splendid isolation which is seen in this view of their citadel, and maintain to the present day such ancient rites as the famous snake dance.



Photograph by Herbert J. Spinden

A TRAIL IN THE TEWA COUNTRY

The Tewa Indians live in six villages located along the Río Grande and its tributaries to the northeast of Santa Fé. The sparse vegetation of the region consists of dwarf pine and juniper and straggling sage, but along the horizon on all sides rise timbered mountains. The trail shown in the picture leads north to the pueblo of San Ildefonso



From the copyrighted photograph by E. S. Curtis

VASH GON, A JICARILLA

The Jicarilla Apache formerly lived on the upper Rio Grande in New Mexico and at the eastern base of the Sangre de Cristo Mountains of Colorado, and were in touch with the buffalo-hunting tribes of the Great Plains as well as with the more civilized peoples of the Southwest. Today they live on a reservation to the west of the Rio Grande in the northern part of New Mexico



From the copyrighted photograph by E. S. Curtis

CAÑON DEL MUERTO, IN THE NAVAHO COUNTRY OF NORTHEASTERN ARIZONA

This "ravine of the dead," a branch of the monumental gorge of Cañon Chelly, cut through hundreds of feet of reddish sandstone, takes its name from a cliff dwelling in which were found several ancient mummies. A portion of the cañon is to be reproduced in the Navaho group now under construction for the Southwest Indian hall of the American Museum of Natural History



Photograph by Herbert J. Spinden

ON THE SUMMIT OF HERMIT PEAK, NEW MEXICO

This rocky outpost on the eastern front of the Sangre de Cristo range rises to the height of twelve thousand feet. A peculiar religious sect, called the "Brotherhood of the Hermit," has erected crosses upon the summit. Looking to the east from the top one sees the land falling off rapidly toward the Great Plains, and to the west a wilderness of mountains, some of which are covered with snow and mountain forests of pine and mountain yellow pine.



From the copyrighted photograph by E. S. Curtis

THE STORM

The Apache and Navaho tribes are hunters and warriors, the nomads of the Southwest, in striking contrast with the sedentary Pueblo Indians. The Navaho, the largest pagan Indian group, numbers between thirty and forty thousand. They raise sheep and have adopted a few of the customs of the white man, but still use their primitive dwellings and keep up their old religious ceremonies. As the supply of game disappeared, these hunting tribes have been forced into cattle stealing. It is only in recent years that they have been brought into complete subjugation; Geronimo, the last of their chiefs to give trouble to the Government, died in 1909, a prisoner of war of the United States



Photograph by Herbert J. Spinden

THE VALLEY OF SANTA FÉ, NEW MEXICO

The history of Spanish occupation in the Southwest centers about Santa Fé, the city of the Holy Faith, which was made the capital in the first decade of the seventeenth century. Remains of a prehistoric village of Pueblo Indians are found here. During the interregnum of the great rebellion, 1680 to 1693, the Indians of Galisteo occupied the town and built their many-storied structures around the plaza.

The Meaning of Bird Music

By HENRY OLDYS

WHEN, on some dark, overcast night in late September, there come to the ear from overhead sundry piping or chirping notes, it is easy to recognize them as auditory signals holding together certain flocks of migrating birds on their annual journey to the South. But when one of these migrants, while returning to its summer home, perches on a twig and, with head thrown back and throat vibrating, pours out a series of orderly tones, the significance of the utterance is not so apparent.

It is now the well-settled opinion that such utterances do not find their primary stimulus in courtship and mating. Darwin's theory that the choice of mate on the part of the female is an important factor in development of song in the male has been sufficiently discredited by Herbert Spencer, St. George Mivart, August Weismann, and others, and is now discarded by virtually all the leading students of evolution. It is, of course, undeniable that songs, like plumage displays, are used in connection with courtship; but such use is merely an incidental one, as it is with human beings, and is probably seldom, if ever, the determining factor in the female's choice of a mate. Moreover, even on Darwin's assumption that the finest singers mate most easily and so transmit their superior qualities by inheritance more frequently than singers of a lower grade, thus gradually improving the race musically, it is doubtful if such progenial transmission of musical qualities would prove to be the chief means of progress, in view of the important part played by acquisition of song by imitation in musical

improvement among birds. It is well known that the singing powers of canaries are not produced by breeding from gifted ancestors, but by associating the birds with unrelated superior singers known as "campaninis," which are kept for this special purpose and which often command very high prices. Wild birds similarly improve their singing by imitation of better singers of their own species, as is evidenced by several direct examples of such imitation which have come to my personal attention. Furthermore, few female birds sing; and it seems most probable that if they possessed sufficiently discriminative ears to appreciate and select the finest singers among the males, they would themselves become singers.

But if Darwin's theory of sexual selection be inadequate to account for the development of bird song from the original unmusical ejaculations to the present melodies, what is the true cause of such development? The simple and natural answer is that musical evolution among birds is due to the same causes that have produced musical evolution in man, especially as the results of the two streams of evolution show marked resemblances.

It is customary, at the present time, to deprecate any interpretation of animal behavior in terms of human behavior—to attempt to explain all actions of the lower animals on the basis of different psychological processes from those producing similar actions on the part of the human species. This attitude expresses the natural reaction against the popular tendency to overhumanize the lower animals. Unscientific minds as-

sume for the behavior of all animate beings the same mental causes that would produce such behavior in themselves; but scientific minds, in combating this error, transgress equally in the opposite direction. Such reactions generally go too far. Thus the constant use of consecutive fifths and octaves for several centuries in the earlier stages of our modern music has led to a rabid proscription of such harmonic progressions; and a later overindulgence in the chord of the diminished seventh has brought that attractive and serviceable combination of tones into almost equal disrepute. Hence, the complete humanizing of the animal world by ignorance has led to the complete dehumanizing of it by learning. It is the reverse swing of the pendulum.

Disregarding the many physiological likenesses between ourselves and these feller creatures of a lower evolutionary stage, science emphasizes the physiological differences and makes them the basis for an almost totally different psychological method of arriving at results. Yet, as in the human mind instinct mingles with reason, so in the animal mind reason mingles with instinct. When we are confronted with two musical evolutions paralleling each other remarkably, the most rational supposition is that such evolutions are alike in their origin and in their sustaining causes. The birds display evidence of enjoyment of their songs; they manifest a proneness to sing freely when happy and to be mute when unhappy; they show a seeming interest in the performances of more accomplished singers, and an apparent desire to acquire phrases and tones that excel their own; they exhibit much knowledge of the value of rhythm, of melody, of tonality, and even of sequence of related musical phrases; in all these

things paralleling ourselves. An explanation of these attributes on any basis but that of musical appreciation (by which human attributes of the same kind are explained) would be most complicated, far-fetched, and altogether unsatisfactory. The rule adopted by investigators of the psychology of the lower animals is never to accept an explanation based on higher psychical processes when one based on lower psychical processes may be made. A useful rule; but it is easily metamorphosed into a rule never to accept a simple, direct explanation when a more complicated, indirect one may be assumed. And many of the interpretations of psychologists seem to be governed by this derived (and pernicious) rule.

As with man, so with birds, the development of musical appreciation ranges from zero to the maximum. While the impulse to express emotion vocally is common to many creatures, such expression in musical form is limited to comparatively few. The dog barks his joy, the bull roars his defiance, the cat purrs her content, the hog grunts its satisfaction, but utterances of this character can by no legitimate stretching of the term be described as music. So, too, among birds the rattle of a kingfisher, the scream of an eagle, the squawk of a parrot, cannot be classed as musical performances. Nor is there any physiological line of demarcation between musical and non-musical birds. The crow and grackle, although properly classed structurally with the Oscines, or singing birds, are lacking in musical expression; while the wood pewee, dove, bobwhite, and others beyond the pale physiologically, express themselves musically, the wood pewee taking high rank in this regard.

Even the common barnyard cock will occasionally express his exuberant feelings in true melody, as in this paean with which I heard a Maryland cock greet the dawn on a November morning:

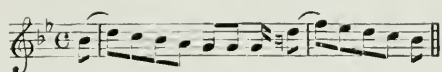


and in which the final descent of the gamut was accomplished by distinct steps, unblurred by any *portamento*, or slur, and in good strict time. Many of the Oscines that may properly be classed as melodists hold their title by a very slight grip. The lisping or buzzing songs of most species of warblers, the incoherent utterances of purple finch, goldfinch, warbling vireo, junco, and like singers, the twittering chirpings of swallows, the monotones of nuthatch and chipping sparrow, and the indeterminate notes of house wren, indigo bird, and English sparrow (in his rare musical moods)—these performances, although often pleasing to the ear, are almost entirely lacking in melody, as known and enjoyed by man; while the dickcissel expresses his emotions in articulations that seem to belong to speech, rather than song.

On the other hand, some of the avian melodists are entitled to high rank as musicians, even when judged by human musical standards. Many of their productions, although brief, excel in melodious beauty the best efforts of some primitive human races, and a few are worthy of a place beside the melodies of the civilized world. Here is an attractive passage¹ in which a theme in a minor key is followed by the same theme in the relative major key, with a

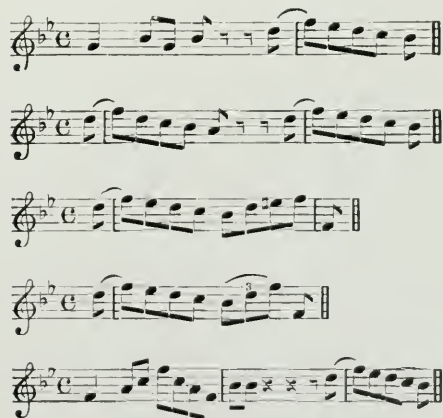
¹ Although the fact is unimportant, it may be stated that all the bird songs given in this article were sung an octave higher than they are here written.

change from *piano* to *forte* that gives a distinct touch of brilliancy:



This is not, as might be thought, an extract from the note book of Mozart, Bach, or Mendelssohn, but an excerpt from the song of a rock thrush (*Monticola saxicola*) I heard in the Worthington Aviary at Shawnee-on-Delaware, Pennsylvania, four or five years ago. The notes were perfectly true to pitch and were given in a quality of tone that was exactly that of the human whistle. The attendants at the aviary had picked up the bird's phrases, and during my three days there I could never tell without inquiry whether the bird or an attendant was responsible for any particular rendering of them I happened to hear.

Like the true little musician that he was, the thrush avoided monotony by varying his utterances, sometimes with different themes, sometimes with different combinations of themes. His ingenious use of the second theme of the song quoted above appears in the following notations of some of the combinations:



But while the theme that plays so prominent a part in the examples I

have given of the bird's music was a favorite with him and was freely used, he had several other phrases in which it did not appear. The following one will be sufficient to indicate the general character of the rest of his music:



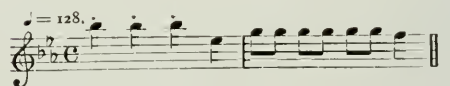
It will be apparent to any musician, of however humble rank, that the music here written (and it is an exact transcription of the notes sung by the bird) is perfectly comparable to our own music of this twentieth century; and not only in the use of the same scale, but in rhythm, melodiousness, and harmonious balancing of phrases. Careful examination will disclose several effective touches, such as the use, in one of the combinations given above, of the E \sharp before the following F's.

The rock thrush is found in southern Europe, and, if I may safely judge from my own experience with this one individual bird and from the rank accorded the species by some observers of it in its wild state, I should say that it is of all European birds the most melodious—using the term in its proper sense and not in the loose way in which it is generally handled by a careless public. Its chief rival seems to be the European blackbird (*Merula merula*). Personally I have little knowledge of the singing of the blackbird, although I have noted one or two utterances from some in American zoölogical collections that indicated the high musical character of the bird in its native wilds. I am able, however, to reproduce three blackbird songs of a very choice quality musically, which were recorded at Sèvres, France, a few years ago by an accomplished musician and lecturer on music, Mrs. Amelia von Ende:



These three songs disclose a strong feeling for harmony as well as for melody. The alternation of tonic and dominant harmony in the first is very effective, while the pleasant modulation to E minor in the second is quite satisfying. Particular praise must, however, be accorded to the third song, which presents an attractive, sprightly, and well-developed theme.

But it is not necessary to cross the ocean to obtain examples of good music from birds; our own land is the home of some of the best of avian musicians. I have secured several four-phrase songs from our own thrushes which in beauty of melody and arrangement of themes surpass all other avian music that has come to my attention, and we have other species that take high musical rank. The song sparrows furnish melodies enough to equip nearly every member of the woodland chorus with a different song for each. Some of these song-sparrow themes are very satisfying. Here is one I heard in northern Ohio last spring:



This, although simple, is a very pleasing and melodious phrase, one that no human musician need be ashamed to borrow for incorporation into some

more elaborate composition of his own. And let me say here that our woods and fields are full of suggestive themes for the enterprising musician who awakens to the fact that man has no monopoly of melody. One, at least, of the fraternity recently had his eyes opened to this wealth of musical material, and the result of his discovery is a book of songs about birds in which the melody of each song is made up of themes furnished by the bird to which it relates. Some of these songs are very beautiful.

More remarkable than the union of related phrases in sequence by one bird are those performances, occasionally to be met with, in which two related phrases are sung antiphonally by two separate birds. The meadow larks of the eastern half of the United States (*Sturnella magna*) are especially prone to sing duets of this kind. From forty or more such meadow lark duets that I have noted I here reproduce one sung by two birds on my own place last March:



Were the first bird saying, "I love to sing," and the second rejoining, "So I perceive," the effect of phrase and answer would not be more marked.

From such examples of bird music what are we to conclude as to the meaning of bird song? We find some of the birds uttering musical phrases and sequences of phrases that are governed in their construction by rules that

govern the construction of our own musical compositions—that conform to those constructive principles that are developed by musical taste in man. Melody, rhythm, harmony, and tonality combine to make them pleasing to our ears in precisely the same way that human music appeals to us. To account for this phenomenon by a theory of chance coincidence requires a degree of credulity that is immense. That a bird should so combine notes as to produce human music accidentally is as incredible as that it should so combine articulate sounds as to form human speech accidentally. To assume that birds are the unconscious instruments of a higher power made to produce such performances as man alone can appreciate and enjoy, is to return to the long-abandoned attitude under which the stars were regarded as mere points of light, created for the purpose of relieving man of absolute darkness on moonless nights. There remains only the idea that birds sing songs of whose musical beauty they are consciously appreciative. This is the simplest and most plausible interpretation of the matter; and if we are brave enough to disregard that bugbear of the average psychologist, anthropomorphism, we shall understand that birds share with man an intelligent appreciation of music, the difference being one of degree, not of kind. We may not comprehend the full philosophical significance of our own musical emotion, but we may safely rest in the assumption that whatever light we have in this respect equally illumines and makes plain the meaning of bird song.



Photo by M. P. Skinner

A SQUADRON OF YOUNG PELICANS ON YELLOWSTONE LAKE

Pelicans, driven westward by advancing civilization, have found a haven on "Molly Island" in the Yellowstone, where they nest in large numbers. They are beautiful as they ride majestically over the water, but they are a sight never to be forgotten when they rise, strong, graceful, and gleaming white, into the blue depths of the sky

Some Birds of the Yellowstone

By M. P. SKINNER

WE often gain a wrong impression as to the number of birds within Yellowstone Park, thinking them few. Heavy timber is seldom found to be very bird-populous anywhere; and, besides, in the parks the heavy timber is where the stage roads are, and the constant travel frightens the birds away. For these are shy birds, not the half-domesticated ones of the farms and villages. Another reason for the conclusion that birds are few lies in the fact that the tourist travels during the heat of the day when the birds are resting. Scarcity, however, is more seeming than real; the birds are there—in large numbers. At present one hundred and ninety-seven species have been recorded. Let the bird-lover go out early and walk along the brush-lined brooks and through the meadows, and he will find birds in plenty. To be sure, there will not be as many as in a cultivated section; there never are. The cultivated area has too many attractions in the way of grains, fruits, and insects.

Usually the first bird noticed in the Yellowstone is one that is small and almost black, flying along close to the surface of a stream. He tries to alight on a slippery rock, slides off into the water, unconcernedly paddles ashore, and climbs out. A close scrutiny shows this oddity to resemble a wren, except that he is darker, and has feet of ordinary passerine construction and not webbed. He is the dainty little "dipper," or "water ouzel," of the mountain streams. If you watch him, he does still more curious stunts. He sits on a stone for a few moments, only his white eyelid moving; then comes to life,

bows first toward you, then turns and repeats his curtsy in the opposite direction, walks down the rock into the water, under the water, and across the pool bottom, stopping here and there for a moment, and finally comes shooting up to the surface as buoyant as a cork. No misanthropic hermit is the dipper. True, he lives alone with his family on his own section of stream, which he is always ready to clear of poachers by force of bill and wing, but he picks out the true scenic parts. A waterfall is a favorite dwelling place, and I have never found the nest anywhere but near rapid water. Usually a rock in mid-stream is selected and the nest placed so that it is directly above the water, the opening downstream. Both birds work hard at building the nest—a ball eight inches in diameter, made of a peculiar kind of moss and fastened in a crevice or notch in the rock with a cement of mud. The ball is lined with mud, and the inner nest constructed of fine, waterproof grass that will not become sodden. The spray from the rushing water keeps the moss green, and during the summer grass seeds are sure to lodge on the ball and sprout there, so that the nest soon resembles a small clod of earth supporting a tuft of luxuriant grasses. The entrance to the nest is usually arched over, or bottle-necked with opening downward, to shed the spray. The brainy little architect waits until after the June freshets before building a nest—which might be inundated earlier. He really seems to wait, for he mates early, after having sung his dainty little song since Christmas. One of the strangest facts in nature is that this tiny bird is a *winter* songster.

He is not just a mere chirper, his notes are varied and unusually sweet. Often he is heard in the depths of a wintry world, when his song rings out above the noise of such rapid waters as are open in January.

Barely has one crossed the northern boundary of Yellowstone Park, before the driver points out Eagle Nest Rock, and the "eagle's" nest on it, but the birds nesting there are actually ospreys. Eagles, both golden and bald, are resident in Yellowstone, build their nests and raise their young there. They are so scarce, however, as to be rarely seen, whereas the ospreys are conspicuous along every large stream. They are found by hundreds about Yellowstone Lake and Cañon. One who has watched and studied the osprey, finds him a far nobler bird than either of the eagles. The golden eagle is a fine bird and usually captures his own prey, but the osprey will touch nothing but fresh fish of his own catching. The bald eagle, unfortunately chosen our national bird, is a robber and a carrion-feeder. He watches the more expert osprey, and when the trout has been secured, he torments the smaller bird until it drops the fish. Then with an exultant scream, the eagle swoops down and catches up his unlawful prey. Often the bald eagle is ignobly caught in a coyote trap set near a dead elk. The osprey is a far different bird, cleanly in his habits—and his young are the models of deportment among birds.

The original nesting site of ospreys in Yellowstone was the tip of a pine or fir, where a great mass of sticks six feet or more in diameter was deposited, at times a stick as large as a man's wrist being used. About Yellowstone Lake there are literally hundreds of these nests. In various other parts of the

park, however, notably in the Yellowstone and Gardiner cañons, the osprey has found the pinnacles of out-jutting rock adapted to his purpose, and builds his nest and raises his young there, to the delight of thousands of visitors who can look down upon the family. I cannot confirm other writers in their reports that the ospreys repair their nests in the fall; they may do so. I have repeatedly seen them rebuilding and repairing in April and May, however, when they first return from the South. As a rule the same birds return to a given nest year after year. After the eggs are laid, the mother broods them for four weeks. I do not believe that the male makes it a rule to relieve her, but he does do the hunting and is very conscientious in seeing that she gets her share. Occasionally when the sun is warm, the female gets away from the nest for a short time. The two or three young are hatched so tender that the mother remains on the nest to shield them from the sun with her half-opened wings. When the father brings in a fish, from which he has first removed the head and entrails, there is none of that hurly-burly so characteristic of other birds. The youngsters sit in an orderly row, without any attempt to get the fish, perhaps within three inches of them. The father stands on the trout, tears off half-inch bits which he gives to the mother, she "chews" them a few seconds and then gives some to each nestling in turn. Sometimes the male turns the catch over to the female, letting her do all the tearing and feeding; and he occasionally feeds a bit directly to a youngster. Not only at feeding time do the young ospreys show their training. Let an enemy appear, a warning note is sounded by a parent, usually the mother, and the young instantly throw themselves flat on the

floor of the nest and remain there motionless. Should one be picked up, he is like a lump of putty and can be placed in any posture. Nothing but the parent's cry of "All's well," perhaps not given until an hour or more after the warning, will bring him back to the semblance of a living bird.

The mountain bluebird is of a beautiful blue, indeed; even the breast is blue instead of the chestnut of the eastern bird. This bird is not quite so domesticated as the better known species, but otherwise is much the same. About the few buildings in the Yellowstone the bluebird nests as fearlessly as about an eastern farm; but buildings are scarce, and many bluebirds still follow their old-time plan of building a nest in the trunk of a quaking asp. It is a pretty sight to see a pair hunting a nesting place in early May. The husband is the scout; he goes ahead and locates a likely tree with an old woodpecker hole in it. Then he brings his wife, no doubt telling her how superior the tree is to all other trees, and the neighborhood to all other neighborhoods, and perhaps calling attention to the running water in the near brook. She hovers for a few minutes in front, looking the opening, the tree, and the neighborhood all over, and when she makes up her mind it is final. Should it be "No," the husband does not sulk but immediately hunts another tree over which he is just as enthusiastic. Should the answer be "Yes," they both set to work to collect materials, but I believe that she places most of it while he cheers her on with his gentle love song. When the bairns arrive, all is hustle and bustle. For a time, I do believe that they are the busiest parents alive. Vast, indeed, is the number of grasshoppers and caterpillars caught to satisfy that hungry nestful.

At the other extreme is the nutcracker, or Clark's crow; nothing soft, nor gentle, nor musical about him! But perhaps our ears are not properly attuned to appreciate the rolling "c-crack-k-k-k" with which he announces his presence. His uniform of gray with flashes of black and white is neat and attractive, and his ready adaptability to conditions should win our respect. This species seems more abundant about Mammoth Hot Springs than anywhere else; presumably the large supply of pine cones, as well as the kitchen scraps, draws the birds there. Sometimes the nutcracker, by a swift, sudden swoop, robs a squirrel of his cone. The squirrel may be knocked from his perch, but even if he keeps his footing he is almost sure to drop the cone. A sudden dive and the nutcracker has it, perhaps before it touches the ground. Now the pine squirrel, himself, is an impudent fellow, a noted thief and robber; but well he knows that the bird can best him. He sneaks back into some protecting cranny and then proceeds to enliven the woods by the vituperation he hurls at his enemy; and that enemy is not slow to give back his unfavorable opinion of squirrels in general, and of that squirrel in particular. I am sure that I should not dare to attempt a translation of those vitriolic remarks.

Impudent rascal and freebooter that he is, the nutcracker is never quite so happy as when a fight is going on. I even suspect him of engineering difficulties for other birds. One day two little mountain bluebirds got into an altercation. They were hard at it, when the nutcrackers began to arrive, screaming. One became so excited that he flew into a wire fence and partially stunned himself. Nor does the nutcracker always confine his attentions to

small birds. Mobbing hawks seems to be a favorite amusement. If the hawk is big and clumsy, so much the better. But it is the breeding habits chiefly that make the nutcracker interesting. February is the height of winter in the Yellowstone, the nights are intensely cold, and the snow still lies deep everywhere. Yet the nutcrackers mate then and build a nest of cedar twigs and such straws as can be found above the snow. Frequently the eggs are laid during the last days of February and brooding begins immediately. I have seen the mother on the nest when the thermometer was below zero, and at other times during a raging blizzard. The young birds are out of the nest and flying about by May first, before most other birds have begun to nest.

It is the Rocky Mountain jay that is beloved of the camper. This bird, known as the "camp robber," although he scavenges rather than robs, is closely related to the nutcracker. He bears a superficial resemblance to that bird, but is smaller, of a gray color without the black and white markings of the other, and his calls are different. The "camp robber" is bold and fearless without the impudent, noisy ways and pugnacious proclivities of the nutcracker. At camp he is always about, always getting into trouble, and always trying to share the camper's good things with him. He claims his share, perhaps because he is socialistic and believes the camper should divide his goods. If the camper is hard-hearted, or even slow, the jay will tell him all about how hungry he is, how scarce food is, how "high the cost of living" is getting, and end his appeal in the most coaxing, wheedling tones imaginable. Hard-hearted, indeed, is he who can resist this daring little beggar. He is into everything, he knows no fear. It is not safe to take a

pot or a pan off the fire and set it down to cool—the "camp robber" is watching for just such chances. But he more than makes up for the crumbs and scraps by the companionship he affords.

Perhaps the most astonishing thing about the Yellowstone birds is the friendliness of the ducks and larger waterfowl. It is often hard to believe that the ducks feeding within a few feet of the passing stages are actually "wild." This tameness is not any more peculiar to the Yellowstone, to be sure, than to other absolutely protected places. It is interesting to see how shy the migrating ducks are when they arrive, and how soon they lose their wildness and adopt Yellowstone ways. The mallards are to be found on or near most of the ponds and smaller lakes, usually with a half dozen fuzzy little ducklings following the mother about everywhere. Although the little chaps are expert hiders and dodgers, there is no doubt that the fierce duck hawk and the large owls get a good many. On land they are subject to attack by wolf, coyote, bobcat, and a whole host of smaller fur-bearing animals. Even in the water there is an enemy. I was riding past a pond and noticed a brood of ducklings swimming. They were sunning themselves, and occasionally chasing a venturesome bug across the surface. Apparently they were care-free and safe. Suddenly the mother sounded a note of alarm and made for the farther shore with the whole brood after her. Soon a muskrat appeared swimming rapidly toward the ducks. How they did swim! Not fast enough, although they used their stubby little wings to help them along. The muskrat was almost upon the duckling in the rear, when the mother saw the danger and in an instant was there scooping water with her wings into the rat's

face. This secured delay enough to let the duckling gain a lead. Soon the race was on again and the enemy was getting uncomfortably near. The mother drove him off a second time, and yet a third time, before she had her brood safe on shore.

Some of the big Canada geese stay in Yellowstone Park all winter, finding favorable conditions along the rivers kept open by the hot-spring water. But most of them arrive from the South in early April, and then the ponds and flooded meadows are a riot of noise. The "honk-ah-honk" of geese flying far up overhead is a silvery, musical note; but heard near at hand, especially on a cold, stormy morning when the tired camper is trying to sleep, it arouses other feelings than appreciation of musical quality. Geese are long-lived and are believed to mate for life, yet every spring they become as restless and ardent as any of the courting song birds. After the selection of the nest site, usually the top of a beaver house, a rock surrounded by water, or a low mound of some kind, the birds settle down and give their whole attention to important affairs. There is no nest building beyond lining a slight hollow with a few feathers from the goose's breast. About eight eggs are laid and the goslings appear late in May. It is amusing to see the old goose swimming across a pond with her little ones strung out at regular intervals behind—just as if she were a tugboat towing a string of barges. About four hundred pairs of geese are believed to nest within Yellowstone Park. Like the mallards, the geese become very tame, and are an unfailing source of interest.

I know of no place where protection makes the big hawks as tame and as easily studied as in Yellowstone. Ordinarily hawks are so hunted and har-

ried that the bird-lover must devote considerable time to them before he can say he knows them. Here everything helps the acquaintance. Few of us have much love for the fierce accipitrine hawks, but fortunately these are rare. The western red-tail is the largest hawk, but he does even less damage than his eastern relative, and confines his attentions almost exclusively to gopher and ground squirrel. It is Swainson's hawk that upsets one's preconceived notions of hawks. This species is nearly as large as the red-tail and much more numerous, enough so in the open country to be called abundant. Even the timid little wood warblers have so much confidence in this big rodent catcher that they fly fearlessly all about him and even nest in his immediate neighborhood. Both this hawk and the red-tail vary much in color, from reddish brown to almost black. The marsh hawk is guilty elsewhere of killing small birds; but in the park he too is on his good behavior and devotes his time to mice with an occasional frog or small snake for relish. He is a pretty chap when seen just skimming the brush tops on his way to and fro across the meadows. In places like the Pelican and Hayden valleys, the marsh hawk is astonishingly abundant. It is the little sparrow hawk, however, that attracts the most attention. He does not get up into the elevated sections nor into the timber, but often he is the only animated thing to be seen as we ride through the lower, warmer open country.

In the southeastern part of Yellowstone Lake are two small islets known collectively as "Molly Island." They are low and consist of sand and gravel with only a few bedraggled bushes, but the big white pelicans find them a suitable nesting place. There every summer

about two hundred pairs of these birds lay their eggs and raise their ungainly, unlovely offspring. Molly Island is almost ideal for them; it is secluded in a long, sheltered arm of the lake, yet is far enough from shore to prevent predacious animals from getting to the young birds; also the waters abound in fish, the food of the pelican. In former years, these birds nested as far east as the Dakota lakes, but the steadily advancing civilization has driven them farther and farther west until these little islands are their "farthest East." The pelicans are expert fishermen and their search for prey carries them to all parts of the lake and even down the Yellowstone River below the lake. From the boat that carries passengers across, at least one pelican is invariably seen and the cry "Swan! Swan!" is always raised. This is not so surprising an error, since the birds are large and white, and make very conspicuous objects as they move majestically over the water. In flight pelicans are still more striking in appearance. A single one flying past is a sight to be noted, so white, so large, so strong and

graceful. If a small group of them passes, it will be seen that they are flying in line, each pair of black-tipped wings stroking in perfect time with the leader. Then follows a short glide on set wings, which is broken first by the leader, the second bird takes up the stroke, and after an interval as accurate as if timed, the third one joins in. But to see these wonderful flyers at their best, one must go to the southern end of the lake. At certain periods during the day the males relieve their mates on the nest, and then the arriving and departing birds are in squadrons that wheel and maneuver with wonderful precision. To see a flock of a hundred of these great, swift-moving, gleaming-white birds against an intensely blue sky is the sight of a lifetime. It is a picture well calculated to remind us of the wonderful series of birds and animals that has been ours in North America in the recent past; and it can but interest us greatly in the work being done by the United States Government, through the National Parks, in preserving parts of our elsewhere-squandered inheritance.



"Eagle" Nest Rock, a haunt of ospreys in Yellowstone Park

Monoclonius, a Cretaceous Horned Dinosaur

THE FIRST COMPLETE SKELETON OF ITS KIND KNOWN

By BARNUM BROWN

FEW animals have been more discussed than the Ceratopsia, the horned dinosaurs, and none has so stimulated the imagination of the observer to speculate on scenes of prehistoric times. Incomplete skeletons, chiefly skulls, have long been known, yet previous to the American Museum expeditions into Canada several important parts of the anatomy, such as the structure of the feet and length of the tail, remained problematical.

Some of the Ceratopsia were large, others were small, but in all the skull was disproportionately large compared with other dinosaurs of equal bulk. With gigantic head, horns above the eyes and nose, a beak like a turtle's, and double-rooted teeth, they present characters unique among reptiles, living or extinct.

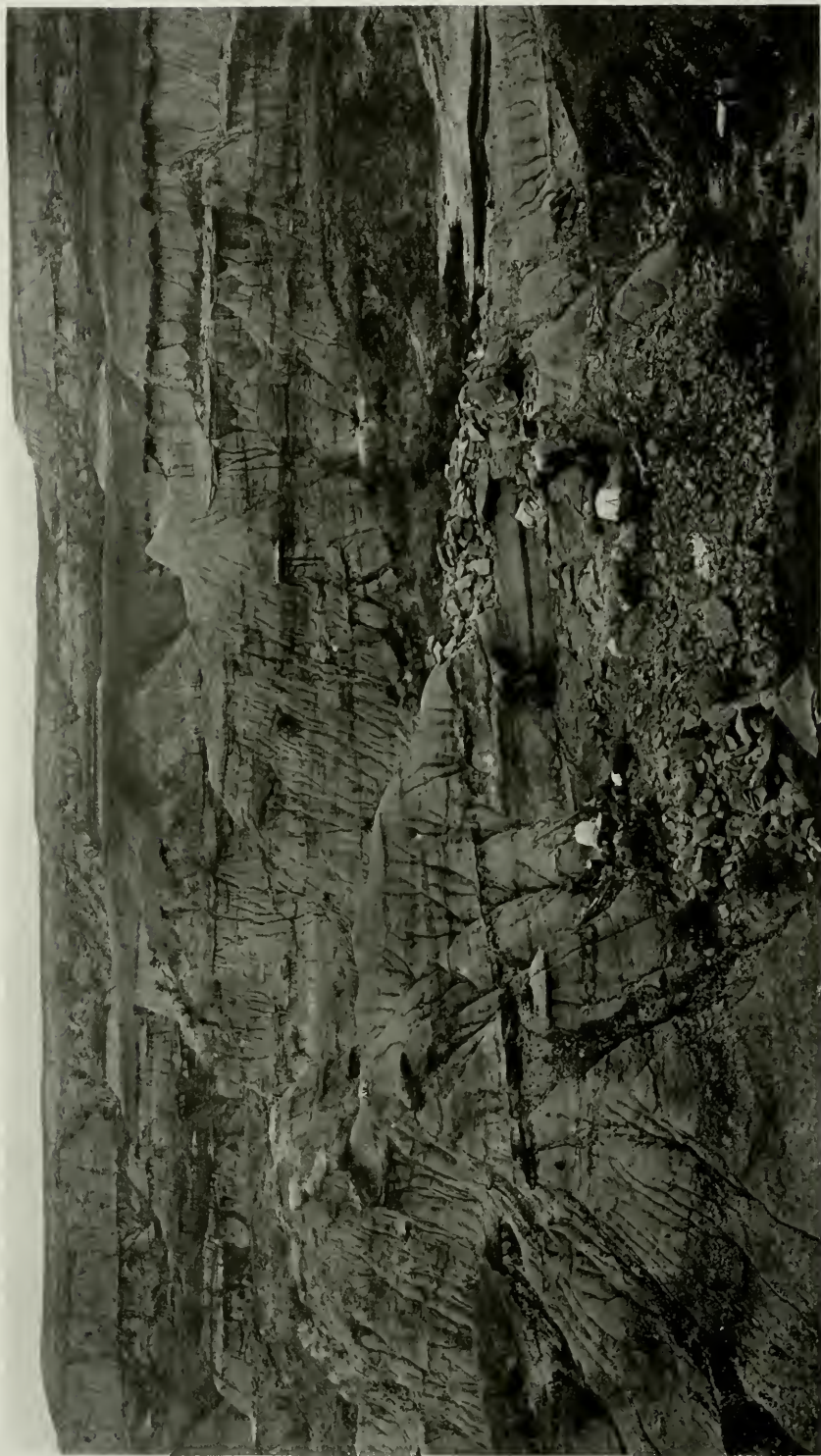
The American Museum expedition of 1914 was fortunate in finding a skeleton of one of the earliest known members of the family, a *Monoclonius*, complete in all details from the tip of the nose to the end of the tail, with most of the bones articulated excepting a part of the feet that had weathered out of the bank. The skeleton was found on Sand Creek, a tributary of the Red Deer River, twelve miles below Steveville, in rocks of the Belly River Cretaceous age, and gives for the first time a knowledge of the complete anatomy of any member of the family Ceratopsia. This skeleton, recently placed on view in the dinosaur hall of the American Museum, has been mounted practically as found, the vertebral column, pelvis, femora and parts of the feet being chiseled out in relief from

the original rock. Those parts of the front feet that were scattered have been assembled, after another specimen in which they are preserved in position.

In life this animal was about seventeen feet long from the tip of the tail to the end of the nose, and when standing erect would have measured a little more than six feet in height. It was remarkably short-bodied and walked on all four feet with the front legs bowed outward. On the front feet there were five toes, the three inner ones bearing small hoofs, and on the hind feet four functional toes, each bearing a hoof, and a rudimentary fifth toe.

Its most striking feature is the enormous skull, five feet in length, with a scalloped frill extending over the neck, a rhinoceros-like horn above the nose and a rudimentary horn above each eye, and a beak like a turtle's, sheathed in horn and doubtless used for clipping the leafy foliage on which it browsed. Back of the beak there are rows of double-rooted teeth. Its brain of low development was exceedingly small and the comparatively small eye contained a bony ring of plates like those of an owl, which were doubtless a development for the adjustment of light, probably enabling the animal to see at night as clearly as in the day. The tail, though fairly long, was weakly developed and did not function as a balancing or propelling organ. Above the pelvis a series of bony rods is preserved, the contracted portions of some of the stronger back muscles.

In another specimen of *Monoclonius* a part of the epidermis impression is preserved and we now know that the



Photograph by Barnum Brown

A TREASURE GROUND OF DINOSAURS

No area of equal dimensions has yielded so many well-preserved specimens or such varied forms of dinosaur life as the banks of the Red Deer River and its tributaries in Alberta. When these rocks were deposited, conditions were here most favorable for the preservation of animal remains. Now fields of yellow grain cover the level prairies above and beyond. Rainstorms are infrequent but torrential in this section, and rivulets plunging down to the river three hundred feet below have long roiled through the underlying soft clays and sands, winding, cutting, and ever exposing countless fossil treasures. Four dinosaur skeletons, many skulls and incomplete skeletons, turtles, and plants were collected from this small area on Sand Creek



Photograph by Barnum Brown

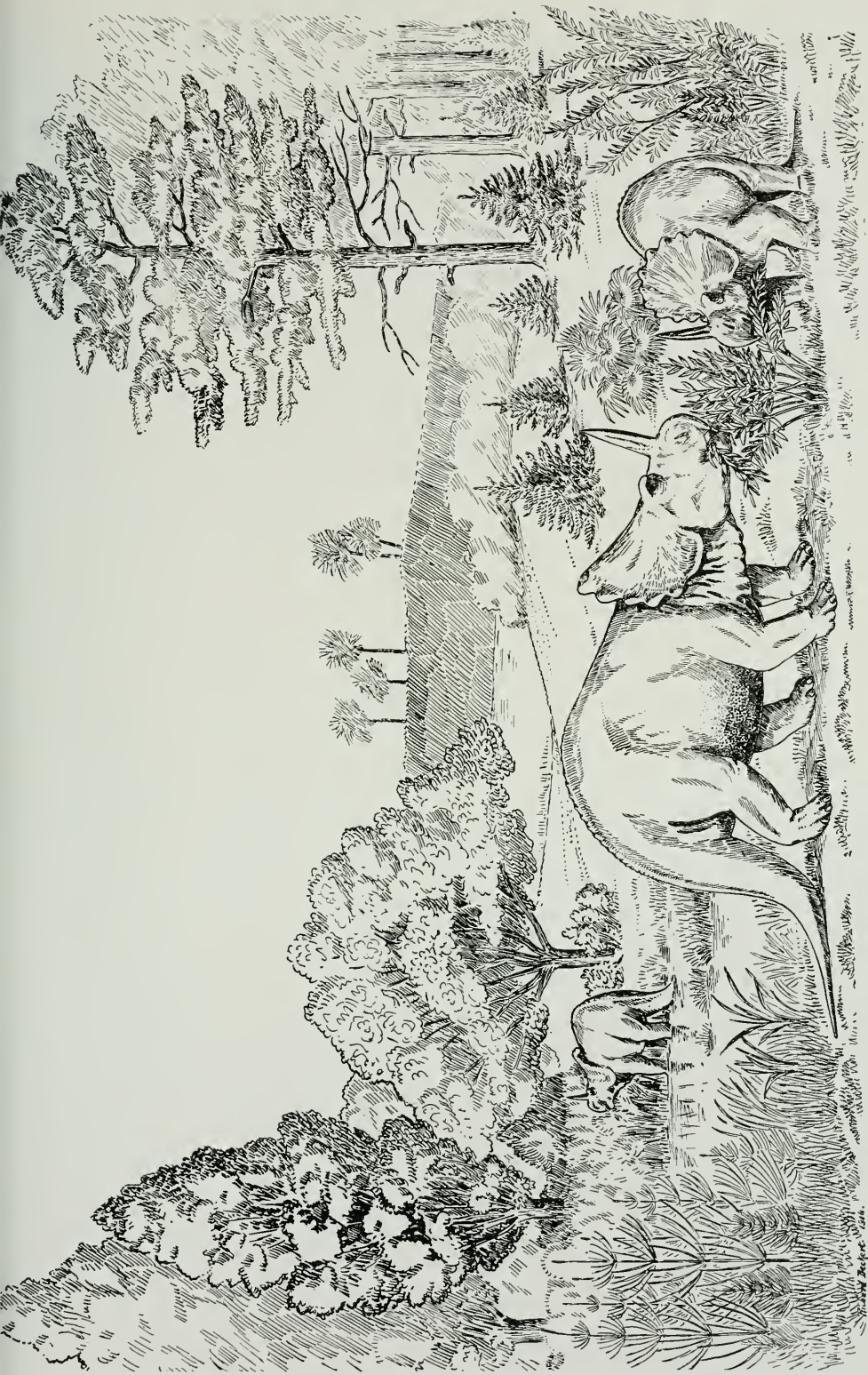
EXCAVATION OF *MONOCLONIUS* SKELETON

The complete *Monoclonius* skeleton uncovered ready for plaster jackets; patches of plaster are seen covering the foot bones that were exposed on the original hillside when the specimen was discovered



MONOCLONIUS SKELETON RECENTLY EXHIBITED IN THE AMERICAN MUSEUM

The vertebral column and most of the other bones were in position; they have been chiseled out in relief and the scattered parts have been assembled after another specimen in which they were articulated



A CRETACEOUS SUBTROPICAL GLADE IN ALBERTA, CANADA

Palms, fig trees, sequoias, and plane trees formed the "sylvannas" of those early days. Knee-deep in grasses, *Monoclonius* peacefully browsed, his only concern the giant flesh eaters. Restoration made by Richard Deckert under the supervision of the Author.

skin of the horned dinosaurs, like that of some modern lizards and of the duck-billed dinosaurs, consisted of low polygonal tubercles surrounding widely separated, large, low, round tubercles. Above the backbone, especially in the tail region, there was probably a row of small plates, one above each vertebra.

The horned dinosaurs lived during the close of the Cretaceous period and their remains are found from Texas northward to southern Alberta. Several genera are distinguished, chiefly by characters of the skull which in all forms was disproportionately large. In some genera like the present *Monoclonius* the nasal horn was long and the horns above the eyes were short, while in the last and largest of the race, *Triceratops*, the nasal horn was short and the orbital horns extremely long. In the genus *Styracosaurus*, also from the Belly River rocks of Alberta, there was a long nasal horn, and in addition longer bristling spikes that radiated from the border of the frill like a crown similar to the spikes on the modern lizard *Phrynosoma*, popularly known as the "horned toad."

Some writers have argued that the horns were offensive and defensive weapons, as on occasion they may well

have been. A great variety of horn development, however, is displayed in different genera of similar habits, and the horns and skull excrescences were doubtless to a large extent ornamental, as they are in many living lizards.

The horned dinosaurs were huge bulky creatures and were probably sluggish of habit, but the living animal weighed much less than a mammal of equal size. The skeleton, petrified, is very heavy, whereas in life it was light, for the bones are composed of highly cellular tissue, while in the fossil state the cavities are filled with silicates.

These animals were land-living, vegetable-feeding reptiles that lived along the marshes of a sea which at that time washed the eastern slope of the Rocky Mountains. Their extinction was not due to any great cataclysm nor on account of any sudden change in temperature, for many plants that were contemporaneous with them persisted over the general region long after the dinosaurs disappeared. As the mountains were elevated this sea gradually drained, cutting off their particular kind of food, and as they were not migratory creatures, the final disappearance of the sea marked the end of the dinosaurs in any given locality.



Fossil Man in South Africa

A LETTER FROM DR. ROBERT BROOM

FRIENDS of the Museum will recall with pleasure the visit of Dr. Robert Broom, the well-known South African palaeontologist, two years ago. Dr. Broom's stay resulted in the acquisition by the Museum of his splendid collection of fossil reptiles from the Permian of South Africa, and in a series of valuable researches upon these and other fossil vertebrates. The outbreak of the great war found him on his way back home, but he promptly enlisted, served for a term in his professional capacity as army surgeon, and has since returned to South Africa. His continued interest in the Museum and appreciation of its work and ideals are shown in the following announcement of an important new discovery:

PORT ELIZABETH, SOUTH AFRICA
November 12, 1916.

MY DEAR PROFESSOR OSBORN:

Knowing how interested you are in primitive man, I thought you would be pleased to have an early account of what is, with the exception of the Piltdown skull, the most interesting early skull known.

In 1913 a farmer digging a trench through surface laterite on his farm at Boskop near Potchefstroom, Transvaal, discovered much of the skull and some fragmentary remains of a human skeleton. The remains are now in the Port Elizabeth Museum. A preliminary note has been made on the remains by Mr. S. H. Haughton, of Cape Town, and his view is endorsed by Dr. L. Péringuey, of Cape Town—that the remains are those of an early type of modern man most nearly allied to the Crô-Magnon type and perhaps ancestral to existing African types.

The skull is represented by the nearly perfect frontals and parietals with part of the occipital, the nearly perfect right temporal, and the greater part of the horizontal ramus of the left mandible. The skull is of great length. The calvarium as preserved measures 205 mm. and the greatest length was probably originally about 210 mm. The bones are extremely thick. The parietals in the region of the eminences measure 13–15

mm. and the frontals 12 mm. The cranium is quite unlike that of the Neanderthal type in having a well-marked, low, but not retreating brow, and very feebly developed supra-orbital ridges—not much larger than in most Kaffirs. Notwithstanding the thickness of the skull, the brain is enormous. The restored brain cast indicates that the cranial capacity was about 1960 c.c.

The lower jaw has lost, unfortunately, all teeth except the roots of the second molar, but the socket of the canine is fairly well preserved, and there is to my mind no doubt that the canine was about as large as in the jaw which I still believe belongs to the Piltdown skull. The incisors must also have been very much larger than in any modern man. The transverse measurement across the two canines cannot by any possibility have been less than 40 mm. and was probably 44 mm. A large Kaffir jaw on my table has a corresponding measurement of only 32 mm.

In a paper I have just sent to the Zoölogical Society, London, I have regarded the Boskop skull as the type of a new species of man, *Homo capensis*. I regard it as intermediate between the "dawn man," *Eoanthropus dawsoni*, and the early African type of man as represented by the Crô-Magnon man and the ancestral negroid type. The Australian native is regarded as possibly also derived from a similar early type, and perhaps even the Neanderthal man, whom I regard as not a primitive but a highly specialized type. *Homo capensis* has very small frontal sinuses and supra-orbital ridges. *Homo neanderthalensis* differs but little except in having the modern type of dentition and in having the ridges and sinuses greatly developed.

The skull is completely fossilized—every cavity of the bone being filled by laterite. These surface laterites have long been known to be of great age, but exactly how old we cannot say. In our surface deposits we have also long known a great abundance of huge *bouchers* [skinning knives] of Chellean or Acheulean types, but hitherto we have never obtained any human remains. In a gravel deposit in the Kimberley district *bouchers*

of the same type have been found associated with mastodon teeth. Whether, however, the maker of the *boucher* was contemporaneous with the mastodon, as I am inclined to believe, or the mastodon tooth washed into the gravel deposit from an earlier bed, may be regarded as an open question.

The probabilities seem to be that while the mastodon was still alive in South Africa we had large numbers of some pre-Bushman race whose only remains hitherto known have been the thousands of *bouchers*, sometimes of huge size, scattered over most of the country. The Boskop man is probably a member of this race, and perhaps of the same race as made the Acheulean implements so well known in Europe.

Ever yours sincerely,
[Signed] R. BROOM.

The significance of the (indirect) association of the Boskop skull with the mastodon may not be apparent to American readers. In this country the mastodon is best

known from the Pleistocene, the age of man, and survived to recent time, after the last of the great ice sheets had disappeared. Man contemporary with mastodon would not here imply any great antiquity, geologically speaking.

In the Old World, however, the mastodons all disappeared much earlier, and the latest of the Old World mastodons, unless these Kimberley specimens be an exception, are found in the Upper Pliocene epoch, older than any fossil human remains yet discovered.

If therefore the Boskop skull was really contemporaneous with mastodons in South Africa, it means either that the mastodon survived much later there than in Europe or Asia, or that the skull, typically human though it be, is of Pliocene age. In view of so important a possible conclusion, the guarded terms in which Dr. Broom describes the circumstances and character of the find should be very carefully studied.

W. D. M.

The Great Jade Mass from Jordansmühl

The largest piece of jade ever found in situ and the largest ever polished, measuring seven feet long by two and one half wide, and weighing 4718 pounds (2140 kilograms)

THE great mass of jade (nephrite), whose polished green surface now gives a note of color to the somber circle of meteorites in Memorial Hall at the American Museum of Natural History, is unique among the mineral collections of this or other museums, intrinsically and because of its bearing on a disputed ethnological question. The mass, which weighs between two and three tons, presents the most extensive surface of jade that has ever been polished, and is the largest piece of jade ever found *in situ*, though its weight is not as great as that of a waterworn specimen from New Zealand, weighing three and one half tons, on exhibition in the South Sea Islands hall of the Museum.

While preparing the catalogue of the large collection of jade and jadeite of the late Heber R. Bishop, the writer noted that it contained no specimen with the matrix attached; further inquiry revealed that the

same was true of the collections of all European and American museums. When abroad in 1899 to obtain such a specimen, I visited Jordansmühl, southwest of Breslau in Silesia, where small specimens of jade had been found by Dr. Traube in 1884. Through the courtesy of Dr. C. F. Hintze, professor of mineralogy in the University of Breslau, I was enabled to locate the quarry of Jordansmühl, get the permission of the owner to visit it, and use to the best advantage the single day at my disposal for the search.

Although Dr. Hintze was skeptical about the possibility of securing a large specimen in so short a time, an examination of the quarry at once gave evidences of nephrite. In a bowl-shaped hill of serpentine, about seventy-five feet high and two thousand feet long, several protuberances were noted. Most of these were *weisstein*, but one, greenish in color, proved upon investigation to be nephrite, or jade. The dimensions of



Quarry at Jordansmühl, Silesia, where the largest block of jade ever mined was discovered in 1899. Although people familiar with Jordansmühl were skeptical as to the chances of obtaining jade specimens of note in a spot where quarrying had been going on since Roman times, a search of less than a day was rewarded by the discovery of a jade block weighing between two and three tons. The cross indicates the original position of the mass



A near view of the original resting place of the jade block of Jordansmühl, now exhibited in Memorial Hall of the American Museum of Natural History. To the left is seen Dr. Carl Hintze, of the University of Breslau, Germany, through whose courtesy was made possible the acquiring of this remarkable specimen

this mass were seven feet in length, two and one half in breadth, and one foot in thickness. The strictness of the German regulations made dynamiting out of the question, but by means of a lever drill—a heavy crowbar embedded in a log twelve feet long and six inches in diameter—wielded by a dozen men, the great mass was loosened from its position. Dr. Hintze, who had the right to claim one half of what was found, kindly made arrangements to allow me to transport to America the whole of the giant mass.

There is ethnological significance in this great mass of jade, which had so curiously remained unnoticed in a hill where quarrying has been going on since the time of the Romans. Dr. Heinrich Fischer, of the University of Freiburg in Baden, who devoted his life to the study of jade (*Die Nephritfrage*), concluded from a consideration of

race migration that all the jade objects found in Europe had an Asiatic origin. Professor A. B. Meyer, director of the Royal Anthropological Museum at Dresden, regarded the presence of jade in Europe as a chemical problem, not an ethnological one, although his views were assailed by the leading scientists of his day. Dr. Meyer's opinions have been reinforced by the finding in Germany of this great mass of nephrite, sufficient in itself to furnish material for all the jade objects and ornaments yet found in Europe. There is now no reason to believe that prehistoric jades need, necessarily, to have been brought to Europe in race migrations from the Orient.

Tiffany and Company, of New York City, did the polishing of this great mass—a triumph, owing to the extreme toughness of jade.

GEORGE F. KUNZ.

Report from the Asiatic Zoölogical Expedition

THE Asiatic Zoölogical Expedition of the American Museum of Natural History was organized early in 1916, and placed under the leadership of Mr. Roy C. Andrews, assistant curator of mammals in this institution, for the purpose of collecting zoölogical and ethnological material in southeastern China, particular attention being given to the mammals and birds. The expedition has been financed in part by a fund made up of contributions from Mr. and Mrs. Charles L. Bernheimer, Mr. George T. Bowdoin, Mr. and Mrs. Sidney M. Colgate, Mr. Lincoln Ellsworth, Mr. James B. Ford, Mr. Childs Frick, Mr. Henry Frick, and Mrs. Adrian Hoffman Joline, and in part by the Jesup Fund of the American Museum.

Mr. Andrews, accompanied by his wife, who is the official photographer of the expedition, sailed from San Francisco March 28, 1916, and after spending about three weeks in Japan making colored and motion pictures, proceeded to Peking, arriving there early in May. From Peking they went by rail to Foochow, the port of Fukien Province, the region where the first real collecting was to begin.

One of the special objects of the expedi-

tion was to secure, if possible, specimens of the so-called "blue tiger." Mr. Andrews was fortunate in making the acquaintance of the Rev. Harry R. Caldwell, a missionary, who, having seen two of these animals during his residence in that region, was the first to give authentic reports of the presence of this species of tiger. From latest information received, the expedition has been unable to secure any specimens of the animal. They report that upon two occasions they had the blue tiger almost within reach, but that he could not be induced to come out into view from the grass, which would have given an opportunity for a shot. During their stay in this province, however, they secured about three hundred and fifty birds and one hundred and fifty mammals, which have already been received at the Museum.

In view of the difficult conditions under which the expedition had to labor—a temperature registering about 150° F. at midday and 95° F. in the evening, with a humidity of approximately 95—the results are highly satisfactory. Among the specimens secured were a number of interesting mammals, including two species of muntjæ, two remarkable raccoon dogs, several wild cats (not yet identified), and six species of bats

belonging to at least five genera. The success of the expedition in obtaining this fine series of mammals is largely due to the assistance and coöperation of two men familiar with the region, the Rev. H. R. Caldwell and Professor C. R. Keller.

On July 20, 1916, Mr. Andrews' party was joined at Fu-tsing by Mr. Edmund Heller, an American collector of wide experience in securing and preserving mammals and birds in tropical countries. After a further stay of a few weeks in this locality, the party returned to Foochow and proceeded by boat to Hanoi, Tongking, China, and thence by rail to Yunnanfu, the capital of Yunnan Province, which was made the headquarters of the expedition. Here the party engaged and outfitted thirty-three mules, and started for Talifu, which was reached by fourteen days of steady riding. After resting at Talifu for a few days, they engaged a new caravan and proceeded to Li-Chiang, a five days' journey distant, where they began collecting. They expected to stay along the edge of Tibet in Yunnan until about December first, going as far north as Atumtyu and then returning to Talifu.

While on their journey to Yunnanfu, through a region notorious for bandits, they were fearful of trouble but passed unmolested. On the ninth day out, however, while they were riding along in a deep pass, a boy came running down the trail to inform them that his caravan, which was not far in advance, had been attacked by robbers. Mr. Andrews and Mr. Heller scouted ahead, found the caravan which had been attacked, and ascertained that no one had been killed, although the packs had been thoroughly ransacked and the bandits, about forty in number, had made off with a good supply of jade, musk, and gold dust.

While in the vicinity of Li-Chiang, the expedition worked for seven weeks on the slopes of a mountain eighteen thousand feet high, and during that time collected more than eleven hundred mammals, which indicates the richness of the fauna. Among other specimens they secured five gorals (*Nemorrhædus*) of both sexes and of different ages, also four serows (*Capricornis*). Both of these animals are exceedingly rare and difficult to secure, and Mr. Andrews writes that they have obtained what is without doubt the finest series ever taken from one place in Asia. A large percentage of the

mammals secured here will undoubtedly prove new to science, since no zoölogist has previously visited this region. Mr. Andrews, in one of his recent letters, writes that this particular region is essentially Tibetan, that there are very few Chinese, and the people belong to the original tribes (Mosso, Lolo, and Shaus), while two days' travel north of Li-Chiang there are only Tibetans—consequently ethnological work was of interest.

When the expedition left New York, the plan was that it should return in June, 1917. Through contributions from some of the patrons who first financed the organization, it has been made possible to grant an extension of time. The expedition, therefore, will probably not reach New York until about October of the present year.

Since the foregoing was put into type, we have received a letter from Mr. Andrews, headed Talifu, January 10, 1917, in which he says:

"We have returned from our northern trip along the Tibetan border and have over thirteen hundred specimens to show for it. We were somewhat disappointed in the large game, for we found no hunting grounds equal to those of Li-chiang, where we got the fine series of gorals and serows. We found small mammals abundant, and we believe we have a lot of things which will prove new to science. We went as far north as we could, to Hsias-chientien, and then the snow and cold drove us out. . . . We went westward then to the Mekong River, only one day's trip from the edge of Burma, and back to this place. The trip consumed three months and we now have a splendid idea of the country and its fauna along the edge of Tibet.

"We are at present preparing for a trip southward into tropical country. . . . We plan to go straight south for about fifteen days' travel and will then be at the edge of Burma. We shall work the Burma frontier and swing around northward, ending our field work at Teng-yue. . . .

Yunnan is by far the most interesting province of China, zoölogically, for its faunal range is very great. . . . We did not get a large quantity of big game, for it is not here; nevertheless, we have a good representation of what is here, and because of its rarity, it is especially interesting and valuable."

J. A. ALLEN.



JADE ORNAMENTS FROM OAXACA, SOUTHERN MEXICO

The chief beauty of these stones, recently acquired by the American Museum, lies in their exquisite coloring—which unfortunately cannot be reproduced in a photograph. The designs represent human figures with enlarged heads, the limbs being warped to fill the irregularities of the stone. See note on page 147

Museum Notes

SINCE the last issue of the JOURNAL, the following persons have become members of the Museum:

Patron, MRS. WILLARD STRAIGHT.

Life Members, MRS. DELOS O. WICKHAM, and MESSRS. WM. REYNOLDS BROWN, HENRY L. DOHERTY, BRUCE FORD, E. H. R. GREEN, H. M. HANNA, JR., W. P. HARDENBERGH, EDWIN KUTROFF, W. H. MARSHALL, WM. H. NICHOLS, E. W. RICE, JR., ARCHIBALD T. SCOFIELD, EDW. R. STETTINIUS, and SAMUEL M. VAUCLAIN.

Sustaining Member, MR. C. H. ZEHNDER.

Annual Members, MRS. FREDERICK H. EATON, MRS. LOUIS FITZGERALD, MRS. MAUDE KISSAM, MRS. GEO. LAUDER, JR., MISSES A. V. ACKER, THORA RONALDS, and ANNETTE YOUNG, GENERAL JOHN PITMAN, United States Army, COLONEL DAVID L. BRAINARD, United States Army, DR. E. H. ARNOLD, DR. JAMES C. AYER, DR. FRANK ERDWURM, and MESSRS. FRANK ALTSCHUL, W. I. BABCOCK, GEORGE V. N. BALDWIN, JR., PAUL J. BAUMGARTEN, ROBERT C. BIRKHAHN, HENRY BLOCK, ALBERT BLUM, ERNEST CLIVE BROWN, EDWIN G. BRUNS, JR., WILLIAM J. BURNS, GEORGE H. BURR, CHARLES E. BUSHNELL, EDWARD T. CALDWELL, HERBERT J. CARR, JOHN J. CARTY, J. HERBERT CASE, A. WAYNE CLARK, WM. EDWARD COFFIN, MARTIN CONBOY, H. C. CORSON, GEORGE D. CROSS, JOHN V. N. DORR, LEONARD H. DYER, ERNEST ELLINGER, FRANKLIN FORD, W. W. FRAZIER, ABRAHAM A. HELLER, VICTOR HERBERT, CHAS. H. HERTY, HARVEY LEWIS HOOKE, EDWIN J. KEANE, F. J. LE MAISTRE, FRITZ LINDENMEYR, E. C. LUFKIN, NELSON B. MAYER, T. E. MITTEN, EWALD MOMMER, CHARLES S. MONTGOMERY, WILLIAM J. PALMER, BERNARD E. POLLAK, DAVID PRICE, LOUIS RIEGEL, EDWARD G. RIGGS, JOSEPH RUNSHEIM, RAYMOND M. SCHRENKEISEN, HERBERT SCOVILLE, JOHN SLOANE, AUGUSTUS SMITH, ELMER A. SPERRY, C. W. STOWELL, DUNCAN D. SUTPHEN, W. E. SYMONS, ALFONSO P. VILLA, FRANCIS RAWLE WADLEIGH, ELLIS D. WILLIAMS, and WALTER H. WILSON, and the ETHICAL CULTURE SCHOOL.

For their generous gifts and continued cooperation in the work of the American Museum, the following have been elected to higher degrees of membership:

Associate Founder, MR. A. D. JULLIARD.

Associate Benefactors, MESSRS. FREDERICK F. BREWSTER, JAMES B. FORD, HENRY C. FRICK, and ADRIAN ISELIN, JR.

Patrons, MRS. PAUL J. SACHS, and MESSRS. HENRY P. DAVISON and PAUL J. SACHS.

Fellows, MESSRS. CHARLES L. BERNHEIMER and B. PRESTON CLARK.

AN interesting series of slabs of carved jade, together with other semiprecious stones from the state of Oaxaca in southern Mexico, has recently been acquired by the American Museum. The slabs of jade are perforated for suspension and were probably used as breast ornaments by persons of rank. They were cut from stream-worn pebbles, by a tedious process, using sand and water and a cord, and were afterward carved by the same general method, the circle being made by means of hollow canes, and the lines by means of a pointed stick and sand. The designs in most cases represent entire human figures with greatly enlarged heads and with limbs warped to fill out the irregularities of the slab. Headdresses of animals are worn by the figures in some instances, but are so conventionalized that only the eyes and teeth can be made out. The chief beauty of the carvings consists, however, not in the design, but in the exquisite coloring of the stones.

The town of Tuxtepec, from which the specimens come, is a region now occupied by the Chinanteca Indians, and the carvings resemble those found at the famous ruin of Monte Alban, which occupies the great hill overlooking the city of Oaxaca and represents one of the earlier civilizations of the Mexican highlands. The fact that most of these tablets show weathered surfaces gives some indication of the geological conditions under which the jade occurs. As yet jade has not been found *in situ* in this region, and it has been a mystery to many persons where the material was obtained by the Indians in such quantity. Examination of the Aztec documents discloses the fact that jade and other precious stones, called by the Aztecs "*chalchihuitl*," were demanded as a tribute from certain vassal towns in southern Mexico. This fact seems to localize the occurrence of jade and to offer hints to the mineralogist. Carved stones of this type

were used in later times in Mexico, but the style of art is different. Jade is so precious, however, that these objects probably outlasted all others and were passed down, so that even in later times stones representing earlier grades of civilization still existed. In view of the Museum's extensive exploration in southern Mexico in former years, this acquisition of a series of the rarer art objects from the same district is especially valuable.

At the annual meeting of the trustees of the American Museum of Natural History, held February 5 at the home of Henry C. Frick, the board of officers was reelected for the ensuing year—namely, President, Henry Fairfield Osborn; First Vice-President, Cleveland H. Dodge; Second Vice-President, J. P. Morgan; Treasurer, Henry P. Davison; Secretary, Adrian Iselin, Jr.; Trustees for the class of 1921, Charles Lanier, Anson W. Hard, Frederick F. Brewster, and R. Fulton Cutting. The trustees adopted the largest budget in the history of the institution, and discussed plans for the extension of the usefulness of the Museum to industry, art, and civic life in view of the deprivations in these lines due to the European war.

It has been found that the most interesting specimens in the fish collections brought back by the Congo Expedition are the catfishes (Siluridae). Messrs. John T. Nichols and Ludlow Griscom have just completed the classification of representatives of this group and find sixty-three species, including eight species and four genera new to science. The new forms will later appear described and figured in the *Bulletin* of the American Museum.

Two new acquisitions in the hall of public health are models showing methods of control of certain insect-borne diseases in Africa. The ticks which carry African tick fever, or relapsing fever, are destroyed by the very effective means of burning down the native huts which they have infested. The tsetse fly, carrier of sleeping sickness, lives along the shaded banks of the rivers, and one of the models shows men at work clearing these areas. The models were made from pictures taken by Mr. Herbert Lang in the Belgian Congo.

AMONG recent acquisitions the Library is glad to acknowledge three works of moment

both for subject matter and for their place in the history of their peculiar branch of science. The first is a two-volume folio set: Buc'hoz, P. J., *Première (-Seconde) Centurie de Planches . . . représentant au naturel ce qui se trouve de plus intéressant et de plus curieux parmi les Animaux, les Végétaux, et les Minéraux*. Paris, (1775), 1773-1781. "Intéressant et curieux" the volumes certainly are, and while any one trained in present day realism might smile with a bit of superiority over the "naturel," a continued perusal will cause him to grant the naïve and comprehensive claims of the title page. The second acquisition, *Der Organismus der Infusionstiere*, Leipzig, 1859-1883, is by Dr. Friedrich Stein, a pupil of Johannes Müller, founder of the modern school of biology in Germany. This monograph has long been needed by the Museum library. The third acquisition, *The Birds of California*, by William Leon Dawson, comes through the courtesy of Professor Henry Fairfield Osborn. The prospectus of this work promises that it will be a comprehensive bird book of great working value.

A MONOGRAPH on the Rhynchophora, or weevils, of northeastern America by Messrs. Charles W. Leng and W. S. Blatchley, has recently been published. Not only has a comprehensive treatment of these important insects been needed for some time, but this work is more than ordinarily useful because the authors have succeeded, by means of keys based on easily observed characters, in making it available to those not already well acquainted with the group.

THE entomological department of the Museum receives every year a large number of letters from insect collectors inspired by the erroneous idea that the collection and sale of butterflies and moths is a very profitable undertaking. This idea generally owes its origin to the publication of fictitious stories in periodicals or newspapers about persons who have made money in this way, and the writers ask for pamphlets or information on the "business of butterflies" and the "butterfly markets." In order adequately to deal with this considerable correspondence a circular has been prepared by the department to be sent to inquirers.

THERE has been published by the Museum a four-page leaflet by Dr. Frank E. Lutz

giving an outline of the plan of the hall of insect life, and designed not only to give information about insects and the biological problems which they illustrate, but also to interest the visitor in the subject of entomology. The exhibits have been arranged as far as possible to tell a connected story. Some of the headings of the series are "The Importance of Insects," "What is an Insect," "Ontogeny, Anatomy, and Physiology," "Taxonomy," "Phylogeny," "The Four Ages and the Seasons," "Insect Associations," "Enemies of Insects," "Evolution," and "Social Insects."

THE Museum has purchased from Mr. E. L. Troxell a massive mastodon skeleton from the Pliocene of Texas. It is unfortunately incomplete: the hind limbs are missing, and of the skull there are preserved only the lower jaws, one upper tusk, and a few fragments. It is finely preserved, however, and represents a remarkable race of Tertiary mastodons which seems to have reached its climax in North America. It is distinguished especially by the immense length of the jaw, by the bulky body, and very short legs. In this specimen the body and fore legs are as bulky as those of the great Warren mastodon, but the fore limb bones are only about three quarters as long; the hind feet and presumably the hind limbs are smaller, while the lower jaw exceeds six feet in length, more than twice as long as in the Warren mastodon. Its geological age is much greater.

THE Museum has received an important Alaskan Eskimo collection from Lieutenant George T. Emmons, one of the most distinguished anthropological collectors in America, noted for the precision and accuracy of his field notes. The collection comes from the mouth of the Kuskokwim River and northward. This is a region hitherto not well represented in the Museum's collections, but with this acquisition there is now a good study collection for the whole stretch of Alaskan coast. The material covers all phases of Eskimo culture that can be represented in a collection, but is particularly strong on hunting and industrial objects. Altogether the collection contains about seven hundred and fifty pieces.

IN recognition of his services to the American Museum in scientific research and in the

painting of South American birds, the trustees of the Museum elected Louis Agassiz Fuertes a Life Member at the annual meeting on February 5.

THE second annual meeting of the American Society of Ichthyologists and Herpetologists, which was organized at the American Museum of Natural History a year ago, was held at Philadelphia, March 8. The Museum was represented on the program by the following papers: "On the Fishes of the American Museum Congo Expedition," John T. Nichols; "Illustrations of Fish in Mediæval Manuscripts and Early Printed Books," Charles R. Eastman; "A Reconstruction of the Musculature of the Permian Reptile *Cynognathus*," Charles L. Camp; "On Certain Congo Reptiles," Herbert Lang; and "Notes on the Types of West African Species of Lizards described by Dr. Edward Hallowell," Karl P. Schmidt.

MR. W. DE WITT MILLER, assistant curator of ornithology in the American Museum, started February 18, via New Orleans, Colon, and Costa Rica, for Nicaragua, where he will spend three months or more in making ornithological collections. Mr. Miller's perfect acquaintance with the Museum's series of tropical birds will enable him to fill gaps in the collection. He is to bring back not only bird skins, but also alcoholic specimens, together with data on nests and feeding habits of birds, studies of faunal zones, and other matters frequently neglected by collectors, but invaluable for an adequate understanding of the specimens. Mr. Miller is accompanied by Mr. Ludlow Griscom, who, although going on a private venture, will nevertheless collect for the Museum. In Nicaragua Mr. Miller and Mr. Griscom will meet Mr. William B. Richardson, of Matagalpa, who has done much collecting for the Museum, and whose advice and experience will be invaluable.

MR. FRANK W. KITCHING has contributed to the general endowment of the American Museum, shares of stock of the Anaconda Mining Company valued at more than \$10,000, the income of which is to be devoted to general museum purposes. In recognition of his generosity, the trustees of the institution at their annual meeting elected Mr. Kitching an Associate Benefactor of the Museum.

THE department of anthropology has recently received as a gift from Mrs. Wm. Tod Helmuth a sacred belt, apron, and headdress from Darjeeling, Tibet. They are made of shuttle-shaped pieces of human bone, ornately carved and strung together with smaller bead-shaped bits of bone, against a background of green cloth. The Tibetan wearer believes that the garments have the power of transmitting to him the virtues of the saints of whose bones they are made. In recognition of this gift, Mrs. Helmuth has been elected a Patron of the American Museum.

MR. ALESSANDRO FABBRI has been appointed research associate in physiology in the department of anatomy and physiology of the American Museum. Mr. Fabbri, who has gained fame for his marvelous work in the production of motion picture films of microscopic forms, is at present devoting himself to making motion photographs of isolated living cells in which it is intended to show, in a graphic way, contractility and like phenomena. Mr. Fabbri will present to the Museum copies of the films he makes.

THE first exhibition of prizma motion pictures, given at the American Museum of Natural History on February 8, called forth more than three thousand spectators, so many that to accommodate an overflow of fully a thousand people the films were run through a second time. The prizma pictures furnish a most remarkable reproduction of the colors of nature. Four colors, made up of two pairs of complementary colors, and covering photographically the whole range of visible colors, are made use of to give a roundness and depth to the pictures which could never be attained in black and white. The pictures are taken on standard panchromatic film, and, although in the hand they have the appearance of the black and white films in general use, they possess color values which are reproduced by special attachments applicable to standard projecting machines.

THE American Museum has acquired by purchase the complete fall of the new meteorite known as Burkett. It is in six pieces and weighs 8,018 grams. The specimen was found by Mr. W. A. Smith, October, 1913, on the premises of his father-in-law, Mr. D. W. Howe, in Coleman County, Texas, about eighteen and a half miles

northeast of Coleman City on the waters of Pecan Bayou known as Section 24, surveyed by the Houston, Texas, and Brazos River Railroad, and patented by D. W. Howe. The Holloway Peaks bear east about three miles, and the town of Burkett bears north about three and a half miles, latitude thirty-two degrees north and longitude one hundred degrees west from Greenwich. The mass was partially buried with the large end down, dipping toward the east at an angle of about twenty degrees. It was found on level ground. The soils of this area are sandy loam and gravelly loam types, interspersed with belts of black soil. These soils seem to be of residual origin, the sands, sandy loams, and gravelly loams being derived from the underlying Carboniferous sandstones and conglomerates,—all of which are overspread with a dwarfish growth of post oak, Spanish oak, mesquite, elm, and hackberry. A portion of the fall was analyzed by Booth, Garrett, and Blair, of Philadelphia, for the Foote Mineral Company, in 1915. The composition of the meteorite is as follows: silicon, 0.004; sulphur, 0.172; phosphorus, 0.169; nickel, 6.670; cobalt, 0.560; copper, 0.014; carbon, 0.163; iron, 90.028; and iron oxide, 2.230. The specific gravity is 7.718.

One piece was used for the determination of troilite and schreibersite. The amount of sulphur is so small that the presence of troilite is doubted. Material resembling schreibersite to the amount of 9.343 per cent, was obtained, that is, 1.1175 grams of material insoluble in dilute hydrochloric acid was obtained from 11.96 grams of the original iron. This by analysis gave: iron, 68.594; phosphorus, 2.350; nickel, 4.920; cobalt, 0.180; and iron oxide, 24.000. This composition does not conform to that of schreibersite, and must represent some other phosphide.

MR. GEORGE K. CHERRIE, who left New York for South America in May, 1916, has returned after ten months spent in the swamps and forests of Paraguay and Brazil. During these months he continued the explorations begun by the Roosevelt-Rondon Expedition, which explored the "River of Doubt" in 1914, but which was unable to remain to investigate closely the life histories of the remarkable birds and mammals of the region. The most serious work of the new expedition began at Puerto Pinasco

in the Paraguayan *chaco*. Here about two months were spent in making collections. Three months were spent in field work in the Panateles, vast alluvial plains, entirely submerged during the rainy season, and the home of many species of water birds. As a result of the work Mr. Cherrie brings to the American Museum a collection of three thousand bird skins and four hundred skins of mammals, together with fifteen hundred photographs and a wealth of valuable data.

For several years about one hundred and fifty textile pupils and students of design a month have been making use of the Museum collection of ancient Peruvian textiles and pottery vessels. This number has been doubled of late since trade has discovered the value and fine state of preservation of the Museum collection. For the benefit of commercial workers in textiles, who have felt the dearth in design due to the cutting off of new ideas from abroad by the European war, the department of anthropology of the American Museum offered in February a series of lectures, illustrated by lantern slides of objects in the Museum, on primitive decorative design in the New World. The subjects discussed were: February 5, "Indian Pottery and Decorative Art," February 19, "Costume and Costume Decoration," both by Dr. Herbert J. Spinden, and February 26, "Primitive American Textiles," by Mr. M. D. C. Crawford. These lectures supplement an earlier series on primitive textile art in ancient and modern times, given at the Museum by the department of anthropology during October, 1916. There has recently been installed on the main floor of the Museum, through the courtesy of several silk manufacturing companies, an exhibit of silk fabrics and ribbons with designs inspired by the Museum's Mexican, Peruvian, and Amur River collections. The exhibit represents only a fraction of what has already been accomplished in design through the study of Indian art. Not only have the silk designers been busy, but cotton fabric and costume designers are becoming interested, and fabrics lately sent over from Paris show that the new note in American textile art may be expected to produce results in Europe after the war. The number of pieces of ancient American textiles in the Museum available for use of designers and others has been very largely increased by the donations of Mr.

A. D. Juilliard. One of his gifts, a beautiful shawl-like garment found in a prehistoric grave near Ica, Peru, has recently been put on exhibition at the head of the stairway on the third floor of the Museum.

THERE is on view in the west assembly hall of the American Museum an interesting exhibit of paintings by William de la Montagne Cary, showing the West as it appeared during the years 1861 to 1874. The pictures, with their abundance of detail and local flavor, give intimate glimpses of Indians, traders, and settlers, of wolf packs and buffalo herds, the vanished features of a wonderland of life and adventure long since swept away by the westward spread of population.

THE American Museum expedition to Nicaragua for collections of reptiles and fishes has returned from the field. The expedition left New York on May 31, 1916, for Bluefields on the eastern coast of Nicaragua, going via New Orleans. Two weeks were spent collecting at Maselina Creek near Bluefields. On July 1 a trip was started up the Rio Grande and one of its tributaries, Sixicuas Creek. In August the expedition moved to the coastal belt and collected near Pearl Lagoon, midway between Bluefields and the mouth of the Rio Grande. In September the members of the expedition parted,—Mr. L. Alfred Mannhardt to operate near the mining regions of the north, Mr. Clarence R. Halter to go southward and to the west coast. Mr. Mannhardt sailed for the mouth of the Prinzapolka River, up which he proceeded one hundred miles, exploring the Yoyo and Pia creeks as far as the dugout pitpans could be poled. On the first of November an overland trip was begun, the equipment being forwarded by Indian pack carriers to the town of Tunky at the junction of the Tunky and Banbana rivers. In order to find a favorable field for collecting, a scouting trip was undertaken through Siuna and San Pedro, ending at Eden Mine in the heart of the gold district. Mr. Halter, in charge of the other division, went south to Barra del Colorado, Costa Rica, and up the San Juan River, collecting at La Hunter, Machuca, El Castillo, and San Carlos on Lake Nicaragua. Thence he continued up the lake to San Miguelito. Collections and studies were made along Tule Creek to its source; then followed an overland excursion in a northeasterly direction in the Chontales Moun-

tains. Steps were retraced to San Miguelito and work was carried on in this vicinity and on the island of Boquete. A trip was made to Managua, the capital, situated on the lake of the same name, stops being made along the way at Morito on the eastern coast of Lake Nicaragua, at Moyagalpa on Ometepe Island, at Rivas on the western coast, and at Granada. The collectors brought back more than fifteen hundred fish taken from many sections of the country, twenty-three hundred herpetological specimens comprising more than a hundred species, and two hundred and fifty photographs of the species and their habitats.

THE spring schedule of popular lectures at the American Museum of Natural History is as follows: on Thursday evenings the members' course of four lectures—March 8, "In the Jungles of British Guiana," by C. William Beebe; March 15, "In the High Sierras with John Muir," by Herbert W. Gleason; March 22, "Our Debt to Ancient American Civilizations," by Herbert J. Spinden; and March 29, "With Camera and Gun through Western Colombia," by Leo E. Miller; on Saturday mornings a series of stories for the children of members—March 3, "Among the Penguins of South Georgia," by Robert Cushman Murphy; March 10, "In the Land of Hiawatha," by Ann E. Thomas; March 17, "Wild Flowers of Spring," by G. Clyde Fisher; and March 24, "At Home in the Zoo," by E. R. Sanborn. There are also offered four courses of six lectures each, open to school children: on Mondays—March 12, "Our Waterways and their Protection," by George H. Sherwood; March 19, "A Journey in Western Europe," by Charles H. Rogers; March 26, "Through the African Jungle," by James P. Chapin; April 9, "Mexico and Central America," by Charles H. Rogers; April 16, "Our Newest Possessions—The Danish West Indies," by G. Clyde Fisher; and April 23, "Travels in South America," by Howarth S. Boyle; on Wednesdays—March 14, "The Explorers of Eastern North America," by Ann E. Thomas; March 21, "Early History of New York," by Roy W. Miner; March 28, "Lake Champlain, Lake George and the Hudson," and April 11, "Colonial and Revolutionary New England," by Ann E. Thomas; April 18, "The Growth of New York City," by Roy W. Miner; and April 25, "The Song of Hiawatha," by Ann E. Thomas; on Fridays

—March 16, "The Conservation of Our Forests," by G. Clyde Fisher; March 23, "The History of Our Country's Transportation," by Ann E. Thomas; March 30, "Agriculture in the United States," by G. Clyde Fisher; April 13, "The City's Fire Department," by Fred H. Smyth; April 20, "Governing New York City," by Ann E. Thomas; April 27, "The Story of a Piece of Coal," by G. Clyde Fisher; on Tuesdays and Fridays—May 1, "The Story of the Winds," by George H. Sherwood; May 4, "Wild Birds of New York City," by S. H. Chubb; May 8, "Wild Animals near Home," by G. Clyde Fisher; May 11, "The Three F's—Fingers, Food, and Flies," by T. G. Hull; May 15, "How Life Begins," by G. Clyde Fisher; and May 18, "The Wonderful Work of Water," by George H. Sherwood.

FROM a preliminary survey of the lizards in the reptile collections brought back by the American Museum Congo Expedition, it appears that the 1435 specimens represent about forty species, several of which are new to science. The collection affords large series of many forms, especially of the skinks (Scincidae), which will be of value in defining species hitherto known from relatively few specimens. As would be expected from the tropical forest habitat, the snakes, with 805 specimens, greatly outnumber the lizards in species, about seventy (several of these also new) being represented. In the course of the study of the Congo species a reëxamination of Dr. Hallowell's West African types at the Academy of Sciences of Philadelphia is being made; also the Richard Douglas collection from Matabeleland, belonging to the American Museum, will be reported on in the same connection.

AT the time of his death, July 6, 1914, Dr. Seth E. Meek of the Field Museum of Natural History, Chicago, was engaged in the preparation of an exhaustive catalogue of the fishes of the fresh waters of Panama. This work has recently been brought to a successful conclusion by S. F. Hildebrand of the United States Bureau of Fisheries and published by the Field Museum. Such an addition to the knowledge of the fauna of Panama, the present connection between North and South America, is of importance to the science of zoögeography, in which Dr. Meek was interested. The present work contains plates of many interesting neotropical catfish, Characins, Gymnotids, and of a new genus of goby.

The American Museum of Natural History

Its Work, Membership, and Publications

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

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

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

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

The educational work of the Museum is carried on also by numerous lectures to children, special series of lectures to the blind, provided for by the Thorne Memorial Fund, and the issue to public schools of collections and lantern slides illustrating various branches of nature study. There are in addition special series of evening lectures for Members in the fall and spring of each year, and on Saturday mornings lectures for the children of Members. Among those who have appeared in these lecture courses are Admiral Peary, Dean Worcester, Sir John Murray, Vilhjálmur Stefánsson, the Prince of Monaco, and Theodore Roosevelt. The following are the statistics for the year 1916:

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

Membership

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

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The various Classes of Resident Membership are as follows :

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

They have the following privileges :

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

Associate Membership

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

- Current issues of the AMERICAN MUSEUM JOURNAL—a popular illustrated magazine of science, travel, exploration, and discovery, published monthly from October to May (eight numbers annually), the volume beginning in January
- A complimentary copy of the President's Annual Report, giving a complete list of all Members
- An Annual Pass admitting to the Members' Room. This large tower room on the third floor of the building, open every day in the year, is given over exclusively to Members, and is equipped with every comfort for rest, reading, and correspondence
- Two complimentary tickets admitting to the Members' Room for distribution by Members to their friends
- The services of an Instructor for guidance when visiting the Museum

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

labors are presented to the million public school children through the Museum Extension System. In brief it is a medium for the dissemination of the idea to which the Museum itself is dedicated—namely, that without deepening appreciation of nature, no people can attain to the highest grades of knowledge and worth.

Publications of the Museum

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

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

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MARY CYNTHIA DICKERSON, *Editor*

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DRIFTING CLOUDS AMONG HIGH ANDEAN PEAKS

Each morning the bleak *paramos*, above timber line in the Andes, are covered with clouds, through which the lofty mountain peaks stand forth like islands in an ocean of foam. The work of the expedition in this region was done under disadvantages, for in addition to the intense cold and the lack of fuel, there was always the possibility of being trapped far from camp by the unexpected rolling in of these banks of clouds. There is nothing to do, when thus "lost" in the cold, dense mist, but wait the long hours until it is lifted

A Search for *Scytalopus*

By LEO E. MILLER

*Leader of the American Museum's South American Expedition, 1915-1916*¹

Illustrations from photographs by the Author

THE little wrenlike birds of the genus *Scytalopus*, known commonly as "tapacolos," are perhaps among the most difficult to collect of any species in South America, and for this reason they are invariably only poorly represented in museum collections. Native collectors, hunting mainly with blowguns, have gathered many thousands of birds, the greater number of which have eventually found their way to millinery establishments and scientific institutions in many parts of the world; but usually only those of brilliant plumage, and others which could be taken with little difficulty, have been collected. The small, slate-colored or blackish tapacolos, found only in the densest of subtropical forests or among the tangled vegetation bordering bleak, frigid *paramos*, have usually been overlooked. This is not to be wondered at when we find how seldom even the trained field naturalist of today finds it possible to lure the tiny, feathered creature from its secure retreat among the mosses, roots, and ferns to which its mouselike habits confine it, and how rarely he succeeds in recovering the inconspicuously colored bird after it has been shot. Even after a long, patient search

has revealed the specimen lodged somewhere in the deep stratum of matted plants, it is by no means sure of reaching the museum; I have heard of instances where birds, slipping from the hunter's hands and dropping at his feet, have been forever lost in the riot of vegetation which carpets the ground.

After completing eight months' work in Bolivia, the expedition started for the Argentine Republic. Sucre had been our headquarters for a number of weeks, and to reach La Quiaca, on the Argentine frontier, it was necessary to traverse the high Bolivian plateau a distance of more than three hundred miles.

During the dry season motor cars are run from Sucre to Potosí in one day's time. A railroad connects the latter place with a small station a short distance this side of Tupiza, and from this point one may reach La Quiaca via carriage in two days. During the rainy season, however, both automobile and carriage service are suspended; and the difficulty of twice securing mules on which to cover the two stretches of road between railway terminals, and the delays and other inconveniences, are so great that we decided to travel the entire distance by

¹ Mr. Howarth S. Boyle, assistant in the American Museum, accompanied Mr. Miller on the South American Expedition, 1915-1916

pack train. This also gave us an opportunity to see the country.

The expedition left Sucre December 22 (1915). We had engaged an adequate caravan of mules and burros and a number of Quichua drivers for the journey. All supplies had to be taken with us, as very little in the way of provisions may be had from the Indians who are virtually the sole inhabitants of the cheerless highlands. There are a number of villages, it is true, but the person who relies upon them for maintenance must either live on coca and *chicha*, the native beer, or meet with disaster. The country is rolling, dry, and unproductive. In places there is a sparse growth of cacti and thorny shrubbery, but vast areas are rocky and barren of all vegetation. We crossed ridge after ridge, the elevation of the trail varying between eight thousand and twelve thousand feet. Travel in this type of country is most trying. Water is so scarce that long distances must be covered in order to find suitable camping sites; in one instance we were compelled to ride thirty-six miles in the course of a day, between streams. The temperature varies one hundred degrees each twenty-four hours. At two in the afternoon the thermometer registered 132° F. in the sun; at night it dropped to 32°.

After twelve days, two of which had been spent in a Quichua village called Puna, with every member of the party suffering from sunburn or mountain sickness, we reached Villazón on the Bolivian side of the border. Villazón contains about a score of scattered, low, adobe buildings. We arrived on a Sunday, when the custom house was closed, but the officials in charge very courteously permitted us to proceed on our way. A brook three or four feet

wide separates the two republics, and stepping across this, we found ourselves in La Quiaca, a village of Argentina very similar to Villazón.

This section of the Argentine is rich in mines, and multitudes of llamas and mules came down from the mountains each day, laden with copper, bismuth, silver ore, and gold ore. They discharged their burden at the railroad station where it was loaded on cars to be taken to the smelters in Buenos Aires.

Our object in coming to the Argentine was to continue the biological survey we had carried on in Bolivia; and also to secure specimens of a species of *Scytalopus* which was thought to exist in the province of Salta. The acquisition of this bird was most important for the light it would throw on certain problems of distribution. We therefore took the first available train and started southward.

From La Quiaca the railroad winds upward through a narrow, rocky gorge to the station Tres Cruces, the altitude of which is 12,400 feet. Then it descends at a steep grade—so steep in fact that a rack and pinion are used part of the distance.

Our first headquarters were made at Rosario de Lerma, near the city of Salta. We had been informed that the town was in the center of a heavily forested region, but found upon our arrival that it was surrounded by cultivated fields, pastures, and a few clumps of open, low woods. The attractiveness of the region, however, cannot be exaggerated, and the courtesy of the inhabitants will always remain one of the bright spots of our many years' experience in South America. Birds were most abundant also. They were nesting, so that it was possible to secure not only a large amount of un-

usually interesting material, but a great deal of information about their life histories as well.

Using Rosario de Lerma as a base, we made a number of excursions into regions several hundreds of miles distant, in the hope of finding the dense forest which we thought would shelter the bird we were seeking. One of these was to the *chaco*, far to the east. In this place we found rheas, which are still fairly abundant in spite of the persecution to which they have been subjected. These birds were nesting, and the eggs were commonly sold in the village markets at about twenty cents apiece. As the contents of each egg is equal to that of a dozen hen's eggs, and the quality is fully as good, this price is not exorbitant. As a rule a single nest contains eight to fifteen eggs, but we heard of one instance in which twenty-four were found, and this number is about as many as one man can carry.

The city of Tucuman was our next objective. Our first care was to secure a collecting permit as the hunting season had not yet opened. Each province, it seems, has its own game laws so that it was necessary to secure a separate permit every time we moved from one locality to another. In this we had so far been successful, but in Tucuman we faced an extraordinary situation, and it seemed impossible to secure the permits. As a last resort I appealed to the British consul (there being no American consul in Tucuman), who very kindly spent a great many hours in attempts to explain our mission, but all his efforts were in vain. Our quest seemed hopeless until one day a copy of one of the large daily newspapers of Buenos Aires arrived, and in this I found a lengthy account of how representatives of Latin-American countries

who were attending the scientific congress in Washington had been received and entertained at the American Museum of Natural History during their visit to New York. Armed with this account I again called at the palace. Ordinarily I should not have thought of such a move, as there are many reasons why it is not commendable; but the situation was desperate. Suffice it to say that this visit was the last, for when I left the building the permit was in my pocket.

A range of comparatively low mountains rises directly west of Tucuman. This we found to be covered with a growth of tall, dense forest, so we lost no time in going there. We left the city by rail and proceeded southwestward to a little station called San Pablo, a short distance away. This is in the heart of the sugar region, and vast fields of cane stretch on either side of the railway. Here and there the tall, brick chimneys of a refinery rise above the waving green of the fields, and wide, deep canals divide the cultivated areas into sections and supply water for irrigation.

A good cart road leads from San Pablo, up the side of the mountains to the very summit, four thousand six hundred feet high, where the little town of Villa Nougnes is situated. The settlement is a favorite resort of the wealthier class of people who come up from Tucuman to spend the summer months in pleasant chateaux, thereby avoiding the great heat of the lower country. The view from the top of the range is superb; the country to the east is perfectly level, and is laid out in symmetrical fields of cane as far as the eye can see. A small, muddy river, threading its way through the ocean of green, divides it into two sections and vanishes into the horizon in a haze of



Expedition on the march over the highland of Bolivia. The temperature in this region, which is between ten thousand and twelve thousand feet high, varied one hundred degrees each twenty-four hours



In Tucuman, Argentina, the cows are driven from door to door, and milk is delivered fresh to customers



Because the slope of the mountains is gentle, it is possible to use carts between Sucre and Potosí, a journey of four or five days



The Quichua Indian village of Puna is built entirely of adobe. It seems as if a heavy rain would wash all the structures away, but they are nevertheless able to withstand climatic conditions for a number of years



The railroad between La Quiaca and Salta, Argentina, runs through a narrow, rocky gorge flanked by high, barren hills, over the tops of which may be seen the snow-crowned peaks of the Andes

purple mist. To the west rises the stern Andean chain, barren and precipitous, its top hidden in banks of grayish clouds.

We made a first camp in the forest below Villa Nongués, at an altitude of

four thousand feet. From the very first day we heard a shrill little call which we thought belonged to *Scytalopus*; but the elusive bird always remained in concealment among the ferns and mosses, and not once did we

get a glimpse of it. Then we moved to the other side of the mountain where, we had been told, hunting was not so difficult.

Birds were not abundant, the fall migrations having left the forest almost deserted. The few species which remained, however, such as wood hewers, thrushes, tanagers and jays, were plentiful, and several species of humming birds lent color and life to the somber green of the vegetation. After many days, we succeeded in tracing the mysterious chirp to its source, and found, not the bird we were seeking, but a dainty little wood wren of the shyest possible nature. The minute, secretive creature seemed to spend its entire time among the buttressed roots and moss-draped undergrowth, where no ray of sunlight ever penetrated to dispel the chill and semi-darkness, or give a touch of cheer to the



In spite of the hundreds of thousands of rheas killed for their feathers, which are used in making dusters, these great birds are still fairly abundant in Argentina. Their eggs sell in the local markets for about twenty cents apiece, not an exorbitant price for an egg which equals a dozen hen's eggs in size and probably in food value

soggy mould. Its glimpses of daylight must be brief indeed, and at infrequent intervals.

We had come to the mountains in a state of enthusiasm and expectancy, for here it seemed we should succeed in ending our long quest. As the days passed, thrilling excitement gave way to exasperation; and finally, disap-

appointment. Birds were more abundant than at Villa Nougnes, but the tapacolo was not forthcoming. As a last resort it was therefore decided to visit the top of the range, which at this point attains an altitude of over ten thousand feet. This necessitated the securing of a pack train of mules, but the matter was arranged, and one



Llamas, laden with potatoes and other produce, and driven always by Quichua Indians, frequently come down from the highlands into the streets of Sucre. The limit of the llama's load is about one hundred pounds. If it be given a heavier burden, it will lie down and stubbornly refuse to move.

pointment alone remained to fill the void created by the flight of the other emotions.

We returned to Tucuman to pack the collections which had been made, and then struck for the forest farther south. This time we left the railroad at a station called Aguilares, two and one half hours from Tucuman, and camped in the forest at the foot of the ridge. Again we were doomed to dis-

appointment. In the morning at one o'clock we mounted and started up the slope. A full moon showered a flood of light upon the earth, but the overhanging branches formed a thick canopy over the trail, impermeable to the silvery radiance save when an occasional breeze stirred the leafy arch, thus permitting fitful shafts of light to pierce the darkness of the tunnel, and to fall in quivering, dancing blotches on the ground. We

could almost feel the impenetrable blackness which closed in from all sides like water in a deep, dark pool. The light touch of a streamer dangling from the moss-festooned branches overhead, or the velvety swish of fern leaves protruding beyond the protecting walls of tree-trunks, made it seem as if the forest were peopled with hovering, invisible forms. No sound disturbed the brooding silence of the night, except the dull hoof-beats of the mules, as, guided by some mysterious instinct, they cautiously picked their way through the muddy and rock-strewn lane.

Hour after hour we followed blindly in the wake of the bell-mule, winding back and forth along the mountain-side, but mounting ever upward. The latter part of the way seemed to lie near the course of a small mountain torrent, for we were almost constantly within hearing distance of rushing

water. Finally, we emerged from the forest, and, just as day was breaking, reached a brush-covered strip of country, the elevation of which is five thousand feet. This continued to the top of the ridge, two thousand feet above. Then there was a depression of considerable extent, filled with rank, low vegetation and infested with swarms of bloodthirsty flies which render it uninhabitable.

After ascending another ridge, the trail led gently downward into a level valley a dozen miles long and from one to two miles wide. Herds of cattle were grazing on the abundant grass: a few small areas had been enclosed within stone walls and planted in maize; and at the far end, half-concealed by willows and fruit trees, lay a village of whitewashed houses. At half past four in the afternoon we reached the settlement, called Tafi del Valle, and soon after were comfortably



On account of the abundance of moisture in the Cloud Forest of the Andean slopes, the trees are covered with mosses, and their branches form aerial gardens of orchids, ferns, and parasitic plants. It was through this deep, dark tangle, to which the rays of the sun never penetrate, that the expedition made the ride at night on the search for *Scytalopus*



Bush-covered fissures in the cold *paramo* slopes above Tafi del Valle, Argentina. It was in this desolate spot that *Scytalopus* was finally discovered

ensconced in a hut hospitably provided by one of the inhabitants. After the fifteen and a half hours' uninterrupted ride over a difficult trail we were ready for a journey into a still more remote region, and the sun was shining brightly the following morning when we again returned to the stern realities of this world.

Tafí del Valle is a most delightful place. Even though the altitude is seven thousand feet, the surrounding peaks shut in the valley and protect it from the icy winds. There is no natural forest in this region, but groves of willows have been planted near the houses; to these, large numbers of birds came to spend the night. Hawks were especially abundant and of many kinds—we collected no fewer than seventeen species during our ten days' stay; then there were also burrowing owls, larks, flycatchers, thrushes, and

many other birds. Some species which ordinarily live in brush-covered country had become adapted to their barren surroundings and were nesting in holes excavated in banks of earth. When the birds had reared their broods, rats, mice, and pigmy opossums occupied the old nesting sites.

A clear, cold stream, which flows through one side of the valley, spreads out at the lower end over a large area, forming lagoons and marshes. Geese, ducks, coots, night herons, and sandpipers made these places a favorite resort. Pectoral sandpipers were not uncommon, and were so fat that they were unable to fly and could be taken with the hands. There were also flocks of stilts: they are beautiful creatures, either when flying in compact formation, with measured wing-beats and outstretched necks and legs, or when standing motionless in the shallow

water, their snowy underparts reflected in quivering outlines. Lapwings screamed and cackled in resentment of our visit and frequently frightened away flocks of waterfowl which we were stalking.

Apparently our *Scytalopus* was not a bird of the open highlands. We even began to wonder if it existed at all, because, so far, the most thorough search had failed to reveal any trace of it. There remained, however, the high *paramo* above, and to this we next turned our attention.

Our sudden arrival at Tafi had caused much comment among the inhabitants. They found it impossible to believe that we had come to that remote region in search of a small, dull-colored bird, and after a few days it became an open secret that we were regarded as spies—though just what nature of information we sought, could not be determined. They even went so far as to refer to the matter occasionally in a good-natured manner; and when we were away on hunting excursions, it was the custom to put our cook, a Bolivian, through a sort of "third degree" in an effort to compel him to confess the real object of our visit. Therefore, when we planned to move to the high peaks bordering the little valley, the natives considered their evidence complete: we were going, they said, to prepare a diagram of the country from our new point of vantage. The only person who really understood the purpose of our mission was a man from Tucuman who had been sent up to vaccinate the Indians. He started out each morning accompanied by two or three soldiers, rounded up all the Indians of a given locality, and vaccinated them. The natives did not at the time realize the significance of this act; but when, a few weeks later, the

inoculations had had time to become effective, they grew frantic, and grim-faced little parties began to scour the country in search of the person who had "poisoned" them. Fortunately, none of the scouting parties came our way, for to them all strangers look very much alike, and there was the possibility that one of us might have been mistaken for the doctor.

The *paramo* above Tafi is a bleak region, almost perpetually enveloped in mist. Work in this type of country possesses its disadvantages, for in addition to the intense cold and the lack of fuel, there is always the possibility that one may be trapped far from camp by banks of clouds which roll in unexpectedly! The cold, penetrating mist is so dense that it is impossible to distinguish objects but a few yards away, and the most familiar landmarks assume strange and fantastic outlines. In the event that one is overtaken by this phenomenon, there is nothing to do but wait until the mist lifts, which may be in a few hours, or perhaps, not until the next day. Strange to say, the inhospitable *paramo* supports a varied fauna. Herds of wary guanacos feed on the tall, wiry grass growing in the more sheltered places; when alarmed, they flee to the inaccessible rocky slopes. The *paja*, or grass, harbors also a species of large tinamou, but the bird is loath to leave its safe cover, for no sooner does it take wing than hawks, which are always hovering about, swoop down and carry it away.

Numbers of deep ravines have been worn in the mountain-sides by water coming from the melting snows on the higher peaks. These are filled with a rank growth of shrubbery. The sides are so abrupt that we could find no spot where a descent was possible without the aid of a thousand feet or more

of rope. After a number of days, however, a narrow fissure was discovered leading to one of the ravines from which came faint bird calls that we at once recognized with a fair degree of certainty. On account of the high altitude and tangled plant life it was slow, tiring work to follow along the bottom of the jagged gash; there was also the unpleasant possibility of breaking through the matted brush and falling into deep crevices among the rocks.

As we struggled along slowly, high-pitched whistling calls rang clear and loud from numerous points nearby, but still it seemed as if our efforts might be of no avail; for among that chaos of vegetation it was impossible to move without causing great disturbance and frightening the birds away. Then there recurred to us the old saying about Mahomet and the mountain and we resorted to quiet concealment.

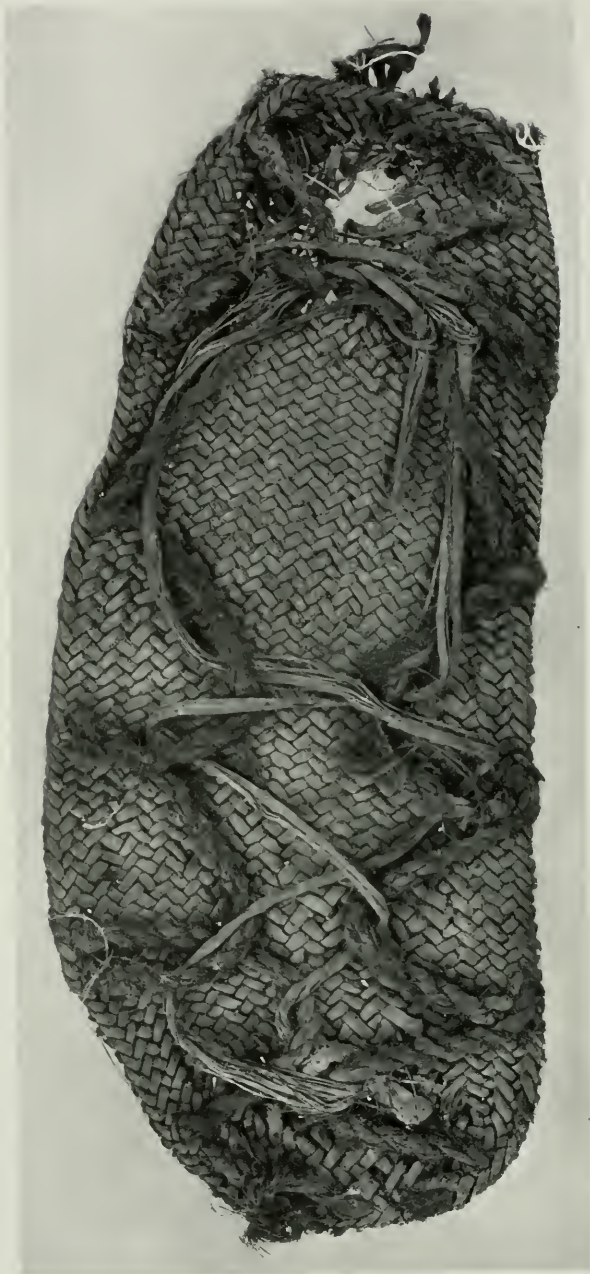
Presently there was a crisp little

chirp and a rustle among the mosses a few yards away; one, two, five minutes passed; then a minute, shadowy form darted out of the darkness, perched on a moss-covered boulder, and turned a pair of bright, inquisitive eyes upon the strange monsters which had invaded its snug retreat. The white throat gleamed conspicuously among the deep green surroundings as the bird paused a moment to complete its inspection; then up went the short, barred tail, straight into the air, and a succession of low, scolding notes emanated from the feathered mite as it hopped about in angry excitement.

We found that the bird existed in numbers; once we had discovered a way of entering its stronghold, it was possible to make the desired studies. Thus our difficult search, covering so many hundreds of miles, came to a pleasant and successful close.



Scytalopus, the tiny, wary bird in search of which the South American Expedition of the American Museum traveled many hundreds of miles. *Scytalopus* was finally discovered on the cold, bleak *paramo* above Tafi del Valle, Argentina. Drawn for the JOURNAL by Mr. Henry Thurston



A YUCCA SANDAL MANY CENTURIES OLD

The clever skill and unflinching patience with which the ancient Pueblos wrung from barren nature the things necessary for their existence can be no better illustrated than by this yucca sandal. Leaves of the soap weed were split, trimmed, and plaited to form the tough sole, and cords of fiber from the same plant served as lashings to hold the sole in place. When the soles became worn by sharp stones and grinding sand, they were patched and mended, and often reinforced with a lining of husks. When one gazes upon the vast bulk of the Aztec ruin, and tries to imagine how many thousand pairs of these sandals were worn out by the feet of the workmen as they plied to and from the quarries, one's thought goes forth in tribute to the sturdy barbarians who dreamed, achieved, and went their way generations before Columbus first set foot on Western shores

Discoveries at the Aztec Ruin¹

By EARL H. MORRIS

Illustrations from specimens in the American Museum

TO reconstruct the life and customs of a people from the products of its material achievements is one of the tasks confronting the student who undertakes the systematic exploration of a prehistoric village or city. Difficult, even hopeless, such a task might seem to one who views the crumbling mass of earth and stone to which the elements have reduced the ancient Pueblo community village at Aztec, New Mexico. But slowly from the wreck of dwellings, of ceremonial and burial chambers, the spade brings forth examples of aboriginal handiwork. These are veritable bits of mosaic which careful skill may rearrange to yield a vivid picture of this town before the vicissitudes of time dispersed its builders, and made their hearths the homes of prairie dogs and owls. Since "the picture" can not be drawn until after the work of several years, all that will be attempted at this time is a description of some of the specimens found during the summer of 1916, and the conditions under which they were discovered.

Pottery vessels are perhaps the most striking feature of the collection gained from a

preliminary excavation of the Aztec ruin. Because of the absence of metal and the limited use to which basketry can be put, vessels of clay served these people in a multitude of needs. There are many shapes among the vessels found, each suited to a par-



Photograph by Earl H. Morris

The Pueblos often used abandoned portions of their dwellings as repositories for discarded material. This room on the second floor of the north wing of the Aztec ruin proved to be a treasure house for the archaeologist. The deposit, which covered the floor to a considerable depth, was filled with sandals, cloth, matting, baskets, cords, and fiber, seeds, bones of animals, broken pottery, arrow points, turquoise, and beads. Throughout the centuries no moisture penetrated the refuse, so even the most perishable articles were perfectly preserved. In fact, some of the dried corn leaves were as green as if taken from a last-season's shock

¹ This article follows the article by Mr. N. C. Nelson in the February *JOURNAL*, describing the excavation of the Aztec ruin. The excavation and reparation will be continued by the American Museum of Natural History through a period of several years, and make the largest piece of work of the kind ever undertaken in the United States.

ticular type of function. In bowls various foods were served, or clay or pigment mixed for pottery making, or even mortar carried to the masons building the pueblo. Flat-bottomed mugs and tall pitchers with globular bases and straight necks were used no

doubt as drinking vessels. Water was carried from the river in graceful jars, some of them of a capacity of several gallons. The jars are fitted with handles or lugs, the smaller ones for suspension by means of a thong, the larger for transportation by the hands, or to



The hollow bones of birds were fashioned into needles, beads and whistles. Scrapes or paddles were made from the short heavy bones of deer and elk, the trochanters offering a convenient grip for the hand. The longer bones were sawed and split longitudinally with flakes of flint into slender sections. These sections were then reduced by rubbing upon pieces of sandstone to highly polished and keen-pointed daggers, awls, and punches (The numerals in ink represent the catalogue numbers put on them by the American Museum)

aid the women in placing them upon their heads, in which position they were carried, either full or empty.

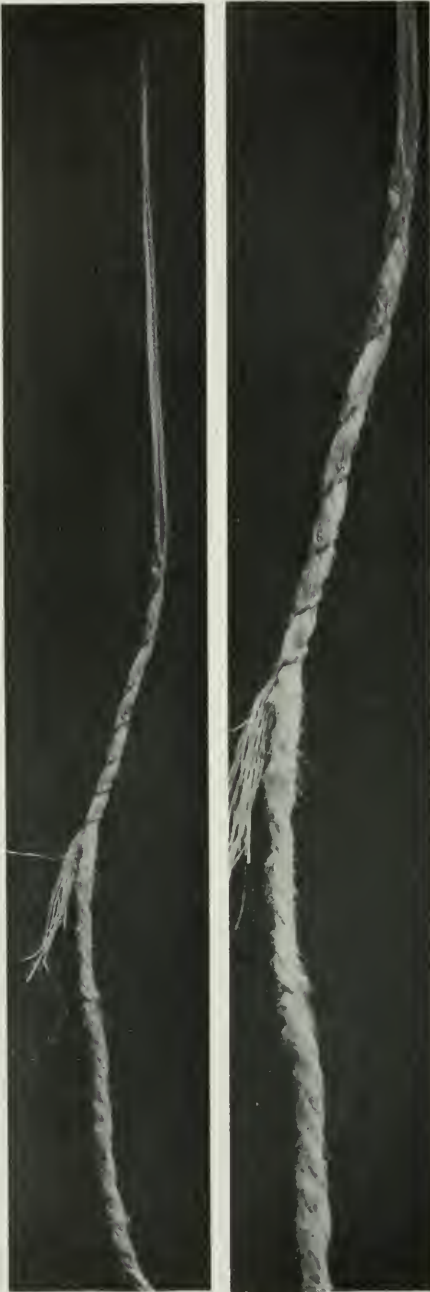
There were evidently occasional attempts to mold the forms of men or animals in clay, due perhaps to the individual caprice of the potter, or to a desire to represent some deity. Examples are rare, however, only one having

been taken from the Aztec ruin. This is a seated human figure which had been broken. The marks of a keen-edged flake of stone upon the severed neck show that it was intentionally decapitated.

The most beautiful variety of pottery shows a red ground ornamented with black on the interior of the vessel,



These long chisel-like blades, commonly called skinning knives, are the most beautiful stone implements found in the Aztec ruin. They are made from an extremely hard, fine-grained material varying in color from black to creamy gray. Usually they are shaped so that the dark mottling and banding of the stone form a pleasing ornamentation. Such objects are called *teamahias* by the Hopi Indians today, and in certain ceremonies they place them upon their altars to symbolize the spirits of departed warriors. No stone of the kind from which they are made is known to occur within one hundred and fifty miles of Aztec



The yucca plant furnished needles. A long slender strip was split from a leaf, and the basal portion chewed or beaten until the fibers were separated, and all but a few broken off. Those remaining were twisted around the cotton thread, thus attaching it firmly to the needle. The sharp thorny point of the leaf was strong and keen enough to pierce ordinary cloth, but if skins or tough fabrics were to be joined, doubtless a bone awl was used to open a way for the needle

and with yellow or cream color on the outside. This red pottery is rare at Aztec. Some specimens are evidently local products, while others so closely resemble the pottery typical of other parts of the Southwest, that from the evidence they furnish, it may be possible to determine that the people of the Animas Valley carried on primitive commerce with contemporaneous villages hundreds of miles distant.

Most of the pottery is found with the dead. It was a peculiar custom of the Pueblos to bury certain individuals, probably the more important persons, beneath the floors of living rooms, or in rooms set aside for mortuary purposes. Only a few graves were found last summer, but it is to be expected that many, some of them very rich, will be encountered before the excavations are completed.

Cooking was done in rough pots whose soot-covered exteriors resemble coiled baskets. They were made by the coiling process of pottery manufacture, and the resulting ridges were not smoothed down upon the outside. The cooking vessels never bear painted decorations, but the other types usually are highly ornamented. Upon the gray or white groundwork, attained in most cases by the application of a light-colored slip over the darker paste of the vessel, designs were traced in black pigment, and fired in. Most of the patterns are geometrical, with only now and then an attempt at realistic representation.

The large cooking pots are found as they were left, sometimes sitting in the ashes of extinguished fires. It was a common practice, when they were cracked, or would no longer hold liquids, to sink them into the floors, where they were used as bins or storage jars. Flat stones were put over them

for covers, and often the place of their concealment was completely hidden by a layer of mud. Under such conditions they would be passed over by the workmen during our work of excavation, were it not for the hollow rumble they emit when the floor above them is struck by the pick or shovel.

The difficulty which may be attached to the recovery of specimens during the excavation, and the extreme caution that must be exercised to make sure that none are overlooked, are well illustrated by the circumstances under which was made one of the best finds of the season—that of a large red bowl. The bowl was broken and the fragments had become scattered over the floor of a second story room. As slow decay of the supporting timbers enabled the rain to wear holes through the floor, one by one many of the fragments fell into the room beneath, and were covered by an accumulation of rain-washed earth. As this lower room was being excavated, a workman caught the glint of the sun upon a bright red potsherd (the name by which a fragment of pottery is known to an archaeologist) in a shovelful of dirt. A day and a half of sifting followed, with the result that over ninety per cent of the bowl was recovered. The fragments were scattered over an area eight by eleven feet, and from six inches to three feet in depth. To recover them, 176 cubic feet of earth—more than six wagon loads—were run through the sieve.

Sifting is slow and tedious at best, but when it has to be done within doors, it acquires the qualities of an ordeal. In a room where not a drop of moisture has penetrated for centuries, and no current of air can enter save through an aperture only large enough for a man to crawl through, each

movement stirs up a reek of pungent dust. In a few minutes the atmosphere is so thick that a man can not be seen five feet distant. The workmen cough and choke behind masks of wet cloths and sponges, and every little while have to come into the open for a breath of clean air. The acrid quality of the dust, due to its dryness and the presence of finely divided ashes, gypsum, and filth, leaves the membranes of the nose and throat inflamed for several days.

To the uninitiated there is nothing particularly suggestive or interesting about a few cartloads of rubbish; but a back room on the north side of the ruin, containing such an accumulation of refuse, proved to be a veritable treasure house. About thirty years ago relic hunters tunneled into the ruin and opened some rooms whose ceilings are still intact. The protection of these ceilings is one of the most difficult problems connected with the preservation of the Aztec ruin, and it was decided to clear one of them, and to lay a heavy coating of cement upon it in order to ascertain if in this way the beams could be kept sufficiently dry to resist decay. Men were put to work to remove the thirty tons of earth and stone which had fallen upon the ceiling from the walls of the third and the upper part of the second story. The first workman to reach the floor raised a section of a beam which had fallen from above, and beneath it lay a yucca sandal. In a few moments it became evident that the floor was covered to a considerable depth with refuse, every shovelful of which contained something of importance. Sieves were brought, and for five days two men worked in a cloud of dust separating the coarser material from the sweepings and ashes. When the task was completed, there

were eleven wooden dry goods boxes filled with a surprising variety of objects, something over six hundred speci-



Photograph by Earl H. Morris

When cooking pots were cracked or worn out, they were sunk into the adobe floors to serve as storage or hiding places for grain and valued articles. In the picture a portion of one of the floors may be seen in the corner above the mouth of the jar. There was no sign to indicate that anything was concealed beneath until the curiosity of a workman caused him to investigate the hollow rumble which a tap with his pick upon the hardened earth brought forth from the drumlike cavity within the pot

mens in all. The air space in the room below, and the several feet of earth above, had kept the rubbish as dry as if hermetically sealed, so that even the most perishable objects were perfectly preserved.

Grains of corn, together with cobs, tassels, and husks were fully intact; also beans and bean-pods, pine cones and branches, and pumpkin seeds and shells. These, together with bones of turkey, rabbit, deer, and antelope, show plainly upon what wild and cultivated foods the aborigines depended for sustenance.

Cotton fiber, yucca leaves, and rushes represent the raw materials for textile products. The cotton was twisted into yarn and woven into cloth of excellent strength and texture, some of it ornamented in red and brown. The needles with which this cloth was sewed were ingeniously devised. A long strip was split from a yucca leaf, and the basal portion macerated so that only a few strands of fiber remained. The thorn at the end of the leaf made an effective point for the needle, and the frayed fiber at the opposite end was twisted in and around the cotton thread.

Yucca leaves, whole or split, were plaited into sandals and mats, or the separated fiber was twisted into cord. Some of the cord is as fine as number sixty linen, and some is as large as quarter-inch rope. A soft and heavy cloth was made from yucca cord and feathers. The down was stripped from the ribs of the feathers and wrapped about the cords, which were then woven into jacket-like garments such as have been found upon the dead in various parts of the Southwest.

Rushes were plaited into mats for covering floors, or for wrapping the dead, also into sandals, baskets, and bags.

What appear to have been snowshoes consist of an oval frame of willow laced across with yucca, and stuffed with husks and grass. They were found in pairs, some of them large, others evidently fashioned for the feet of children.

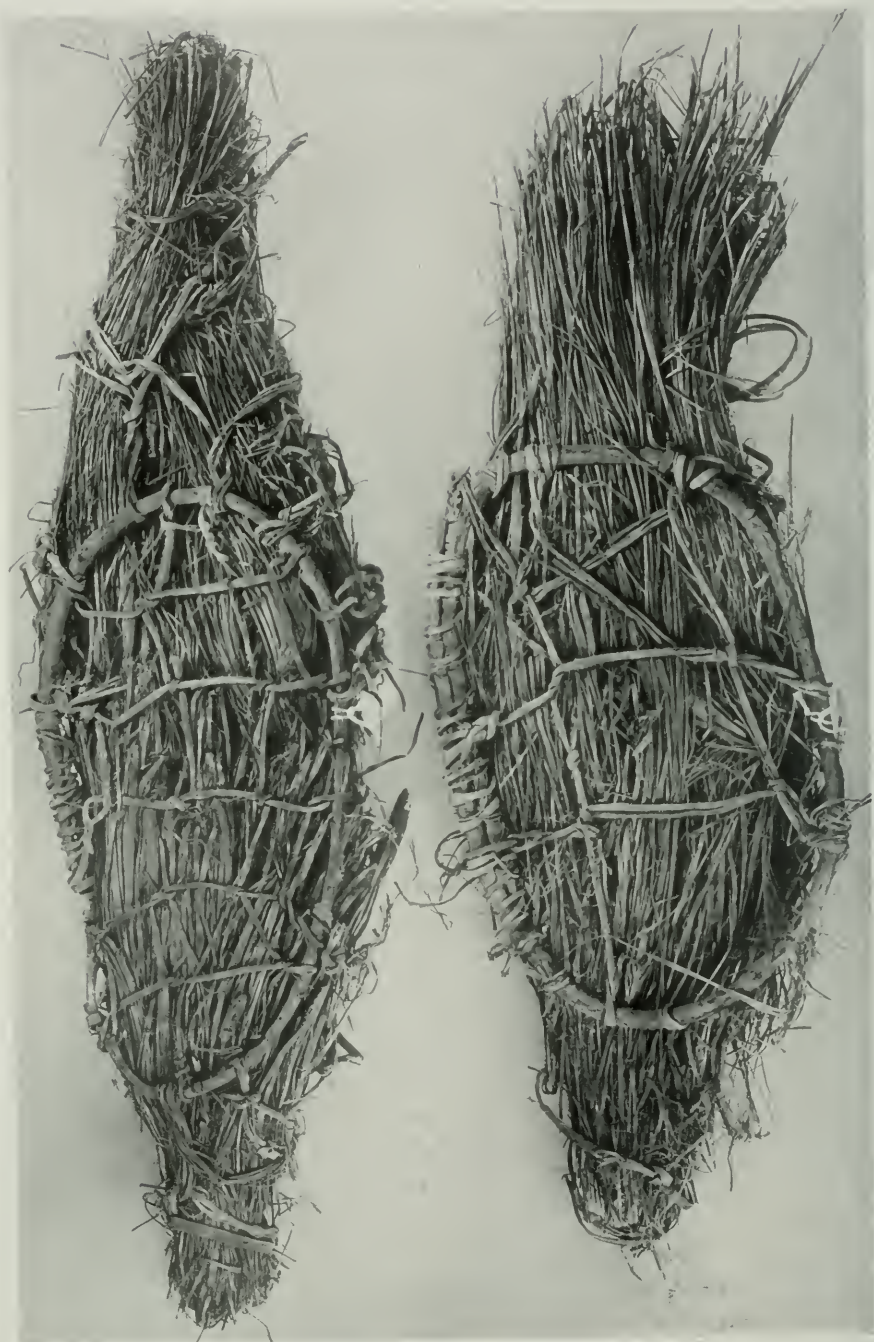
Numerous ornaments and perhaps ceremonial objects were mingled with the sweepings. There are disc-shaped beads of black, white, gray, and red stone, some of them only one sixteenth of an inch in diameter; a number of quartz crystals, one of them bound to a cotton cord with sinew; beaver tusks pierced and strung upon cords, and held in place by a backing of pitch; and more than three hundred sets of turquoise, shell, and coral-colored stone

which had been inlaid in gum upon the surface of some object.

Although these descriptions are brief and fragmentary, they indicate the variety and richness of the material which may be expected to reward the continued excavation of the Aztec ruin. When the work has been finished, the features of the ruin itself and the wealth of specimens from it should make possible an accurate and comprehensive reconstruction of the material culture, as well as an instructive insight into the thoughts, beliefs, and customs of the people, evidences of whose handiwork caused the imaginative Spaniards to name the river which flows past their village Rio de las Animas Perdidas—the River of Lost Souls.

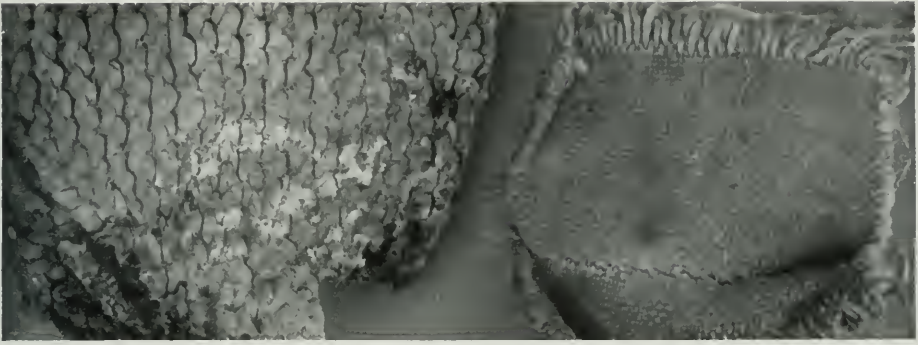


These corrugated cooking vessels are found, the larger ones sitting about where they were abandoned, sometimes in the ashes of extinguished fires; the smaller ones in the graves where they were placed to contain food for the dead. Why those who dwelt in the Aztec ruin should have used only vessels with rough exteriors for culinary purposes, is a question that is still unanswered

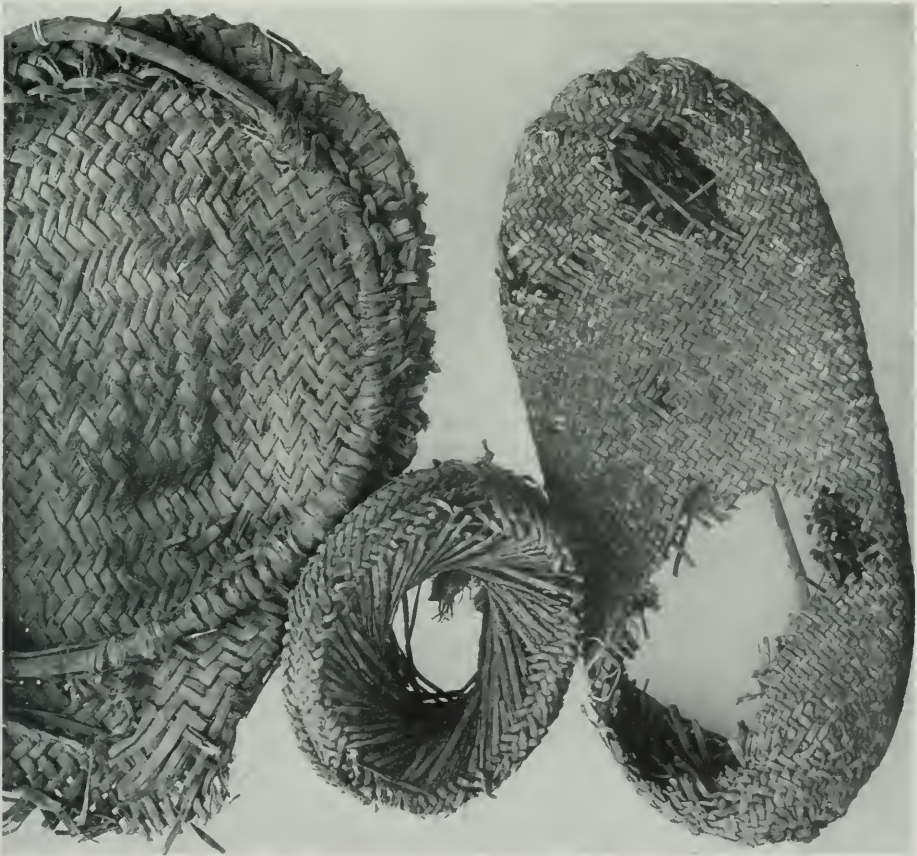


SNOWSHOES FROM AZTEC RUIN

Although winter storms seldom leave more than a few inches of snow upon the ground in the vicinity of Aztec, sandals were an inadequate protection against even so slight a fall. In consequence crude snowshoes were made from an oval loop of willow beneath which was lashed a bundle of grass or husks. When wearing these the traveler might go dry-shod and well protected from the stinging cold of the snow



The builders of the Aztec ruin used fiber of cotton and yucca for cloth making. The cotton garments intended to be worn during ritualistic ceremonies, and upon dress occasions, were as soft and pliable as heavy muslin. Ordinary apparel, sacks, and burden straps were woven from the coarser fiber of the yucca, or occasionally with warp of yucca and woof of cotton. The cotton plant was cultivated in the fields along the river, while the yucca grew—and still flourishes—on the rocky slopes and sandy wastes of the neighboring mesas



It is clear to what uses matting made of plaited rushes, baskets, and ring-shaped pot rests might be put, but there are some forms, like the cylindrical bag appearing at the right side of the picture, whose function baffles the imagination. A pillow, a cushion, a pad for the back when carrying burdens, are among the possibilities, but all are equally problematical and unsatisfactory



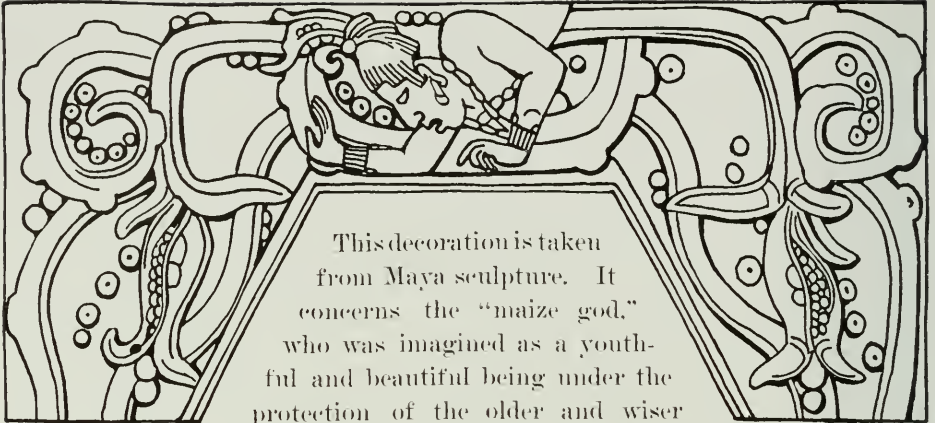
In pottery making Pueblo art found its highest expression. The gracefulness of contour, and the dignified simplicity of ornamentation to be observed in some of the specimens, make one realize that the search for beauty was as keenly alive in the hearts of prehistoric Southwestern peoples as it is in our own today



Due to the absence of metal, and the restricted use of basketry, pottery bowls were used for innumerable purposes. In them food was served, clay and pigment mixed for pottery making, earth borne away from excavations, and mortar carried to the masons. Refuse heaps are filled with fragments of them, and many excellent specimens are found with the dead



This large bowl is the finest pottery vessel found during the first season's excavations in the Aztec ruin. The ground-color of the interior is a dark red, upon which the graceful geometric pattern is traced in black pigment, while the dominant tone of the exterior is a light yellow, and the design is drawn in the same shade of red as was used to stain the background of the interior. This type of pottery is characteristic of another part of the Southwest, and from the presence of a few specimens at Aztec, we may safely conclude that the inhabitants of the Animas Valley traded with contemporaneous peoples hundreds of miles distant



This decoration is taken from Maya sculpture. It concerns the "maize god," who was imagined as a youthful and beautiful being under the protection of the older and wiser gods of rain and of sunshine. The upper detail is a stucco relief from the Palace at Palenque. The god comes down from above and at right and left are seen leaves and bursting ears of maize. The side details are from Stele H at Copan, where several maize gods clamber among feathers and twining serpents. The maize god always wears a headdress fashioned into a conventional ear of maize. Elsewhere in the New World also agriculture reacted strongly upon religion and art.

The world today is indebted to the work of the American Indian for the following :

Food Plants

- Maize
- Potatoes
- Sweet potatoes
- Tomatoes
- Pumpkins
- Squashes
- Lima beans
- Kidney beans
- Peppers
- Cacao
- Pineapples
- Strawberries
- Cassava
- Guava
- Peanuts
- Alligator pear

Medicines

- Tobacco
- Quinine
- Cascara sagrada
- Cocaine

Fibers

- Cotton
- Henequen

Gums

- Rubber
- Copal
- Peruvian balsam

Domestic Animals

- Alpaca
- Llama
- Guinea pig
- Muscovy duck
- Turkey



The Invention and Spread of Agriculture in America¹

By HERBERT J. SPINDEN

ON the foreland of ancient American history the invention of agriculture is the one outstanding fact. For without a sure and abundant food supply, to be secured only by domesticating plants, the American Indians could never have risen above the status of hunters, herders, or lowly fishermen. Agriculture was indeed the indispensable invention that made possible all the higher arts, both in the Old World and the New.

Yet agriculture began independently in the two hemispheres. The plants found under domestication among the American Indians are distinct as a group from those known in Europe, Africa, Asia, and the Pacific islands, before the discovery of America. We have, then, in the New World and the Old two unrelated families of civilization, each dependent upon agriculture, but with unrelated groups of plants as the bases. In each area, the increase in population and the accumulation of wealth that resulted from this conquest of the vegetable kingdom made possible intellectual and artistic expression upon a grand scale.

The idea of agriculture may have had several points of origin in America, but this does not seem likely, since maize, beans, and squashes were common products wherever agriculture was practised. Other plants, fitted for special environments, had a more limited distribution, examples being the manioc of the humid lowlands of the

Amazon basin and of the West Indies, and the common potato that was cultivated most extensively in the rather arid highlands of Peru. Wild stocks for some of the aboriginal food plants of America are often difficult to obtain, but botanical knowledge is far from complete for the more significant regions.

The cradle of New World agriculture appears to have been the high-



Pottery reproductions of maize, cast in molds that were made over actual ears of maize, have much scientific value. These reproductions were sometimes used as details on great ceremonial urns in southern Mexico

¹ The substance of this article was presented at the Second Pan-American Congress, Washington, D. C., December, 1916.

lands of Mexico and Central America. The nearest wild relative of maize so far discovered is a grass called in the Aztec tongue *teocentli* (sacred maize). When we consider the geographical and climatic range of maize, we must admit that the Mexican plateau is an intermediate and very likely home for the wild ancestor of this great food plant. On the north its cultivation had been extended in pre-Columbian times to the mouth of the St. Lawrence, and on the south to the mouth of the Rio de la Plata. It had been modified by careful breeding to meet extreme conditions of heat and cold, drought and moisture.

In restoring the early history of agriculture the most important source of information is archaeological rather than botanical. There are manufactured objects, such as pottery vessels, associated with agriculture or dependent in a general way upon it, and some of these are practically indestructible: whereas plants and seeds survive only under the most exceptional conditions. Earthen bowls are both heavy and fragile and consequently of little use to wandering peoples. Stationary peoples alone develop pottery, and such peoples are usually on the agricultural plane of life. In America we find that the boundaries of pottery distribution closely parallel the boundaries of agriculture distribution, extending in some regions slightly beyond them. Pottery is made with an infinite variation in form and ornament and has almost the historical value of a written document. Like agriculture, pottery making was independently invented in the New World, along with loom weaving and other high arts, and probably spread outward from a single point of origin.

In the valley of Mexico pottery re-

mains of sharply differing styles have been found in layers one above the other, and it is clear that the lowest layer is historically the earliest. The pottery of this lowest layer shows peculiar features in construction and ornament, and it has been possible to prove by these special features that ceramic art spread from Central America across northern South America to the mouth of the Amazon, and over the mountains of Colombia and Ecuador to the coast of Peru. All the higher civilizations in the New World seem to have risen from the general level of what has been called the "archaic horizon." The trail of pottery of the ancient type marks the first distribution of agriculture.

When we examine the exact distribution of this most ancient of all pottery, we find that it is abundant in open, arid country, and rare or wanting in humid, forested country. Theoretically, agriculture would be more likely to originate under conditions that were hard rather than under those that were easy. Necessity, they say, is the mother of invention.

Irrigation is often looked upon as a remarkable sequel to the introduction of agriculture into an arid country. But from the best historical evidence at our command, we should rather regard it as an invention which accounts for the very origin of agriculture itself. The earliest records of cultivated plants are found in Mesopotamia, Egypt, Mexico, and Peru, where irrigation was practised, and in each region are likewise found the earliest developments of the characteristic arts of sedentary peoples—namely, pottery and weaving, and the elaborate social and religious structures that result from a sure food supply and a reasonable amount of leisure.

Quite aside from these known facts



POTTERY REPRODUCTIONS OF SQUASHES

Peruvian collections give us many examples of molded and modeled squashes (see the first two specimens), showing the special breeds developed in that region. The very texture of the rind is minutely reproduced in some pieces.

Gourds, squashes, and pumpkins were cultivated by the ancient Mound Builders of the eastern United States (see third specimen). Representative art never attained to the skill that is exhibited in Peruvian pottery, nevertheless the intention is unmistakable

in the case, there are several reasons why we should expect to find the first appearance of agriculture in an arid environment. The press of population on food supply is greater there than in the free-and-easy lands where nature

man culture, there is usually such a supply of wild game, of berries, and of edible roots, that the advantage of tilling the soil does not at first appear. Even when agriculture is known in such favorable country, the indigenous



The "maize god" of the Peruvians (see figure at the left) was buried in the field as a prayer for good crops, and in some sections the ceremony is still kept up. The body is formed of molded ears of maize.

The cemetery of Chimbote on the arid coast of Peru has furnished us this jar decorated with peanuts (water jar at right). The realism of these ancient casts made from molds is in contrast with the rather conventional treatment of modeled representations

is bountiful but where an insidious competition works behind the screen of plenty and cuts down life. In the desert the clearing of the field is less laborious than in the jungle, and the control of the life-giving water makes man the master of the entire situation. As for the intermediate type of environment, where agriculture is possible without irrigation, and where it normally spreads with the rise of hu-

plants are seldom found under cultivation.¹

It is perhaps an open question whether the extreme tendency to conserve energy, seen in most desert plants, has not increased their com-

¹ The abundant harvests of wild acorns in California, of wokus in southern Oregon, of wappato along the Columbia, of camas and kous in the pleasant uplands of Idaho, and of wild rice in the lake regions of Minnesota and southern Canada, were effectual barriers against the invention or spread of agriculture among the tribes inhabiting these regions.

parative food value over plants of more propitious climes. At any rate, seeds that grow with avidity on the slightest encouragement form a large part of the dietary of desert peoples. The screening and washing of these seeds at springs and beside streams would naturally result in volunteer crops and suggest artificial watering. Whether the release of these wild plants from a harsh life to one of continuous ease under irrigation would result in physical changes greatly increasing their food value is a question that botanists should answer. Certainly after the plant has been reduced to cultivation, the adaptation to new environments must be tremendously hastened by artificial selection. Only the plants that grow to maturity give seeds for the next planting, and these seeds are carefully preserved and planted in the most favorable situations.

Agriculture received special emphasis in Mexico and Peru. Maize, beans, and squashes are common to both areas, but with considerable local variation. Sweet potatoes, the *camote* of the Aztecs, are also cultivated in both Mexico and Peru, but are probably of humid lowland origin. In Mexico several varieties of red peppers, often called by the Aztec word *chile*, were cultivated, as well as the tomato called *tomatl* in the same language. The latter was used mostly in softening the rigors of chile sauce, and several varieties are described in early books. Cacao takes its mispronounced name from the Aztec word *cacauatl*, which referred to the dried nibs. When ground, this fruit seed was called *chocolatl* and was made into a delicious drink. Cacao was grown in the lower and more humid parts of Mexico and Central America, under the shade of another tree, called the "mother of cacao," and

was an object of trade with the highland tribes. This plant does not seem to have been known to Peru, although the mountain tribes of western Venezuela cultivated it and made a drink called *chorate* from the seeds. Cacao was grown also in many parts of the lowlands of South America and in the West Indies.

In Peru the potato was especially developed. It is doubtful if this plant was known to the Mexicans, although it was commonly grown throughout the Andean region, and a wild form occurs as far north as Colorado. Peanuts also appear to be a Peruvian specialty.¹

The weight of anthropological science is strongly against over-sea transmission as an easy explanation of enigmas in human culture, and it behooves us not to assume lightly that any cultivated plant was common to both the Old World and the New before the coming of Columbus, until the fact has been established beyond doubt. Domestic species of plants in cosmopolitan use in 1500 are rare, and possibly the only example is the common gourd, which appears to be one and the same in the Old World, in the islands of the Pacific, and in America. It is not a food plant, but was much cultivated for household and ceremonial uses. An important economic plant, that does not appear as a single species but rather as a world-encircling family of closely related species, is cotton. Many

¹ There was also a sort of fruit called by the Aztecs *tlacacauatl* (earth cacao), which is said to have been roasted before eating. This fruit may possibly be identified with the peanut, since the modern Mexican word for peanut is *cacahuate*. In South America the Peruvian word *mani* is used. Several wild species of peanuts are said to occur in South America. Other Peruvian and Colombian products are the roots of the *oca*, and the *arracacha*. Great use was also made in Peru of the seeds of quinoa, a plant of the pigweed family, and in Mexico small seeds of similar type were used.

wild species have never been brought under cultivation or turned to human use. Cotton also occurs on oceanic islands, such as the Galapagos, which were entirely uninhabited until modern times. But it is important to note that the modern cotton of commerce is essentially that of the American Indians.

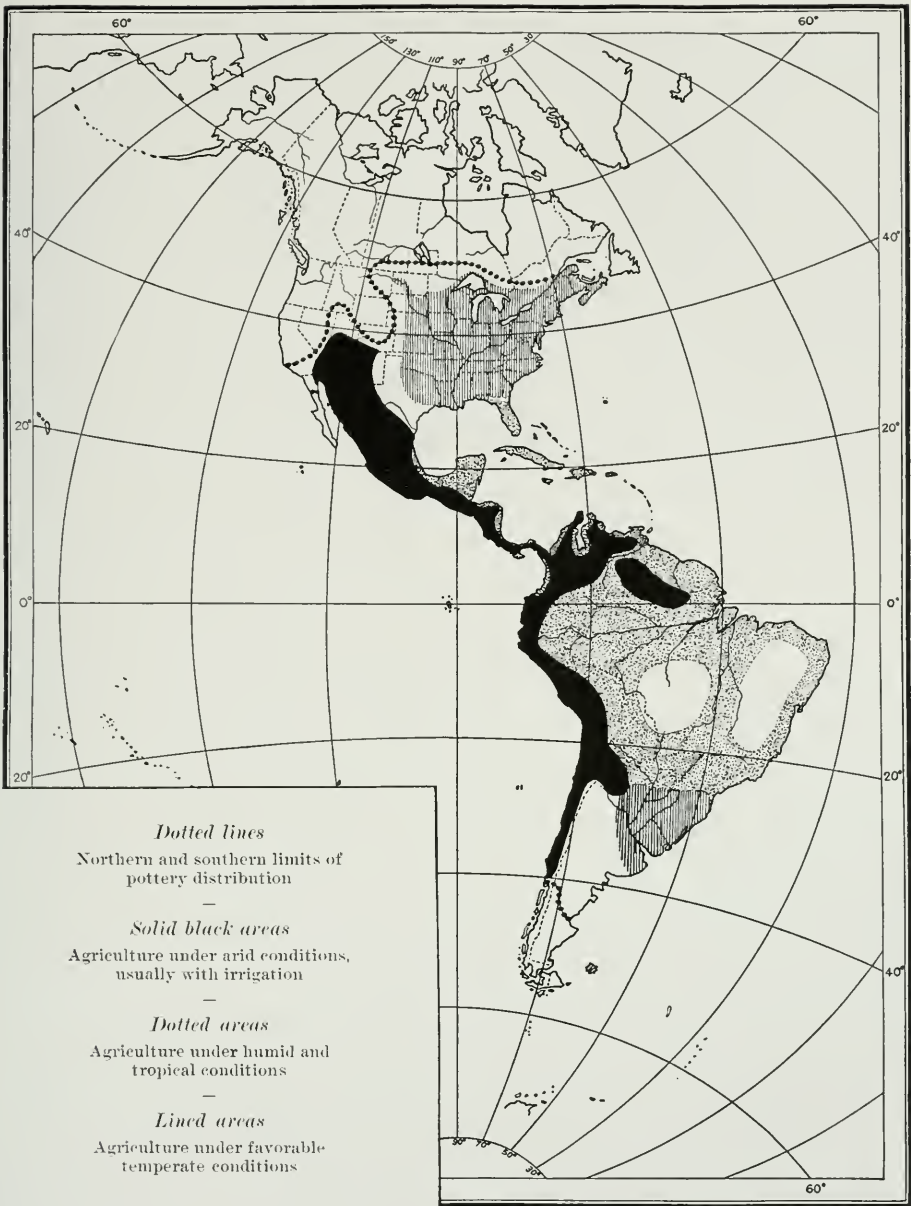
Both the gourd and the cotton are enabled by nature to take the widest advantage of distribution by wind and water, and we may be permitted to assume that they passed in such fashion from the Old World to the New. The coconut, which was doubtless known in the Old World before the discovery of America, may have been distributed by ocean currents. Nearly all the related palms are indigenous to tropical America, but there is no certain evidence that the coconut itself actually existed under cultivation, or even in a wild state, in pre-Columbian America. No remains of the fruit and no pictures of the tree are found in archaeological collections, and native names for the coconut are conspicuously absent among Indian tribes.

The earliest references to maize in China are considerably subsequent to the discovery and conquest of America, and while the evidence points to Tibet as the region from which maize entered China, we must remember that the caravan trade between the Near and the Far East was at its height in 1500. Moreover, the world empire of Spain embraced large sections of the East Indies as well as of the West Indies and the mainland of America. It was an age that throbbed with energy, when new ideas were eagerly seized upon. The exchange of occidental and oriental food plants is seen not only in the introduction of maize and sweet potatoes into China, but also in the intro-

duction of the banana and sugar-cane into America.

The map given herewith shows the limits of pottery distribution and, within these limits, the areas known to have been given over to agriculture. A rough distinction is made between three general types of agriculture. The first, and apparently oldest, type occurs in open and rather arid territory of considerable elevation, where irrigation is usually necessary. The second type is found in the humid, tropical lowlands where the land must ordinarily be cleared of the forest before planting can be done. The third type occurs under temperate conditions in partly open and partly forested country where irrigation is not required. The arid highland area extends from southern Colorado and Utah to southern Chile. An outlying area is also drawn across the Guiana highlands, but this is somewhat doubtful and proof of its existence must await future exploration. As we have already seen, agriculture seems to have spread over most of this open country on the first wave.

The second type of agriculture is that developed to meet the conditions of the humid and heavily forested tropics. The Maya civilization, probably the most brilliant of the New World, was made possible by the agricultural conquest of the rich lowlands of Central America. On the highlands the preparation of the soil is comparatively easy, owing to scanty vegetation and a control vested in irrigation. On the lowlands, however, great trees have to be felled and fast-growing bushes kept down by untiring energy. But when nature is truly tamed, she returns recompense manifold to the daring farmers. Moreover, there is reason to believe that the removal of the for-



POTTERY DISTRIBUTION AND AGRICULTURE IN THE NEW WORLD

The most reliable information regarding the agriculture of the past lies in the pottery (fortunately indestructible through the centuries) which was inseparably associated with it. The oldest type of agriculture (black on the map) appears to have arisen in arid country of high altitude, where irrigation was necessary, extending finally from southern Colorado and Utah to southern Chile.

The second type (dotted on the map) developed in humid and heavily forested tropical lowlands, where the land had to be cleared before planting. The brilliant Maya civilization was founded on an agricultural conquest of the rich lowlands of Central America.

The third type developed in temperate country, partly open and partly forested, and was best represented in the eastern part of the United States. Maize, beans, and squashes were common products of all three types of agriculture

est-cover over large areas affects favorably the conditions of human life, which under a canopy of leaves are hard indeed.

But while extremely high civilization might result when the material wealth of the humid tropics is garnered by a closely organized people, the general run of more or less haphazard agriculture in the tropics leads to no such state of affairs. In the great Amazon Valley, and in the flanking valleys of the Orinoco and the Plata, we find agriculture unaccompanied by high social developments, although weaving and pottery-making are everywhere practised. Maize, beans, and squashes are known throughout this area, but maize is displaced from the position of first importance by manioc. Two species of this plant are used, one having a poisonous juice, the other being harmless. Both plants, along with many other species of the same family, are said to grow wild in Brazil, and there is little doubt that domestication first took place in this area. A single technical process of extracting the poisonous juice of the favorite manioc is found wherever the plant is cultivated, and similar types of clay griddles are used in making the cassava cakes.¹

The third type of agriculture was adapted to temperate conditions. It is most completely exemplified in the

eastern half of the United States, but seems also to have been developed, although to a much less extent, in parts of the Argentine and Uruguayan pampas. Maize is again the staple, with beans and squashes as associated crops. Among the Mandan Indians of North Dakota maize was modified to meet the conditions of a very short summer and to ripen within sixty or seventy days after planting. Among the Iroquois agriculture was also brought to a high plane, especially when we consider that all the plants under cultivation were indigenous to the tropics.

If we glance at the crop report of the United States, we find that the annual value for this country alone of plants brought under cultivation by the Indians amounts to three thousand millions of dollars—and the debt of the world is only partly acknowledged. Maize is our principal farm crop, and in its production we lead the world, but in certain other products of the American Indians, such as beans and potatoes, the production of the United States is but a very small part of the world's production. If we remember that in the four hundred years that the white man has dominated the New World he has not reduced to cultivation from wild stock a single important staple, the wonder of the American Indian agriculture becomes still greater.

¹ If we should extend our study of agriculture to semi-cultivated trees, the list of valuable products would be greatly increased. Mention may be made of the favorite alligator pear, whose current name is a gross mispronunciation of *aguacate*, of several members of the *auona* or custard-apple family, including the soursop or *guanabena*, the *chirimoya* or sweetsop, and the custard apple, of the *granadilla* which is the fruit of the passion flower, of the *lucuma* and its relative the marmalade plum, of the star apple, of the *sapote* or *nispero*, of the *mamey* apple, of the *nance* or Barbados cherry, of

the *guava*, of the *ciruela* or *jocote*, and even with these names the list is far from complete.

Nor can we take time to more than mention some of the other important economic plants cultivated by the Indians. Of these the first in value is the modern cotton of commerce. The cultivated cotton of the American Indians has virtually displaced the Old-World types. Many other fiber plants were also brought under cultivation such as *henequen*. Tobacco was widely domesticated from several species both in temperate and tropical America. Important medicines derived from the Indians are *cascara sagrada*, *cocaine*, and *quinine*.

On the Greater Use of Indian Foods

THE war that is upon us will sooner or later compel us to conserve to the last degree our economic strength by the elimination of actual waste in food and by the higher and more scientific use of the materials at hand. Food habits are notoriously fixed, but great events sweep away prejudices. We have inherited most of our food habits from the Old World and we call wheat bread "the staff of life," even though the same nourishment can easily be secured in other foods. Now maize is the great aboriginal food of America and its possibilities have been imperfectly realized by ourselves. This grain is just as much a favorite staple among our neighbors in Central America as is rice among the peoples of southern Asia or wheat in western Europe.

Certain dishes of the American Indians were adopted by the early colonists in New England and elsewhere. Thus samp was instantly appreciated by the hungry English and described by Roger Williams in 1643 as "Indian corn beaten and boiled and eaten hot or cold with milk or butter." At a still earlier date, 1630, Captain John Smith mentions hominy, a name ordinarily applied to maize that has been boiled with alkali. The alkali (lime, potash, snails' shells, etc.) causes the outer skin of the grain to peel away, leaving the white inner portion soft and palatable. This method of preparing maize was widespread over North and Central America. Succotash is a Narraganset word that has been misapplied to a mixture of corn and beans; it originally meant simply an ear of maize. Hoe cake was taken over from the southern Indians. A favorite food of the early explorers and trappers was parched corn meal, which combines great nourishing power

with slight weight. This was much used by the Iroquois warriors in their long raids against other tribes, when each man had to carry his own food.

But the Indian tribes of our Southwest and of Mexico and Central America are more civilized than those from whom these foods have been adopted, and their culinary efforts are more worthy of imitation. A greater use is made by them of maize flour in contradistinction to rough meal. The "paper bread" of the Pueblo Indians is gruel baked on stone stoves. The top of the stove is smoothed by an addition of clay and oiled with pumpkin seeds. This "paper bread" may be of several colors, according to the different kinds of maize, and it has excellent keeping qualities. In Mexico the same method is employed for *totopoztli*, which is, however, baked until brown and crisp.

Hulled corn or hominy, ground into a paste, furnishes dough for the *tortillas* or unleavened cakes that take the place of bread in Mexico. Although the ordinary *tortilla* is rather soggy, when made thin it is delicious. For a breakfast dish nothing can surpass the *enchilada*, which is a *tortilla* rolled up cigar-fashion with a little meat, cheese, or chili pepper as a surprise in the center. This is toasted before the fire until it is crisp and crackling. *Pinole* is, properly speaking, a parched meal made from maize and other seeds. The word is applied to a variety of dishes, such as stews of maize, meat, and chili peppers. *Pinolatl* (*pinole* water) and *posole* are refreshing drinks made by stirring maize paste or dough into sweetened water. The *tamale* is perhaps the best known dish of the Mexican Indians, at least as far as the word is concerned. It is made in many different fashions.

HERBERT J. SPINDEN.



ONLY HIEROGLYPHIC
INSCRIPTION FOUND AT TULOOM

Monument three feet wide, eight inches thick, found by Stephens in 1842. Both faces are sculptured with human figures, the one shown above carrying the two-headed ceremonial bar, the most common emblem of authority in Maya sculpture. The inscriptions on both surfaces are presented in two vertical panels and in a horizontal panel across the top. The date recorded (at the left) is 9.6.10.0.0 8 Ahau 13 Pax of Maya chronology, approximately 290 A.D. See page 201

The Ruins of Tuloom, Yucatan

THE RECORD OF A VISIT OF THE CARNEGIE INSTITUTION CENTRAL AMERICAN EXPEDITION, 1916, TO AN IMPORTANT BUT LITTLE KNOWN ANCIENT MAYA CITY. TULOOM HAS BEEN INACCESSIBLE SINCE 1848 BECAUSE OF INDIAN HOSTILITY

By SYLVANUS GRISWOLD MORLEY

Illustrations from photographs and drawings by the Expedition

THE ruins of Tuloom¹ on the eastern coast of the peninsula of Yucatan have long held a peculiar interest, not to say allure-ment, for the student of Maya archaeology. Perhaps no other city of this great native American civilization, which flourished during the first fifteen centuries of the Christian era in Middle America, has been invested with greater mystery, and has at the same time been less known. Only thrice since its discovery in 1842 has this inaccessible spot been visited by scientific parties, and only once—namely, last year—has an expedition succeeded in establishing itself there for more than twenty-four hours.

The first European notice of Tuloom seems to be that in the itinerary of the voyage of Juan de Grijalva to the coast of Yucatan, in 1518, written by the chaplain of the expedition, Padre Juan Diaz. In this itinerary, which naïvely refers to the "Island of Yucatan," mention is made of a large city on the east coast, which can hardly have been other than Tuloom: "We ran along the coast a day and a night, and the next day toward sunset, we perceived a city

or town so large that Seville would not have appeared more considerable or better. A very large tower [probably the Castillo] was seen there, and on the bank there was a crowd of Indians, who carried two standards which they raised and lowered to signal us to land, but the commander did not wish it."²

The first modern notice of the site was that of the American traveler Stephens in 1842, which, as far as general knowledge was concerned, had all the value of actual discovery. This intrepid explorer with his *fidus Achates*, the English artist Catherwood, visited Tuloom, coming thither in a small open boat from the island of Cozumel.

The results of his visit were given to the world in his highly entertaining *Incidents of Travel in Yucatan*,³ which (together with the companion volume *Incidents of Travel in Central America, Chiapas and Yucatan*) yet remains, after the lapse of more than three-quarters of a century, the classic on this region.

He published a map of the site, together with Catherwood's splendid drawings of the principal buildings.

¹ The spelling "Tuluum" is to be preferred on etymological grounds, but "Tuloom" is the generally accepted spelling. Luum in Maya means "land" or "earth"; and tu, "in" or "to" with the possessive pronoun of the third person. Tuluum may mean "In his or its land," a not inappropriate name for a coast city.

² *Recueil de Pièces Relatives à la Conquête du Mexique. Voyages, Relations et Mémoires originaux pour servir à l'histoire de la découverte de l'Amérique*. Vol. X, p. 11. H. Ternaux Compans.

³ John Lloyd Stephens, *Incidents of Travel in Yucatan*. Harper & Brothers, New York, 1843. Chapters XXI and XXII.

His description is close, and, as far as it goes, conveys an adequate impression of what he saw, and it must be admitted he missed but very little. He was the first to describe the hieroglyphic monument (Stele 1) found broken into fragments on the floor of Temple 7, to secure photographs and drawings of which was the especial object of the Carnegie Institution Expedition to Tuloom last winter.

In 1848, a few years after Stephens' visit, the so-called "War of the Castes" devastated Yucatan. The Maya Indians, goaded to desperation by three centuries of abuse and misrule, rose against the *hacendados*, or planters, and drove them from the plantations and villages throughout the country into Mérida, the capital of the state.

After the planters had succeeded in quelling this sanguinary revolt, many of the Maya fled eastward into the uninhabited parts of the peninsula along the east coast, and settled in the region around Tuloom, whither the whites dared not follow them. Here they have maintained themselves in virtual independence ever since. Even under the iron rule of Diaz, this section of Mexico, the territory of Quintana Roo, was never brought under effectual control by the federal government, and the Mexican garrison maintained at the territorial capital, Santa Cruz de Bravo, was practically in a state of siege. Only large bodies of troops could move through the bush with safety, stragglers being slaughtered without mercy. For this reason the ruins of Tuloom have been closed to investigation for the past seventy years, and to this same reason also is doubtless due the atmosphere of mystery and romance which has grown up around the site.

The Field Columbian Expedition of 1895 was deterred from visiting the site, although Mr. William H. Holmes secured several drawings of the principal temple, from the yacht "Ituna," which was put in close to shore for this purpose.¹ Indeed, as recently as 1914, the local Mexican authorities at Santa Cruz de Bravo prevented members of the Peabody Museum Central American Expedition for that year from visiting the site, giving as their reason the hostile character of the Indians.

The first scientific expedition to visit Tuloom since Stephens' time was that under Dr. George Howe, of the Peabody Museum, in 1911. Dr. Howe and his companion, Mr. William D. Parmelee, made the journey from Progreso, the port of northern Yucatan, to the island of Cozumel, on a Mexican gunboat, and thence by a sailing vessel of small tonnage to Tuloom. He was at the ruins only parts of two days, and then, having seen supposed Indian signals—a fire on shore at night, and during the day a white flag waved inland in the direction where the Indian village was supposed to lie—his party became convinced that an attack by the Indians was imminent, and made immediate preparations for departure. These hostile demonstrations largely prevented Dr. Howe from carrying out an extended study, and with the exception of a few rather inadequate photographs and such hasty observations as he was able to make in the limited time he was there, little was accomplished in furthering the general knowledge of the site.

Dr. Howe's most valuable contribution was the reading of the date on the

¹ William Henry Holmes, *Archæological Studies Among the Ancient Cities of Mexico*, Field Columbian Museum, Publication 8, Anthropological Series, Vol. I, pp. 75-78, figs. 23 and 24.

hieroglyphic monument discovered by Stephens in Temple 7. This he deciphered as "9.6.10.0.0 8 Ahau 13 Pax," of the Maya chronological era, which in the writer's correlation of Maya and Christian chronology corresponds to 290 A.D. Unfortunately his photographs of this important monument were very indistinct, and his reading for this reason remained open to considerable doubt. The results of his visit to Tuloom were published in the *American Anthropologist* for December, 1911.¹

In 1913 the writer and Mr. J. L. Nusbaum paid a very brief visit (five hours) to the ruins in behalf of the School of American Archaeology. The journey was made in the same way as that of Dr. Howe two years earlier, and its results were even more unsatisfactory. The dory in which the writer's party landed was capsized in the heavy surf which always pounds the Tuloom beach, and all but five of the photographic plates were ruined. Happily, however, every one of these resulted in a brilliant, clear negative.

A more serious matter was the failure to locate the hieroglyphic monument first reported by Stephens and later by Howe, which had been the primary



The east coast of Yucatan from Tuloom to Cape Catoche is dotted with ruins of small temples. Some of these doubtless correspond with "the three large villages distant some two miles one from the other," consisting of "a great number of stone houses, some towers very high, and many houses covered with thatch," mentioned by the chronicler of the Grijalva expedition of 1518



Off the coast at Tuloom a reef, about a quarter of a mile out, extends for a long distance north and south. Over this in rough weather booms the sea, making itself heard for some distance inland. Within the reef the water is comparatively calm, and here the "Corozal" lay at anchor with her fires out while the expedition was exploring the ruin

object of the visit. Not until many months later, after he had returned to the United States, did he learn that

¹ The Ruins of Tuloom. *American Anthropologist*, N. S., Vol. XIII, No. 4, Oct.-Dec., 1911, pp. 539-550.

Dr. Howe had removed this monument to the beach north of the principal temple.¹

The past field season (1916) seemed especially favorable for visiting this little-known but highly interesting center of aboriginal population, a com-

transferred from Santa Cruz de Bravo in the interior to Payo Obispo on the shores of Chetumal Bay, and the old capital with all its improvements had been turned over to the Indians, thus settling an old controversy. Again, the writer was at Belize, much the best



The rugged outline of the bluff at Tuloom and the surging surf at the base. Above rises the Castillo, the "very great tower" of Padre Diaz' early sixteenth century description, pricked out in striking silhouette against the sky. All modern nautical charts give this tower as a prominent landmark, visible for many miles

bination of unusual factors making the moment peculiarly opportune for the attempt. To begin with, for the first time in many years, the Mexican government had reached a friendly understanding with the Santa Cruz Indians; the capital of Quintana Roo had been

¹ Since the foregoing was written a letter from Mr. Lothrop, at Belize, British Honduras, states that the Tuloom stele has probably been lost. A small sailing vessel from Cozumel, commissioned to bring out the monument, has apparently gone down in a great storm that swept the coast of Yucatan.

point of departure for visiting Tuloom, with an unusually complete field equipment; and finally, the staff of the expedition was sufficiently large, including five investigators and assistants, to insure a fairly adequate preliminary study of the site in a minimum of time—the latter not an inconsiderable factor in spite of the recent "peace negotiations." The dry season was at its height; in short, all factors com-

bined to make the moment ripe for the attempt.

A small steamboat, the "Corozal," of about forty tons, was chartered in Belize with a crew of ten, and these with the expedition staff and servants made a total of seventeen on board. The "Corozal," in palmier days, several

tion consisted of the writer; Mr. A. W. Carpenter, the photographer; Dr. G. Underhill, the physician; and two collaborators, Dr. T. Gann, Chief Medical Officer of British Honduras, and Mr. S. K. Lothrop, of Harvard University.

The expedition sailed from Belize on March 19 and two days later anchored



The breakers run high at Tuloom. The beach slopes gently so that our dory was brought within a hundred feet of the land. Here the boys took the baggage of the expedition on their shoulders and waded ashore

decades earlier, had been a tugboat in the United States. Having outlived her usefulness, or perhaps better her "safefulness," in this country—it was understood she had been condemned here—she had been sent to Belize for use in the coastwise shipping trade. Her pilot assured the writer that, "Thirty years ago when she had a gold h'eagle h'up for'ards she were a good boat!" The staff of the expedi-

tion had been uneventful except for the complete and scientific demonstration that the "Corozal" could not under any circumstances do the nine knots an hour her owner generously and optimistically accredited her. The truth was that by crowding her boilers beyond a reasonable margin of safety and with the current in her favor, she managed to limp along at six.



Panorama of Tuloom, looking eastward toward the sea.—The city as it might have appeared some five hundred years ago, if viewed from an aeroplane. Such a view today, however, would show only the unbroken top of the dense tropical forest in which the crumbling buildings now lie buried. The enclosure comprises about twenty-two acres, wherein are scattered a score of temples. The chief sanctuary, at once the religious and architectural center of the city, dominates the entire space, other buildings being grouped to accentuate further its importance

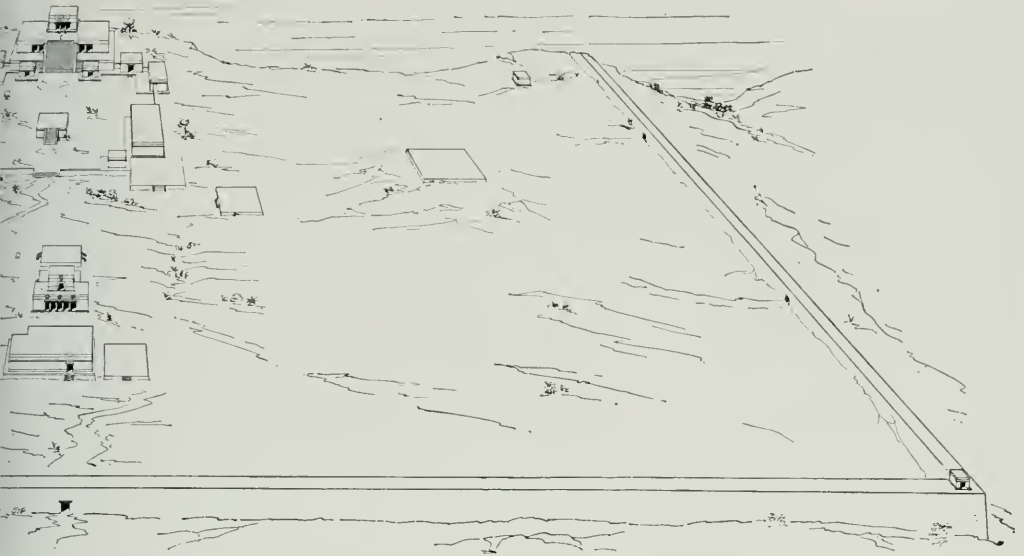
The ruins of Tuloom are located on a bluff overlooking the Caribbean Sea. The principal buildings—probably the civic and religious center of the city—are surrounded by a wall. The wall forms three sides of the enclosure, the fourth side being the precipitous and in many places unscalable bluff fronting on the sea. The area within the walls is fifteen hundred feet long (north and south), and six hundred and fifty feet wide (east and west). It comprises about twenty-two acres, and is now completely overgrown with a dense tropical bush, which hides one building from another.

The wall is an interesting and almost unique feature, there being but one or two others known in all Maya cities.¹ It is rudely constructed of unsquared

stones, and is of varying thickness and height owing to the rolling nature of the ground. The top is generally level, and sufficiently wide, in places, for four men to walk abreast. The average height is from ten to fifteen feet. The three sides are pierced by narrow passages, the one toward the eastern end of the north wall having an offset in it, which must greatly have facilitated its defense.

The two corners are surmounted by small towers twelve feet square, each containing a single room entered by three doorways. Against the back in each is a small altar. This wall, the most extensive construction at Tuloom, has given rise to much speculation. What was its function? Was it built for defense or to enclose a sacred precinct? Both explanations have something in their favor, but a combination of the two probably more nearly explains its function. While built proba-

¹ Mayapan in northern Yucatan was a walled city. Possibly Tenampua, Honduras, and Santa Cruz Quiche, Guatemala, may have had defensive walls, although nothing so extensive as those at Tuloom and Mayapan.



At the height of the glory of Tuloom, the glistening white buildings with their barbaric mural paintings, standing out clearly against the dark green forests of the seaward slope, the crowds of gaily dressed natives thronging the shore, and the brilliant blue of the Caribbean Sea stretching between, so impressed Padre Diaz, the priestly chronicler of the Grijalva expedition, that he was moved to write that his beloved "Seville would not have appeared more considerable or better." *Panoramic sketch by Mr. S. K. Lothrop*

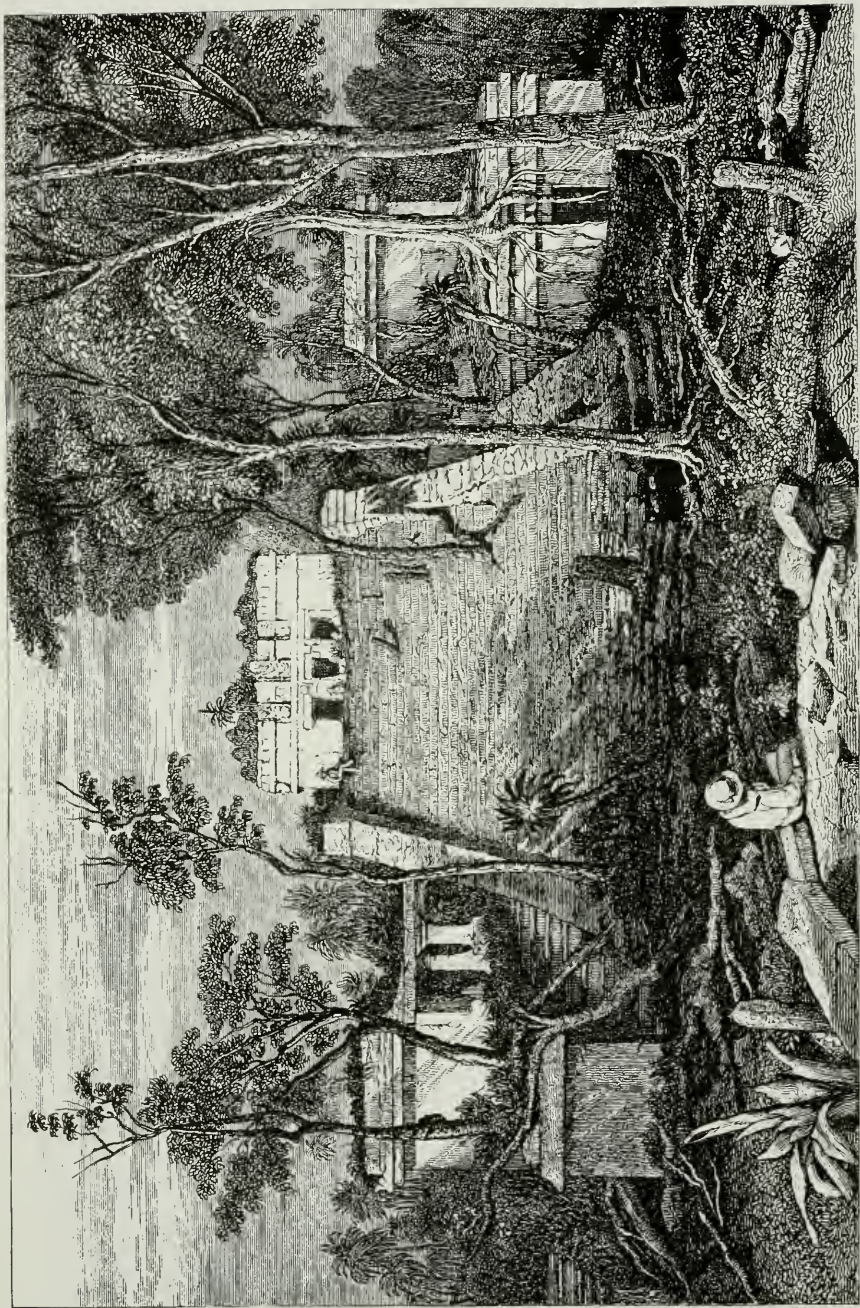
bly primarily to enclose the temple area, its admirable defensive possibilities can hardly have been overlooked, and would appear to have been intensified by the use of narrow offset passageways and watchtowers.

Within the walls are scattered a score or more of buildings, and there are perhaps half as many, although smaller, hidden in the bush outside. The ground rises gently from the southwest corner of the enclosure to the top of the bluff along the sea. The principal temple, the so-called "Castillo," surmounts this crest facing toward the enclosure, that is, away from the sea. This is an elaborate construction on three different levels, the two-room building on top, probably the chief sanctuary of the city, being approached by a broad steep stairway. The flanking structures on either side are symmetrically arranged with reference to the central part, and present a number

of interesting features, such as columns, wooden lintels, stucco figures, faces, animals, and mural paintings.

The architecture of Tuloom is distinctly of a late and debased period. Stylistically considered, the greater part of the structures now standing probably dates from after 1200 A.D. when the Maya had all but lost their ancient cunning. The building blocks are not even squared or faced,¹ as the walls were finished with a hard plaster coat. While the latter is doubtless true of other great Maya cities both of the Old and New Empires, that is, of the south and north respectively, elsewhere the building blocks are both squared and faced. The Tuloom masons, on the other hand, were slovenly and depended upon the plaster finish to cover up the more glaring faults of their

¹ Mr. Lothrop noted a possible exception in the walls of Temple 30, where the blocks appear to have been both squared and dressed.



THE CASTILLO IN 1842

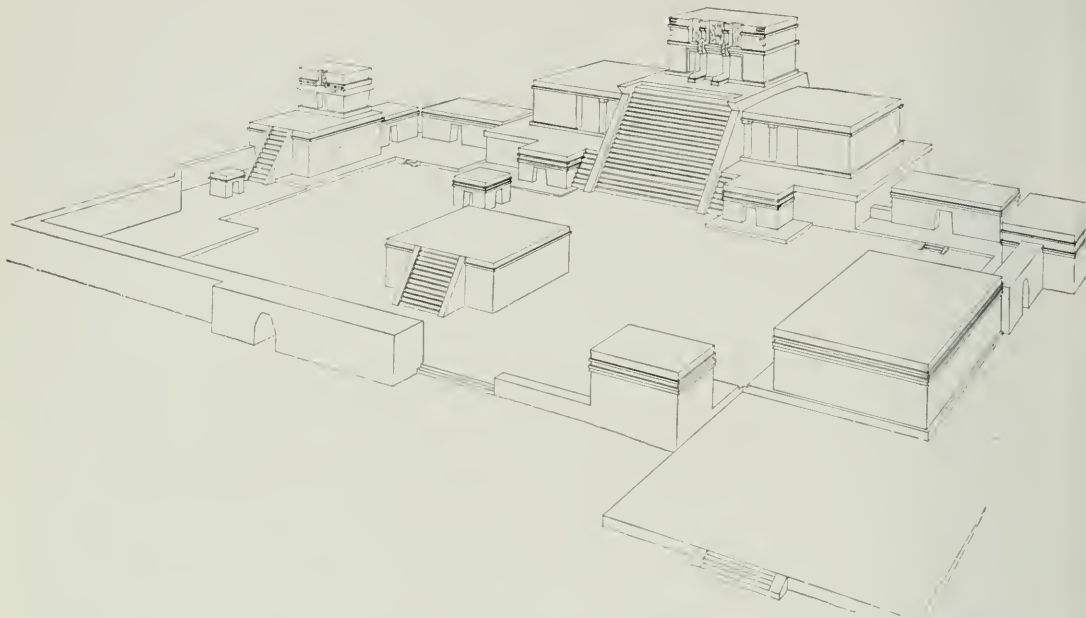
"The steps, the platform . . . and the whole area in front were overgrown with trees . . . which, with their deep green foliage and the mysterious buildings around, presented an image of a grove sacred to Druidical worship. . . . A few of the trees . . . appear in the engraving, and one is left growing . . . with its gnarled roots binding the front wall and obstructing the doorway, but no words and no drawing could convey a true idea of the solemnity of its living shroud, or of the impression made upon us when the ring of the axe first broke the stillness." From Stephens, *Incidents of Travel in Yucatan*

THE CASTILLO IN 1916

The chief agent responsible for the destruction of the ancient Maya cities is not the hand of man, disastrous as that has been, but the mighty strength of an irresistible vegetation. Large trees, striking their powerful roots deep into the foundations of temple or palace, literally rend it stone from stone, the masonry collapses, and disintegration follows.

This photograph shows the extent of the destruction wrought in the past seventy-five years. The cornice of the main temple, the balustrades and stairway appear to have lost a few stones, but otherwise the Castillo looks much as it did in Stephens' time





Drawing to show partial restoration of the principal temple group at Tuloom



This near view of the Castillo shows the feathered serpent columns, a late development of Maya art, portraying the rattlesnake, and probably introduced from the Mexican plateau sometime after 1200 A.D. The big block at the base is the head, the column itself is the plumed body, and the capital with its upward extension, the rattles. This type of column reached its highest development at Chichenitza, some sixty miles to the west of Tuloom

stonecutting, all of which was done with stone tools.

All walls, both exterior and interior, were originally treated with painted decorations. In some places, particularly on interior walls, these paintings have been partially preserved. The subjects depicted are the different deities of the Maya pantheon in acts of sacrifice. The famous red hand found by Stephens at so many places in Yucatan frequently occurs here. Dr. Gann made a number of tracings of these wall paintings, although in the limited time available it was possible to undertake little more than a beginning upon this important work.¹ Stucco was extensively employed in facade decoration. Discs, rosettes, and scrolls adorn the medial cornices and sometimes serpent or grotesque heads are used in

the upper zones. The most elaborate development of stucco work is the large human figures in the niches over the exterior doorways. These stand three feet high, and probably represent the principal Maya deities. About half of them are in a diving posture, that is,

¹ In the accompanying color reproductions, the background color, a deep purplish red, has been omitted in order to simplify the designs. In the originals the black outlines and the more delicate pale blue decorations are almost lost against the solid darker color of the background.

the feet are elevated above the head, with the arms together under the chin.

Several buildings show different periods of construction, and careful study would doubtless develop different periods of building activity throughout the city.

The hieroglyphic monument was found where Dr. Howe had left it on the beach, and its inscription was drawn and photographed. His reading of the date, "9.6.10.0.0 8 Abau 13 Pax," approximately 290 A.D., was verified, thereby developing an exceedingly complex problem. The occurrence of such an early date as 290 A.D. at such an obviously late Maya city as Tuloom is difficult to explain. Geographically, architecturally, stylistically, and historically considered, Tuloom is a thousand years later than the date on



Human figures in stucco adorn the niches over the doorways of the principal temples at Tuloom. Some are erect, others are in a diving posture. They probably represent the principal deities worshiped at the place

this monument. Indeed, barring this one early date, there is nothing at Tuloom to connect it with the Old Empire; on the contrary, its location, art, and architecture strongly indicate that it is to be referred to the close of the New Empire, probably after 1200 A.D.² This

² Dr. Gann, who has published tracings of wall paintings at Santa Rita Corozal that show a strong Nahua influence, probably felt subsequent to 1200 A.D., declares that the Tuloom and Santa Rita frescoes are very similar in treatment.

question is an important one, and further work will be necessary here before the apparent anachronism can be satisfactorily explained.

By specialization of work, it was possible to gather in four days sufficient data for a preliminary report on the site. Mr. Carpenter devoted himself exclusively to the photographic record, which involved considerable clearing. Dr. Gann spent all his time copying the mural paintings, while Mr. Lothrop made the observations for the map, ground plans, and elevations, and drew an excellent panorama of the site. The

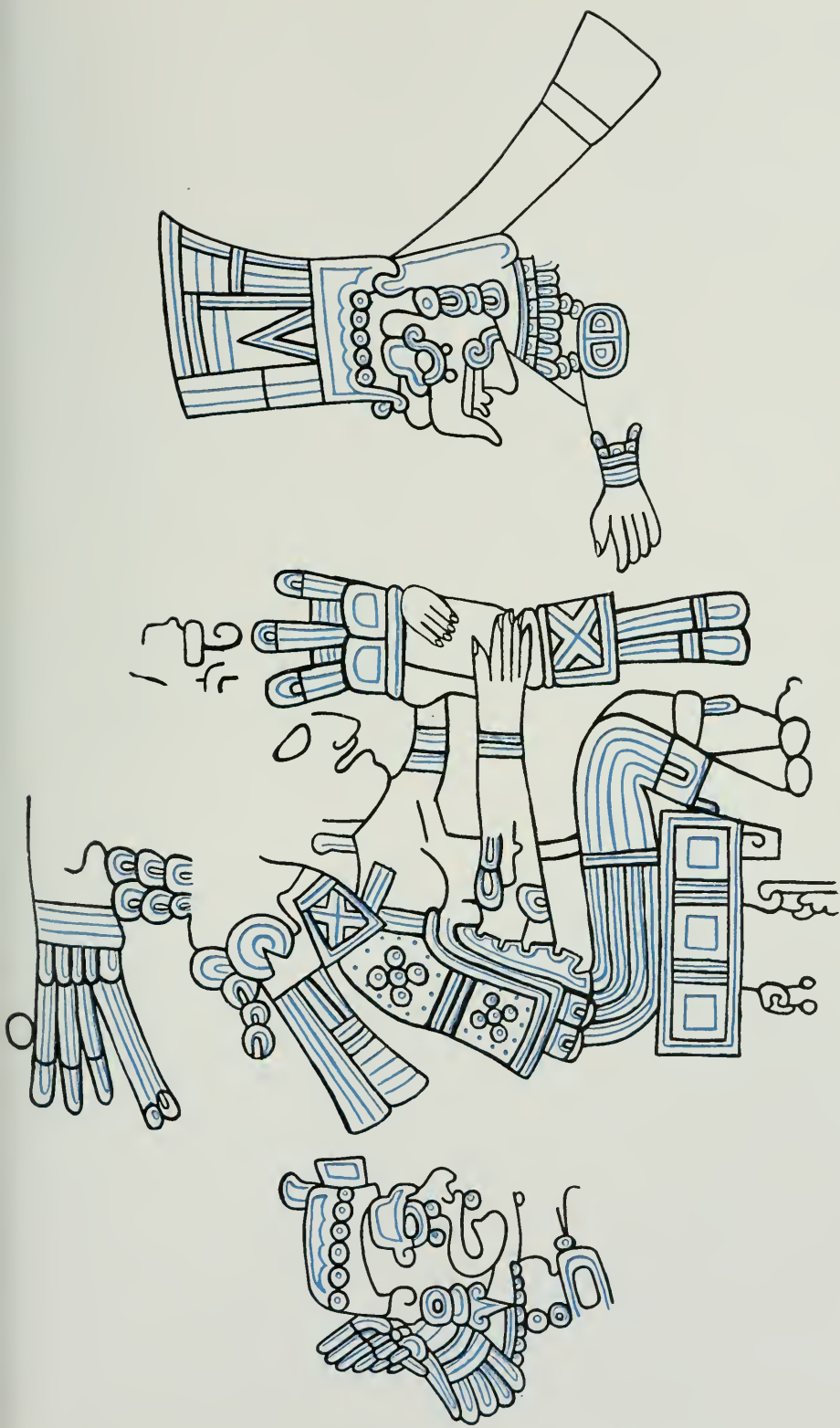
writer copied the inscription on the monument, drew the figure, and made the general archæological notes on the site. Dr. Underhill remained on the "Corozal" to watch the crew. These cowardly fellows, with but one exception, flatly refused to leave the boat, and spent the days and nights in discussing the "Indian peril," which was never acute. Dr. Gann and the writer slept on shore four nights without any untoward interruptions. Evidence of recent Indian visits to the ruins, however, was not wanting—meat-slings, broken turtle-eggs, and candle-drippings being found in several of the buildings.

But at last work was over, and the moment for leaving the ruins had come. With profound regret all bade good-by to this romantic spot, so replete with memories of another time and people. Our incursion was but transitory, our noise of occupation, fleeting; and again the crumbling temples were left to the solitude of the bush, and its all-engulfing vegetation.

The "Corozal" weighed anchor, and put out past the reef to open sea. A norther was raging outside, and for the next twelve hours it was doubtful whether or not the ancient craft would weather the storm. Huge waves crashed over her bows, and all but beat her to the bottom. She lost her copper sheathing and when within some ten miles of Belize, her coal gave out. Fortu-



"Temple 16" contains the best preserved wall paintings at Tulum. These are on the inner walls of the outer corridor of the first story, and portray the deities of the Maya pantheon in acts of sacrifice. Niches over the doorways are filled with representations in stucco of the human figure. This temple shows several different periods of construction. Before a good photograph could be obtained, the roof of the first story had to be cleared of its screen of riotous vegetation



THREE DETAILS OF MURAL PAINTINGS IN "TEMPLE 16"

The large full figure in the center holds in his hands a baton, which seems to have been the chief emblem of divine authority at Tuloom, since it is carried by most of the deities in the wall paintings. The head to the right represents one of the leading members of the Maya pantheon, a god associated with rain and fertility. The head to the left is that of Itzamna, the sun deity, patron of the calendar, chronology, and hieroglyphic writing. In the Tuloom wall paintings the figures are outlined in blue and black against a purple background

nately the sea had fallen sufficiently to enable the crew to put off in the dory to a key nearby where mangrove wood was

cut, and with scarcely enough fires to keep steam up, she crept into Belize one morning, after an absence of eight days.



This small temple, standing a few hundred yards outside the walls to the north, presents a feature common in Maya architecture—namely, the roof comb, a wall purely decorative in purpose and usually embellished with an elaborate design in stucco

On the coast of Yucatan,¹
As untenanted of man
As a castle under ban
By a doom,
For the deeds of bloody hours,
Overgrown with tropic bowers,
Stand the teocallis towers
Of Tuloom.

One of these is fair to sight,
Where it pinnacles a height;
And the breakers blossom white,
As they boom
And split beneath the walls,
And an ocean murmur falls
Through the melancholy halls
Of Tuloom.

Here are corridors, and there,
From the terrace, goes a stair;
And the way is broad and fair
To the room
Where the inner altar stands;
And the mortar's tempered sands
Bear the print of human hands,
In Tuloom.

We are tenants on the strand
Of the same mysterious land.
Must the shores, that we command,
Reassume
Their primeval forest hum,
And the future pilgrim come
Unto monuments as dumb
As Tuloom?

¹ These stanzas are from the poem "Tuloom," by Erastus W. Ellsworth, 1855

The Eulachon—and its Kindred

A DELICIOUS FOOD FISH WHICH, BY ITS ABUNDANCE AND
CONSEQUENT LOW MARKET PRICE, IS MAKING
“A NICK IN THE HIGH COST OF LIVING
IN THE NORTHWEST”

By DAVID STARR JORDAN

THE finest food fish in the world, tender, fragrant, digestible, is the eulachon (*Thaleichthys pacificus*), known to the trade as the “Columbia River smelt.” It belongs to the smelt family (Argentinidae), but it differs widely in habit and substance from the two species of smelt found on the two shores of the North Atlantic, and its nearest relative is the capelin of arctic and subarctic waters.

The eulachon has much smaller scales than the true smelt. Its flesh is more tender, more substantial, and at its best extremely full of oil, but this oil, unlike that of the mackerel and the salmon, is very delicate, and very easy of digestion.

The eulachon is a slender fish, dusky olive in color, about eight inches in length. It is found on the Pacific Coast from Sitka to Monterey Bay, entering the mouths of the rivers to spawn in midwinter, and not going far out to sea at any time. The spawning males have little warty edgings on the scales, making them velvety to the touch. The eggs are very small and white, deposited by the thousand between tide marks on the sand of the river mouths. Just now, February, 1917, the beaches at the mouth of the Columbia are lined with these fishes. They can be shoveled up and shipped in boxes; they sell at three to five cents a pound in Portland. These are spent fish. Probably they would die, even if put back into the sea. Whether any sur-

vive the spawning act is uncertain. To die after spawning, the protoplasm in the cells being exhausted as in a dead cornstalk, is a common attribute of many fishes in the Pacific. The six species of salmon, the Japanese icefish (*Salangichthys*), and the capelin (*Mallotus*), all perish after the first sex impulse. For this reason, the eulachon is at its worst when it comes into the market, soft, mealy, and with scanty oil. Even then, no fish is better, and at the ruling prices it makes a nick in the high cost of living in the Northwest.

It is said that when a eulachon is at its fattest, in the fall, a wick can be drawn through the body and it will burn like a candle. Hence it has been called in books (nowhere else) “candle-fish.” The Indians of southern Alaska carve vats in the rocks, fill them with eulachon, and with hot stones try out the oil, which they greatly appreciate. But the oil extracted from rotting fish has an odor of its own which it takes a hardened Indian to appreciate.

The Indian name of the fish, as I have heard it among the Chinooks, I should spell “oulehn.” But one of the early explorers wrote this same word “eulachon,” which is quite pronounceable and has a Greek look, and this name should be kept, not lost in the expressionless “Columbia River smelt.” The species was first named by Sir John Richardson in the *Fauna Borcali-Americana*, in 1836. But in the notebook of William Clark of the Lewis-

Clark Expedition about 1805, we find this memorandum, accompanied by a fair pen sketch of the fish:

"I think them superior to any fish I ever tasted, even more delicate and luscious than the white fish of the Lakes which have heretofore formed my standard of excellence among the fishes. I have heard the fresh anchovy much extolled but I hope I shall be pardoned for believing this quite as good. The bones are so soft and fine that they form no obstruction in eating this fish."

The capelin (*Mallotus villosus*) is very much like the eulachon, a little larger in size, and in the males some of the scales in rows, are produced, making the whole surface of the fish woolly to the touch. This is a northern fish, native to Greenland, Siberia, and Alaska; and to the Indians and the Eskimos, both in Greenland and Alaska, it is of the greatest food value. It spawns in the surf, and the falling tide leaves it by the million on the islands of southern Alaska. It lines the beaches in summer as the eulachon farther south does in the winter. But the eulachon chooses the river mouths while the capelin is satisfied with any sandy beach.

The little icefish or whitebait (*Salangichthys*) of the rivers of Japan runs in the summer time in the streams. It is a small, tender, translucent creature not three inches long, but it has the salmon habits, and the delicate flavor of the smelt. We suppose this to be its life history, although the details are not proved. It runs in the summer and casts its spawn in the brooks. The young fish slip down to the sea in the fall, tail-foremost, "in the old salmon fashion," and, as we believe, they return the next summer to spawn and die. If this be true, it is an annual fish, each generation renewed each year from the eggs of the one before.

Another little transparent "smeltling" is the New Zealand whitebait (*Retropinna*). This is now largely canned as a food product, the flavor of the preserved flesh being excellent.

Of the true smelt (*Osmerus*), with large loose scales and sharp teeth, Europe has one species (*Osmerus eperlanus*), and eastern America another (*Osmerus mordax*). The North Pacific is better supplied. One species (*Osmerus thaleichthys*) is common in California. A larger and finer one, the surf smelt (*Hypomesus pretiosus*), spawns in the surf northward, and the pond smelt of Alaska (*Hypomesus inghaghitsch*) spawns in brackish ponds northward. The rainbow smelt (*Osmerus dentex*) is common in the north, and a species large and rare (*Osmerus albatrossis*) lives near the surface in the open sea. Another, with feebler teeth (*Spirinchus verecundus*), clings to the streams of Korea.

None of these is so remarkable as the fur seal smelt (*Therobromus californini*), in the open sea about the Aleutian Islands. Of this dainty little fish no naturalist has ever seen a perfect specimen, but the tender bones have been taken by the thousand from the stomachs of fur seals feeding out in the sea. Dr. Frederic A. Lucas has made a restoration of this animal as if it were a fossil.

Other fish of the smelt kind, *Microstoma* and *Nansenia*, are found in the deep seas of the Arctic, and still others, called *Argentina*, in deep waters farther south. The whole group seems to be an offshoot of the trout and salmon race, carrying the adipose fin, the badge of all that race, as well as of the wholly unrelated race of the catfishes. This fin is probably a remnant of a once continuous fin-fold which existed before it was stiffened up with fin-rays.



Modern pampas deer [From Lydekker's *Deer of All Lands*]

A Fossil Deer from Argentina

WITH A DISCUSSION OF THE DISTRIBUTION OF VARIOUS TYPES
OF DEER IN NORTH AND SOUTH AMERICA

*Skeleton in the American Museum of an extinct species of deer
from the Pampean formation of Argentina*

By W. D. MATTHEW

AMONG the gems of the Cope Pampean Collection is a nearly complete skeleton of the fossil deer, *Cervus* (*Blastocerus*) *pampæus*. It was found in the Pampean formation near Buenos Aires by Florentino Ameghino nearly forty years ago, and was among the many buried treasures found among Professor Cope's collections. This handsome deer was a contemporary of the various strange extinct types of the Pampean fauna of Pleistocene age, of the great ground sloths, toxodonts and *Macrauchenia*, but it is a close relative of the living pampas deer *Blastocerus bezoarticus*, and indeed is barely to be distinguished from it. Like the pampas deer, the antlers are three-tined in the full-grown buck, and have neither "brow tine" nor "sub-basal suag."

This skeleton is probably unique. At all events I have not seen any description or

reference to a fossil deer skeleton from the Pampean in all the published memoirs and minor articles dealing with this remarkable fauna. Various deer remains have been described and figured, but all of them fragmentary—antlers, jaws, and the like, mostly of rather doubtful status. The species *Cervus pampæus* was originally named by Bravard, apparently from fragmentary material, but this skeleton has remained unknown to science.

The specimen was mounted in 1915 by Mr. A. Hermann, using, as a guide to form and pose, the photograph of a modern pampas deer published by Lydekker in *Deer of All Lands*. The skull had been rather crudely restored, probably at the Paris Museum for the Exposition Universelle in 1878, but many small fragments and the more delicate parts of the skull had been left unrecognized

among the fragments of the skeleton. Careful and thorough piecing has enabled us to make a much more complete and more accurate reconstruction of the skull, and to reconstruct the skeleton with but little missing

ment. They are not found in the Tertiary formations, and make their appearance first at the end of the Pliocene and in the Pleistocene (Pampean formation). They were invaders from North America, accompanied by



Fossil skeleton of extinct deer, found forty years ago in the Pampean formation near Buenos Aires, and now mounted in the American Museum. This animal was a contemporary of the great ground sloths, toxodonts, and other curious extinct creatures that inhabited South America in Pleistocene times

and practically nothing of any importance doubtful, save as to the vestiges of the side toes, of which no remains could be found although they were presumably present in the skeleton.

Geologically speaking, deer are rather recent arrivals in the South American conti-

mastodons, camels, peccaries, horses, and tapirs, and by saber-toothed tigers and other northern Carnivora. This invasion seems to have been made possible by the union of the two Americas at Panama and the raising of the isthmus to a height considerably above its present level, aided by a lowering of tem-

peratures even in the tropics, due to the oncoming glacial period. It resulted not only in a great invasion of the northern fauna into South America, but also in a not inconsiderable invasion of the native South American fauna into Central and North America. In the final outcome the invaders from the south were unable to maintain their footing and mostly became extinct, while the northern colonists in South America eventually supplanted the native fauna in great part. To-day the only remains of the southern mammal fauna are a few edentates (sloths, anteaters and armadillos), a large minority of the rodents, and perhaps some or all of the monkeys, bats and opossums. The rest of the mammals are animals whose Tertiary ancestors lived in North America but not in South America.

Among these last must certainly be listed the deer. Yet the distribution of these ruminants is a curious one, not easily explained. In the northern half of North America range the largest and most progressive of the deer tribe, the wapiti, caribou, and moose, closely related to species of the northern Old World. Overlapping their range and stretching to the southward as far as the highlands of Central America and Colombia is the *Odocoileus* or Virginia deer group of species, with forked antlers of three or more tines, distinguished from most of their Old World relatives by the absence of a brow tine. The place of the brow tine is partly supplied by another tine known as the sub-basal snag; but its relations to the beam are different from those of a true brow tine.

Throughout tropical South America and Central America the only deer are the brockets, little fellows much smaller than the Virginia deer and with simple spikelike horns. Far to the southward we again meet with larger deer with complex antlers, inhabiting parts of southern Brazil and Bolivia, Chile, and Argentina south to the Strait of Magellan. These deer lack the brow tine, but unlike *Odocoileus* they also lack the sub-basal snag. In the guemals of the mountain districts the antler is simply forked; in the pampas deer the hinder fork is again divided, and in the marsh deer it is a little further complicated.

All these southern deer look a good deal like the Virginia deer group of the north, and they are in fact related to them more

nearly than to most of the Old World deer. The relationship is not so close, however, as it at first seems to be, and it has been found necessary to separate them as distinct genera, the guemals under the very unsuitable name of *Hippocamelus* (for they have nothing to do with either horse or camel), the pampas and marsh deer under the name of *Blastocerus*. These two genera might very well be united into one, but we will follow the customary usage. Their affinities to the Virginia deer are thought to be due to common descent from some smaller simpler type, pretty closely represented by the brockets (*Pudu*). (The name brocket, belonging originally to a young animal of the red deer, is applied by naturalists to these small forms which never get beyond the spike-horned stage.)

This distribution is not very easy to account for. We might suppose that the brockets first penetrated into South America and that in the far south they evolved into guemals and pampas deer, while in temperate North America they evolved into the true Virginia deer. But the paleontologic record does not seem to support this view. The earliest fossil deer of the Argentine found in the Monte Hermoso formation (late Pliocene) were already moderately large and had complex antlers, while in the Pampean (Pleistocene) they were fully as large and the antlers fully as complex as any modern types. Lydekker suggested that the brockets are degenerate descendants of Pleistocene invaders with complex antlers which were the original invaders of South America; but it is difficult to see any reason for such degeneration. Probably a better understanding of the affinities of the later Tertiary deer of North America would afford some clues, but it must be admitted that as yet these are very imperfectly understood. We do not know for certain whether the Virginia deer group arose in North America or immigrated from the Old World; it has not been positively recognized in formations earlier than the Pleistocene.

Until better evidence is obtained from the fossil record, the best clues to the derivation of these South American deer are perhaps to be found in Dr. Frank M. Chapman's researches upon the geographic and zonal distribution of the fauna, especially the bird fauna, of Colombia. These point apparently to geographic or climatic conditions during



TITIAN RAMSAY PEALE, NATURALIST AND ARTIST

From the painting in the possession of the American Museum. The description designates this painting an "Oil Portrait of T. R. Peale by himself with a little help from his brother Rembrandt"

the late Pliocene or Pleistocene which enabled animals adapted to temperate climate to cross the isthmus and penetrate into South America, and to their subsequent isolation in the mountain zones, separated from their northern relatives by a wide belt of tropical lowlands which they cannot—or at all events do not—cross. Whether this occurred through a rise of the isthmian ridge to a much higher level than at present, bringing it within the zone of temperate climate along its whole length, or through a lowering of temperature in tropical regions during the glacial stage, bringing the zone of temperate climate down near to sea level in the isthmian region, or to a combination of both factors, may be left unsettled. Some such explanation seems to be needed to account for the distribution of the Colombian birds. What would its effect be upon the mammal fauna? Naturally it would enable the late Tertiary deer of temperate North America to find their way along the highlands southward until they reached temperate South America, where they would

spread out and flourish in a congenial and extensive region. At the same time the tropical deer of Central America and the Gulf Coast would spread into tropical South America. Through the subsequent isolation the northward range of the southern types was limited, and in North America they had already been replaced by *Odocoileus*, working its way down from the north as early as the beginning of the Pleistocene, and reaching as far as Colombia before it was cut off by the climatic isolation of temperate South America.

Obviously if this be the real history of the dispersal, we ought to find in the late Tertiary of the Western States the ancestors of the guemals and pampas deer; in an older Tertiary stage we ought to find brockets, while the ancestors of the Virginia deer group should be discovered in the late Tertiary of northwestern Canada or possibly of Alaska. These are matters for future collecting and research to solve; they will provide the test for the soundness of the hypothesis here outlined.

A Forgotten Naturalist

By FREDERIC A. LUCAS

HOW many of us think of Titian Ramsay Peale as a prominent naturalist? How many of our younger men have even heard of him? The writer pleads guilty to having thought of him only in connection with the exhumation of "Peale's Mastodon," one of the first fairly complete skeletons to be rescued from the ancient elephant burying ground that lies back of Newburgh, whence have come most of our good specimens; and but for the fact that in 1915 the Museum acquired some of Peale's paintings, together with the drawings and manuscript of his projected work on North American butterflies, he would have been still further overlooked. Yet Peale was sufficiently well known to have been appointed one of the naturalists of the Wilkes Exploring Expedition to the South Seas (which extended over the years 1838-39-40 and 42), in company with James D. Dana and Horatio Hale, and was at-

tached first to the "Peacock," and after the loss of this frigate, to the "Vincennes."

Peale's scientific career began early, for when only seventeen he was elected a member of the Philadelphia Academy of Natural Sciences, and, in company with Thomas Say and George Ord, visited the Sea Islands and eastern Florida, which at that time still belonged to Spain. Immediately after this he was appointed assistant naturalist to Major Stephen H. Long's expedition to the Rocky Mountains, which added some sixty new species of birds and mammals to our known fauna, besides obtaining large and varied collections of plants and insects. Finally, in 1870, he figured as one of the founders of the Philosophical Society of Washington.

That Peale is so little known in spite of his activity and the very considerable amount of work accomplished by him, is probably due to the fact that he published

very little. His report on the zoölogy of the Wilkes Expedition was practically suppressed,¹ and for some unknown reason he was not allowed to consult the collections he had made, nor to use any of the large number of colored plates prepared by him, although later John Cassin was permitted to do both. Of a projected work entitled *Lepidoptera Americana*, only a single part was issued, in 1833; while his *Lepidoptera of North America* was never completed. This manuscript, with its accompanying volumes of plates, is among the material secured by the American Museum, through the interest of its librarian, Dr. R. W. Tower.

An excellent portrait of Peale is one of the most important of the paintings secured by the Museum, the others being sketches made during the course of the Wilkes Expedition. The paintings intended for plates in the *Lepidoptera of North America* are admirably done, and in many cases portray the various stages in the metamorphosis of the insect. The text was to be very comprehensive and to pay especial attention to habits—a branch of zoölogy still sadly neglected. Too many of our younger natural-

¹ An abridged copy of this, in Peale's handwriting, is among the material obtained by the Museum.

ists seem to look upon the making of species and subspecies as the principal object of zoölogy, whereas these are merely bricks from which master hands may construct many an edifice of fact or theory.

As evidenced by this manuscript, Peale's style was interesting and had the literary flavor that is too often lacking in modern zoölogical papers—another too common mistake being to think that, because a paper is full of little-known technical terms, it is necessarily scientific.

Those who look in encyclopedias for information in regard to Titian Ramsay Peale will find little more than that he was the fifth and youngest son of Charles Willson Peale, a man a century in advance of his time. Rembrandt Peale, another son, is deemed worthy a place in encyclopedias, but the records omit mention of other members of the family.

Dr. Witmer Stone, of the Philadelphia Academy of Sciences, who has rescued many interesting facts from undeserved oblivion, has written a biography of Titian Peale; also a brief sketch of his life and works, written by his relative, A. C. Peale, will be found in the *Bulletin of the Philosophical Society of Washington*, Vol. XIV, pp. 317-326.

Museum Notes

SINCE the last issue of the JOURNAL, the following persons have become members of the Museum:

Fellow, LOUIS T. HAGGIN.

Life Members, MRS. WILLIAM H. CROCKER, MRS. FREDERIC S. LEE, and MESSRS. R. CLIFFORD BLACK, GEORGE A. CROCKER, JR., WILLIAM LOUIS GARRELS, IRVING B. KINGSFORD, ALFRED F. LICHTENSTEIN, MALCOLM S. MACKAY, EDWARD MALLINCKRODT, JR., GEORGE D. ROSENGARTEN, VALENTINE P. SNYDER, and BENJAMIN L. WEBSTER.

Annual Members, MRS. J. C. BERNHEIM, MRS. RANSOM S. HOOKER, MRS. ROGER W. STRAUS, MISS META EILERS, and MESSRS. CHARLES D. BARRY, MORTON G. BOGUE, W. ASHLEY DEWOLF, JOHN H. FLAGLER, STEPHEN B. FLEMING, EDGAR E. FRANK, ALBERT GREENBERGER, HARRY F. GUGGEN-

HEIM, CHARLES J. HARDY, J. B. HAYWARD, GEORGE C. HECK, PETER COOPER HEWITT, N. C. KINGSBURY, WILLIAM T. KOCH, ARTHUR LIPPER, STEPHEN C. MILLETT, C. E. MITCHELL, PHILIP A. MOSMAN, J. R. OGDEN, STUART H. PATTERSON, O. B. PERRY, CARROLL J. POST, JR., FORREST RAYNOR, FRANCIS J. REBMAN, ALLEN MERRILL ROGERS, SAUL E. ROGERS, WALTER E. SACHS, ARCHIBALD G. THACHER, THEO. F. WHITMARSH, and EDWARD W. WOOLMAN.

SIR ERNEST SHACKLETON was elected an Honorary Fellow of the American Museum of Natural History at the regular meeting of the executive committee of the board of trustees on March 21, in appreciation of his work in geographical research and in recognition of his splendid service to science and to humanity.

THE celebration of the centennial of the New York Academy of Sciences, which was to have been held at the American Museum of Natural History during May, has been given up on account of the critical international situation. The original plan included a week's program, with men of science from this country and abroad as guests, and special exhibits at the American Museum. In the present crisis scientists are needed at home, even if they were willing to risk getting across the water. A one day's celebration will be held, however, sometime during May. At this meeting the emphasis will be laid on working for an endowment fund, which was to have been a feature of the celebration as originally planned.

DR. SAMUEL W. WILLISTON, professor of vertebrate palæontology in the University of Chicago, and one of the world's foremost authorities on fossil reptiles, recently visited the American Museum of Natural History to study particular fossil specimens, among them the skeleton of the giant bird from the Lower Eocene of Wyoming, brought back by the field party of the Museum last summer. A reconstruction of this bird is now being made by the department of vertebrate palæontology of the American Museum.

MR. J. T. NICHOLS is spending a few weeks on the southern coast of Florida, making collections for the department of ichthyology of the American Museum.

IF war does not interfere, the anthropological department of the Museum is planning extensive work in the Southwest during the coming summer. Mr. Nelson expects to do reconnaissance work over a large area of south central New Mexico in order to complete the survey of the ancient Pueblo region in which glazed pottery occurs; Mr. Leslie Spier will extend his archaeological reconnaissance, begun at Zuñi in 1916, to the drainage of both the Little Colorado and the Gila rivers in Arizona; and Mr. Earl H. Morris, a graduate student at Columbia University, will proceed with the excavations of the famous Pueblo ruin at Aztec in northwestern New Mexico.

THE meeting for 1917 of the American Association of Museums is to take place in New York City, May 21-23, closely following the date of the meeting of the American

Federation of Arts in order to allow museum representatives from different parts of the country to attend both conventions during the same railroad journey. At the Washington meeting last May, it was suggested that the subject for consideration at the next meeting should be the "Preservation and Care of Museum Specimens," and papers on that subject may now be registered with the secretary of the association, Mr. Paul M. Rea. The American Museum of Natural History is to serve as headquarters for the meeting.

DR. BASHFORD DEAN left New York March 7 on a business trip to the Far East in behalf of the American Museum of Natural History and the Metropolitan Museum of Art. He went by way of Vancouver, stopping along the route at several points to deliver lectures. His original plan included visits to Japan, China, and Australia, but the war situation has curtailed this to a brief stay in Japan, with a return to New York about June first.

ON March 26, Mr. Alessandro Fabbri, in collaboration with Mr. Charles F. Herm, both of the department of physiology of the American Museum, exhibited to the scientific staff of the institution a new film on the embryonic circulation of the chick. The pictures showed a heart at so early a stage in the development that it was transparent, which, by its rhythmic contractions, forced the blood into the adjacent arteries; an isolated heart from an eight-day-old embryo, beating rhythmically outside the body planted in a tissue culture; and a minute section from the same heart growing in normal plasma. One could see the circulation in the body of the young embryo, and again in the large vessels which bring oxygen and nutrition from the yolk area; also the fine anastomoses between two blood vessels—nature's method of feeding the tissues in case one of the regular supply channels is cut off. Particularly remarkable was the demonstration of rapid circulation in the arteries and slower circulation in the capillaries. Mr. Fabbri also showed a series of motion pictures on the formation of crystals by evaporation. These microcinematographs will be of the greatest educational value in presenting graphically to high school and college classes some of the details of biological science.

DR. FRANK M. CHAPMAN was elected an honorary member of the British Ornithologists' Union, at the annual meeting of the society, held on March 14, in London. The membership of the Union, according to its printed rules, includes "ordinary members," elected by ballot of the society; not more than ten "honorary members," to be recruited from eminent ornithologists residing abroad; "colonial members" from the British Colonies and India, also not to exceed ten; and "eminent foreign ornithologists," not to exceed twenty. Before his election as an honorary member, Dr. Chapman had been one of the twenty in the last-mentioned group.

THE bay of Rio de Janeiro, Brazil, shown on the cover of the present JOURNAL, is one of the most beautiful in the world. Tall, barren rocks rise from the bottom of the ocean, and tower above the waves, like giant monoliths. One of them, the famous Pão d'Azucar, or Sugar Loaf Rock (at the right in the picture), attains a height of twelve hundred feet, and from its top, reached by means of an aerial cable car, one has a splendid view of the surrounding country. All ships entering the harbor must sail through the narrow passage in the center. A number of forts, some of which are clearly shown in the picture, protect the entrance and the approach to it. On the opposite side of the bay rise the Organ Mountains, one of the oldest ranges in South America. The peaks have weathered into splendid spires and pinnacles of fantastic shapes, and the entire range is much lower than in bygone ages. Dr. Frank M. Chapman and Mr. Leo E. Miller, of the South American Expedition of the American Museum, spent a short time in this region in the fall of 1916, and secured a collection which throws much light on the changing fauna of the Organ Mountains.

PROFESSOR HENRY FAIRFIELD OSBORN, president of the American Museum, has appointed an American Museum "public information committee," consisting of Dr. Frederic A. Lucas and Messrs. George E. Sherwood, George N. Pindar, and John W. Harrington. This committee will coöperate with the heads of the various departments for the purpose of supplying suitable matter for publication, regarding science and the activities of the American Museum, to news-

papers and the technical and scientific publications of the country.

AMONG recent notable additions to the library of the American Museum are six volumes on costume, *Le Costume Historique*, published at Paris in 1888 under the direction of A. Racinet. The volumes are profusely illustrated, many plates being in color. The books take up the noteworthy types of dress, but also add details on interior furnishing, utensils, conveyances, and the like. Other interesting acquisitions are *Icones Ornithopterorum: A Monograph of the Papilionine Tribe Troides of Hubner*, Volumes I and II, London, 1898, by Robert H. F. Rippon, and *British Coleoptera*, Volumes I to VI, London, 1887 to 1913, by the Reverend W. W. Fowler. The library has also acquired the *Lepidoptera Britannica* by A. H. Haworth, London, 1803, which is rarely found complete, and Volume II of *The Iconography of Manhattan Island, 1498-1909*, by I. N. Phelps Stokes, New York, 1916, a beautiful volume compiled from original sources and illustrated by photo-intaglio reproductions of maps, plans, views, and documents in public and private collections.

THE department of anthropology has acquired by purchase from P. N. Breton a fine wampum belt from the Oka reservation in Canada. This belt had long been in the possession of the fathers of the Seminaire de Saint Sulpice, of Oka, Quebec, missionaries to the Iroquois and Algonquin Indians, and is probably the record of some land cession or treaty between the Indians and the missionaries. The belt is made of regular and beautiful shell beads, which may be of Dutch manufacture, and is ornamented with crosses and other geometric designs in white beads. It is in a state of preservation unusual for specimens of this kind.

IN exchange for American reptile material for exhibition, the American Museum has recently received from the Albany Museum, Grahamstown, South Africa, a collection of nineteen frogs and toads, twenty-seven lizards, and six snakes. Most of the species are new to the collections of the American Museum, and some are rare and little known, for instance, the gecko *Lygodactylus ocellatus*, and *Natalobatrachus bonebergi*, a frog belonging to a recently described genus. The Grahamstown collection sup-

plements a similar exchange from the Durban Museum, Natal, in giving an insight into the extraordinarily interesting and varied herpetological fauna of South Africa.

THE twenty-first annual entertainment of the City History Club of New York was held at the American Museum of Natural History on the morning of Washington's Birthday. Dr. George F. Kunz, first vice-president of the club, presided. The program included selections by the orchestra of the De Witt Clinton High School, songs, historical playlets, and dances by the Catherine Abbe, Joan of Arc, Elsie Rutgers, and Colonial Dames clubs, addresses by the officers of the City History Club and by the Honorable Robert Adamson, commissioner of the fire department, a letter from President Wilson, and motion pictures of the fire department of New York and of scenes from American history from Columbus to Lincoln. The audience joined in patriotic songs.

THE Chinese and Siberian hall of the American Museum has recently been reorganized. The cases, which before stood in isolated and rather confusing positions, have been set together so that they wall in the open space in the center of the hall. Visitors may now view the whole exhibit easily by following the course of the circle of cases. The present arrangement also makes better use of the windows in the hall. The exhibits themselves have been rearranged, and much new material has been added, particularly a number of specimens from Korea and Tibet. On both the Chinese and the Siberian sides of the hall, attention has been given to the display of textiles and embroideries, in consideration of the needs of the designers who are now turning to the Museum in search of new ideas.

THE Jesup collection of building and ornamental stones of North America, consisting of over one thousand specimens, has lately been rearranged according to the kinds of stones, instead of by states as in the old classification. This collection is in part a duplicate of the very extensive series in the National Museum, which was prepared under the direction of the officers of the tenth census of the United States, and was exhibited at the Centennial Exhibition at Philadelphia in 1876.

THE department of anthropology has purchased from Mr. David I. Bushnell a

series of valuable objects, including one hundred baskets, the work of the Alibamu, Attacapa, Chitimacha, and Choctaw Indians of the lower Mississippi region. The baskets are made of a peculiar type of split reed, and are now so scarce as to be difficult to obtain. Other recent acquisitions of Indian material are a painted buffalo robe, probably from the Plains Ojibway, purchased from Mr. J. Alden Loring; ethnological specimens of the Micmac and other eastern tribes, purchased from Dr. Frank G. Speck; and a Blackfoot beaver bundle, purchased from Arthur J. Walters. The department has also purchased an unusually large and fine piece of Hawaiian tapa, a fabric which has been rendered rare by the rapidity with which the people of the Hawaiian Islands have given up their native ways.

A SPECIAL illustrated lecture for Museum members and invited guests, which attracted a large audience, was given at the American Museum of Natural History, Wednesday evening, March 28, under the joint auspices of the American Museum and the American Scenic and Historic Preservation Society. Mr. Samuel Christopher Lancaster, highway engineer and author, and a forceful and fluent speaker, delivered an address on "The Scenic Beauty of Oregon," illustrating his description with pictures from photographs taken by himself and two other enthusiastic mountain-climbers, and views made direct from nature by the Paget process. Mr. Lancaster was consulting engineer in the location and construction of the remarkable highway built by Multnomah County, Oregon, and dedicated in 1916. This highway, which extends for a distance of forty-two miles from Portland along the gorge of the Columbia River, through some of the most wonderful scenery in the United States, was characterized by General George Goethals, who passed over it in 1915, as "absolutely without equal in America for scenic interest." The purpose of Mr. Lancaster's address was to illustrate the great possibilities of scenic highways in America, when undertaken by enlightened and appreciative public authorities, as well as to depict upon the screen some of the extraordinary landscape beauties of the Cascade Range.

MR. H. E. ANTHONY has returned from the expedition to Cuba. The revolution there cut short his search for fossil mammal material, and small guerrilla bands of rebels

rendered the eastern end of the island unsafe for collecting. Fortunately, when the revolution broke out, Mr. Anthony was in a locality rich in possibilities, so that in spite of being prevented from moving about freely, he was able, by making the best of this one spot, to secure a number of desirable fossils, as well as specimens of the Cuban rat, *Capromys*, and a small collection of bats. The work was considerably furthered by the cooperation of the officials of the Spanish-American Iron Company, who gave the party free transportation on their tug and railroad. Also, the members of the expedition were made welcome at one of the mines, Daiquiri, where quarters and horses were furnished free of charge. Most of the material brought back is new to the Museum collections, and some of the fossils will probably prove new to science.

THE department of anthropology has received from Mrs. Wm. Tod Helmuth an ancestor tablet from China. The Chinese keep ancestor tablets on a shelf in the living room, and frequently put before them offerings of food and incense. These tablets are regarded with high reverence, because in them is supposed to reside one of the three souls which the Chinese believe each person possesses, while of the other two, one remains at the grave and the other goes to the unknown world of departed spirits. On account of their sacred character and family significance such relics are hard to obtain. This tablet, which is about a foot in height, is made of wood decorated with gilded carving. The central panel of the tablet bears an inscription in Chinese characters: "This is the dwelling of the soul of our maternal ancestor named Aunt Khek Ugô whose maiden name was Jap. Her dutiful son Se-choan worships."

AN important recent publication of the American Museum is *A Bibliography of Fishes*, Vol. I, by Bashford Dean, edited and enlarged by C. R. Eastman. It comprises 714 pages, and consists of references to the entire scientific literature of fishes, arranged under the names of authors from A to K inclusive. Vol. II, now preparing, will complete the references, the total number of which is estimated to be upwards of forty thousand titles. No other group of the animal kingdom has been so exhaustively

treated in a bibliographical way as are the fishes in this undertaking, which was begun by Dr. Dean twenty-five years ago, and has been steadily carried on by him, largely as a personal matter, ever since. The Museum, out of recognition of the usefulness of the work, has provided for the publication of the two volumes and of a forthcoming subject index to them.

PROFESSOR HENRY E. CRAMPTON has published, through the Carnegie Institution at Washington, the first volume of an extensive and important work entitled *Studies on the Variation, Distribution, and Evolution of the Genus Partula*. The volume just issued, which deals with the species inhabiting the island of Tahiti, is the result of ten years' study. It will be followed by other volumes dealing with the species inhabiting other Pacific islands. Professor Crampton's work is based on personal explorations and observations in Tahiti and the neighboring islands of the Society group, conducted under the auspices of the American Museum of Natural History and the Carnegie Institution of Washington, during the years 1906, 1907, 1908 and 1909, in the course of which extensive collections embracing eighty thousand specimens were obtained from over two hundred valleys in the Society Islands alone. The work was extended in 1909 to include the Cook, Tonga, Samoan, New Zealand, Fiji and Hawaiian islands. The land snails of the genus *Partula* are confined to the islands of the Pacific Ocean, and are especially abundant in the Society group, which is their geographical center of distribution. The various species of the genus exhibit a wide range of variation which is broadly correlated with their degree of isolation from the original center of distribution.

Professor Crampton has studied this genus not only with reference to individual characters, but also in connection with general biological conditions, geographical and topographical locations, and the meteorological and other external influences having a real or apparent effect on the species of the genus. Professor Crampton's volume will take its place as an important contribution to the study of problems of variation, geographical distribution, and evolution, as seen under natural conditions rather than in the laboratory.

The American Museum of Natural History

Its Work, Membership, and Publications

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

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

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

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

The educational work of the Museum is carried on also by numerous lectures to children, special series of lectures to the blind, provided for by the Thorne Memorial Fund, and the issue to public schools of collections and lantern slides illustrating various branches of nature study. There are in addition special series of evening lectures for Members in the fall and spring of each year, and on Saturday mornings lectures for the children of Members. Among those who have appeared in these lecture courses are Admiral Peary, Dean Worcester, Sir John Murray, Vilhjálmur Stefánsson, the Prince of Monaco, and Theodore Roosevelt. The following are the statistics for the year 1916:

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

Membership

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

THE AMERICAN MUSEUM JOURNAL

The various Classes of Resident Membership are as follows:

Annual Member	(annually)	\$10
Sustaining Member	(annually)	25
Life Member		100
Fellow		500
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HERMIT THRUSH AND YOUNG

The hermit thrush is a rare and shy forest bird, living in remote swampy places in the eastern United States.

"A strain has reached my ears from out the depths of the forest that to me is the finest sound in nature,—the song of the hermit-thrush. . . . It is not a proud, gorgeous strain, like the tanager's or the gros-beak's; suggests no passion or emotion,—nothing personal,—but seems to be the voice of that calm, sweet solemnity one attains to in his best moments. . . . A few nights ago I ascended a mountain to see the world by moonlight; and when near the summit he commenced his evening hymn a few rods from me. Listening to this strain on the lone mountain, with the full moon just rounded from the horizon, the pomp of your cities and the pride of your civilization seemed trivial and cheap."—John Burroughs in *Wake Robin*.

"Sing on, sing on, you grey-brown bird,
Sing from the swamps, the recesses, pour your chant from the bushes,
Limitless out of the dusk, out of the cedars and pines. . . .
Load human song, with voice of uttermost woe."

—Walt Whitman in *Memories of President Lincoln*

— See NOTE regarding the photograph, page 280

Kentucky and Her Cave Men

FIRST IMPRESSIONS OF THE WILDERNESS MADE FAMOUS BY THE
EXPLOITS OF DANIEL BOONE, TOGETHER WITH A GLIMPSE
INTO THAT MYSTERIOUS UNDERGROUND WORLD
EXPLORED AND OCCUPIED BY EARLY
ABORIGINES OF AMERICA

By N. C. NELSON

Spurred on partly by the success of cave archæology in Europe and partly by the supposed failure of cave archæology in this country, the American Museum last summer made a preliminary investigation of a series of caverns and rock shelters in the state of Kentucky. This general locality was chosen deliberately as being well south of the limits of glaciation and in some respects similar to the regions in which flourished the cave peoples of Europe. The quest was not precisely to find America's Palæolithic man—although such a possibility could not be ignored. It was rather to ascertain whether in the caves of the Middle Mississippi country there was any trace of a relatively primitive stage of aboriginal development that might have given rise to the mound-builder culture as we know it at its best. In this the writer, who conducted the investigation, is at least morally certain that he succeeded.

In the spring of the year, after consulting with Professor Arthur M. Miller of the geological department of the State University at Lexington, two series of caves and rock shelters were inspected: one along the Kentucky River, south of Lexington, and the other along the Green River in the vicinity of the famous Mammoth Cave. This last named and the neighboring caverns were especially attractive because they had yielded valuable archaeological data for more than a century; and only four years ago the Honorable Albert C. Janin, of Washington, D. C., a trustee of the Mammoth Cave estate, generously presented to the American Museum, among other things, several choice textile specimens found in a large but less renowned cave on his property, known as the Salts Cave. The same gentleman, when last fall it became apparent that the Mammoth Cave entrance had served the aborigines as a camping place, was immediately interested and gladly gave permission for excavation. Only about five weeks' time was given to the work, but the results, though limited in themselves, amply warrant extended future investigations.—THE AUTHOR.

THE ancient cave dwellers of Europe, silenced by untold millenniums, have now almost come into their own. After barely a half century of labor we see at last in dim outline our rude progenitors—their face and form, their simple everyday existence, and just a glimmering of their feeling for the conditions which surrounded them. And as a result not

only are we beginning to find explanations for things as they are in respect to mankind, but also we are learning to look with absolute confidence to the future. The recent book on *The Men of the Old Stone Age*, by Henry Fairfield Osborn, marks a long step toward the viewpoint from which we, like the gods, shall be able to see the beginning from the end. But our advance is only

a step. Asia and Africa have not yet yielded up any profound secrets; and as for the troglodytes of America, who can tell?

Many European archaeologists hold that if we will but apply ourselves we shall find proof of aboriginal existence as ancient and primitive as anything so far discovered in the Old World. For instance, Professor Hugo Obermaier, lately of the Institut de Palæontologie Humaine, of Paris, with whom some four years ago I had the privilege of working for a few weeks in the famous Castillo Cave in Spain, once wagered his head on the outcome. At another time he offered to come over to America to find for us the necessary evidence "inside of three years." I had no such sanguine expectations: in fact, I thought I had reason for being incredulous; but there was something of a challenge in his attitude, and I was made to feel in honor bound to do something about it. The war has played havoc with his own plans, but he has not let me forget mine. His letters usually end with the repeated query, "Have you found Palæolithic man yet?"

The state of Kentucky has many and peculiar claims upon our interest—geographic, topographic, geologic, scenic, historic, and romantic, as well as archaeological. Under the circumstances no one will pretend to do justice to this section of our country in a few paragraphs, and we shall have to be content in this place with suggestions rather than delineations.

We have all read of Kentucky as the "untrodden wilderness" in which Daniel Boone played the hero. This sturdy pathfinder may have suffered somewhat at the hands of modern historians, but there can be no doubt that his exploits

have laid hold on the popular imagination, for many caverns—some that he never could have used as rendezvous—have been named after him; and as for his beloved wilderness, it is still there. The virgin forest I had little occasion to enter, but from all accounts it is, and always was, far less impenetrable than the half despoiled timberlands of today. To one accustomed to the vastness of the North American prairies and to the grandeur of the mountains and the mesas beyond them, there is something confining and repressing about a merely undulating forest country. It seems paradoxical that the spirit of freedom should have flourished in the valleys of Greece and of Switzerland, unless perhaps the secret lies in the provincializing nature of the topography. Referring to Switzerland, I was always conscious of a longing to be on top of the mountains where I could look away; although her scrupulously kept valleys with their matchless lakes and all that, evoked a response, to be sure. And so with Kentucky: you cannot see the forest for the trees, as the saying is, and you cannot find your way anywhere. In the Southwest one may keep his course for days by merely watching some familiar mountain peak on the horizon, but here it seems a risky thing to leave the beaten path without a guide. The novice would soon exhaust himself fighting through the brambly undergrowth, and he might slip into a "sink hole" and be lost forever in a great and fascinating underworld.

But if the aspect of grandeur seems wanting in Kentucky, it does not mean that scenic charm is not there. On the contrary, it is everywhere; but you have to view it one detail at a time. The field, the forest, the hill, and the stream—each and all make their spe-



SCENES LOVED BY DANIEL BOONE

The cliffs bordering the two beautiful rivers here shown, the Kentucky and the Dix, contain many caverns said to have been places of refuge for Kentucky's most noted pioneer. A delightful row up the Dix brought us to "Daniel Boone's Cave," a narrow cavern in process of formation by a stream of water, which could never by any stretch of imagination have been used as an abode

cial appeal, partly by virtue of intrinsic merit and partly by contrast with their varied general settings. Thus, for example, the open blue grass country about Lexington, with its splendid pikes, its mansions, its fine horses, and great dairies, seems a bit of the matured Old World transferred. Bounding it on the south, however, is the wild-looking gorge of the Kentucky River, presenting cliffs that are worthy of comparison with the Palisades of the Hudson; and beyond lies the wilderness, perhaps the primeval forest—I do not know.

If we transport ourselves about one hundred miles in a southwesterly direction over the semiforested tableland to the approximate geographical center of the state, we come to another equally enticing stream known as the Green River. We are told that it was named after General Nathanael Greene; but it is green in fact as well as in name, and it flows on calmly and majestically without giving a hint of its peculiar origin. Its bordering cliffs may be less abrupt, as a general thing, than those of the Kentucky, but the winding gorge is



The entrance to the Mammoth Cave at present measures about forty feet from side to side and twenty feet from floor to ceiling. The slope down which the steps lead is about thirty-five feet high and has been artificially graded. The floor in the foreground has also been raised by recent filling. A small stream of water falls over the mouth of the cave (see photograph, page 227), and as daylight reaches back about one hundred feet, this entrance is a cool and comfortable place on a hot summer's day and a convenient camping ground. Conditions were not so favorable, however, when the Indian lived here, because at that time the entrance was nearly closed with débris and very little daylight entered



General view within the vestibule of Mammoth Cave, showing some of the trenches which the American Museum Expedition dug for the purpose of examining the Indian refuse



In this small chamber lay the skeleton of a woman in a rock shelter on Green River, six miles below the Mammoth Cave. This type of stone grave burial is common to the Ohio Valley region, and is regarded as belonging to a relatively late period of Indian history. The box-like coffin was made by setting up a number of stone slabs around an oval space about two and one half feet wide by three and one half feet long, the whole being covered by two larger slabs

just as deep. Dense foliage of oak, beech, sycamore, hickory, walnut, chestnut, dogwood, and other deciduous trees, screens all but the most pronounced sears on the sharper curves, and whether you are on the river or at the top of the gorge, you are seldom permitted to see more of the landscape than you can appreciate at a glance. In the early morning hours of May these woods were alive with song birds and I was told, confidentially, that fishing was excellent in the stream; but my own especial interest took me to quite another world, the region whence come the waters of the Green River.

If one goes prowling over the forested tableland, he soon becomes aware of several unusual things. In the first place, he cannot fail to notice occasional eminences, sometimes of a pyramidal character and often several hundred feet high. These heights are known as "knobs," and they appear to register for us the amount of erosion to which this section of the country has been subjected since it was lifted out of the sea. Excellent as "lookouts," these knobs are, besides, of especial interest to the archaeologist, because many of them are also natural strongholds and as such were once occupied by the Indian. In the second place, the adventurer will be struck by the singular fact that he finds no streams to cross. Here and there he may discover valley-like depressions—some of them large enough to swallow up an appreciable slice of Manhattan Island; but whether or not they have an outlet to the river gorge, there is seldom any water to be seen in them. Passing on, he will encounter again and again sudden depressions of smaller dimensions, some oval, some bowl-shaped; some perhaps less than fifty feet in depth and diameter, and others possibly three

hundred feet deep and several hundred yards across. In a few instances a small pool of water may reflect the sky and surrounding landscape, but ordinarily the big bowl is dry, and there may be a visible hole in the bottom. The really inquisitive explorer may discover a strong air current going in or out of this hole; and if he sit down to reflect at all on the strange phenomenon, a long series of observed facts will soon fall into definite relations, and the mystery of the Green River sources will be solved. In brief, the whole three-hundred-foot limestone formation between the top of the plateau and the river level is actually honeycombed with caverns; the depressions in the plateau surface, known as sink holes, are merely collapsed cave roofs; and the rainfall on the plateau is caught up in these thousands of sink holes, which act as so many funnels for the labyrinthian cave system below, that finally conducts it to the river.

How the water got started on its underground course we cannot stop to explain; but it has been at work probably for millions of years and has literally eaten out several successive systems of passages, the topmost vaults being of course exceedingly old and now in process of refilling. In the Mammoth Cave, for example, there are no fewer than five superposed sets of galleries, the upper one being close to the surface of the plateau and the lower one so far down that the river floods back up into it every spring. And the Mammoth Cave is not a mere local feature. There are said to be more than eight thousand square miles of limestone formation in Kentucky suitably disposed for the development of immense caves. This means that the state possesses thousands of miles of subter-



A DOOR TO THE UNDERWORLD OF KENTUCKY

This yawning black mouth is the only known entrance to the Mammoth Cave. In 1811, so the story goes, while this opening was still almost choked with fallen trees and rocky débris, a hunter named Hutchins, in an exciting chase after a bear, followed the animal into a small hole among the rocks, discovering for the world this famous cavern



"Violet City" is reached at the end of a long walk through dark corridors and mysterious side chambers. When the guide throws his lighted brands into the dark corners, a thousand fairy beams are reflected from the many colored stalactites which drop from the ceiling to meet the up-springing stalagmites of the floor. On one side of the chamber a veritable pipe organ is formed, called the "Chimes," the stalactites giving forth musical sounds when struck. *Courtesy of John P. Morton & Company, Louisville*



A distinctly new experience is the short ride on the Echo River, deep down in the Mammoth Cave. We sang "My Old Kentucky Home" and "Way Down upon the Suwanee River" and were answered by hundreds of musical murmurs as the great resonance chamber above us reverberated the sounds again and again. *Courtesy of John P. Morton & Company, Louisville*

ranean vaults, constituting a world in themselves.

Here the mere tourist as well as the chemist, the geologist, the palæontologist, the botanist, and the naturalist could get enough material each for a great book. Consequently it is almost useless for us to enter even one cave for purposes of description. Many other hands have tried it. We are told that more than four hundred books, pamphlets, scientific treatises, and magazine articles have been printed about the Mammoth Cave alone; and among the great variety of talent so employed have been such "wordpickers" as Nathaniel Willis and possibly Bayard Taylor. But no two visitors to this wonder of the New World are impressed equally by the same phenomena. For myself, the cave as a cave excited no unusual interest; while the cave as a century-old repository of slowly accumulated historic and biographic facts, of wit and humor and imaginative interpretation, handed down in the form of place names and in the more or less apt remarks flowing from the lips of our jovial guide, struck me forcibly. Many of his remarks were naïve, even far-fetched, but when people climb mountains or explore caves, the usual

conventions are dropped and it is permissible to laugh at even a poor joke. I shall not relate the guide's stories; and such place names as Star Chamber, Gothic Avenue, Pillars of Hercules,



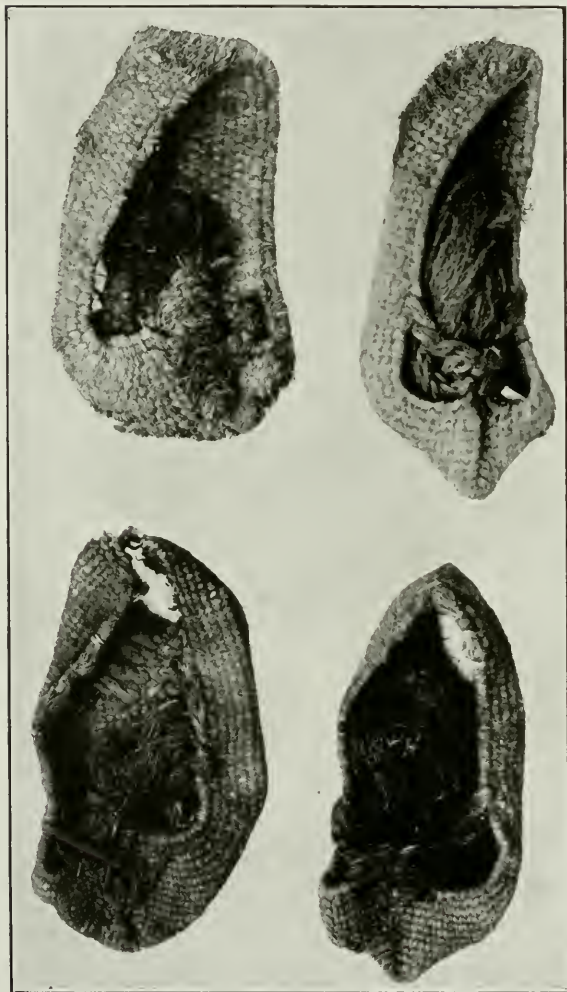
One can imagine something of the feelings of the explorer who, after crawling through a small hole some five hundred feet within the entrance of the Mammoth Cave, unexpectedly found himself within this enormous chamber, twenty-six to forty feet wide and three hundred feet long, with walls rising abruptly to a height of seventy-eight feet. A renewed sense of man's relative insignificance is borne in upon us as we enter the portals of "Vaughn's Dome." *Courtesy of John P. Morton & Company, Louisville*

Bunker Hill, Martha Washington's Statue, Snowball Room, Pineapple Bush, Corkscrew, Scotchman's Trap, Dog Hole, Giant's Coffin, Fat Man's Misery, Lover's Leap, and Mummy Niche, are all more or less suggestive and self-explanatory, at least on paper.

Of a less imaginative but more significant character to some of us are such features as Audubon Avenue, Rafinesque Hall, Putnam's Cabinet, Hovey's Cathedral, Jenny Lind's Armchair, Ole Bull's Concert Hall, and Booth's Amphitheater—the lists might be extended indefinitely.

There are other natural wonders in Kentucky. We have mentioned two rivers only; but probably no equivalent territory in the world is better served by navigable waterways. Perhaps the overland routes may have been correspondingly wanting; but the bison came into the country in late prehistoric times and many of his trails connecting river fords, saltlicks, springs, and open grasslands, have since served both the Indian and the white man as avenues of communication. The saltlicks are of especial interest. They are swampy places where salt exudes from the ground, and thousands of animals, representative of species both living and extinct, coming here to lick the earth, have been mired and their bones left secure for the future palaeontologist.

Into this wonderland came the Indian long ago—we cannot yet say when or how or wherefrom. He lived in the caverns and on the hilltops, he erected mounds and villages, he cultivated the soil, and he burnt thousands of square miles of the natural forest, turning it into grassland to entice the buffalo; and then—after a time—he seems to have gone away again. The reason for his departure is something of a mystery; but, judging from the accounts of Spanish, French, and English explorers during the century preceding the American Revolution, the heart of Kentucky was



Among the most interesting discoveries of Indian relics in the Kentucky caverns were a number of neatly braided sandals found in Salts Cave in 1893. Some are made of the fiber of the cat-tail, others are woven of the inner bark of trees, and still others of wild hemp. They display several distinct forms of braiding as well as occasional ornamental tassels. Other interesting finds in the caves are half-burned torches made of bundles of cane, stone pestles and axes, bone awls, implements of shell, and parts of gourd vessels. *Courtesy of John P. Morton & Company, Louisville*

uninhabited during all this time. The Shawnee were found living in force along the Ohio, the Cherokee were at home directly on the south and southeast, and the Chickasaw held the country to the west and southwest, near the Mississippi. These and other tribes are understood to have made hunting excursions into the abandoned country, and war parties also probably met here at times, for traditions speak of the territory as the "dark and bloody ground." In other words, it was border country or "no man's land," and to whom it originally belonged is uncertain. The tribes mentioned all seem to have claimed it, because—if history is to be believed—they sold their rights to the white man no fewer than five different times, receiving considerable sums of money in at least three of the transactions.

This singular fact of the uninhabited condition of Kentucky, together with her geographical position directly fronting the main gateway through the Alleghenies—the Cumberland Gap—gives the state very great historical importance in the winning of the West for the American Union. Kentucky herself has been called "the child of Virginia" and as such was colonized by people of English and Scotch ancestry, the pure strains of which are still to be found in the mountain districts. Daniel Boone was one of the first to bring his family into the country, and the outpost Boonesborough, which he founded and commanded, was located on the Kentucky River directly above the caves visited by the American Museum Expedition. This happened about the year 1775, and a short time later, near the end of the American Revolution, the immigration of landless soldiers and young women, as well as of united families, became general.

One of the prime necessities of life for the early settlers in the far-away wilderness was gunpowder; and as the principal ingredient of this compound, saltpeter, was known to occur in the floor-earth of caves, it came about in a very natural way that Kentucky soon became world-renowned as the land of caverns. The Mammoth Cave is said to have been known as early as 1797, and in 1812 saltpeter or niter was being manufactured here on a large scale. Some would have it that the battle of New Orleans was won by powder from this cave. However this may be, saltpeter was in great demand and consequently caverns were being searched for. This soon resulted in the discovery of a considerable body of archaeological data in the subterranean chambers. Among other things several "mummies," or desiccated human bodies, were found, some, it is said, in the Mammoth Cave itself. These were accompanied by a great variety of well-preserved articles, such as garments of skin and of woven fabric, feathered mantles, feather headdresses, hats, and moccasins. Lively discussions were precipitated. People for the first time seem to have begun seriously to ask who the original inhabitants really were and when they came. It was generally concluded that these mummies were not Indian, and the theory that they represented some extinct Old World stock is not dead yet. But the discussion subsided after a while and was not renewed until the late Professor F. W. Putnam, of Harvard University, opened it again in 1870-75. Professor Putnam went to Kentucky as a young man to serve as naturalist on the State Geological Survey of that day, and while gathering faunistic material in the Green River caves, he was forcibly attracted by the evidence of



DETAIL OF THE ARCHÆOLOGIST'S WORK IN MAMMOTH CAVE

Section of camp refuse about one hundred feet within the entrance of the Mammoth Cave. Just below the artificially made floor (the boards mark its level) are three to four inches of modern débris, and under that about two and one half feet of a more or less stratified composition containing ashes, charcoal, animal bones, fresh-water shells, and occasional fragments of human bones. In places this kitchen refuse reached a depth of fully four feet, and as a rule some of the material had sifted down about two feet among the rocks on which the main deposit rested. It is from slow, detailed investigation of such deposits that the true history of the prehistoric man of the caverns will finally be read

aboriginal visitation to this underworld. He did not himself carry archaeological investigation very far in the caves; but the contact, it seems, changed his life work. It is probably not far from the truth to say, that it made him the "father of American archaeology."

Whoever wanders into the black odorless depths of the Green River caves, will see evidence in plenty of the Indian's former presence. It is still somewhat doubtful just how Europe's men of the Old Stone age managed to scramble about in their underground retreats, but here are heaps of ashes where fires were built to light the way, and torches of cane lie around in many places. It is no easy matter to move about in the ordinary cave, and the question is commonly asked, "Why did the Indian attempt it?" The answer is not yet entirely clear. Perhaps he liked to explore, perhaps he held secret councils and ceremonies in the far interior, away from feminine eyes. Not being a creature of nocturnal habits, and, besides, not lacking in practical sense, he has never been found to have lived permanently in places of inky darkness, although he may have retreated to them at times. All we know is that he did quite commonly bury his dead in the interior of caves, and to this fact we owe much of our knowledge concerning him.

There is, however, a much more practical reason for the Indian's exploration of Kentucky's underworld. For a time it seemed merely a curious fact that immense quantities of flint were strewn for a hundred yards or more about the entrances to several of

the great caves. Some of the pieces showed evidence of chipping, but the greater number were simply rejected flakes. Finally, just before our expedition left the Mammoth Cave, it was ascertained positively that the Indian had quarried flint in some of the small far-away passages where nodules of excellent quality of this substance projected from the limestone walls. The projecting portions of the nodules had been struck off in most instances, and among the fragments which littered the floor were found two specimens showing unmistakable evidence of having been shaped by human hands. This seems the most illuminating fact yet discovered, because it explains without the possibility of doubt one reason why the Indian came into the caverns to explore. Flint was as necessary to him as saltpeter was to the white man.

Another new discovery in the Mammoth Cave was the fact that the Indian had lived probably for a long period of time directly inside the entrance, within reach of daylight. The camp refuse found there had attained a depth of more than four feet in places and was made up of ashes, animal bones, and fresh-water shells, as well as of articles of bone, stone, and shell. The chief feature of interest about these remains is that they seem to point to a people who lived entirely by hunting, whereas the aborigines of late prehistoric times all over the Ohio Basin were, at least in part, agriculturists. The Museum's investigation is not yet finished. We hope it may continue, and that it will soon lead to a clearer understanding of the Mississippi Valley Indian and his history.



THE ONLY AUTHENTIC HOME-BRED ANTHROPOID APE

Anuna is the daughter of Jimmie and Cucusu, Cuban chimpanzees. Anthropoid apes are highly different from one another in temperament. This is as we should expect from their resemblance to the human race, although as far as study and experiment have been able to bring out, there is no significant difference in degree of individuality even between earthworm and man, or ant and monkey. *Indebtedness for these photographs is due to Señora Abreu*

Individuality, Temperament, and Genius in Animals

FROM SUCH RESEARCH WE LEARN TO APPRECIATE HUMAN INDIVIDUALITY, AND TO REALIZE THAT ANY FUTURE CONSCIOUS CONTROL OF HUMAN LIFE MUST COME THROUGH A STUDY OF THE CONDITIONS UNDER WHICH VARIED TYPES OF TEMPERAMENT WILL DEVELOP THE HIGHEST CHARACTER AND THE GREATEST GENIUS

By ROBERT M. YERKES¹ and ADA W. YERKES

EXPERIMENTAL studies of animal behavior, pursued for the solution of definite problems of sense, instinct, or habit, frequently yield as by-products interesting and important information concerning individual, sex, species, and race differences. Such observations commonly fail to get recorded because of the primary importance to the observer of the problem on which his attention is focused. In preparing his results for publication he would gladly report everything of significance, were it not that exigencies of time and space render this either impracticable or impossible. It is largely because of our conviction that certain of the unrecorded by-products of our investigations are in various respects more important than the data which we have published, that we are attempting to write on evidences of individuality in various organisms.

In this field of naturalistic and experimental observation, there is always the risk of confusing age, sex, or race differences with those which are truly individual. The casual observer readily overlooks the fact that his pet canaries, kittens, or dogs, differ by several weeks in age or are otherwise not suitable for comparison, for as a natu-

ralist he is less concerned with strict comparability than with that knowledge which will lead to sympathetic insight. But to those who are trained in critical and well-controlled observation, it is an easy task to eliminate such sources of error and to obtain fairly comparable data concerning individuality. Field naturalists and the born lovers of animals know by intimate acquaintance that important individual differences exist in many species of organism, but experimentalists are less generally aware of this fact, for their attention tends to be monopolized by problems of species characteristics and of general organic functions or reactive capacity.

Even in invertebrates individuality becomes conspicuous with familiarity. Among earthworms we have observed that specimens, comparable in all essential points and existing under the same conditions of observation, exhibit surprisingly different modes of response. Thus, one individual adapts itself to the demands of a situation, works smoothly, steadily—as it were willingly; another, slowly and haltingly meets the experimenter's requirements. Its tendency to do the wrong thing seemingly amounts to perversity or

¹ Dr. Robert M. Yerkes is assistant professor of comparative psychology at Harvard University, managing editor of the *Journal of Animal Behavior*, and editor of the *Animal Behavior Series*.

stubbornness. And so the observer gains the feeling that the two organisms are quite as different in reactive tendency as are two men.

It has often been remarked that the individuals of a human race with which one is unfamiliar look alike. This we always discover to be due to our failure to notice marked individual differences. As our familiarity with the type increases, these individual traits become increasingly obvious. Now precisely what is true in our experience with our fellow men is still more true of other types of organism. We note at first only the species or racial differences, or perhaps if they be equally conspicuous, certain age and sex differences, but as we continue to live with the organisms and to observe them carefully day by day, we come to appreciate those qualitative and quantitative peculiarities which constitute individuality. As far as we can see, there is no significant difference in degree of individuality between earthworm and man, ant and monkey.

Intimacy of relation with a wide range of organic types has served, among other things, to convince us that temperament, character, and genius are terms, which, like individuality, may be used quite as appropriately in connection with one type of organism as with another. We wish especially, in this paper, to report certain of our observations concerning these aspects of life. Temperament we have come to think of as the sum of fundamental, inborn reactive tendencies,—they are sometimes called primary instincts; character, as these same tendencies organized through environmental contact or experience into a complex and more or less highly adaptive system of behavior; genius, as exceptionally strong or well-marked temperamental traits of a

particular order. The conventional and ancient classification of temperaments according to strength and duration of response as choleric, melancholic, sanguine, and phlegmatic seems unduly simple in the light of our observations, for there are at least several important ingredients or constituents of temperament which apparently vary independently or in groups with respect to strength and duration of response, and possibly also in other important ways. We may not here further dwell upon definitions, but we shall hope to render these suggestions more significant by the facts which we have to record.

Some years ago we undertook a comparative study of two strains of albino rat, the one closely inbred for many generations, the other outbred. Save for this difference, the individuals of the strains were entirely comparable. We attempted by various experimental means to discover peculiarities of behavior in these animals. Soon it became apparent that the inbred individuals adapted themselves less readily to new environmental demands. They proved less apt pupils in tests of habit formation. We were struck, as our observations progressed, by certain peculiarities of behavior which appeared to be characteristic of the strains rather than of individuals. Among them, fear, timidity, savageness, curiosity, sociability were conspicuous. In general, the inbred rats seemed more timid, fearful, more likely to defend themselves by biting if disturbed, less ready to try new things, more suspicious of the experimenter, slower to acquire obviously profitable modes of response than were the outbred animals. These differences in behavior seemed to us to account for an apparent difference in intelligence, and we finally concluded that it is really quite beside the mark

to contrast the two strains by saying that the one is the more or the less intelligent.

Subsequently, increasingly definite and well-controlled studies were made, in which were recorded observations concerning the preferred position of an individual in its cage or nest box; the relative positions at different hours of the two individuals, male and female, in a given cage; the degree or amount of activity; savageness, or the tendency to bite; and the quickness and amount of response to various stimuli. These and similar observations shortly indicated that savageness designates certain tendencies to reaction, as does also fear, timidity, or wildness, and that our only intelligible way of defining these terms is by enumerating the several types of activity. Wildness, for example, is indicated by attempts to hide in the cage or in the observer's hand, random and excited running about with repeated attempts to escape, squeaking, and various other forms of response. Timidity, which seemingly is not identical with wildness or fear, involves the avoidance of the experimenter, a kind of chattering or gnashing of the teeth, cowering, or even trembling.

Although most of our studies have been concerned with relations of behavior to inbreeding or to the crossing of individuals which differ markedly in some trait, we have incidentally obtained abundant evidence of important individual differences of the temperamental sort.¹ One rat, for example, is

¹ Basset, G. C. Habit Formation in a Strain of Albino Rats of Less than Normal Brain Weight. *Behavior Monographs*, 1914: 2: Serial No. 9.

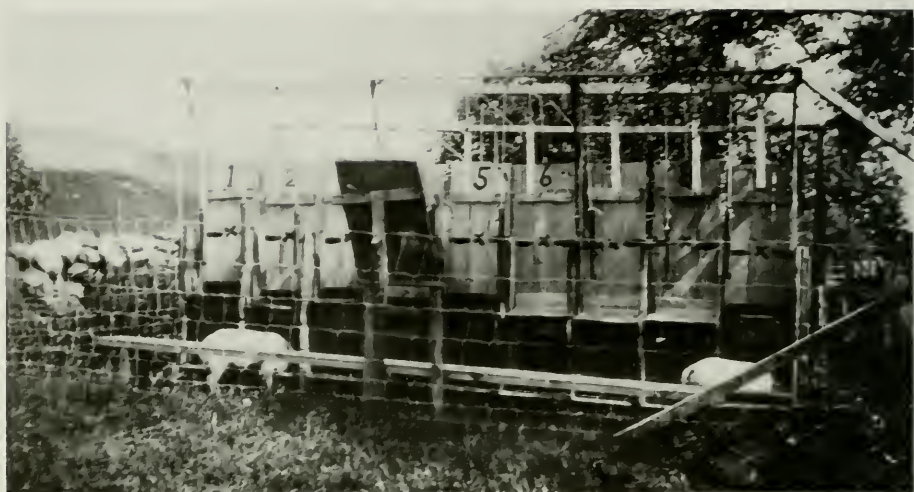
Yerkes, Robert M. The Heredity of Savageness and Wildness in Rats. *Journal of Animal Behavior*, 1913: 3: 286-296.

Yerkes, Ada W. Comparison of the Behavior of Stock and Inbred Albino Rats. *Journal of Animal Behavior*, 1916: 6: 267-296.

Utsurikawa, Nenozo. Temperamental Differences Between Outbred and Inbred Strains of the Albino Rat. *Journal of Animal Behavior*, 1917: 2: 111-129.

extremely fearful of anything new or unusual, it shrinks timidly from the experimenter. It can only with difficulty be induced to try to find its way through the experimental apparatus. When cornered, it defends itself by biting the experimenter's hand. Its wildness is indicated by persistent efforts to hide or to escape. It responds quickly and markedly to any sudden and unexpected stimulus; peculiarly startling stimuli at times cause it to tremble. Another individual of the same age and sex, born in the same litter, is by contrast aggressive and exhibits marked initiative in new situations. Its fear or timidity is readily overcome by its curiosity. It quickly becomes accustomed to the experimenter, and allows him to touch it or take it up in his hand without attempting to bite, and shortly without effort to escape. It responds slowly and only slightly to most stimuli and is disturbed only by strong stimulation. In a word, the two rats are temperamentally as different as any two human beings one is likely to meet. It is such observations as these, made on many different individuals, that have wholly convinced us of the desirability of a careful analysis of temperament and the reduction to terms of measured description of its chief constituents.

We once undertook to study experimentally the ideational behavior of pigs. For this purpose two young animals were chosen, the one a male, the other a female. They were observed daily, and for several hours each day, the whole of one summer. We became sufficiently well acquainted with their characteristics to appreciate alike their varying degrees of intelligence and their temperamental peculiarities. What we have not published in our report on the behavior of these creatures



Nip and Tuck being fed as a reward for faithful service in an experiment. These two pigs were observed for several hours each day throughout one summer. Nip was less active than his sister Tuck, and also less greedy, but both worked remarkably well on their ideational problems under the spur of hunger, and their success justified the impression that the pig is one of the more intelligent mammals



At the left is shown Jim Crow in his favorite feeding place; at the right our carnivorous pet is evincing his marked preference for attached morsels. One summer we removed a brood of young crows from the nest and reared them by hand. They thrived mightily and soon became very tame, showing marked temperamental differences; in fact, the four specimens were as different in temperament as are the children of any household

certainly would interest the general reader much more than our printed contribution toward the solution of our problem.¹ We therefore venture to present certain of the fascinating by-products of our summer's work. That the differences which we are about to emphasize are not necessarily individual, we readily admit; that they are not age or species differences, we are certain. We suspect that some, at least, are sex differences.

Nip and Tuck, for thus we early decided to designate our subjects, soon made us feel their individuality. Both, under the spur of the hunger motive, worked remarkably well toward the solution of ideational problems, and their success in this work fully justified the popular impression that the pig is one of the more intelligent among mammals. Nip, the male, was less active and energetic than his sister, Tuck. He also was less greedy, and showed rather less initiative and a more limited range of reactions. Tuck it was who usually led if there was opportunity for competition, while Nip followed. Both quickly became accustomed to the experiment, but Nip showed more persistent wariness, timidity, and suspicion than did Tuck. She, however, was much quicker in response, more alert, curious, and quick to discover new opportunities for pig satisfaction. When at work on experimental problems, Nip was much more easily discouraged and tended earlier than Tuck to give up his search for the reward of success. Tuck constantly acquired new and profitable tricks, which as a rule sooner or later appeared in Nip also, sometimes spontaneously and again by reason of the imitative tendency.

As day after day we observed these two specimens of a mammalian type whose life under domestication gives its intelligence slight opportunity for display, we were strongly impressed, as we had been in the case of rats also, by the importance of temperamental reactive tendencies in responses to any experimentally arranged situation. The experimenter who ignores individuality or temperament in his subjects runs a grave risk of misunderstanding or wrongly evaluating his results. Our descriptions sound anthropomorphic, but that, the alert reader will appreciate, is due to our avoidance of stilted and unnatural terminology. We are attempting to describe in an intelligible way, and briefly, behavior which, if we should restrict ourselves to wholly objective terms, would require pages of unusual behavioristic statement.

Among the birds, there is probably no more interesting object of study than the crow. Its species characteristics are notably alluring to the psychologist, but to us, as a result of varied observations in the corn fields of Pennsylvania and on the wooded hills of New Hampshire, sex, age, and individual differences are no less fascinating. One summer we removed a brood of four young crows from their nest just before they were able to fly. We could not identify the sexes at the time, so the differences we observed may be either sex or individual, but at any rate, the four specimens were as sharply contrasted in temperament as are the children of any household.

We set about rearing these birds by hand, the while taming them for experimental purposes. Within a few days, one of the four began to exhibit the characteristic fear reaction of its species, and at once it became extremely difficult to feed. For a few days we

¹ Yerkes, Robert M., and Coburn, Charles A. A Study of the Behavior of the Pig, *Sus scrofa*, by the Multiple-Choice Method. *Journal of Animal Behavior*, 1915: 5: 185-225.

persisted in our attempts, and then as he or she, as the case may have been, was no less persistent, we decided to devote our time and energies to his three companions. Thus, at the very outset, temperamental peculiarities, perhaps amounting to nothing more than exceptionally strong and persistent fear reactions, served to eliminate one of the individuals from our collection.

Our space will not permit us to recite in detail, as we are tempted to do, the peculiarities which these birds exhibited during a memorable summer. We must content ourselves with the simple statement that in reactions which may be designated as those of wildness, fear, timidity, curiosity, suspicion, initiative, sociability, the individuals differed most obviously and importantly. We hope sometime, in justice to the problem of crow temperament, to devote a summer to the intensive study of sex and individual differences in these extremely intelligent birds.¹

Concerning temperament, character, and genius in the Primates, our materials are at once abundant and to us absorbing. Every one who knows anything about Primates, high or low, realizes that in them individuality is more conspicuous for the human observer than in most other organisms. But our results do not justify the conclusion that temperamental differences are more obvious or more important in monkeys, anthropoid apes, or man, than in crows, pigs, or rats. We have come to suspect that the popular opinion concerning the matter is due chiefly to similarity of structure and behavior

—in a word, to felt kinship. It is simply because we are more like monkeys and apes that we more readily notice and more highly value their individual characteristics.

Not so very long ago, we had a splendid opportunity to become intimately acquainted with two adult male monkeys of the species *Pithecius irus*. The one, we shall call Skirrl; the other, Jimmie. It would be easier to tell what these individuals had in common than to enumerate their differences. Their temperamental divergences constantly amazed us. But here we must content ourselves with an account of a few of the most remarkable differences in behavior.

Skirrl's attitude toward the friendly experimenter was frankly aggressive, but not vicious. Jimmie was extremely vicious; he never could be trusted. Skirrl's interest in objects which he could play with or in any wise manipulate proved inexhaustible, whereas Jimmie exhibited slight interest in other objects than the members of his species, his enemies, or foods. By a competent observer who had studied him carefully prior to our acquaintance, we were told that Skirrl was feeble-minded. And it certainly seemed so, when, as frequently happened, he sat before an experiment box, yawning repeatedly, and from time to time interrupting these expressions of ennui by half-hearted attempts to solve his problem. Whereas Skirrl rather quickly became accustomed to unusual experimental situations, Jimmie was so wary and distrustful that we finally gave up our attempts to observe his behavior under rigidly controlled conditions, and treated him merely as a visitor in the laboratory.

One day we noticed Skirrl pounding with a stick a nail which he had found in his cage. We were quick to follow

¹ Coburn, Charles A. The Behavior of the Crow, *Corvus Americanus*, Aud. *Journal of Animal Behavior*, 1914: 4: 185-201.

Coburn, Charles A., and Yerkes, Robert M. A Study of the Behavior of the Crow, *Corvus Americanus*, Aud., by the Multiple-Choice Method. *Journal of Animal Behavior*, 1915: 5: 75-114.



At the left, Skirrl sits pensively waiting for something to do. At the right, he is shown in one of his early attempts at sawing. Skirrl was studied in comparison with Jimmie, another adult male monkey of the same species (*Pithecus irus*). Jimmie, vicious and never to be trusted, showed no interest except in other monkeys, in his enemies, or food, whereas Skirrl was delighted with any object which he might put to some mechanical use. He used a saw in as many ways as might a boy of four or five years. He did not imitate the experimenter and learn to use it in the conventional manner, but preferred to work out his own methods. In the use of tools this monkey's behavior was so unusual and individual that it amounted to genius



One day Skirrl was noticed pounding a nail he had found in his cage. He was at once provided with hammer, nails, and a board, and soon his skill, without tuition, in driving the nail into the board more than equaled that of the unpracticed human being. Jimmie, on the other hand, would throw the hammer into one corner of his cage, scatter the nails about, and try to tear the board to pieces with his teeth. Observations of such extreme differences in individuality among animals are a spur to a more profound study of man, to the end that there may be formulated for the future a science of human behavior

this cue. The monkey was provided with a suitable hammer, nails, and a board. He went to work immediately, and although he exhibited no constructive ability, his skill, without tuition, in handling hammer and nails and in driving the latter into the board or elsewhere, according to his taste, more than equaled that of the unpracticed human. In the presence of the same outfit of tools, Jimmie threw the hammer into one corner of his cage, scattered the nails about the floor, and proceeded to tear the board to pieces with his teeth. Never did he exhibit the least inclination to use hammer and nails independently or together as tools or implements.

When given a saw, rendered indestructible by metallic guards for the handle, and a heavy wooden block on which the saw might be used, Skirrl was manifestly pleased. He used the saw in quite as many and varied ways as might a boy of four or five years. By sawing before him at various times, the observer tried to teach him to use it in the conventional human way. But to this he paid scant attention, preferring, it seemed, to work out his own modes of amusement. Finally, he hit upon a way of using the saw which we have been told is in vogue among certain peoples of the East. Sitting on the floor, he held it, teeth uppermost, his feet grasping the handle tightly and holding the saw firmly in position. He then grasped a nail by both ends and rubbed it rapidly over the teeth of the saw, thus producing a noise which evidently delighted his soul.

It is clear enough from the responses of other monkeys of the same and opposite sex (the same and other species) to saw, hammer, and nails, as well as to other implements, that Skirrl's behavior must be described as highly indi-

vidual or temperamental. Never have we observed anything comparable with it in any untaught Primate other than the human. We have agreed to call Skirrl's behavior an expression of genius, for the more we consider the matter the more certain we feel that this particular individual possesses remarkably strong tendencies to react to certain objects as tools or mechanical devices. From our point of view, he possesses an unusual type of interest or the same to an unusual degree. Feeble-minded though he may be as far as most intellectual requirements are concerned, he is a genius in mechanical manipulation, and to him we feel indebted for a new point of view and for new insight into the meaning of genius.

The anthropoid apes are so manlike in appearance and behavior that we should be surprised were they not highly individualized and possessed of temperamental traits as well as forms of genius strikingly similar to our own. Our opportunities for intimate acquaintance with the higher apes have been disappointingly few, but with one young orang-utan whom we knew as Julius, we came into delightfully friendly relations. Julius was not born in captivity—few anthropoid apes have that advantage, or disadvantage—but he was captured young, and when we knew him in California, he was probably not far from five years old. Already we have recorded in print many interesting features of his behavior, as well as our strong conviction of the supreme importance to science and to other aspects of civilization of the thorough study of the anthropoid apes.¹

Julius one day was resting placidly

¹ Yerkes, Robert M. Provision for the Study of Monkeys and Apes. *Science*, 1916 N. S., 43: 231-234.

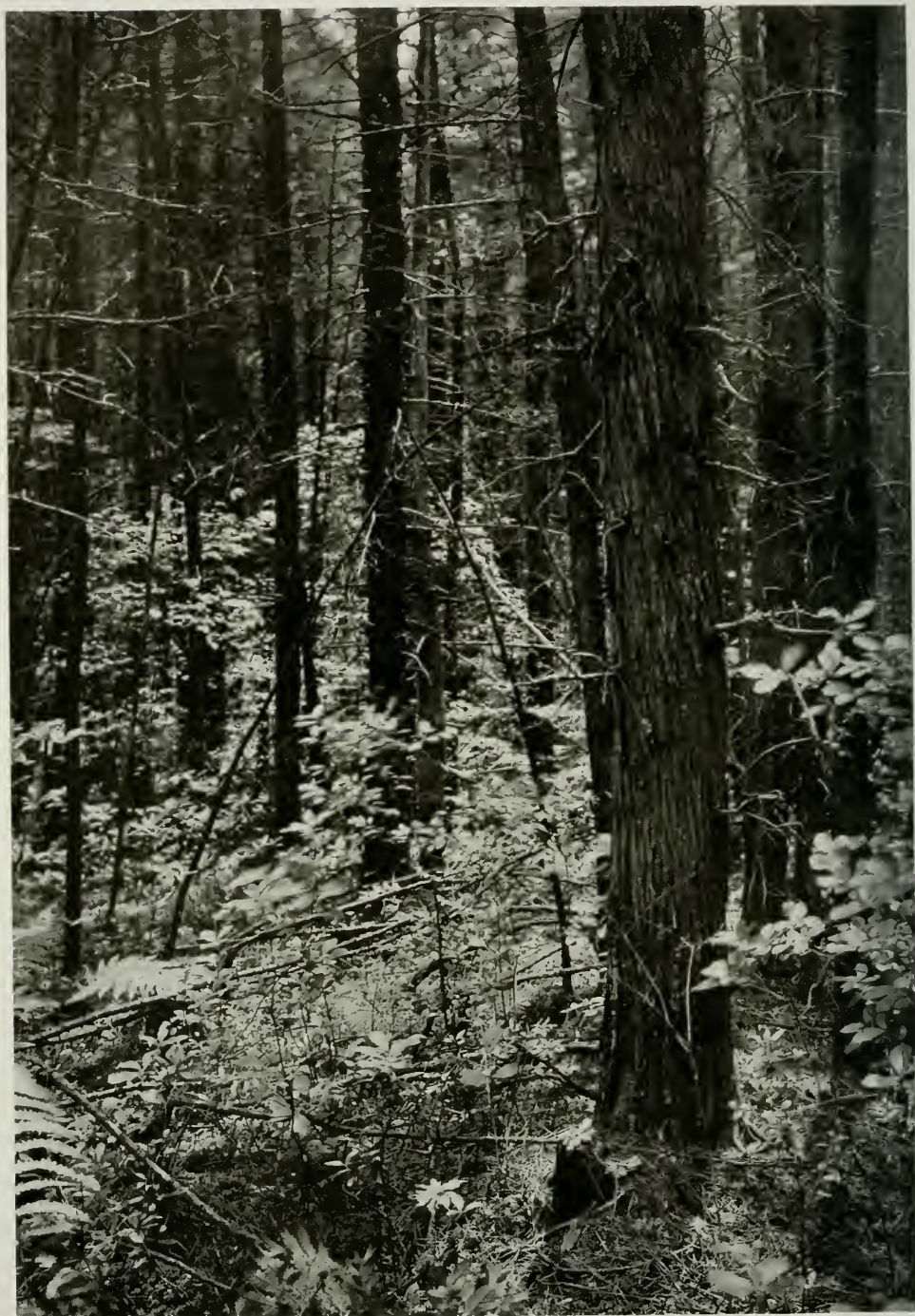
Yerkes, Robert M. The Mental Life of Monkeys and Apes: a Study of Ideational Behavior. *Behavior Monographs*, 1916; 3: Serial No. 12.

in his good-sized cage. A workman passing the cage stopped and offered him a banana. He hurried over to get the proffered food, but just as he reached out his hand for it, the man unkindly drew it away and started to walk off. Julius, evidently disappointed and seemingly resentful, turned, and by a series of somersaults rapidly rolled the whole length of his cage. Later, the same sort of behavior was observed in quite different situations. When, for instance, after working persistently to solve an experimental problem, he failed to obtain the desired reward of food, Julius would bring his head to the floor with a thump and turn a few somersaults. In thus expressing his feelings of disappointment and resentment, he seemed to relieve himself, for afterward he would go to work, sometimes with energy and a fair show of cheerfulness. It may be remarked, by the way, that similar modes of response have been observed in children of two to six years of age. We recall an instance in which a little boy who for some time had been working unsuccessfully on an ideational problem bumped his head several times, carefully it is true, against a wooden partition, and then remarked, by way of explanation, that he wished to stir things up.

When threatened with punishment or actually punished, and when out of sorts or ill, the young orang-utan behaved so like a child of two or three years that he caused the observers to feel uncomfortably sympathetic. Many aspects of his behavior, which unhappily we may not now stop to describe, reminded us of our observations of children, and we found ourselves involuntarily comparing him with human subjects.

How surprising it is, as one stops to reflect on this matter of temperament, that in the same household, as children of the same parents, we find individuals who seem to be opposites in the most varied respects. The one child is sympathetic; the other tends to be cold, unresponsive, or even cruel. The one is frank, naturally honest; the other sly, secretive, and unreliable. The one kindly, good-natured; the other sour and resentful. As these children develop, their temperamental traits may be molded perhaps by educational influences into equally valuable types of character. But never by any chance can they come to possess similar temperamental characteristics.

Surely we shall do well to observe diligently and develop means of studying carefully and measuring the various constituents of temperament, and the factors which enter into character. We should study the constitution and varieties of genius, and especially the conditions which, as experience, operate upon temperamental traits to develop the responses of genius and to elaborate character. For in our efforts to control and direct human life knowledge of these aspects of individuality is of fundamental importance, and there are to-day unmistakable indications that the future will require of us a science of human behavior which shall consider as carefully the individual as the species. We live in the era of the biological sciences, and we look forward to an unprecedented development of the sciences of organic function, and especially of those which, like physiology, psychology, and sociology, attempt to inform us concerning phenomena of behavior. These sciences promise to become of supreme importance to civilization.



A CEDAR SWAMP AT SHAMONG, NEW JERSEY

The cedar swamp forms a picturesque part of the vegetation of South Jersey. The trees (*Chamaecyparis thyoides*) are evergreen and their dense growth forms a shelter, cool in summer and warm in winter, for many wild birds and animals. Growing in the sphagnum moss beneath the cedars are shade-loving plants, such as the sumac, red maple, pepper bush, bayberry, blueberry, the cinnamon fern, and delicate star flower (Photograph taken in late June)



An old colonial sawmill, in continuous use since 1750. When the early settlers were driven by force of numbers from the alluvial river bottoms to the more barren pine lands, a new industry sprang into existence. Sawmills, driven by water power, were in operation as early as 1700

The New Jersey Pine Barrens¹

By JOHN W. HARSHBERGER

Professor of Botany, University of Pennsylvania

EDITORIAL NOTE.—It would be well if New Jersey could set aside a portion, at least, of the Pine Barrens as a state reserve. Although the question of reservation has been agitated by interested botanists and ornithologists, at various times, the state has as yet taken no definite step in the direction of protection. The Pine Barrens have been likened to a transported bit of the South, and they have long had a reputation as a place where rare wild flowers might be found. Conditions are changing, however, and in many parts today there is no longer any evidence of the primeval wilderness known to Audubon, to Baird, and even to Witmer Stone in 1901 and later. And what pine woods are left are being destroyed, both by fire and by the axe. All the cedars are being cut for lumber, exposing also the delicate plants of the forest swamp to wind and sun and consequent destruction. Choice bog orchids and other species are killed by the artificial flooding of cranberry marshes. The Pine Barrens have suffered besides from proximity to New York and Philadelphia; mistletoe has been completely killed out and little holly remains; the land has been robbed that its laurel might grace suburban estates; sweet bay unfortunately has a large market value; trailing arbutus and pyxie are rooted out to sell on city streets. The sphagnum even is raked from the swamps to be used as packing by city florists. In the meantime automobile roads are penetrating farther and farther into the parts still untouched; while railroads with new towns and their surrounding areas of cultivation, added to the other causes of destruction, are slowly but surely putting an end to New Jersey's primeval coniferous forests and to her choice wild flowers. Is America still so young and so prodigal that in a case like this she cannot see and act before scourged by loss of her natural treasure?

WHEN that part of New Jersey known as the "Pine Barrens" was first settled, and before roads and clearings were made in the primeval forest, the pioneers inhabited the country along the

large streams, notably along the Delaware River where the alluvial soil was rich and productive. After all the available land along the river banks had been patented, the early settlers were forced to utilize the wilderness to

¹ The illustrations are from photographs by Messrs. Henry Troth and J. W. Harshberger

the eastward. As the population became denser, it encroached more and more upon the land covered with the pitch pine, and as the soil of this region was less productive, and in many cases poor, the settlers began to look upon it as barren, hence the epithet "Pine Barrens."

The influence that this barren pine land had on the inhabitants of the region was soon seen in the local industries. Throughout the "pines," the sawmills, driven by water power, heralded the advent of permanent settlement. These mills were erected first in the period 1700-25. The pitch pine is the tree which gives character to the Pine Barrens of southern New Jersey, and with it is sometimes associated the yellow pine. The pitch pine satisfied the needs of the settlers for the sills and beams of buildings. As compared with modern logging, the methods of cutting and handling the logs in the forest were simple. Horse and ox-teams sufficed to transport the logs to the sawmill. As the country was level and flat, no insuperable difficulties were presented in getting the logs out of the woods, especially if the lumbering was done when the ground was frozen or covered with snow. Also turpentine, resin, tar, and charcoal were obtained from the pitch pine tree. Fat pine knots were used as a substitute for lamps and candles in the early days by splitting the knots into thin splints. The white cedar of the swamps yielded a fine grade of lumber for vats, tanks, churns, buckets, and firkins. Shingles were made from white cedar, and these shingles covered many of the houses built in New Jersey in the last century. Aside from the forests, an important industry arose in southern New Jersey through the cultivation of the native cranberry, for which a large

demand has developed in the United States.

There are several types of pine barren vegetation:¹ the pine forest proper, the cedar swamp vegetation, the deciduous swamps, the savannahs, the bogs, and the plains. The tree which makes up the bulk of the New Jersey pine forest is the pitch pine. In old stands of pine the average height of trees from ten to fourteen inches in diameter is about fifty feet. Where fire has destroyed the original forest, the pine trees are stunted and reach only a height of about twenty feet. The undergrowth in the pine forest consists of several species of dwarf oaks, the sassafras, sweet ferns, blueberries, huckleberries, sand myrtles, and laurels. The tall herbs are goat's-rue, lupine, wild indigo, and various grasses. The plants of the forest floor are bearberry, trailing arbutus, wintergreen, and pyxie. As the plants of the heath family, such as the laurels, huckleberries, and blueberries, form numerically the largest part of the undergrowth, the pine barren forest forms what the European plant geographers call a "pine heath," and this comparison of American with European vegetation is heightened in a study of the plains of the central part of the state, for here are hills covered with forests of dwarf—"elfin," or "pigmy"—pitch pines and oaks, with laurel, and other shrubs. These plants owe their dwarfed condition to a hard-

¹The history of the New Jersey pine barren region begins with the formation of the marginal plain known as the "pre-Pensauken penepain," covered with a fairly uniform vegetation. With the beginning of the Pleistocene, part of the Atlantic coastal plain was depressed, but an island, representing the Beacon Hill formation, remained covered by the remnant of the ancient coastal plain vegetation. Pensauken Island was separated from the mainland by Pensauken Sound, and when the land emerged again, the pine barren vegetation occupied an area coincident with the outline of Pensauken Island, retaining these boundaries up to the present, as a new vegetation surrounded that of the Pine Barrens.



A PICTURESQUE BEACH AT SOMERS POINT

No more inviting region in its primeval conditions lies so accessible to large centers of population such as New York and Philadelphia. The dense forest on the bluff with its undergrowth of holly, red cedar, and post oak blends with the vegetation of the beach—goldenrod and broomlike panic grass (*Panicum virgatum*) (Photograph made in April)



A STAND OF PITCH PINE

The pitch pine (*Pinus rigida*) grew originally from forty to seventy-five feet tall in the primeval forest, but owing to frequent forest fires it is now rare to find trees as tall as fifty feet. The wood is used for building and cabinet purposes; in olden days torches, made from the fat pine knots, were used as substitutes for lamps and candles. As a lower story of growth in this particular forest at Shamong we find several species of oak, the huckleberry, blueberry, inkberry, sassafras, and common brake

pan several feet below the surface. This corresponds to the Ortstein found in German heathland, where similarly the trees are dwarfed because the tap roots are unable to penetrate this strongly impervious layer of soil. The trees reach a certain size, then die back, to be replaced later by seedlings which go through the same course of development. Occasionally, where the hardpan is not continuous, a few taller pine trees are found. On the plains of New Jersey, the dwarf pitch pines assume a basket-like form and so does the broom crowberry (*Corema Conradii*), a plant found nowhere else in the state.¹

In the seasonal aspects of the Pine Barrens we miss the familiar spring flowers, such as the wood anemones, spring beauties, bloodroots, rue anemones, violets, and hepaticas, which in deciduous forests flower before the leaves of the trees appear. In the Pine Barrens, the dark green color of the prevailing pines is enlivened in the spring only by the light greens of the developing oaks and deciduous shrubs. Autumn, however, is sometimes a riot of color—as it was last October.

The cedar swamps form an important part of the vegetation of South Jersey, and also a noticeable feature, because the sky line is everywhere cut by the spire-shaped tops of the trees. The white cedar trees (*Chamaecyparis*

thyoides) are evergreen, and grow so closely together that they form a dense shade in which only the most shade-loving plants will grow. Three facts are noteworthy about a cedar swamp. In the first place, a white cedar forest is protective, as far as the movements of air are concerned. The wind may be blowing hard outside, but within the cedar grove all is calm and still, so that the few deciduous trees there may hold their leaves until the advent of spring. Secondly, a cedar swamp in summer is cooler than the surrounding pine forest, on account of the dense shade and the evaporation of water from the bog moss, or sphagnum, which holds the water as a sponge and gives it off during the hot weather. Thirdly, a cedar swamp in winter is warmer than the adjoining pine forest through which the wintry winds can blow, and thus, during the inclement periods of the year, the cedar grove forms a covert for many birds and wild animals. Associated with the white cedar and capable of growing in the shade are red maple, magnolia, sour gum, laurel, swamp azalea, leatherleaf, sweet pepper bush, and high-bush blueberries. In some cedar groves we find the curly grass fern (*Schizaea pusilla*).

The deciduous swamps which are found along the slow-moving streams may have succeeded white cedar swamps on the removal of the valuable evergreen trees for lumber, and the trees and shrubs of such swamps are those which, held in subjection beneath the shade of the cedar trees, have sprung to maturity with the stimulus of the increased sunlight. Many times, however, the deciduous swamp has been in undisturbed possession of a stream valley from time immemorial. Open pools in the swampy areas are covered with white water lilies, golden clubs,

¹ The region, outside of its botanic aspects, presents much of interest. A study of the place names shows that the white cedar tree has been used in designating a number of geographic features, as: Cedar Brook and Cedar Grove. Next to the cedar, the white oak has been used, as in White Oak Bottom and White Oak Branch. Indian names linger in Manahawkin, Manumuskin, and Shamong. A number of geographic features are designated by well-known articles of human use. Such are Apple Pie Hill, Bread and Cheese Run, Breeches Branch, Cabin Branch, Calico, Featherbed Brook, One Hundred Dollar Bridge; and some have a personal flavor, as Comical Corner, Double Trouble, Friendship Bog, Good Luck, Hospitality Branch, Mary Ann Furnace, Mount Misery, and the like. Among the names are many recognized as exotic in origin, such as Chatsworth, Chesilhurst, Lakehurst, and Penbryn.



Where the pine forest reaches a projecting arm into the salt marsh at Somers Point—fronted by a strip of switch grass



In the heart of the Pine Barrens, on the south bank of the Wading River, are the typical New Jersey savannas, wet grassy lands dotted with groups of pine and of white cedar trees. The photograph was made in late May and shows the tall umbrella-like flowers of the pitcher plant rising above the swamp grasses



Leaves of the pitcher plant photographed in March where they were growing on the ground in the dense velvet of sphagnum moss in a cedar swamp. The yellowish green leaves are pitchers handsomely veined with crimson



On the lower plain, patches of broom crowberry (*Corema Conradii*) mingle with low pine trees and dwarf oaks. Reindeer lichen and flowering moss carpet the ground

and spatter-docks, while at the edges grow cinnamon and royal ferns, pitcher plants, sundews, and bladderworts.

True savannahs similar to those of the southern states are found in the pine barren region, as along some branches of Wading River. These are usually terraced, presenting alternately a wet terrace and a dry terrace. Grasses and sedges with a few peculiar

and characteristic herbs cover these savannahs, which are distinguished by the growth of scattered pitch pine or white cedar trees. These are open, sunlit breaks in the monotonous forests of pine and white cedar.

The growing season in the Pine Barrens is between the last killing frost of spring and the first killing frost of autumn. At Vineland, according to

the records of the United States Weather Bureau, the average date of the last killing frost is April 19, and the latest recorded date in the spring is May 13. The average date of the first killing frost in autumn is October 19, the earliest recorded date October 2. If we take the average dates, the season of growth is exactly six months, or 183 days, in length. The culmination of the flowering season of pine barren plants is in August, when a larger percentage of plants is in bloom than at any other season of the year.

An examination of the underground systems of pine barren plants brings out some important principles of plant growth. The rainfall is sufficient during the year for the superficially rooted annuals and perennials, but there are critical periods when no rain falls, and then certain marvelous leaf structures, which control loss of water, become efficient. With the deep-rooted trees it is otherwise, for during the critical period of dry weather their deep root systems enable them to get a supply of

water from the subsoil. These considerations indicate that most of the pine barren plants have methods of enduring drought, or of evading or escaping it.¹

No more inviting region in its almost primeval conditions lies so accessible to the busy dwellers in our large centers of population, such as New York and Philadelphia. The region, having a salubrious climate, should attract the health and pleasure seekers, and the state of New Jersey should preserve intact large stretches of the forest so that the healthy and the sick, the wealthy and the poor, can derive benefit from the life-giving air of the pines.

¹The soils of the pine barren region are sandy with a gravelly subsoil, and the rate of percolation of water through the layers of soil from different localities shows that water passes through beach or dune sand more quickly than through pine barren sand, and through pine barren sands more rapidly than through soils covered with a deciduous forest. Experiments on the water-holding capacity of these types of soils show that dune sand retains 33 per cent of water which falls as rain, the pine barren soils 45 per cent, and the deciduous forest soils 56 per cent. These matters are considered at some length in *The Vegetation of the New Jersey Pine Barrens*, by John W. Harshberger, published by Christopher Sower Company, Philadelphia, 1916.



This colonial log schoolhouse at Speedwell shows the style of old pine barren architecture and construction. Photograph used through the courtesy of Professor Herbert N. Morse

Creative Textile Art and the American Museum¹

By M. D. C. CRAWFORD

With two color plates presented to the JOURNAL by H. R. Mallinson & Co. and Johnson, Cowdin & Co., respectively

THE silk industry in America amounts to \$500,000,000 yearly. Ninety-seven per cent of the silks worn by American women are woven in the United States. It may also be added that the United States uses more raw silk than all of Europe combined. Thirty years ago the proportion of imports to exports was just reversed, and so within the business career of men still active, this industry has grown to its present enormous proportions.

Inspiring as these statements are for our industrial development, however, it must be said that the decorative ideas have been almost always foreign in origin. We looked to Europe for almost every suggestion of style in fabrics and in garments, until the necessity of the last two years compelled us to exert our own originality. The textile art was very much neglected in this country and, while it is unjust to the few men of original ideas, who did not wait for the spur of necessity, to say that there was no creation in America previous to the war, yet the statement requires only this qualification to be accurate.

This great industry during the past year has made extensive use of the American Museum collections. The cotton manufacturers are following this example, and before many weeks are past, this industry also will be indebted to the American Museum for decorative schemes. In New York City, besides the textile interests, there is an enormous investment of capital in the garment business. The number

of employees runs into the hundreds of thousands, and this is easily the best paid labor in the world. The volume of business in ready-to-wear garments that leaves Greater New York yearly runs close to the half billion mark—and this industry also is turning to the American Museum collections for artistic inspiration. But the silk men came first. Nor is the reason for this far to seek, since silk is a luxury and requires a continual succession of new and beautiful ideas in order to induce people to buy it.

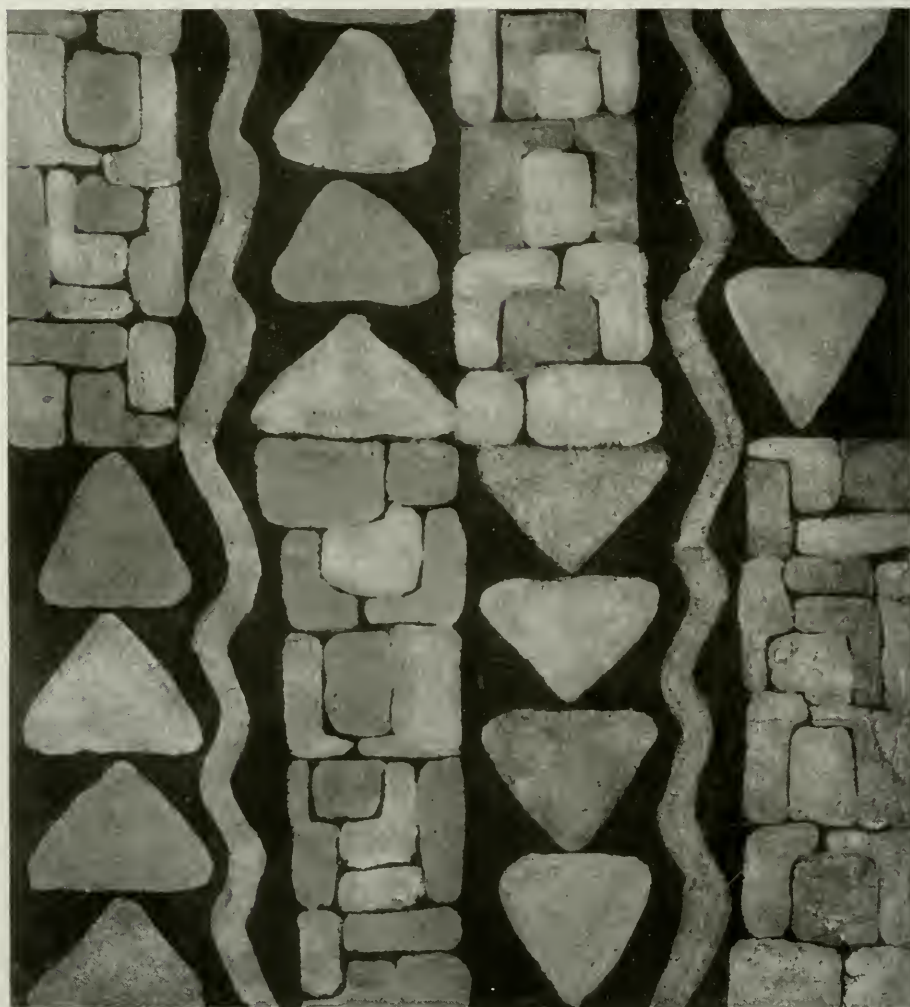
While it is unquestionably true that the great collections of primitive American art have largely affected the present styles (and no one can be indifferent to the significance of the tardy appreciation of this wonderful material), yet the other great collections, such as the Chinese, Koryak, Philippine, and South Sea Island, have also been of great interest. Fashion seems to require almost constant change, and it may well be that the designers will at different times emphasize different collections in the Museum. But the addition to our decorative arts of the inspirational wealth of aboriginal American design will be of permanent value. We shall turn to it again and again, each time with added skill and appreciation. These records are so intimately, so unquestionably our own, that they will serve as a basis for our distinctive decorative arts, and will lend a virile character to all our future creative work.

¹ See previous article by Mr. Crawford, AMERICAN MUSEUM JOURNAL, Vol. XVI, page 417, which gives many illustrations of Peruvian and other original sources of design in the American Museum.

It is by the simple, everyday objects and materials which touch our lives that we receive, for good or ill, the message of art. It has been so in every nation that has created a truly great school, and it was eminently true of the aboriginal Americans. Their art touched every phase of their existence, and it is richest in its textile and costume expression. It will therefore be evident to the thoughtful that the aesthetic possibilities of beautiful tex-

tiles are almost limitless. That other arts today, such as interior decoration, will follow the tendency in our costumes, is a natural corollary. To see and to wear beautiful fabrics and costumes cannot fail to develop our artistic appreciation in other lines.

This movement will have a great effect on our export business, for it goes without saying that the wonderful war energies awakened in America during the last two years must find vent in the



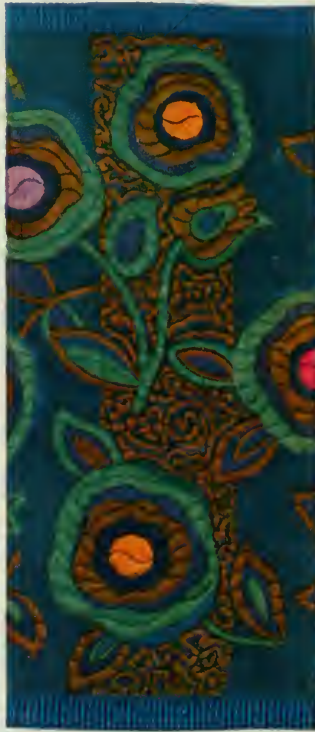
This design, which won second prize in the recent design contest, was suggested by the Indian collections in the American Museum. It was the first textile design ever made by the artist, Miss Ryther. The sample of silk incorporating it was furnished by Belding Brothers



The stripe at the top, made by Arthur Curren, was taken from a Titicaca pot. The second, designed by Harriet Hart, was taken from motives of primitive basketry of the Southwest. These are all part of the silks of H. R. Mallinson & Company, which were inspired by material in the Museum collections.



This lower pattern, designed by Miss Ilonka Karasz, was inspired by Guatemala belts and girdles in the American Museum



The designs of these ribbons were inspired by various collections in the American Museum. The Amur River and Koryak art is represented, as well as that of Peru and the Southwest. The designs were made by Mr. Emil Speck and the ribbons woven by Johnson, Cowdin & Co.

exports of peace, once the shipment of munitions ceases. It is essential to the success of a great part of this business that the product be typical of our artistic, as well as of our industrial development. If we are only copyists we can never be serious competitors.

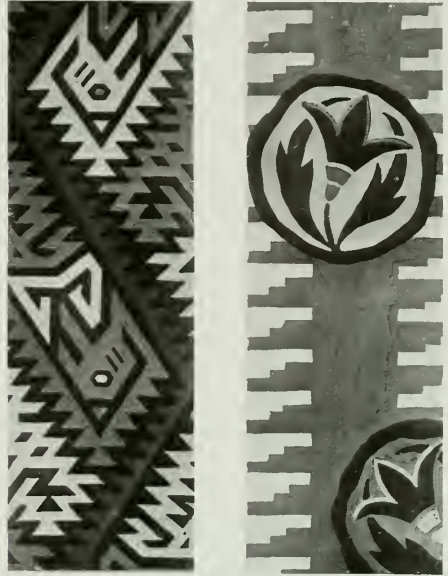
Bringing the industry, the artist, and the American Museum into closer relation has been a personal campaign,¹ the actual details of which were divided among lecture courses, personal visits by the artists and the responsible men in the industry to the Museum, and by a design contest (conducted by *Women's Wear*), in which designs submitted from all over the country had to have museum material for inspiration. This design contest developed many artists who have since been successful in the industry, and through it first learned how to use a museum in their work.² During the last few months, Saturday afternoons have been given over to the technical instruction of an ever-increasing group of designers, who in this way become familiar not only with the problems of the industry, but also with the collections in our exhibition halls.

The first man to visit the Museum as a representative of the industry was Mr. E. Irving Hanson, of H. R. Malinson & Co. At the beginning of the campaign, Mr. Hanson visited the Peruvian collection in order to get some ideas for making his silks more beautiful. He was an immediate convert to the suggestion, and many of the designs on his famous Khaki-Kool fabric were inspired by the beautiful things he saw.

¹ In this movement I have been greatly aided by Mr. Albert Blum, treasurer of the United Piece Dye Works, and by the publicity circulated among the industry through the columns of *Women's Wear*.

² A list of names of these artists is kept open to the industry.

The visit that Johnson, Cowdin and Company's organization made to the Museum was typical of the proper way of approach: Mr. MacLaren, business manager, Mr. Jacobs, mill expert, and Mr. Emil Speck, designer, came together. Mr. MacLaren wished to determine whether the claims I had made



Striking designs inspired by the Peruvian and Koryak collections of the American Museum. The samples of heavy silk embodying them were furnished by Cheney Brothers

to him concerning these collections were based on fact; Mr. Jacobs came to see whether such ideas could be developed on the loom; Mr. Speck came to convert the documents he saw into modern designs. Mr. Speck was and is a constant visitor to the collections, and the beautiful ribbons shown in the color illustrations are the result of his research in the Museum and his skill as a designer. These concerns have made it possible for the American woman to portray in her costume the great arts of the New World.

A scarcely less constant visitor to the



The idea for the upper design, made by Mr. Makoto Nishimura, was taken from the American Museum's collections of primitive American art. Mr. Nishimura was a prize winner in the recent design contest. Samples of silk bearing this design and the following were furnished by Belding Brothers

The lower design shows a graceful motive suggested to the artist, Mr. Andrew Fleury, by the Museum's Amur River collections. The design won third prize in the contest

collections has been Mr. O. G. Fisher, of Belding Brothers, and he has been very much influenced in his designing by the material he has seen here. The same may be said of Cheney Brothers, who are making use of ideas developed from this material. It would be tedi-

ous to enumerate each person who has come to the American Museum and found it a great commercial asset—as well as a delightful recreation. John Wanamaker's store recently had a very interesting exhibit of "Mayan Fabrics," the motives for which were taken from the Museum. These fabrics were exhibited in several other cities, even as far west as Portland, Oregon.

It would be impossible, within reasonable space limits, to show a tithe of the designs which have been created from this inspiration. Indeed, they are coming out so fast that it is impossible even to keep trace of them. The designers, working under the guidance of the Museum, are spreading this art so rapidly among the industry that many people are buying designs and do not realize that the ideas have been suggested by Museum material. As before stated, representatives of the cotton and garment concerns also are beginning to visit the Museum with serious intentions. Burton Bros. & Co.,

Wm. H. Brown Son & Co., Clarence Whitman & Co., Inc., Renfrew Mfg. Co., and Eddystone Mfg. Co., are among the cotton concerns that have come up to this date, and the firms of J. Rapoport & Co., A. Beller & Co., and E. J. Wile & Co., are among the costumers who have

come. It has grown to be the habit of out-of-town retailers to include a visit to the American Museum as a part of their New York activities. In this way the educational value of the institution is widely disseminated, and this tendency will be much strengthened as time goes on. Lazarus & Co., a large retail store in Columbus, Ohio, re-

cently had an exhibition of Peruvian art. It was extensively advertised and had unquestioned educational value.

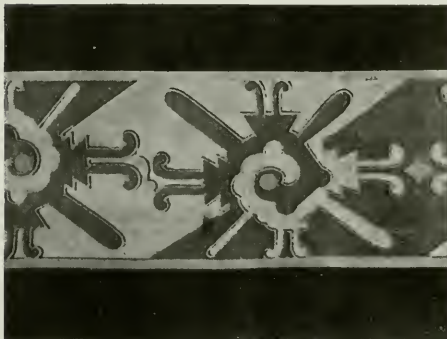
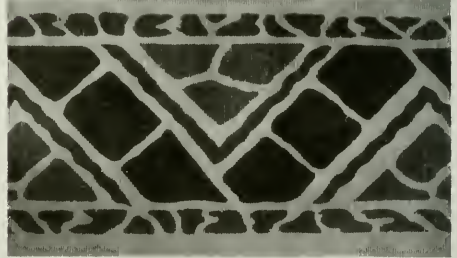
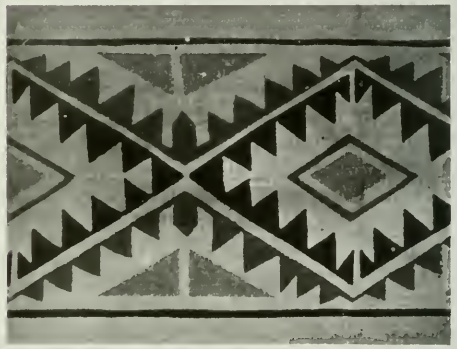
Thus it can be seen that at least the foundations for a national textile art have been laid, and that the part the American Museum has played in this movement is of importance. Educational work cannot be limited by the



These three designs were all taken directly from specimens in the American Museum, and are displayed in silks manufactured by John Wanamaker. The figure at the left is from a Peruvian poncho, that in the middle from a Mexican terra cotta stamp, and the one on the right from a Peruvian cylinder roller

commercial advantages which accrue to certain enterprising concerns, for the value to the country at large of a great and distinctive art must be obvious. Nothing, unless it be music, so unites a people as a similarity or a sympathy in their decorative associations. We are a nation composed of many strains of blood, a people which has drawn traditions from innumerable sources, and the political unity which

holds us together will be strengthened and vivified by an art which we may truthfully call our own. To make life a little more gracious; to make beautiful things a little more charming; to bring into the lives of millions of people simple things which carry a message of loveliness: this is the meaning of creative art in America, and this is one phase of the educational work that the American Museum is doing. This



The two upper designs at the left were taken from Aztec shields in the collections of the American Museum. The third is Mexican, the design signifying "sand and water." All three have been incorporated in silks manufactured by the Joseph Berlinger Company.

Of the designs at the right, basketry and pottery motives from the Southwest inspired the two uppermost, taken from specimens in the American Museum's collections. The third design was suggested by the Amur River collections. Levinson and Bessels are the manufacturers.

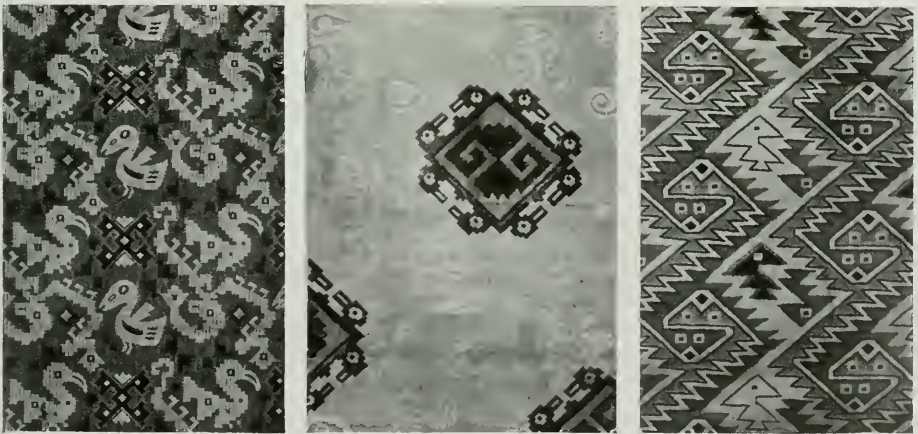
transcends in significance the commercial phases of the subject. The loom and the printing frame, the embroidery machine and the garment factory are but the fluid mediums through which the creative ability of American artists is reaching the American nation. And it is a matter of satisfaction to realize that the diffusion of the new ideas has been and will continue to be a profitable undertaking.

It is perhaps of human interest that through this movement and because of it, an increasing number of young American artists are receiving recognition and profitable employment, and it is not too much to say that they are developing a fine feeling of loyalty toward this Museum for the cordial reception they have received and the unflinching assistance that has been extended to them. To have taught so earnest a group to make use of the original sources of design in Museum material, is in itself an achievement. The habits thus acquired, leading to individual successes, will encourage artists just beginning their career to follow such examples, and the effects of

such association must eventually be felt in every branch of American decorative art. This is the true significance of the work.

This movement is the result of the unselfish and coöperative efforts of a number of men. To give a list here would occupy too much space. The members of the Museum staff and representatives of the industry who have given their time unsparingly in lectures and individual instruction have contributed largely to its success. But it must also be borne in mind that many other men for a generation have felt that some day such a movement must come, and have built up these wonderful collections so that the American Museum would be ready to give the service when the time was ripe,—these equally share the credit.

In the future, the fact that the collections of this Museum are of immense value to the artists and to the industry will be so obvious as to require no comment, but this article and the illustrations are intended to mark the first success in the campaign for creative design from New World inspiration.



The two outer panels, representing bird and conventionalized fish designs, were inspired by Peruvian textiles in the collections of the American Museum. The middle design of conventionalized birds was taken from the Peruvian, Amur River and Koryak collections of the Museum. They have been brought out in silks manufactured by the Central Textile Company



THE OHIO SENATOR RECEIVES A DELEGATION OPPOSED TO THE QUAIL BILL

This and six other cartoons, by W. A. Ireland, were published in the Columbus *Dispatch* during the fight for the protection of the quail in Ohio, and proved largely instrumental in rousing the state legislature to action. The Ohio quail bill saved this "game bird" by placing it on the "song bird" list—a classification none will question who has pleasant memories of the quail's musical "bobwhite" notes, and especially who knows its seater song heard from the woods in the fall

The War for America's Wild Life

By WILLIAM T. HORNADAY

Director of the New York Zoological Park, and Campaigning Trustee of the Permanent Wild Life Protection Fund

ON account of the many and frequent changes in the conditions affecting wild life, the defenders of our fauna must maintain a close surveillance of their entire field of activity, in order to meet new dangers with new measures. Even during the past three years, so many changes have occurred that a new bird's-eye view of the national field is both desirable and interesting.

During the past five years two great classes of our wild life have been brought under good protection, and two more remain exposed to the dangers of extermination according to law. They stand as follows:

Under halfway protection

Both the singing and the songless insectivorous birds are now appreciated, and protected by state and federal laws; and they are increasing.

The migratory game birds are 75 per cent protected by the federal law, and they also are increasing.

In danger of extermination

The nonmigratory upland game birds are, as a rule, feebly and inadequately protected by their state laws; and in most localities they are rapidly vanishing through over-shooting, legal and illegal, and through other causes.

The big game of the West, outside the game sanctuaries, has been going out at a frightful rate; and to this rule there are only a limited number of local exceptions. Local extinction on a vast scale, and in the near future, seems certain to supervene.

Finally, far too much attention has been focused on the breeding and introduction of foreign game birds while the protection and rehabilitation of native species have been sadly neglected. The movement to breed exotic pheasants on game farms, at state expense,

extends, with a few barren intervals, across the continent. Alien species are bred and coddled, while our native species are shot. The most aggravated case of this kind has been on exhibition in Iowa, where the pheasant-devoted state game warden has bitterly fought—fortunately in vain—the state-wide demand for a five-year close season on quail and pinnated grouse.

In the fall of 1915 when the writer made a long tour of inspection through eleven western states, the alarming condition of the upland game birds of that vast region became painfully apparent. Throughout that whole area not one move had been made to give long close seasons to the sage grouse or the pinnated grouse, and both of those fine species were fast going down to oblivion. The big game was vanishing at a tremendously rapid rate, by over-shooting; and in several states female deer were being killed for sport.

The advent of the automobile and its concomitant "good roads" was like the sudden rising of a hundred thousand new dragons to destroy the remnant of game. Some of the stories told were alarming, and the game-slaughter pictures that came out of Texas were appalling. Some of the open seasons on the magnificent sage grouse began *August 15*, with chicks hardly able to fly, and the bag "limits" were a ghastly joke.

For the saving of the remnants of deer, elk, mountain sheep, and goats, and the restocking of lifeless areas, a workable plan for the making of game sanctuaries in national forests was

wrought out and launched in Congress, in December, 1915. Two and one half years of hard labor have been devoted to that Chamberlain-Hayden bill, and \$3,255 in money has been paid out in campaign expenses. Up to this date it has been a physical impossibility to secure a vote on the bill, in either house of Congress. We believe that the votes are there to pass the bill, whenever it can be brought to a vote. When enacted into law, it means anywhere from one hundred to one hundred and fifty big-game sanctuaries in national forests not suitable for grazing or agriculture; and until the bill is passed and signed, its supporters will strive for it.

In 1915, and again in 1916, two great contests were fought out in Congress, when the spring-shooting "sportsmen" of Missouri and adjacent territory undertook to kill the federal migratory bird law, by cutting off the annual \$50,000 for its enforcement. On both occasions they were routed. The principle of "no spring shooting" still stands like a Rock of Gibraltar for the defense of our one hundred and fifty-four species of migratory game birds.

But what of the upland game birds of the West? In the autumn of last year we started a great "drive," covering all the states west of the Mississippi, except Louisiana, Missouri, and Arkansas, for new game laws that would save the sage grouse and all other grouse and quail from extinction, and place them on a continuing basis. We began to hammer at the doors of nineteen state legislatures that convened early in January, 1917, hurried through their sixty-day sessions, and then stampeded for home. We spent six months of hard labor on that widespread campaign, \$2,350 in money, and about 15,000 pieces of "literature."

Our Bulletin No. 5 (8,000 copies) went to every legislator in the nineteen states, to hundreds of newspapers, and to thousands of picked leading citizens. The American Educators Conservation Society sent out 2,500 special appeals to educators, and 1,500 to lawmakers.

It was one of the most interesting campaigns we ever entered, and it won sweeping reforms in seven of the nineteen states. The real winnings were as follows,—but it is too bad that space limitations prevent mentioning by name each of the gallant men in the seven states who did the work:

Idaho—Important improvements were made in the wild life laws of Idaho. Sage grouse were given a close season until August 15, 1922; quail shooting was closed until 1920; the limit on deer was reduced from two to one; all big game killed must be tagged; and the regulations of the federal migratory bird law were made Idaho state law.

Montana—The protection of mountain sheep and goats was extended to 1922. The bag limit on deer was reduced from two to one, and the hunting season was shortened to two weeks. All upland game birds throughout the state are protected, except for an open season of two weeks. Killing elk merely for their teeth or heads is made a felony!

Nevada—In Nevada all grouse and mountain quail are protected until 1922. Mountain sheep, goats, and antelope are protected until 1930. The sale of game is prohibited, and the state bird laws are made to conform to the migratory bird law.

Utah—Utah achieved a sweeping victory. All upland game birds—grouse, ptarmigan, and quail—were given long close seasons. All shore birds, gulls, pelicans, and doves were permanently protected.

New Mexico—New Mexico has experienced a great awakening, and is fairly seething with the reform spirit. Nine game protective associations have been formed. Sage grouse, bobwhite quail, sheep, and antelope are protected for long periods. The state game and fish department is excellently managed, and public sympathy is now fully mobilized.

Arizona—In Arizona a "buck law" has been enacted, the bag reduced to one

deer per year, and the deer season has been reduced to thirty days. The wild-fowl season has been made to conform to the federal bird law, and the limit on quail has been reduced to twenty birds in a day.

Iowa—The Iowa legislature enacted two laws, in spite of fierce opposition by the state game warden and many "sportsmen," according five-year close seasons to quail and pinnated grouse throughout the state.

A great victory was won in Ohio, but hardly any portion of it belongs to our bow and spear. We did not start it, and we had very little to do with it, aside from promulgating widespread revilement of Ohio for its gameless and hopeless condition. The one thing that

roused the members of the Ohio legislature to action on the proposition to put all quail "in the class of song birds," and swept certain Ohio "sportsmen" off their feet as if by a cyclone, was a series of seven thrilling drawings by cartoonist W. A. Ireland, that were published at the right times in the *Columbus Dispatch*. These cartoons are so good that it really seems as though they would make mummies sit up and vote for quail protection!

Two of the states in which we made very vigorous campaigns, Wyoming and Texas, were sullenly obstinate and unyielding. Wyoming made no concessions whatever to wild life, and Texas,



Game slaughter as it was carried on in one state of the Union in 1915, and still continues there to the disgrace of America. Men, dogs, pump guns, and automobiles working together can quickly bring extinction to all the game of any region. Mountain sheep and antelope are already so nearly exterminated in Texas that the state has been forced to pass a law providing for long close seasons.



UNDER THE PROTECTION OF THE UNITED STATES GOVERNMENT

Fortunately, before many more years are past, cooperation is certain to be established between state and national governments for the protection of wild life. This photograph, taken in the Wichita National Bison Range four years after protection was established, is a delightful illustration of the effect of complete protection on wild

"the dark and bloody ground," yielded only a law giving long protection to her pitiful last remnants of mountain sheep and antelope. Arizona made good last year at her November election. Oregon, California, Colorado, Nebraska, the two Dakotas, Minnesota, Kansas, and Oklahoma yielded nothing of any real importance, but Minnesota came near to effecting a reform. A demand for a three-year close season for pinnated grouse was backed by the best sportsmen of the state.

The East that lies east of Pittsburgh is far more aroused for the perpetuation of wild life than is the West or the South. New Mexico is bubbling over with enthusiasm to bring back the game that once was so abundant in that state. Colorado is a sad example of the results of game laws that have looked good on the outside, but which have really been far too liberal to the hunter and too hard upon the game. Out of her once great stock of elk, deer of two species, mountain sheep, antelope, and bison, no hunting now is permitted of anything save rabbits and upland game birds! The big game is so fearfully scarce that all hunting of it has been stopped.

Texas is in a deplorable condition. With no paid game wardens, with lack of enforcement of ineffectual laws, and with automobiles and pump guns combined with a savage determination to kill until the last head of game is dead, the game is being swept away at a frightful rate.

The automobile, as a factor in game destruction, surely has come "slaying and to slay." It is doing its deadly work among the upland game birds through the whole width of the American continent. In India it operates with telling effect among the big game of the western Ghauts, and in Australia

it is fatally active among the kangaroos. New York and North Dakota have forbidden, by law, the use of the automobile in hunting—and all other states must do the same!

Public aversion to the killing of female deer has taken form in "buck laws" in twenty states. Quail now are protected by long close seasons in fourteen states. Prong-horned antelope are protected in all the states they inhabit, and mountain sheep are immune from slaughter in all states save Wyoming. The total number of migratory bird species protected by the federal law is 1,022.

The international migratory bird treaty with Canada was fully ratified on December 6, 1916. It lacks, however, an enabling act of Congress to carry its terms into effect, as well as \$200,000 to meet the cost of enforcement throughout the United States. The Hitchcock bill, introduced in the last session of the 64th Congress, was almost completely eviscerated in the committees to which it was referred, and its proposed appropriation (\$170,000) was calmly stricken out. If the people of the United States desire to see that treaty enforced, it is time for about one million of them to say so, and ask for the fund necessary! The bill was re-introduced in the new Senate on April 10, by Senator Smith, of Arizona (S. 1553), minus the \$170,000 absolutely required for enforcement in the forty-eight states.

The hardest fighting, and the most of it, that occurred in the great western drive for the protection of wild life, took place in Iowa over the quail. Eight college professors, representing seven institutions, a dozen Iowa editors, a goodly array of farmers, and strong bodies in the two houses of the legislature, fought the state game warden and

his "sportsmen" following, to a glorious finish. The final fight in the Senate lasted four hours, and ended in a victory for the quail, thirty-four to fourteen.¹

By their own acts and ethies, the men who shoot game are now dividing themselves into two distinct groups. Heretofore all the members of the entire body have been known as "sportsmen," chiefly because the line of cleavage has not been clearly defined. Now, however, the time has arrived when it is not only possible, but also necessary, to separate into two classes the men who hunt and kill game.

One class consists of real sportsmen, who may be defined as men with logical minds, high moral principles, ethical standards either developed or latent, and a willingness to make any personal sacrifice for the preservation and increase of wild life that circumstances may render necessary. The other class consists of men whom we shall call "gunners," whose minds are impervious to logic, who recognize nothing resembling broad policies in the protection of wild life, who are devoted to the gun and shooting, and who believe in killing game by every means that the law permits, as long as any game remains

alive, and regardless of the prospect of the extinction of species.

The word "sportsman" has reached the point where it must either disappear altogether or be split into fragments, each one bearing either a new name or a qualifying adjective. The time when the old and favorite term necessarily meant a game protector is gone by. The men who lack the sense of fairness, and the spirit of self-sacrifice which is found in every true sportsman, must now and henceforth be reckoned with separately.

The true sportsmen have joined hands with the great mass of the friends and protectors of wild life, who do not shoot and who never kill game. It is incumbent upon this class to meet the gunners whenever necessary, and fight the battles of the vanishing wild life. Today the gunners are still keeping up the senseless slaughter that disgraces Texas; but surely some day the people of that state will arouse from their lethargy. Whether they will do so before the game is entirely gone—remains to be seen.

The American people are big enough, and rich enough, and sufficiently numerous, to continue to defend and increase the wild life of the American continent, even during a war with Germany. War or no war, we must pay our taxes, educate our children, and protect our wild life and forests from destruction. We are strong to do all these things, at the same time that we join the World War for democracy and the rights of man.

¹ The factor that enabled the educational leaders of that fight to engage in it as they did, was nothing more nor less than two hundred and fifty paltry dollars in money that were thrown into the contest from the Permanent Wild Life Protection Fund, when none of the fighters had time to stop to raise campaign expense funds. It was very much like buying a victory for \$250; and when the whole western campaign was over, there remained in the treasury of the Permanent Wild Life Protection Fund only one hundred and twenty very lonesome dollars.

“A Garden in Every Yard”

SLOGAN FOR 1917 IN AMERICA

By JOHN H. FINLEY

President of the University of the State of New York and State Commissioner of Education

THE present food shortage and consequent increase in food prices have emphasized to the American people the necessity for immediate steps toward adequate food production. Conservation agencies interested in farming and those more generally concerned with the whole financial condition of the country agree that no other factor in our present national situation is of greater importance than careful and systematic preparation to secure the largest possible production of food crops during the present year. All the data collected for the government reports show that the quantities of grain and other products remaining upon the farms are less than one half the supply at this time last year. There seems to be no very great promise of an unusual crop for the coming year, and therefore it behooves every American citizen to do what he can in the way of producing, so far as possible, some of the food which he and his family will necessarily consume during the coming year. If production is not possible, the least that any one can do is to conserve carefully the food supply produced by others.

There is, throughout the land, a most intense interest in the campaign which has been started with the young people for more and better gardens. Every community should coordinate all of the forces—educational, social, business, and religious—interested in the promotion of garden work among young people and cause their efforts to be united in an effective campaign. A garden committee composed of a representative of each organization interested might well be formed to direct the work. The superintendent of schools or a member of the board of education might well be chairman of this committee. Whenever practicable a trained supervisor or director of this work should be employed by the board

of education to insure the proper development and permanency of the work. In the larger school systems teachers already in service, who have had some experience and training in garden work, might well be enlisted to act as local supervisors under the guidance of the trained director. In the smaller school systems, where possibly a director who will give his whole time to the work is impracticable or impossible, a teacher already in service might be retained during the summer, while, from the spring planting until the harvesting of the crops in the fall, he might give part time to the direction of garden work.

One of the first necessities is to arouse interest in the work among the young people of the community, but fully as important as this is securing the cooperation of the parents. It is quite necessary for the entire success of this movement, that the older people not only realize the importance of increased production during the coming year, but that they also take an active part in the production.

It is especially important that only good seeds and good plants be used. Therefore, those who are in charge of this work should see to it that those having gardens be referred only to reliable firms for seeds. In order that lack of capital may be no handicap to those desiring to take up the work, there should be provided and administered a loan fund for those who need assistance in buying manure, hiring vacant lots or large garden plots, and in paying for plowing and harrowing same.

Now is the time to deal with next winter's disturbances: high cost of living, boycotts, and embargoes. A national preparedness for either peace or war demands that immediate steps be taken by every individual to do his share in the production movement. “A garden in every yard” should be our slogan.



GEORGE K. CHERRIE, FIELD NATURALIST

EDITORIAL NOTE.—Mr. Cherrie is a veteran of the tropics. He has made twenty-seven faunistic expeditions into tropical countries and has visited every state in South America except Chile. He began his tropical field work in 1889, when he went to Costa Rica under contract with the Costa Rica government to collect natural history specimens and to do taxidermy work for the little natural history museum at San José. He soon became curator of birds and mammals there, and in connection with his work headed many expeditions into the high mountainous interior of the country, as well as along both the Atlantic and Pacific coasts of Costa Rica and Chiriqui. During the three years that he remained in Costa Rica he brought together a collection of twelve thousand bird skins, many of which found their way into American and European museums.

Returning to the United States in 1892, Mr. Cherrie became assistant curator in charge of the department of birds of the Field Museum of Chicago and immediately entered upon exploration work for that institution. He went into the West Indies, particularly into Santo Domingo and Haiti, and also made expedition into Florida, southern Texas and along the Gulf Coast. After three years' service with the Field Museum, he took up field work in northern South America as a personal venture, and for some years the results of his collecting and study went chiefly to the British Museum and the Rothschild Museum in England. Most of this time was spent in Venezuela on the Orinoco and its tributaries. Some of his most thrilling experiences with wild animals occurred during this stay in Venezuela, where also he passed through many personal dangers in connection with native revolutions.

He made later expeditions into the island of Trinidad, British Guiana, and French Guiana. Although his greatest work has been on birds, he has studied and collected mammals and other forms in the field as well. One gains an intimate knowledge of Mr. Cherrie through the pages of Colonel Roosevelt's *Through the Brazilian Wilderness*, the story of an expedition on which Mr. Cherrie acted as naturalist. With the permission of Charles Scribner's Sons, we make the following quotations:

"Cherrie was . . . born in Iowa, but [is] now a farmer in Vermont. He has a wife and six children. Mrs. Cherrie had accompanied him during two or three years of their early married life in his collecting trips along the Orinoco. Their second child was born when they were in camp a couple of hundred miles from any white man or woman. . . . He was an unusually efficient and fearless man; and willy-nilly he had been forced at times to vary his career by taking part in insur-

To South America for Bird Study

A STORY OF TRAVEL AND OF STRANGE HABITS OF BIRDS.—
PRELIMINARY REPORT BY THE CHERRIE-ROOSEVELT
EXPEDITION OF THE AMERICAN MUSEUM

By GEORGE K. CHERRIE

BEFORE the end of the Roosevelt Expedition of 1913-14, while we were still in the heart of South America, Colonel Roosevelt realized that the observations on the life and habits of the animals of the region through which we were rapidly journeying must of necessity be fragmentary. The work of that expedition, on which the famous "River of Doubt" was explored, was of necessity mainly geographical. Colonel Roosevelt accordingly determined that there should be one or two supplementary expeditions for field study of animals, particularly of birds. Mr. Leo E. Miller has already been sent into the field on what might be termed the Miller-Roosevelt Expedition of the American Museum, and in the fall of 1915 it was decided that the Cherrie-Roosevelt Expedition should be sent out the following spring. Inasmuch as Dr. Frank M. Chapman, of the American

Museum of Natural History, was making an expedition into the Andes of Ecuador, Peru, and Bolivia, it was felt that the interests of the work would be advanced by combining the forces of the two expeditions.

Accordingly the writer, in company with Dr. Chapman, left New York in May, 1916, for Colon, where we secured a steamer that took us through the Panama Canal and down the west coast of South America. We made our first stop at Guayaquil, Ecuador. From that point we went into the interior, stopping about half way to Quito at the town of Riobamba, which we made the base for our collecting work in that region. From Riobamba, we proceeded to the volcano of Chimborazo, where we camped, and did collecting at an altitude of fourteen thousand feet. We also did more or less collecting in the environs of Quito.

Returning to Guayaquil, we traveled

rections. Twice he had been behind the bars in consequence, on one occasion spending three months in a prison of a certain South American state, expecting each day to be taken out and shot." (P. 3.)

"Of all the party Cherrie's experiences had covered the widest range. This was partly owing to the fact that the latter-day naturalist of the most vigorous type who goes into the untrodden wastes of the world must see and do many strange things; and still more owing to the character of the man himself. The things he had seen and done and undergone often enabled him to cast the light of his own past experience on unexpected subjects. Once we were talking about the proper weapons for cavalry, and some one mentioned the theory that the lance is especially formidable because of the moral effect it produces on the enemy. Cherrie nodded emphatically; and a little cross-examination elicited the fact that he was speaking from lively personal recollection. . . ." (P. 179.)

"Cherrie, in addition to being out after birds in every spare moment, helped in all emergencies. He was a veteran in the work of the tropic wilderness. We talked together often, and of many things, for our views of life, and of a man's duty to his wife and children, to other men, and to women, and to the state in peace and war, were in all essentials the same. His father had served all through the Civil War, entering an Iowa cavalry regiment as a private and coming out as a captain; his breast-bone was shattered by a blow from a musket-butt, in hand-to-hand fighting at Shiloh." (P. 297.)

For a man of his achievement, Mr. Cherrie is extremely modest. Colonel Roosevelt is quoted as saying that the only occasion on which he ever witnessed any display of vanity in Mr. Cherrie was one day during the exploration of the "River of Doubt" when the party was in a starving condition and Mr. Cherrie came into camp with two howling monkeys he had shot. It was on this "River of Doubt" expedition that Colonel Roosevelt was so impressed with Mr. Cherrie's power as a field naturalist that he conceived the idea of sending him back into the region for intensive study. What he says has been quoted in the *JOURNAL* previously, but it is worth repeating:

"I think that a museum could now confer most lasting benefit, and could do work of most permanent good, by sending out into the immense wildernesses, where wild nature is at her best, trained observers with the gift of recording what they have observed. Such men should be collectors, for collecting is still necessary; but they should also, and indeed primarily, be able themselves to see, and to set vividly before the eyes of others, the full life-histories of the creatures that dwell in the waste spaces of the world" (P. 161.)



The great colony nests of the parakeets are sometimes occupied by as many as one hundred pairs of birds. The construction of these nests, contrary to most nest-building operations, begins at the roof. Separate entrances, cunningly devised of thorny twigs to exclude enemies, lead to nursery chambers where from one to five families are reared



SOUTH AMERICAN HOMES OF PARRAKEET AND JABIRU

The jabiru, or giant stork, attains a height of five feet. In a rookery containing a colony of wood ibis I found a single jabiru which had established himself in the center of the colony, and built his nest on the extreme top of one of the trees, from which he overlooked the near nests of the ibis and in the distance the vast stretches of alluvial plain

down the coast to Callao, remaining, however, only one day, in order to visit Lima. While at Lima, we visited the zoölogical garden and other points of interest in and about that old city. From Callao we sailed down the coast to Mollendo, which is the port of entry to the high interior of Peru and Bolivia. From Mollendo there is railroad communication with Arequipa, Lake Titicaca, and Cuzco. Dr. Chapman remained at Arequipa, while I went on to Cuzco in order to arrange for transportation for a contemplated trip down the Urubamba Valley. While waiting for Dr. Chapman to join me, I spent much time visiting the Inca ruins in and about the city of Cuzco. A few days later we started on the expedition through the Urubamba Cañon, past Ollantaytambo, and on to Machu Picchu, the old Inca City of Refuge.

We made our camp at the foot of the mountain spur on which Machu Picchu is situated, devoting our time for a couple of days to securing a collection of birds typical of that region. Also we spent one day climbing to the top of the mountain spur in order to obtain photographs of the ruins that once again are being buried under tropical foliage. I shall long remember what a tremendous climb it was. Both hands and feet were employed as we worked our way along narrow ledges or scrambled up the nearly vertical cliffs, catching here and there on projecting bits of rock, or putting our faith in the strength of some aerial root stalk that elung close to the face of the cliff. Up, up, for almost three thousand feet, to the very topmost point of the mountain spur, from where we were able to look down on the ruins. Here we found that we were on what had once been a well-paved highway leading directly to the ruins. Sometimes we descended ancient stairways cut into the living rock, narrow and tortuous, pierced here and there by narrow channels that undoubtedly had been used for conducting water to the city. A day was spent among the ruins before we made the return journey, which was found to be even more difficult than the climb had been. Going down, it was necessary to hold on with the hands and feel carefully for a solid resting place for the feet, and as we were continually bringing into use a set of muscles that are not ordinarily employed in walking, we were pretty nearly exhausted

before we reached solid ground. We felt fortunate indeed that all the members of our party escaped without accident. There were many places in the descent where a misstep would have meant plunging for hundreds of feet down on the rocks below.

We then continued through the valley as far as Trinidad, which is located just at the edge of the tropic zone. Here we had opportunity to do some splendid bird collecting. The journey down the valley was a ride through a wonderland. On both sides of the Urubamba Cañon are continuous series of terraces that had made available for cultivation every foot of soil in the valley. The wonderful aqueducts for supplying water to these terraces are still intact in places.

We then packed our outfit and moved back toward the plateau in which rests Lake Titicaca. At Tirapata, near which is a small lake that Dr. Chapman desired to visit, the expedition divided, and I started on my journey across the continent for the interior of Matto Grosso in Brazil, in order to complete the observations that were begun during the Roosevelt Expedition in 1913-14.

My way lay first across Lake Titicaca. On a previous expedition I had crossed this lake at night; now I was pleased that I had an opportunity to go around the lake by day and stop at the various small ports and villages, an opportunity of which I availed myself with great satisfaction. But I was to be disappointed in the result. The season was midwinter, and neither saloons nor state rooms on the little steamers plying on Titicaca were heated. Even on deck in the sun it was cold, for the wind that came down from the hills around the lake was icy. The passengers stood about and shivered, although wearing all the wraps they possessed. Also the hills, instead of being bright green, were dull, gray, and lifeless. The two days' journey was one of great discomfort and the scenery was of little interest. I then went on to La Paz, Bolivia, from which point one can get railroad transportation through the Andes as far as Atocha, on the line toward the Argentine frontier. This journey also was not one I would wish to repeat for pleasure. All the passengers suffered greatly from the cold. The cars were not heated, although the temperature was ten degrees below zero. At

Atocha we had heard we could get good hotel accommodations. We finally found that the accommodations were a mud-floored shack with a room about twelve by twenty-four feet, containing ten cot beds. From Atocha a coach road leads to La Quiaca on the northern frontier of the Argentine. We left early one freezing morning, but suffered much distress on the journey because of the volumes of choking, blinding dust, which enveloped the coach from the start until we finally halted for the night at one of the little Bolivian towns.

From La Quiaca railroad transportation can be secured to Buenos Aires. It was to this city that the American Museum had forwarded a new outfit for me. Having reached Buenos Aires, and the mouth of the Parana River, I felt that I was finally embarked on the more important work of my expedition. As soon as I could make arrangements, I secured a steamer going up the Paraguay River, my first stop being at Asunción, where I had to remain a few days waiting for a boat that would carry me farther up the river. Collecting on this part of the journey began at Puerto Pinasco, in the Paraguayan *chaco*, a region in which little zoölogical work has been done. During the first Roosevelt trip Mr. Miller and I had made a short excursion from Asunción up the Pilcomayo River, the result of which proved so interesting that I was anxious to know more of the region. Probably one of the principal reasons that little is known of the *chaco*, is that the Indians throughout that region have been more successful than the natives in any other part of South America in retarding inroads by Europeans. Many expeditions which have started into the *chaco* region have been annihilated. Even today, although cattle ranches have been founded at one point or another, and companies formed for the exploitation of quebracho, for tanning leather, there is real danger from Indian attacks if one goes any distance back from the Paraguay River.

From Puerto Pinasco (the property of an American syndicate), there is a service railway running inland for a distance of about twenty-five miles, and from there on, a good cattle trail for another twenty-five miles into the interior, where is located a large cattle ranch at a point known as Fort Wheeler. Between Puerto Pinasco and Fort Wheeler I spent about two months collecting

birds and making a careful study of bird habits. I was successful in obtaining pictures of a number of species which have never previously been photographed. I also found many nests and eggs of rare forms. At Puerto Pinasco I was much interested to find flocks of a species of parrakeet associating with flocks of cow-birds all feeding on the ground. They wandered about, following grazing cattle, walking, not hopping, and apparently feeding on whatever vegetable or animal substances they could secure. These were the same parrakeets that later I found constructing great colony nests, occupied by from two or three pairs to one hundred pairs of birds. These nests had separate entrance ways into nursery chambers where from one to four or five families were reared. I found that these parrakeets began the construction of the nest at the roof instead of at the foundation, contrary to most nest-building operations, and not infrequently used one of the large platform nests of the giant jabiru storks as a roof for their apartment dwelling.

I succeeded in getting many interesting pictures of rheas while in the *chaco* region. At the time of the Roosevelt Expedition, during our stop at Buenos Aires, we visited some of the large fur houses and saw thousands upon thousands of bales of rhea plumes, and learned that for years the Indians and other native hunters had been hunting these birds ruthlessly. It did not seem possible that such enormous quantities of plumes could have been secured without depleting the rhea population, but we found them very abundant indeed, scarcely a morning passing without our seeing nests and single eggs scattered here and there across the open *campo*. Day after day the Indians brought to camp loads of eggs that they had taken from nests. As is well known, several females lay eggs in the same nest, but incubation is attended to by the male bird only. He also takes care of the young. I found one nest containing thirty-seven eggs, and many others with a less number.

In October I embarked on a small steamer that carried me farther up the Paraguay River to Corumbá, Brazil. At Agua Blanca, three or four hours above Corumbá, I did my next collecting. Later I ascended the river for a distance of about five hundred miles to one of the large cattle *fazendas*, property of the Farquhar syndicate.

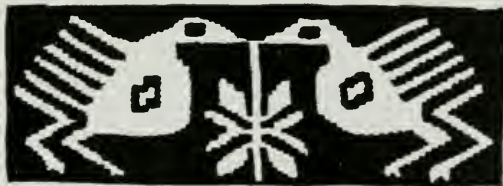
One day, on the trip up the river from Corumbá, members of our crew pointed excitedly to something ahead of us in the middle of the river. What was our astonishment to find as we drew nearer, that there were a couple of white-lipped peccaries swimming in midstream! They had undoubtedly taken to the water voluntarily in order to cross the river, which at that point must be at least five hundred yards wide. It was only a few moments before a boat was manned and the peccaries overtaken. That night we had roast pork for supper.

During my stay I was the guest of the superintendent of the *fazenda*, and made Descalvados (the headquarters of the ranch) the base of my operations. From that point I made excursions along both sides of the Paraguay River, and learned to know what the Panateles really are,—vast alluvial plains that during the rainy season are entirely submerged, the water varying in depth from a few inches to many feet. During the dry season much of this vast region is dry land, but everywhere so crossed and intersected with irregular channels of stagnant or sluggish water, that rarely can one ride more than a few hundred yards in a straight line without having to struggle through the mud and water of the ponds or streams.

The Panateles are the homes of immense flocks of many species of water birds—ducks, herons, grebes, and rails. While the greater part of the region is treeless, there are, nevertheless, small islands densely forested. These are rookeries for colonies of

egrets or various species of ibis. I had the pleasure of visiting a number of these colonies. The Indian guides that I had with me in the Panateles proved to be remarkably efficient. They were also relatively trustworthy zoölogical observers. From one of them I learned first that some of the rookeries, which are occupied from the first of August until the end of September by colonies of egrets, are later occupied by colonies of wood ibis, the latter not only occupying the same region but also employing the same nests as the egrets,—without even so much as a thorough housecleaning. In one of these rookeries, where there was a colony of wood ibis, I found a single jabiru which had established himself in the center of the colony, and built his nest on the extreme top of one of the trees, from which he not only overlooked the nests of the ibis, but also had an unobstructed view of the Panateles in all directions.

There were deer in the open country, as well as rheas, and storks—in fact, they were sometimes abundant. In one day's ride across the Panateles I counted forty bucks of the black-tailed swamp deer and numberless does. In addition to these, we saw a few specimens of the beautiful white-tailed deer, also puma, peccaries, and two species of anteater, besides countless numbers of birds of many varieties. Three months' work in this region of marshes and open plains—the last collecting point—supplied the expedition with collections which will prove of great interest to the public, as well as to the scientific work of the American Museum.



An Exhibit of Military Hygiene

HOW SCIENCE SUPPLIES THE NEEDS OF THE MODERN SOLDIER

By C.-E. A. WINSLOW

THE department of public health of the American Museum has recently installed an exhibit on military hygiene, designed to deal with a problem at present of supreme interest to all of us—the needs and requirements of the modern soldier, and the part that science plays in supplying these needs.

In the matter of clothing for the soldier, two things are primarily considered: the texture and material, according to the climate in which the troops are to serve; and the color of the uniform. Although various distinctive colors give an *esprit de corps* to bodies of troops, modern warfare demands that in the field all other considerations must be subordinated to “low visibility.” The relative values of colors in the field are illustrated in the exhibit by a series of samples of cloth for uniforms arranged according to their visibility from a distance, and accompanied by a color sketch showing soldiers in uniforms of various shades, seen at close range, at eight hundred and eighty yards, and at a distance of one mile. In the test of distance white has the highest visibility, red comes next; khaki and the olive drab at present in use in the United States Army fade away into the ordinary background at relatively close range.

The head covering of the soldier must protect the head and shield the eyes and the nape of the neck from the sun. While its nature depends on the locality in which the men are to serve, for temperate zones the campaign hat with the “Montana peak” proves very satisfactory. This kind of hat provides sufficient air space above the head, good circulation being insured by four eyelets. For trench warfare a more efficient protection is required, and this is obtained by the use of the steel helmet, a sample of which from the French trenches is exhibited through the courtesy of Dr. Louis Livingston Seaman and the American Museum of Safety.

Among newly recruited troops ten per cent of the men used to be disabled by injuries due to ill-fitting shoes. It should be remem-

bered that under the weight of the body and the added weight of the equipment which the soldier carries, the foot may lengthen half an inch and broaden a quarter of an inch. This necessitates shoes of the right shape and size, and of flexible material. As a buffer between skin and leather, a thick woolen sock is used.

The equipment of the soldier should be as complete as possible without being so heavy that it fatigues him. If it is reduced too much, he is liable to suffer in camp through insufficient protection from the weather; and if it is very elaborate, his efficiency will become impaired from carrying too heavy a load. The weight carried on the march by a United States soldier varies from thirty-nine to sixty pounds. This should be so distributed that posture and the free movement of the chest and arms are not interfered with.

Among the items of the soldier's equipment featured in the exhibit is the typical daily field ration of the United States, an amount of food supplying 4,199 calories of energy and shown realistically in terms of bread and bacon and potatoes and other ingredients. There are also the mess kit, consisting of fork, spoon, knife, and meat can, the last to be used ordinarily as a plate, but in time of need also as a cooking dish; the canteen, which suffices to supply the few swallows of water so much better for the soldier on the march than a longer draught; the gas mask essential in the horrors of modern warfare; and the little sealed first aid packet of sterile dressings for the prompt bandaging of wounds, now supplied to our soldiers with instructions as to their proper application.

In the realm of camp sanitation there are models showing methods for the disposal of waste and the purification of water, factors which have played a large part in reducing the havoc wrought in war time in the past by diseases like cholera, dysentery, and typhoid fever. In the Crimean War, in pre-sanitary times, armies of the contending nations lost more than one third of their numbers from disease, and only one tenth from

wounds. Typhoid fever in the past was the worst scourge of the military camp. It killed 14 per 1,000 of the British soldiers in the Boer War, and 15 per 1,000 of our own soldiers during the Spanish War. Of the American soldiers in the Spanish War in 1898, 142 in 1,000 were sick with typhoid and 15 died, while only 14 in 1,000 were wounded in battle and 2 died. Today improved camp sanitation and above all antityphoid vac-

cross field work, particularly in the typhus infected districts in Serbia; supplies from the Manhattan Chapter of the American Red Cross; the improved "trench stretcher," which is so constructed that it can be separated into halves along the middle line, allowing the attendant to transfer the wounded man to a cot by slipping the stretcher out from under him at each side; the lungmotor, loaned by the Life Saving Devices Company,



The exigencies of trench warfare call not only upon modern inventiveness in the preparation of safety appliances for the soldier, but also borrow from the war trappings of the past. At the left is a steel helmet, such as are being worn by the soldiers of the French Republic; at the right a primitive type of gas mask from the equipment of a soldier who was wounded at Verdun and died on the way back from the front in an ambulance of the American volunteer corps

cination offer almost complete protection against this disease. Vaccination against typhoid was first introduced in the American army in 1909, and made compulsory in 1912. The result was a reduction in the typhoid rate from 3.2 per 1,000 in 1908 to .03 in 1913. When 10,759 troops were encamped at Jacksonville in 1898, there were 1,729 cases of typhoid and 248 deaths, while among 20,000 troops encamped in a similar region during the Texas maneuvers of 1912, there were only two cases of typhoid and no deaths.

The care of the wounded is demonstrated by a series of objects: models showing Red

and used to restore respiration in cases of gas poisoning or drowning; and a machine, run by a small electric motor, used as a suction apparatus to dispose of excess amounts of blood and mucus during field operations.

Of particular interest is the group of objects illustrating the malady known as "trench foot," a gangrenous condition contracted by soldiers standing for days in water, as they frequently have to do in the trenches. It has been recently discovered in France that this disease is not the result of simple chill, but of invasion by molds, such as *Penicillium glaucum*, which enter from damp and filthy socks, penetrate cracks in

the skin, and block the blood and lymph vessels. This stoppage of circulation robs the tissues of the foot of their natural defenses, and leads to gangrene, which frequently necessitates amputation. There are on exhibition a broken shoe and a moldy sock such as those that have caused the prevalence of "trench foot" in the French army, and a culture of one of the molds at fault. There are shown also cultures of the gas bacillus, which infects the wounds of men living in the trenches in regions like Flanders, where the soil has been cultivated abundantly with manure. This bacillus, growing in the depths of the wound from which the air is

excluded, may reach the blood stream, where it produces gas bubbles that clog the blood vessels and cause death.

The exhibit properly includes pictures of several of the men who have rendered notable service in adding to the scientific knowledge of combating disease, even in some cases laying down their lives for the cause. We never can be too familiar with the faces and achievements of Walter Reed, Aristides Agramonte, James Carroll, Jesse W. Lazear, and Surgeon General Gorgas, heroes of the war against disease who conquered yellow fever in Havana and made possible the construction of the Panama Canal.

Museum Notes

SINCE the last issue of the JOURNAL, the following persons have become members of the Museum:

Life Members. MRS. JAMES B. HAGGIN, MRS. HORACE RUSSELL, and MESSRS. EDWARD DUDLEY KENNA and EDMUND J. SCHEIDER.

Annual Members. MRS. W. H. ALDRIDGE, MRS. AGNES C. L. DONOHUGH, MRS. WARNER M. LEEDS, MRS. RUFUS L. PATTERSON, MRS. WILLIAM A. READ, MRS. M. M. RIGLANDER, MRS. SAMUEL SLOAN, MRS. JACQUES WEINBERGER, MABEL CHOATE, the MISSES ANNA E. CHAIRES, ALICE S. COFFIN, MARGARET H. GARRARD, and MARY O. STEVENS, and MESSRS. F. H. BROWNELL, T. B. BRYSON, H. B. DOMINICK, F. H. ECKER, JOHN S. FISKE, MATTHEW C. FLEMING, HERMAN L. HEIDE, A. R. HERR, SEYMOUR WORRALL HYDE, HENRY NECARSLUMER, GEO. M. SIDENBERG, FRANK V. STORRS, A. T. THOMSON, W. J. K. VANSTON, and G. H. WALBRIDGE.

In the work of general preparedness now being carried on throughout the United States the American Museum is taking part along the following lines:

A meeting of the faculty was held on March 6, at which a Preparedness Committee was appointed by President Osborn, composed of Messrs. Frederic A. Lucas, George H. Sherwood, Henry E. Crampton, W. B. Matthew, Clark Wissler, C.-E. A. Winslow, Barnum Brown, Chester A. Reeds, George

N. Pindar, Fred H. Smyth, Charles Lang, and George B. Dill. A subcommittee was appointed with Mr. George N. Pindar as chairman to make arrangements for a military drill among the Museum men. Drills are now being held in the Philippine Hall on Mondays, Wednesdays and Fridays from eleven to twelve and from four to five. A second subcommittee was appointed to consider the matter of Red Cross and first aid instruction in the building. Of this committee Mr. George H. Sherwood is chairman, assisted by Dr. R. W. Tower and Miss Marguerite Engler. The work of this committee is further assisted by a special committee of which Miss Engler is chairman, that has been actively engaged in an inquiry into all forms of work which the women of the Museum may undertake. Blanks have been distributed for the registration of all employees in the lines of work they would be willing to undertake in case of need, these blanks to be eventually turned over to the National Council of Defense. Believing that the women of the Museum can do more effective work along the lines in which they are daily employed than by organizing a Red Cross Auxiliary for the making of hospital supplies, yet wishing to assist in Red Cross work, it was decided to undertake to secure members for the Red Cross Society both in the Museum and among friends outside. For this purpose another special committee was formed with Mrs. N. C. Nelson as chairman.

Permission has been granted by the trustees of the Museum for the establishment of an enrollment center in the Museum building for the purpose of helping in the work of taking the State Census. The time allotted for such service will be so arranged that the work of each department will not be seriously interfered with. To promote an interest in gardening there is under consideration a series of lectures on agriculture to be held in the Museum building in the near future.

At the meeting of the executive committee of the American Museum on April 18, Mr. Waldron DeWitt Miller, assistant curator of birds, was advanced to the rank of associate curator.

A letter from Mr. Miller reports his safe arrival at Corinto, Nicaragua, on March 10, only one day behind schedule time—an unusual record for a country in which transportation facilities are limited and uncertain. At Corinto Mr. Miller was joined by Mr. William B. Richardson, the veteran collector of tropical birds, whose long residence in Nicaragua has especially fitted him for efficient coöperation in carrying to a successful conclusion Mr. Miller's plan for an ornithological reconnaissance in Nicaragua. Mr. Miller writes that, with Mr. Richardson, he called upon the President of Nicaragua, and received from him personal letters to the authorities residing in the localities which the expedition proposes to visit. He also states that in the museum at Managua, the capital, he found five species of birds not heretofore recorded from Nicaragua; while, on the afternoon of his arrival at Corinto, he observed in a mangrove swamp at the border of the town a vireo of which there is only one previous record for Nicaragua, and which is wholly unrepresented in the collections of the American Museum.

THE American Museum of Natural History has a profound desire for a more definite and more cordial affiliation with the scientific museums of Central and South America, and hails with satisfaction any step in the direction of increased friendly acquaintance and coöperation. It is therefore a pleasure to know that on the Museum's recent South American Expedition Dr. Frank M. Chapman was most cordially welcomed by the naturalists connected with the Museo Nacional in Buenos Aires. A spe-

cial meeting of the Argentine Society of Natural Sciences and the Ornithological Society of the Plata was held, and Dr. Chapman was given the opportunity to tell of the itinerary and purposes of the work undertaken by our expedition. Also Mr. Leo E. Miller was given the opportunity to describe his experiences on the Roosevelt-Rondon Expedition. Addresses were made by the resident scientists, Dr. Angel Gallardo, director of the museum at Buenos Aires, Dr. Roberto Dabbene, president of the Ornithological Society, and Dr. J. M. de la Rúa, president of the Society of Natural Sciences. Dr. Chapman was made an honorary member of the Ornithological Society, and a corresponding member of the Society of Natural Sciences. The friendly relations established at this time in Buenos Aires—added to those made at other points along the route of the expedition—have already given rise to exchanges of valuable material. In connection with these exchanges the American Museum acknowledges the receipt just at the moment of collections of birds from the Museu Paulista at São Paulo, Brazil, the Museo Nacional at Buenos Aires, and the Natural History Museum at Mendoza, Argentina.

PROFESSOR HENRY FAIRFIELD OSBORN, president of the American Museum, has given to the press the following expression of his views on the "interning" of the liquor traffic: "I am supporting war prohibition. Alcohol was long regarded as of medical value. It has now been proved by scientific experiment to be a poison both to the present and to the coming generation. Like other heart and brain stimulants, it gives at best a temporary impulse to the system, followed by a reaction which enfeebles the system in normal reaction and resistance and predisposes it to disease."

IN conjunction with the exhibit of military hygiene at the American Museum of Natural History there is being shown by automatic stereopticon a series of more than eighty scenes from the western battle front of France. These illustrate trench life, demolished buildings, scenes from Rheims and the battlegrounds of Champagne and the Somme, and show views from town and country characteristic of trench-scarred France. The slides were obtained by the department of

public health of the Museum from Dr. Walter B. James, a trustee of the institution, and Mr. Marcel Knecht, a representative in this country of the French National Committee.

WITH characteristic impetuosity and enthusiasm all America has thrown itself heart and soul into the movement of gardening for the good of the country and for the support of the Allies. Men, women, and children are arming with spade and hoe; golf links, school grounds, vacant lots, and even lawns and back yards are being plowed. In order that energy may not be wasted, courses in gardening are being given by various agricultural schools, and pamphlets containing information on gardening are being spread abroad for the instruction and guidance of all who will undertake the work. Extensive summer courses in agriculture will be given at many institutions, including Columbia University, the New York School of Agriculture, Cornell University, Syracuse University, and St. Lawrence University. At the New York Botanical Garden simple courses in home gardening are being given. Federal, state, and city governments are coming to the aid of the individual with advice on proper methods of farming, as well as with offers of seed at moderate cost—or free as the case may demand. Real estate men are placing land at the disposal of gardeners or offering it to the Government at a low figure. Seventy-five thousand acres in New York City alone, it is estimated, have thus been added to the acreage available for vegetable gardens, much of which will be planted to potatoes. The National Emergency Food Garden Commission of Washington, D. C., has issued a *Food Garden Primer*, giving detailed information in condensed form on "How to Have a Good Garden," and Mayor Mitchel's Food Supply Committee of this city has put forth a similar pamphlet. New York, as befits the first city of the land, leads in organization and methods of procedure. The Mayor's Committee on Food Gardens is tabulating all the available vacant land, and supplying seeds at reasonable prices to those who wish to raise vegetables. The land is first examined by soil experts to determine its suitability for farming, and is then apportioned in plots to applicants. Already twelve hundred such plots have been assigned within the city

limits and still the demand exceeds the supply. Ninety thousand bushels of seed potatoes recently received from Maine are being distributed for planting. But the movement is not confined to one city or locality. It is nation wide. Congress plaus to help the regular farmer and thus stimulate further the production of food in the present emergency. Organization and coöperation will assist both the individual and the community by bringing better methods and better machinery within the reach of all.

PROFESSOR STEWART A. SMITH, of the University of Sydney, Australia, read a paper before the American Ethnological Society at the American Museum on April 30, entitled "The Talgai Skull, a Fossil Human Skull Found at Queensland, Australia." This remarkable relic, which is destined to become almost as famous as the Piltdown skull, was found buried in a deposit of apparently Pleistocene age. Although it was discovered about thirty years ago, it remained unknown to scientists until recently it chanced to be brought to the notice of Professor J. T. Wilson, a well-known zoölogist. Fortunately the original discoverer is still living, and was able to identify the locality where the skull was found. The specimen is thoroughly fossilized and has been badly distorted by the pressure of the surrounding matrix. It is of commanding importance, since it is a proto-Australian type with an almost apelike form of the upper dental arch, and with very large canines and premolars. Professor Smith has presented a cast of the skull to the Museum.

ON Sunday, April 29, Sir Ernest Shackleton, the noted antarctic explorer, lately elected an Honorary Fellow of the American Museum of Natural History, gave an address before the Explorers' Club of this city at a luncheon given in his honor at the Hotel Majestic. In the course of his short talk Sir Ernest said that the United States had entered the war at the psychological moment and by "rising to the height of which she is capable" could be a power in finishing the conflict at an early day. He himself is sailing immediately to rejoin the English navy. Twelve of the men who accompanied him on his trip to antarctic regions are already at the front, and eleven more will be there soon. One of the twelve was killed on his first day

in the trenches. The explorer further said: "This country has taken its stand. Money and ships will be needed from you but more than that is necessary; it is necessary for the manhood of the nation to stand up and meet the sacrifices that may be entailed."

Theodore D. Rousseau, the Mayor's secretary, on behalf of Mayor Mitchel, who could not be present, presented the key of the city to Sir Ernest Shackleton.

On the evening of the same day, at a meeting held in Carnegie Hall under the joint auspices of the American Museum of Natural History and the American Geographical Society, an audience of twenty-five hundred people greeted Sir Ernest with great enthusiasm. His account of long months spent in an ice-locked region, enduring hardships almost beyond comprehension, was given simply and intermingled with flashes of true Irish humor which delighted his hearers. Nights spent on floating icebergs which were momentarily expected to break up, followed by days in small boats which might at any instant be crushed like eggshells, were regular features of the attempt to cross the south polar sea, an attempt which had finally to be abandoned. To graphic description were added many pictures lending reality to the scenes. Great credit belongs to the leadership which brought back from such a hazardous undertaking the same number of men that went forth. In closing his lecture Sir Ernest spoke of the war situation and the necessity that the Allies stand together in the "great adventure." The proceeds of this lecture go to the war relief fund.

On Tuesday, May 1, Sir Ernest Shackleton visited the American Museum as the guest of President Henry Fairfield Osborn.

DR. HERBERT J. SPINDEN, of the American Museum, and Mr. Sylvanus G. Morley, of the Carnegie Institution of Washington, are spending a few weeks in an archaeological survey in Central America. This work, which is undertaken with the consent of the Central American governments, will probably take them to Guatemala, western Honduras, Salvador, and Nicaragua, and they will pay particular attention to the study and collection of such designs, dyestuffs, native foods, and samples of weaving and costumes as seem to have significance for our country in view of the present war conditions.

IN the recent death of William Hayes, night watchman since 1910 in the American Museum of Natural History, the institution loses a trustworthy and efficient member of its force. It wishes to express to his friends and to those associated with him on the Museum staff appreciation of these years of faithful service.

MR. N. C. NELSON was recently sent by the American Museum to make a brief reconnaissance of Indian shell mounds in the vicinity of Oak Hill and New Smyrna, Florida. These mounds, it was learned not long ago, had been largely cut into in the course of a campaign of road construction, and at least one of them had been very nearly demolished by the steam shovels. Others are, however, intact, and still offer an attractive field for excavation. Such mounds are frequently found to contain bones, refuse, and even implements, all of which are of value in reconstructing the life of the past. During his stay Mr. Nelson visited Tallahassee to confer with Dr. E. H. Sellards, state geologist of Florida.

THE examining board of the United States Army has qualified Mr. Barrington Moore, associate curator of woods and forestry in the American Museum, as a captain of engineers, and instructed him to report at the training camp at Plattsburg, May 8.

THE Museum has recently received as a gift from Mr. Henry Hornbostel a large series of valuable photographs from Central America. These were taken by Mr. Teoberto Maler of the Peabody Museum of Harvard University. They deal almost exclusively with fine examples of Maya temple architecture.

THE teeth of the devilfish recently killed by Colonel Theodore Roosevelt, while the guest of Mr. Russell J. Coles on a fishing cruise off the coast of Florida, are being examined by Dr. Louis Hussakof. This work is in continuation of a study of the anatomy of the devilfish begun by Dr. Hussakof during his connection with the department of ichthyology of the American Museum.

The Geographical Review of April, 1917, prints an illustrated article by Mr. Leo E. Miller, "Up the Orinoco to the Land of the Maquiritares." It is a description of the

zoölogical reconnaissance undertaken in the fall of 1912 by Mr. Miller and Mr. Francis X. Iglseider under the auspices of the American Museum of Natural History. The purpose of the expedition was to explore the wilds of Rio Cunucunuma and Mount Duida, a region incorrectly mapped, of whose people and animal life little was known. Mr. Miller also has an article, "The Quest of the Cock-of-the-Rock," with an introduction by Colonel Roosevelt, in the May issue of *Scribner's Magazine*.

THE latest addition to the series of guide leaflets on the collections of the American Museum is the sixteen-page *Syllabus Guide to Public Health Exhibits* by Mr. Laurence V. Coleman. This publication gives valuable information in concise form regarding the models, charts, and photographs in the hall of public health, illustrating the problems connected with procuring a clean water supply, disposing of municipal wastes, and doing away with insect-borne diseases.

MR. JOHN T. NICHOLS, of the Museum's department of fishes, has returned from a three weeks' cruise among the Florida keys where he went in late March, as the guest of Mr. Herman Armour Nichols of Chicago, to study especially the habits of ground sharks of the genus *Carcharhinus*. These are everywhere the most abundant sharks in inshore waters, where the females resort in numbers at certain seasons to give birth to their young. Two species were met with which are doubtless of regular and common occurrence there in March and April, although one of them (the green shark) had not previously been recorded from Florida; they are the edged shark (*C. limbatus*) and the green shark (*C. acronotus*), the former between five and five and one half, the latter between three and one half and four feet long. As is the case with the brown shark (*C. milberti*) of New York waters in summer, females only were present. Probably the big bulls have a more offshore habitat, certainly they are great wanderers, those of *C. limbatus* occasionally straggling as far north as New York in the warmer months. The edged shark was found to be very good eating, its meat resembling swordfish in flavor and not being at all tough. The fact that several species of shark are not regularly in the market is due entirely to prejudice.

As is often the case, the rarest fish obtained on the cruise was a very small one, captured entirely by accident. On one occasion the fifty-foot cruising ketch "Yuma" lay three nights at one anchorage, held up by high winds. When the big storm anchor was lifted, a clingfish (*Gobiesox*) about an inch long came aboard attached to it and was promptly placed in a vial of preservative. It has so far been impossible to identify this fish as any species known to science. The clingfishes have a peculiar sucking disk on the lower surface of the body by means of which they can hold firmly to any submerged object.

THE department of anthropology of the American Museum was visited recently by Professor Robert G. Aitken, of the Liek Observatory of the University of California, and also by Dr. L. J. Fraughtenberg, linguist of the Bureau of Ethnology in Washington. Dr. Fraughtenberg gave particular study to the anthropological collections from the Northwest Coast and the states of Washington and Oregon.

THE hermit thrush is so rare and nests in such impenetrable and dark places in the forest that few photographs of any kind have been secured of it. The frontispiece of this number of the JOURNAL, Mr. Norman McClintock's photograph of the hermit thrush in its home life, is therefore unusually valuable. It is interesting along three lines: first, zoölogically—especially since it shows the spotted plumage of the young, so strong a mark of the family to which the thrushes belong; second, humanly, for this is the bird immortalized by naturalist, philosopher, and poet for its song; and third, technically, as a triumph of bird photography. It chanced, however, that the photograph was not taken with a telephoto, nor under any unusual circumstances, but was a study at close range made from a blind with an ordinary 8" lens. It would seem that the hermit thrush and its spiritual song are far removed from war and the tragedy of Europe today, but this is the bird whose serene notes will always be known as a "carol of death," for at the close of the Civil War, our American poet, Walt Whitman, linked the song unforgetably with war and heroic death—"the song of the bleeding throat, Death's outlet song of life"—in his *Memories of President Lincoln*.

The American Museum of Natural History

Its Work, Membership, and Publications

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

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

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

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

The educational work of the Museum is carried on also by numerous lectures to children, special series of lectures to the blind, provided for by the Thorne Memorial Fund, and the issue to public schools of collections and lantern slides illustrating various branches of nature study. There are in addition special series of evening lectures for Members in the fall and spring of each year, and on Saturday mornings lectures for the children of Members. Among those who have appeared in these lecture courses are Admiral Peary, Dean Worcester, Sir John Murray, Vilhjálmur Stefánsson, the Prince of Monaco, and Theodore Roosevelt. The following are the statistics for the year 1916:

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

Membership

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

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The various Classes of Resident Membership are as follows:

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

They have the following privileges:

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

Associate Membership

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

- Current issues of the AMERICAN MUSEUM JOURNAL—a popular illustrated magazine of science, travel, exploration, and discovery, published monthly from October to May (eight numbers annually), the volume beginning in January
- A complimentary copy of the President's Annual Report, giving a complete list of all Members
- An Annual Pass admitting to the Members' Room. This large tower room on the third floor of the building, open every day in the year, is given over exclusively to Members, and is equipped with every comfort for rest, reading, and correspondence
- Two complimentary tickets admitting to the Members' Room for distribution by Members to their friends
- The services of an Instructor for guidance when visiting the Museum

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

labors are presented to the million public school children through the Museum Extension System. In brief it is a medium for the dissemination of the idea to which the Museum itself is dedicated—namely, that without deepening appreciation of nature, no people can attain to the highest grades of knowledge and worth.

Publications of the Museum

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

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

POPULAR SCIENTIFIC PUBLICATIONS

HANDBOOKS

NORTH AMERICAN INDIANS OF THE PLAINS	
BY CLARK WISSLER, PH.D.	Paper, 25 cents; cloth, 50 cents
INDIANS OF THE SOUTHWEST	
BY PLINY EARLE GODDARD, PH.D.	Paper, 25 cents; cloth, 50 cents
ANIMALS OF THE PAST	
BY FREDERIC A. LUCAS, SC.D.	Paper, 35 cents
DINOSAURS	
BY W. D. MATTHEW, PH.D.	Price, 25 cents
TEACHERS' HANDBOOK, PART I, THE NORTH AMERICAN INDIAN COLLECTION	
BY ANN E. THOMAS, PH.B.	Price, 10 cents
TREES AND FORESTRY	
BY MARY CYNTHIA DICKERSON	
A new edition in course of preparation.	

ILLUSTRATED GUIDE LEAFLETS

THE COLLECTION OF MINERALS	
BY LOUIS P. GRATACAP, A.M.	Price, 5 cents
NORTH AMERICAN RUMINANTS	
BY J. A. ALLEN, PH.D.	Price, 10 cents
THE ANCIENT BASKET MAKERS OF SOUTHEASTERN UTAH	
BY GEORGE H. PEPPER	Price, 10 cents
THE MUSICAL INSTRUMENTS OF THE INCAS	
BY CHARLES W. MEAD	Price, 10 cents
THE SAGINAW VALLEY COLLECTION	
BY HARLAN I. SMITH	Price, 10 cents
PERUVIAN MUMMIES	
BY CHARLES W. MEAD	Price, 10 cents
THE METEORITES IN THE FOYER OF THE AMERICAN MUSEUM OF NATURAL HISTORY	
BY EDMUND OTIS HOVEY, PH.D.	Price, 10 cents

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THE HABITAT GROUPS OF NORTH AMERICAN BIRDS BY FRANK M. CHAPMAN, Sc.D. Second edition issued May, 1916.	Price, 25 cents
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THE CROCKER LAND PARTY SAFE
ROOSEVELT IN FLORIDA

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THE AMERICAN MUSEUM JOURNAL

DEVOTED TO NATURAL HISTORY, EXPLORATION, AND THE
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THROUGH THE MUSEUM



May, 1917

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MARY CYNTHIA DICKERSON, *Editor*

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



CHARTERED FOR A FIGHT THROUGH THE ICE TO ETAH

The steamship "Neptune" is the third vessel to be sent into the North in an attempt to reach Etah, Greenland, and bring home the Crocker Land Expedition, which set forth from New York in July, 1913. Of the other two ships, the "Cluett" returned after an ineffectual attempt to reach the scientists, and the "Danmark" was caught in the ice of Melville Bay on its way northward and was obliged to winter there. The "Neptune," which is in every way fitted for such a trip, is temporarily engaged in carrying coal for the British Government, but will be released July 5, and it is hoped that early in September she will make a successful return to St. Johns. She will be in charge of Captain Robert A. Bartlett, recognized as the man of greatest capability and experience in guiding a boat through the ice-packed waters of the eastern Arctic.



Joseph H. Choate

Reminiscences of a Founder of the American Museum

THE CITY OF NEW YORK IS THE ABSOLUTE OWNER OF THE BUILDINGS, THE MUSEUM OWNS THE COLLECTIONS—AN ARRANGEMENT WHICH HAS STEADILY FOSTERED MORE AND MORE CLOSE AND CORDIAL RELATIONS BETWEEN THE MUSEUM AND THE PEOPLE

By JOSEPH H. CHOATE

YOU ask me to contribute for the JOURNAL something about the beginnings of the American Museum, in which, as the only surviving founder, I had something to do.

Nobody ever dreamed at that remote time, nearly fifty years ago, that the American Museum of Natural History would ever reach its present vast por-

tions and splendid utility. New York was far behind other American cities in this development of knowledge and science. Sporadic efforts had indeed been made to establish a museum where the collections of New York's learned naturalists might be gathered, but thus far Philadelphia and Boston had been allowed to lead. I remember that, when

IN MEMORIAM.—We have the voice of Mr. Choate with us today, in a loyal and proud word for the institution he helped to found. With other trustees he has for nearly fifty years had a feeling of fatherly ownership and responsibility as year after year he watched the organization rise from its infancy to its present commanding stature in science and education. And for the same fifty years the American Museum on its side has looked upon him with affectionate admiration, and, feeling a contented mind under the protection of this representative of the law, the foremost advocate of the American Bar, has been able to devote itself unreservedly to the work for which it was founded.

It is a satisfaction to remember how greatly Mr. Choate enjoyed the Museum he had helped to found. He was a very frequent visitor up to the last days of his life. I recall one occasion when his enjoyment was very evident. It was one Saturday forenoon in the early spring of 1917, and about time for the "Children's Lecture" to begin in the auditorium of the Museum. Outside, the weather was gray, with a cold wind; inside, where many hundred children had come gaily trooping, there was a great sunshine of adventure and anticipation of the journeyings they were to make into the jungleland of Africa—or was it into the American wildernesses of our wild flowers or birds? I forget, I fear, what was the subject of that particular children's lecture.

Then he came in smiling, among the children, and many people both young and old whispered "Mr. Choate," with accents of reverence for his great name and exultation that they were in an audience of which he was to be a member. He was in one of his gayest moods, it seemed. He was holding a grandchild by each hand, and I veritably believe he was quite as filled with fun and anticipation of the pleasure ahead as were the children. After the lecture and after they had viewed some of the Museum exhibits, accompanying Mr. Sherwood, head of the department of education of the Museum, one of the children said exultingly, "Are we not lucky to have grandpa for a grandpa!" She had quite the right point of view. And the American Museum could have said with equal sincerity and emphasis, "We are immeasurably glad that Mr. Choate is our founder, trustee, and friend."

I regret that the following article, written by Mr. Choate very shortly before his death, was not published, together with an expression of the Museum's appreciation of his wise counsels and his loyalty through the many years, while he could yet see them. The portrait, he sent as his favorite among recent pictures of himself. It conveys the magnetism of his personality in large degree—with its intellectuality and benignity in the upper face and its pathos and humor about the mouth. It is true that from his standpoint at least it could scarcely have mattered that they were not published in time. His last days were full of

it had finally been resolved to establish the American Museum, the first thing was to get a charter from the state, and I went in company with the late William E. Dodge to Albany to consult with members of the Legislature about granting it. To our surprise we found that the matter of granting us a charter depended upon the decision of William M. Tweed, who was then practically in supreme control of the Legislature. We hardly anticipated that he would put no obstacles in our way, but wonderful to tell, he received us really with enthusiasm, and said that he entirely approved of the project as an educational measure and that he would do whatever we wanted. Consequently, we obtained without any delay, or expense, or trouble the much desired charter.

A few men of large wealth were interested in the project, being amateur lovers of natural history in one or another department, but there was no such splendid scientific supervision as the Museum now enjoys in its president and its various curators. Some of the gentlemen interested in the Museum in that early day had little collections of

their own which they were very glad to contribute, and also money to spend for such benign purposes; and I suppose that they wanted me to become one of the founders so that they might have a legal advisor to fall back upon, in case of need, who should be one of their own number, and I very gladly joined, although having nothing to contribute in the way of collection or of money.

Professor A. S. Bickmore fortunately was the great promoter of the organization of the Museum. He had been a pupil of Agassiz, and was besides a young man of energy and persistence. It was he who instigated the various gentlemen of large wealth, of whom I have spoken, to unite for the Museum's formation and first organization. He labored incessantly in season and out of season, and in any history of the American Museum he is to be remembered as its most effective early promoter.

No one thought at that time that a great democratic city like New York would ever contribute two hundred thousand dollars a year for what then seemed such a luxury as a Museum of Natural History or a Museum of Art,

vivid personal enjoyment because of his opportunity to use his eloquence and argument to give all that was in his power to the two causes nearest his heart: the new desire of his vigorous patriotism for the entrance of America into the war on the side of the Allies, and his ever-abiding desire as a diplomat for a closer union of France and England with his home country. Also during his last days, it is good to remember, there were reached out to him from all sides the homage and love of friends and of the public, since as the chief citizen of New York City he had been chosen despite his eighty-five years to represent the government in greeting the English and French Commissions.

The patriotism and loyalty of Mr. Choate, which made him give himself on this occasion, even though he knew it to be at the risk of his life, recall his many patriotic utterances of the past, so eloquent of the situation today. Some of them stand as prophecy and command: "Our frigates may rot in the harbor—our ironclads may rust at the dock, but if ever again the flag is in peril, invincible armies will swarm upon the land, and steel-clad squadrons leap forth upon the sea to maintain it. If we only teach our children patriotism as the first duty and loyalty as the first virtue, America will be safe in the future as she has been in the past. . . . We can always be sure of fleets and armies enough. But shall we always have a Grant to lead the one, and a Farragut to inspire the other? Yes, on this one condition, that every American child learns from his cradle that his first and last duty is to his country, that to live for her is honor, and to die for her is glory."

In the death of the Honorable Joseph Hodges Choate the American Museum has suffered a loss of almost irreparable proportions. None too frequently so far in the history of human evolution have there been combined in one man so many rare qualities of mind and character,—high mentality, great industry, sincerity, high purpose and unselfishness—with energy, simplicity, and a gay humor even to the end of five and four score years. The institution he founded sincerely mourns his death.—THE EDITOR.

and I do not know that any city in America had at that time ever contributed a dollar for any such purpose. In the New York effort we lived from hand to mouth at first, although the gentlemen of whom I have spoken certainly contributed very liberally to the support of the infant institution. It was not, however, until the first building was erected by the city under the authority given by the Legislature that we began to realize what an important project we had in hand.

In the meantime we lived as best we might in quarters hired for the purpose, the old Arsenal Building near the south end of Central Park, and the Museum at first was certainly a very small affair. Only the enthusiasm and unflinching generosity of the more wealthy among the trustees, who year after year put their hands into their pockets to make up the deficit, kept the tottering infant alive during these early years of struggle.

As usual where either individuals or museums become known as collectors, miscellaneous collections of every description came crowding in faster than they could be taken care of. We strove first to gain public attention and confidence by a well-ordered exhibition of our most attractive objects, storing the others away to await future developments. Forty-four thousand dollars were raised the first year by the trustees and their friends, and only five thousand people visited the Museum to reward their efforts. Every day it became more and more obvious that it was quite impossible to build up by private means alone a great museum worthy to compete with the museums of Europe. When we fully realized this, we sent to the Legislature a lengthy petition, signed by forty thousand citizens, asking that a building be erected by the city. Manhattan Square, con-

sisting of eighteen acres, was at that time a remote and almost inaccessible tract of land. This land was granted as the site for the first building. The corner stone was laid, I well remember, in the presence of the President of the United States, accompanied by members of his cabinet, the Governor of the state, and the Mayor of the city. On the twenty-second of December, 1877, the building was formally opened.

The contract entered into at that time between the city and the trustees of the Museum has subsisted without change for forty years. Contracts of the city with other great institutions such as the Metropolitan Museum of Art and the New York Zoölogical Society have been closely modeled upon it. The policy embodied in this contract secures equal advantage to the institution and to the public. It provides for the permanent occupation by the American Museum of all the buildings erected or to be erected in Manhattan Square, and for a free exhibition within the buildings of all our collections, under regulations agreed upon. The city of New York, therefore, is the absolute owner of the buildings, and the American Museum is owner of the collections—an arrangement which has fostered delightful and beneficial relations, steadily growing more close and cordial, between the Museum and the people.

Now the American Museum has grown with incredible speed to wholly unexpected magnitude, and I have every reason to believe that it is now regarded, and in the future will be still more highly valued, as one of the great educational institutions of the city, worthy of the support of its citizens and quite as important as the public schools, as an institution whose maintenance shall be provided for out of the public funds.



OFF THE COAST OF FLORIDA

Theodore Roosevelt, ex-President of the United States and man of vital personality in contact with men, is also a humble field naturalist. The two gopher tortoises (*Testudo polyphemus*) were caught on sandy islands near Punta Gorda. They are thought to live to be very old. They tame easily and show considerable intelligence. They are close relatives of the almost extinct species of the Galapagos Islands in the Pacific, the "giant tortoises," survivors of an age when many reptiles grew to astounding proportions. It is thought possible that the "giant tortoises" live several hundred years

Notes on Florida Turtles³

By THEODORE ROOSEVELT

Written in camp near Punta Gorda on the Gulf of Mexico

DURING the last week of March, 1917, I spent a few days near Punta Gorda, Florida, on a trip after devilfish, being the guest of Mr. Russell J. Coles, whose piece on devilfish in this magazine¹ was the very best thing of its kind that has ever been written.

One day we visited an island which, while I was President, was made into a bird reserve² on the initiative of the

¹ See AMERICAN MUSEUM JOURNAL, Vol. XVI, No. 4.

² One of several small islands in Charlotte Harbor established as government reservations during Roosevelt's administration. The first Federal bird reservation in the United States was made by Roosevelt through his authority as President. Somewhat later a law was passed by Congress vesting in the President power to set aside government lands as bird reserves. No less than fifty-one such reservations were established during Roosevelt's tenure of office, covering many parts of the United States from Florida to Oregon.

³ It chanced that Dr. G. Clyde Fisher, of the scientific staff of the American Museum of Natural History, has given considerable field study to the gopher tortoise (*Testudo polyphemus*) of Florida. It is therefore a pleasure to append to Colonel Roosevelt's valuable record of observations a brief article covering some of Dr. Fisher's personal experiences with this species.—THE EDITOR.



The gopher tortoise digs its own burrow, which may be twenty to thirty feet in length. The sand is heaped at the doorway, and the burrow of course just fits the turtle which has done the digging, the floor being shaped by the flat plastron and the roof arched in just the curve of the carapace. The "gopher snake" (*Spilotes corais couperi*) goes in and out the burrows, no doubt on friendly terms with the owners, and the "gopher frog" (*Rana asopus*), also on friendly terms, sits in the doorway at dusk and hides in the retreat if an enemy appears. One of the first acts of the baby gopher tortoise after coming from its egg is to dig itself a burrow, a miniature of its parent's home

pounds, with a shell $13\frac{1}{2}$ inches long, 9 inches wide, and $5\frac{1}{4}$ inches deep.¹ (Later we secured a small specimen on Captiva Island, which weighed $4\frac{3}{4}$ pounds, was $8\frac{1}{2}$ inches long, 6 inches wide, and $3\frac{1}{2}$ inches deep.) How this big tortoise got to the island is something of a mystery, as the species is entirely terrestrial; it must have been drifted out by some accident of flood or storm.

The gopher tortoise is a vegetable feeder and its flesh is good eating. We found the meat delicious. Unlike our common box tortoise the plastron is not hinged, but when alarmed, the creature draws in the head completely out of sight, and tucks back the feet so that only the rough, flat, scaly surfaces are exposed. The turtle is then practically immune from attack. I was much interested to be told by Captain McCann that he had once found a diamond-back rattlesnake with a small specimen of this species of tortoise inside of him. Captain McCann is an accurate and trustworthy observer. I had supposed that rattlesnakes fed exclusively on birds and mammals.

¹The gopher tortoise (*Testudo polyphemus*) has been known to attain a length of eighteen inches, although the average size is probably in the neighborhood of one foot.

In the fringe of mangrove swamp on the island we got three small diamond-back terrapin of the Gulf variety.

Out in the bay we once or twice saw loggerhead turtles. Mr. Coles and the professional fishermen who were with us related many instances of attacks

they had witnessed by sharks on full-grown sea turtles, both the loggerhead and the green turtle. I knew that sharks gulped down small turtles whenever they met them, but I had not realized that they attacked the big ones. My companions, however, assured me that nearly half of the full-grown turtles which they had caught showed signs of having been attacked at one time or another by sharks. Usually this meant that one flipper



Mr. Russell J. Coles, whose observations on turtles are quoted in the article, and whom Colonel Roosevelt accompanied as guest on his recent devilfish hunt off the west coast of Florida. Mr. Coles is scientific authority on the devilfish (*Manta birostris*), as well as the greatest hunter of the species

was gone. In one case the turtle had lost two flippers, obviously at different times. On one occasion Captain Jack was attracted by a great commotion in the water and sailed toward the scene. He found a very large shark with a huge loggerhead turtle in his mouth, the turtle frantically waving all four legs while the shark shook its head in the effort to get its teeth through the shell. The final outcome he was not able to observe. Mr. Coles said that on several occasions he

had seen sharks attack these big turtles. The turtle would raise itself out of the water and splash with all four flippers, frightening off the shark for a moment; but sooner or later the turtle would attempt to escape by diving, and then the shark, ordinarily, would seize it from behind, shearing off one flipper, and sometimes leaving a semicircular mark on the shell itself.

On one occasion Mr. Coles saw a great shark, which he provisionally identified as a white shark, attack and

seize a big loggerhead turtle, disappearing with it. Next day he found the damaged turtle on the surface of the water unable to dive, and harpooned it. He found a semicircle twenty-four inches across and twelve inches deep, torn out of the two shells on one side of the turtle, which gives a good idea of the width and depth of the shark's bite.

The strength of the gopher tortoise we captured was great. If I stood on it, it would start to walk off with me, not seeming to be bothered by the weight.

"GOPHER PULLING" IN FLORIDA

GOPHER PULLING is a unique sport. Although it may be looked down upon by those sportsmen who enjoy shooting wild fowl on the wing, it is recognized by the legislators, for in Florida there are laws regulating the open and close seasons, and fixing the minimum size of gophers that may be taken,¹ just as there are for brook trout and black bass in the northern states.

In the southeastern states, the name "gopher" is not applied to a ratlike rodent, as it is in the upper Mississippi Valley and the western states. This is true in spite of the fact that in Florida and neighboring states there is a true pocket gopher (*Geomys tuza*)—but it is known to all the inhabitants as the "salamander." How this inappropriate name became attached to the gopher, it would be interesting to know.

While the true gopher of Florida is universally known as a "salamander," the animal, which in this section is known as a "gopher," is really a tortoise or turtle. The gopher tortoise (*Testudo polyphemus*) is strictly terrestrial and lives in burrows which it digs for itself, the forelegs being especially well fitted for excavating. The burrows are always dug in well-drained, sandy soil of the pine-barren regions, and

are so abundant in western and central Florida that several burrows can often be found on a single acre of the higher parts of the "piney" woods. The burrows are from twelve to thirty feet in length, the greater number being from fifteen to twenty. They are usually quite straight, although sometimes stumps, roots, or other obstructions have made crooks or turns necessary. They slope gradually downward so that the lower end is usually about five or six feet lower than the entrance. Gopher burrows are a source of danger to hunters on horseback who follow the hounds in pursuit of the gray fox, and to the woods-rider of the turpentine orchard. Many a running horse has fallen and thrown its rider by stepping into a gopher burrow. The gopher's burrow is frequently resorted to by rabbits, skunks, gray foxes when hard pressed, and even by diamond-back rattlesnakes²—just as a rabbit adopts the burrow of a woodchuck in the northern states.

The gopher tortoise is herbivorous, and feeds upon grass and the leaves of various plants. An examination of the digestive

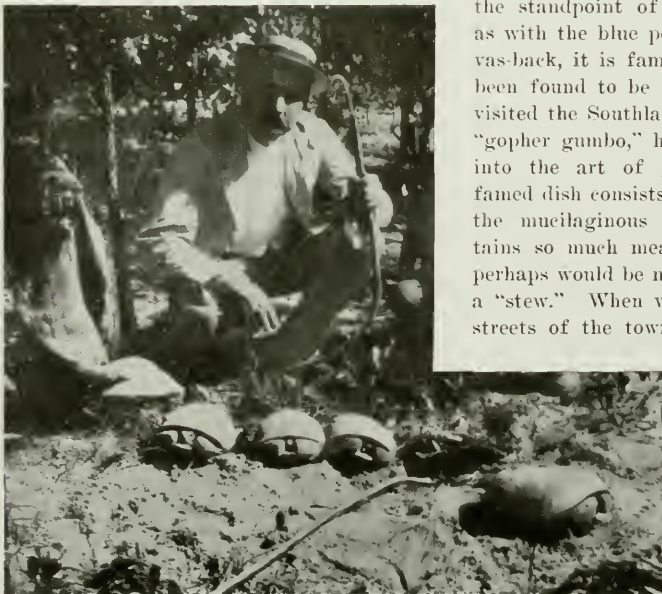
¹ Living in the burrows with the gophers we found two interesting animals, one a parasite and one a commensal insect. The former was the large gopher-tick (*Amblyomma tuberculatum* Marx), the latter was the gopher-cricket (*Ceuthophilus latibuli* Scudder). This is really a cricket-like grasshopper which is closely allied to the colorless and blind cave crickets. Had we been entomologists, we should probably have observed several other peculiar insect guests in the gopher burrows. (See Hubbard, Henry G., *The Insect Guests of the Florida Land Tortoise*, *Insect Life*, 6 : 302-315, May, 1894.)

² In the three most western counties of Florida, by the provisions of an act passed in 1909, it is unlawful to take or sell any gophers during the months of May, June, and July, and by the same law "to take or sell them of a size less than nine (9) inches in length of the under shell" is prohibited.



The flesh of the gopher tortoise is very good eating. In "gopher pulling," a grapevine with an iron hook at the end is thrust into the burrow, and the unfortunate occupant is pulled from its retreat

tracts of a number captured in western Florida showed the chief food to be the common wire grass (*Aristida* sp.). I have the additional proof of having seen the gopher eating wire grass (which, by the way, is the most easily available food where



"Gopher pulling" is regulated by law in Florida and has its open and close seasons as have brook trout and black bass fishing in the North

the gopher is found). With its sharp mandibles it crops this tough grass with as great ease, apparently, as might an animal with sharp, chisel-like teeth. It swallows the grass in pieces nearly two inches long, and the wire grass is so stiff that it must be like swallowing tooth-picks.

The female gopher lays her eggs at the mouth of the burrow, I have been told by reliable observers, and covers them in much the same way as does the green sea turtle.

The number of eggs is surprisingly small, being only from three to six at a laying.

In the daytime, the gopher is frequently seen traveling across the country, but I think it is inclined to be nocturnal in its habits. The fame of the gopher, however, rests not upon its habits which are interesting from the standpoint of the naturalist, but just as with the blue point, or pompano, or canvas-back, it is famous because the flesh has been found to be a delicacy. Whoever has visited the Southland, and has not yet eaten "gopher gumbo," has not yet been initiated into the art of good eating. This far-famed dish consists of a soup thickened with the mucilaginous pods of okra, and contains so much meat of the gopher that it perhaps would be more appropriate to call it a "stew." When we are walking along the streets of the towns and cities of Florida,

it is a common thing to see on the sidewalk in front of grocery stores crates of live chickens, for the South is surely the land of fried chicken; but what impresses a Northerner much more are the crates containing gophers for sale.

These are for the gopher gumbo. I am sure, however, that when I accepted an invitation to accompany two friends on a gopher-pulling expedition, it was my instinct as a naturalist that prompted me. To get tackle for this sport we went out to a bayhead and cut two or three bullace grapevines (*Vitis rotundifolia*), these lianas being common in such places and along streams, often growing to the tops of trees more than one hundred feet in height. For our purpose, we selected several sections of vine, each as straight as possible and a little less than an inch in diameter. With a section thirty feet long, of almost uniform diameter throughout its length, one could reach to the bottom of the longest gopher burrow. Upon one end of each piece of grapevine, we fixed a blunt hook made of iron about a quarter of an inch in diameter. This was fastened to the grapevine with copper wire, as any kind of twine would have been worn out by the friction against the sharp grains of sand in the walls of the burrow. The end of the hook was semicircular in shape, describing a curve about an inch in diameter.

Armed with such tackle, we sallied forth looking for gopher burrows, and when one was found, the end of the grapevine upon which the hook was fastened was pushed into the burrow until the hook reached the inner end. The elasticity of the grapevine permitted it to follow any turns which might be in the burrow. When the hook came up against the end of the burrow, the vine was twisted a part of a turn, and then a sharp pull was made. If there was a gopher in the burrow, not many twists and subsequent pulls of the vine were usually required to hook the gopher either by the carapace or the plastron. Then by a steady pull it was soon brought to the surface and placed in a bag. The hook did not penetrate the skin of the gopher and made no wound. If one relaxed the pull while a gopher was being drawn out of a burrow, it generally freed itself from the hook, probably by pushing

the hook off with one of its feet. Then it retreated to the rear end of the burrow and had to be hooked again. With this apparatus, it did not take long to capture all that one could carry.¹ In fact, this method of capturing gophers is so efficient, that in parts of Florida it is forbidden by law, for the same reasons that certain devices for catching fish or for killing waterfowl are prohibited.

Another method of capturing gopher tortoises is by means of a box sunk at the entrance of the burrow, and lightly covered with twigs and pine "straw" which will give way when the animal attempts to walk over it on leaving the den. If the box is as much as eighteen inches deep, even the largest gopher will not be able to climb up the straight sides; and finding a gopher in one of these box-pits probably affords as much excitement as a trapper feels upon finding a prize in one of his traps. This method reminds one of the covered pits used by certain African tribes in capturing elephants.

Gophers are occasionally taken, it is true, outside their burrows. This is made easier by the fact that the animal moves slowly as do all terrestrial turtles. In watching the turtle plod along, one realizes the striking similarity in shape between its hind feet and legs and those of an elephant, a similarity which extends not only to shape, in fact, but also to manner of movement in walking.

Where gophers are found, the vegetation is usually sparse, so that it is possible to trail them by their tracks in the sand. In this way some specimens are taken. But no method furnishes as much excitement as "pulling," and hence it is the most popular, even if those who participate in it do return home with torn and soiled clothing and probably a few red-bugs or chiggers as souvenirs of the hunt.

G. CLYDE FISHER.

¹ The photographs illustrating "gopher pulling" were taken by Dr. G. Clyde Fisher.

Energy Values in Average Restaurant Portions



343 Calories



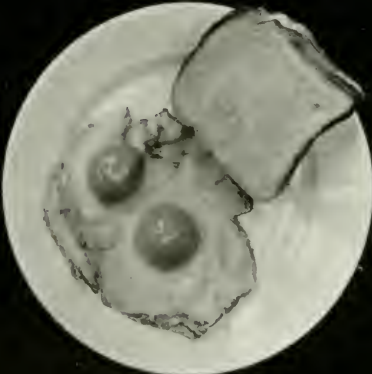
57 Calories



209 Calories



451 Calories



527 Calories



852 Calories

What is most needed in regulating our food allowance is a knowledge of the caloric values of various foods relative to their cost. We should learn to buy food by the 100 calories rather than by the pound. (The foods shown above, apple pie, lettuce and tomato, asparagus, napoleon, fried eggs, chops and potato, are permanent and accurate wax models made in the preparation shops of the American Museum. See note, page 357)

The Conservation of Our Food Supplies in War Time

By T. G. HULL

A SPECIAL exhibit illustrating some of the principal problems of food conservation which confront the United States and the world was opened at the American Museum on May 23, as one contribution of this institution to the task of the National Defense Council, the preparation of our country to play its part in the great crisis.

Reports from various sources as to the condition of the world's crops have been conflicting and confusing. The percentage deficiency of last year's crops was small, the world's wheat crop being ninety-three per cent normal while other crops were also slightly below normal. The total deficiency, however, was enough to create a serious condition. The case is exactly analogous to that of the man on day wages with a large family. The reserve bank account is continually drained so low that the "docking" of even a part of a week's wages makes itself felt at the dinner table.

The underlying cause of food shortage in the United States is well illustrated in a picture painted for the special exhibition, of a young man leaving the farm for the city and its higher wages. Lack of farm labor, added to the demand from Europe for food, has so depleted the reserve on our farms and in cold storage that a real crisis now confronts us.

The outlook for the coming year is not too bright, the winter wheat crop on April first being but sixty-five per cent normal. To offset this a vigorous campaign has been carried on through-

out the country for the planting of other food-stuffs, especially beans, corn, and potatoes. It has been estimated that a double yield of corn and potatoes, with a tenfold yield of beans, would tide us over another winter and allow us to do our duty by our allies.

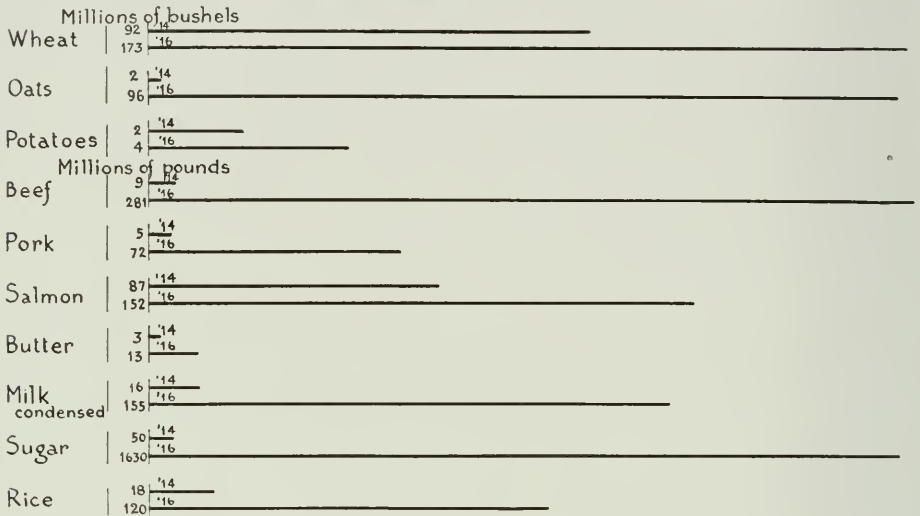
The human body is chiefly made up of the four elements, carbon, hydrogen, oxygen, and nitrogen, but it also contains the following:

Calcium	3.75 lbs.	Magnesium	.10 lbs.
Phosphorus	1.7 "	Sulphur	.10 "
Potassium	.18 "	Silica	.10 "
Sodium	.15 "	Iron	.01 "

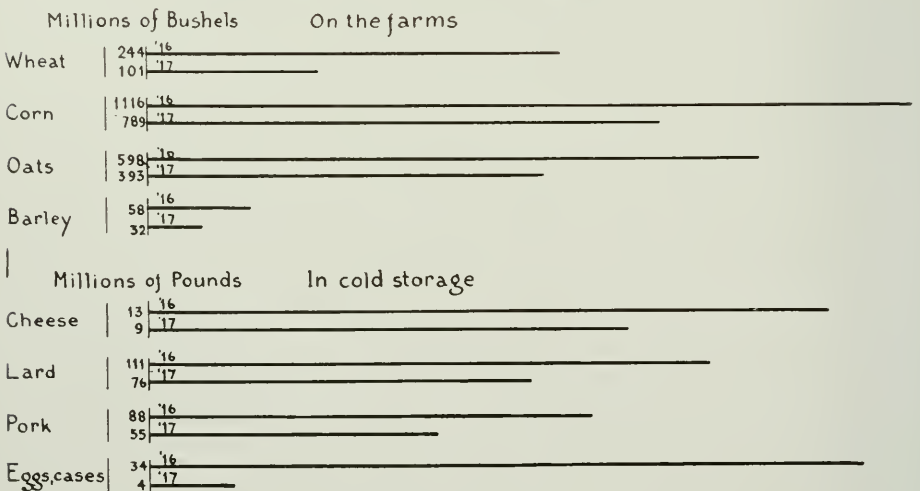
All these elements must be supplied in the food. Above all, however, the food must furnish the energy needed to run the living machine, for food is to the body what fuel is to the engine. The energy value of the food is measured in calories, one calorie being the amount of heat energy required to raise 1 liter (about 1 quart) of water 1° Centigrade (1.8° Fahrenheit). Protein and carbohydrate materials each give per gram 4.1 of these heat units, while fat gives 9. The number of calories required by men of different occupations is illustrated in the exhibit by three piles of coal, 12.3 oz. containing 2500 calories for persons of sedentary habits, 1 lb. 2 oz. containing 3500 calories for those of more active labor, and 3 lbs. 4 oz. containing 10,000 calories for a six-day bicycle rider.

As has been pointed out by Professor Graham Lusk, our greatest need in securing an adequate dietary allowance for the poor is the diffusion of knowledge as to costs and calorie values.

Demand upon the Food Resources of the United States as indicated by exports for fiscal years ending June 30, 1914, and June 30, 1916



Depletion of the Food Reserve of the United States—Stocks on hand March 1, 1916, and March 1, 1917



We must learn to buy food by the 100 calories rather than by the pound if we are to meet the problem of the dinner table wisely.

Our food exhibit therefore contains as one of its principal features a series

of 100-calorie portions of certain common foods so that the meaning of this unit of measure may be clear. Beside each one is shown the composition of the food in question in percentage of protein (the nitrogen-containing and

preëminently tissue-building food-stuffs), of carbohydrate, fat, water, ash or mineral matter, and refuse material, as given in Table A. It will be seen that the 100-calorie portion, corresponding to one large egg, two thirds of a glass of milk, two thin slices of bread, two apples, an ordinary serving of prunes, or a pat of butter, is very convenient for ordinary use in roughly estimating dietary values.

A second series of models (Table B) shows restaurant portions of certain common foods with the calorific value to be obtained from each for five cents on the basis of the studies made in Childs Restaurants in 1915 by Profes-

TABLE B

Relative energy value and protein content of 5 cents' worth of restaurant portions as served at Childs, New York

	Calories for 5 cts.	Per cent protein
Cantaloupe	12	8
Tomatoes and lettuce	13	16
Creamed asparagus on toast	49	16
Stewed corn	52	9
Chicken sandwich	78	18
Bean soup	84	18
Creamed chicken on toast	93	20
Strawberry ice cream	102	5
Cup custard	110	17
Egg salad	116	18
Lamb chops	135	13
Fried eggs	166	15
Baked apple and cream	196	1
Baked beans and macaroni	196	18
Crackers and milk	230	12
Cocoa	247	10
Chipped beef on toast	249	16
Apple pie	337	4
Napoleon	454	4

TABLE A

Portions of various uncooked foods which will yield 100 calories, with per cent of various constituents

100-calorie portions	Calories per pound	Protein	Carbo-hydrate	Fat	Water	Ash	Refuse
10 oysters	43	1.2	.7	.2	16.1	.4	81.4
1½ lbs. lettuce	72	1.0	2.5	.2	80.5	.8	15.0
1 lb. tomatoes	104	.9	3.9	.4	94.3	.5	
¾ lb. carrots	159	.9	7.4	.2	70.6	.9	20.0
¾ lb. beans (string)	176	2.1	6.9	.3	83.0	.7	7.0
1½ lb. cod	210	11.1		.2	58.5	.8	29.9
2 apples	214	.3	10.8	.3	63.3	.3	25.0
1½ lb. chicken	289	12.8		1.4	43.7	.7	41.6
1 large potato	302	1.8	14.7	.1	62.6	.8	20.0
¾ glass milk	314	3.3	5.0	4.0	87.0	.7	
1 dish prune sauce	417	.5	22.3	.1	76.6	.5	
1 large egg	596	11.9		9.3	63.5	.9	11.2
¼ lb. sirloin beef	960	16.5		16.1	54.0	.9	12.8
2 slices bread	1224	10.9	53.6	1.3	33.2	1.0	
1½ lb. beans (dried)	1564	22.5	59.6	1.8	12.6	3.5	
1½ lb. dry oatmeal	1811	16.1	67.5	7.2	7.3	1.9	
6 small lumps sugar	1814		100.0				
1½ lb. peanuts	1858	19.5	18.5	29.1	6.9	1.5	24.5
1½ lb. cheese	2080	25.0	1.0	34.0	35.0	5.0	
1 piece butter	3450	1.3		84.0	12.7	2.0	

sor Lusk and Mr. F. C. Gephart. It is somewhat interesting to note that desserts such as apple pie and the cake known as a napoleon, which are often eaten merely to tickle the palate after a hearty meal, are themselves among the most concentrated sources of food energy.

The sources of our fundamental food supplies and their relative importance are indicated by maps and diagrams. That "all roads lead to the dinner table" is true in war as well as peace.

While the United States is able to furnish most of the staple foodstuffs, it depends upon the rest of the world for accessories, pineapples from Hawaii, olives from Italy, coffee from Brazil, tea from Japan, rice from China, and pepper from Siam. All these contributions appear on our tables so automatically that we scarcely realize their sources. The funda-

mental food of mankind however is wheat, which, with rye and barley, supplies from thirty-one per cent of the calorific value in the American dietary to sixty-three per cent in that of France, and this fraction as determined by racial habits and instincts is an irreducible minimum which cannot safely be replaced from any other source. It is possible and eminently desirable, however, to spare the wheat supply by the admixture of the alternative cereals

(barley and rye) as in the preparation of the various kinds of war bread shown in the exhibit.

Our first task as a nation is to see that these minimum needs of the allied countries, and particularly of France, are fully and promptly met. To this end it behooves us to strain every nerve to increase production and—what is of almost equal importance—to diminish needless waste.

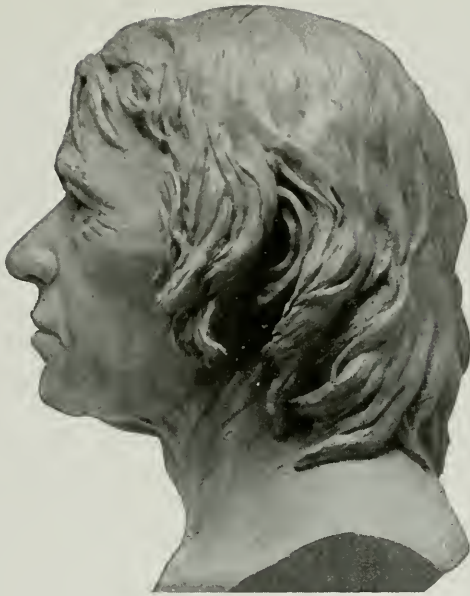
It is estimated by Dr. C. F. Langworthy, of the United States Department of Agriculture, that one tenth of all the food that comes into the home is wasted in the kitchen. This totals for the nation an annual loss of \$700,000,000. In the exhibit are shown methods of economy that should be practised in the use of left-over meat, fish, and vegetables for hash or soup, sour milk for puddings, and the utilization of dry bread in various ways. At the table smaller portions should be served, so as to prevent food being left on the plates and wasted. In cooking, material saving may be obtained in time and labor by the use of a fireless cooker, of which an inexpensive form, easily constructed in the home, is shown. The purchasing of goods in bulk rather than in package is an important factor in household economy, as are the buying of the cheaper cuts of meat and the substitution for meat as a protein-supplying element in the diet, of such foods as milk, beans, fish, and cheese.

Our diet is largely based on habit. All around is an abundance of potential unutilized foods, which are ours for the using. Along our coasts acres of mussels, tons of seaweed, and bushels of periwinkles go to waste every year. Certain kinds of shark have been found to be delicious, and the United States Bureau of Fisheries is promoting the canning of grayfish. Skate is used at

present principally for "scallops," but deserves a wider use. Along the shores of the Hudson wild rice goes unutilized except by the wild ducks. The Indians about the Great Lakes gather wild rice and trade it with the ammunition companies from whom it is purchased by hotels. The wild rice exhibited was cooked in the kitchen of the Waldorf Astoria, New York City. The Chinese make extensive use of the soy bean, easily cultivated in the United States, in the form of sauces, cheeses, and dressings. There are likewise shown, through the courtesy of Dr. Yamei Kin, some preserved duck eggs that are claimed to keep for one hundred years. All of these unutilized foods are shown in the exhibit in Memorial Hall, the specimens of sea foods being contributed by the departments of ichthyology and invertebrate zoölogy of the Museum.

We may learn some things pertinent to the present food crisis even from our predecessors, the native Indian inhabitants of the American continent. The department of anthropology has contributed to the exhibit a series of specimens and models illustrating the skill of the Indians of the Southwest in utilizing the cactus and other local plants as sources of food supply—even making bread out of acorns after extracting their acrid elements by prolonged boiling.

In the past, famine and pestilence have always followed in the wake of war. The danger of epidemic disease has been almost eliminated during the present conflict through the advances in the science of public health. The menace of famine, too, is certain to yield to the application of scientific knowledge as fast as it can be effectively diffused through the medium of public education.



Crô-Magnon Man. After restoration by Professor J. H. McGregor from prehistoric skull found in 1868 in a grotto in the little hamlet of Crô-Magnon, near Les Eyzies, France. Courtesy of Charles Scribner's Sons

The Dawn of History

A DRAMA IN THREE ACTS¹

By T. D. A. COCKERELL

Professor of Zoölogy, University of Colorado

Introduction to Act I.—We commonly divide the human period into the historic and prehistoric. The historic is considered to be that which is recorded in the books,—that concerning which tradition exists, unbroken in the main to the present day. Discoveries of ancient records and writings thus ever tend to press back the date of the beginning of known history, to dispel the mists which hide remote antiquity from us.

There is, however, another way of regarding this matter, and the historic may be separated from the prehistoric without reference to the condition of the records, or even to their existence. There was, strictly speaking, no history as long as man lived in primitive ways, without appreciable progress and with-

out noteworthy deeds. The years rolled by for man as they did for the beasts; as they still do for the wild man of the remoter forests of the Amazon. The ages saw evolutionary progress; but history proper, the marking of time by salient events, did not exist. At long intervals inventions and discoveries did indeed punctuate the centuries, but they were so rare that they produced no connected effect on the human mind, no sense of progress. At length more rapid advance was made, and it was possible in a lifetime to realize that the past and future were not alike, to sense the flow of historic events. The lines below, describing the killing of the first mammoth, attempt to describe the birth of this new age and the new way of regarding human affairs.

¹ Written after reading Professor Henry Fairfield Osborn's *Men of the Old Stone Age*.

Act I.

A cavern in southern France, with group of

CRÔ-MAGNON PEOPLE

ELA. Ah me! Ah me! I fear the worst,
For half the night is spent, and we're alone
And they, and he, all gone to hunt the hairy
beast
Which no man yet has slain. They can but
fail,
And failing, leave us here alone, to starve
and weep,
While in some forest glade their naked bones
Lie bleaching in the sun.

ZUN [*her father*]. You sent them forth,
'twas your desire, you said to them,
"Go kill the hairy mammoth, and bring home
Good meat for all the winter days."

ELA. And if I did, 'twas theirs to know
I was but jesting; need they show
Such zeal to take a woman's word
As a command; as if they heard
The voices of the gods!

ZUN. It *was* no jest—but hist! I hear
A sound upon the breeze. It louder grows,
and seems to bring a message of good
cheer.

[*Sound of shouting and laughing; and
presently a dozen men rush into the cave
bearing the tusks, ears and tail of a
mammoth.*]

THE MEN. Ah ha! Ah ha! Ah ha! Ah ha!
The mammoth's dead, and we're alive—
save only one!

ELA. Save only one! Come, tell me where
is Akak, did he fall
A prey to this mad beast, and you rejoice,
while I must weep—
For he was all mine own!

DUK [*leader of band*]. What matters Akak,
we have slain
The hairy mammoth, and his meat
Will keep us all the winter days.

ELA. What matters meat when he is gone?
When all I loved is gone, and you I hate!

DUK. Come, hate us not, we did but follow
your advice.

The beast, not we, did step on Akak as he
fell,
The foremost in the fight. We think the price
A little one for such a victory.

PANCK [*wise man of tribe*]. The stream of
life from day to day

Has flowed unheeding on its way.
Who died, who lived, it mattered not,
The winter cold, the summer hot,
Were parts of an appointed plan,
Which never ended, nor began.
Yet now, in midst of ebb and flow
Of human tide, a date is set—
This noble deed, this mighty blow,
Which killed the beast, that we might get
Our meat for winter; this has met
The challenge of the eyes, and today
Historic progress lights our future way.

ZUK [*artist of the tribe*]. Bring chisel,
paints, and on the cavern wall
We'll paint the scene, that in the days to be,
As bright fire rays upon the picture fall,
Our sons and their sons' sons may know that
we

The mammoth slew, and thus began
A path of progress for the feet of man—
Treading this path, he can but upward go,
His life no longer simple ebb and flow,
While Akak, slain, of all shall longest live,
On lips of men who eager praises give.

Introduction to Act II.—The animals live the lives for which they are fitted; it can scarcely be said that their powers exceed their performance. Man, especially primitive man, is a creature of unfulfilled promises. He is capable of he knows not what; hidden within his mind are powers which may, under other circumstances and in the ripeness of time, transform the world. One of the greatest obstacles to progress and to human happiness in general is the failure to appreciate what is possible; man's inability to realize his own powers. Through long ages the Crô-Magnon man, though endowed with a splendid brain, lived in caves, primitively and with little progress. This condition of things is set forth in verses

purporting to represent a discussion among the angels in heaven. They deplore man's low estate, and finally decide to bring him counsel. Thus, perhaps, religion comes into the world; but, as we shall see, it is not altogether intelligent or wise. The angels do not know that man must slowly and with labor tread the upward path, that he cannot be made over all at once. They do not know that progress may not be altogether beneficial, that the changes ahead are full of woe as well as weal; that man, did he know what was coming, might well refuse to leave his Eden and enter upon a sea of troubles. Yet, after all, they represent the future, and through much error and travail man may yet realize his true mission on earth.

Act II. *The halls of Heaven. Three ANGELS, representing victory in war, the wealth of cities, and the power of science, talk together*

FIRST ANGEL. The earth is peopled by a noble race of men,

Fair as the gods, endowed with ev'ry gift
To make the world anew, and so to lift
Mankind above the brutes, and set him up
In lordly state to rule the crawling host;
To bend all nature to his will, that he may boast

The world is his, and all the life thereon!

SECOND ANGEL. I saw this wondrous creature in the caves

Of France and Spain, and living such a life
As beasts that hunt their prey, in constant strife

With other beasts, to gain the right to live,
To struggle through this world, content to hold

Enough of this world's goods to shelter from the cold

And keep the flickering flame of life alive.

FIRST ANGEL. 'Tis so, and yet the humble race you saw

Has brains to rise above its low estate,
Has godlike gifts whereby it may create
Houses of wonder, filled with ev'ry gift
Of art and science, helping men to know
The mysteries of nature, ebb and flow
Of life and death, and all that comes thereof.

SECOND ANGEL. The lower beasts do live their lives in full,

But this new creature man is blind indeed,
He knows not what he is, nor can he heed
The promptings of a higher power within.
His godlike gifts mean nothing to him now,
In vain did all the heavenly powers endow
This being with the power to rule the earth.

FIRST ANGEL. Man slowly treads with halting feet the way

To higher things, and as the flowers that blow
In forest glades, from lowly roots must grow

To later loveliness; so given time
This creature man will show his native power,
Will blossom forth in strength as does the flower

And come unto his very own at last!

SECOND ANGEL. For fifty thousand years this man has trod

The same dull path of routine, nor has grown
In intellectual stature; nor has shown
The promise of a better state to come.
What hope remains that he will shortly rend
The crust of ancient custom, and ascend
The throne to which his nature bids him rise?

THIRD ANGEL. Why argue thus about the fate of man

When we have power to set the matter straight,

When we, descending, may point out the gate
To glory, and in glowing words

Describe the gains of progress to the race,
Until, now understanding, he will face
His future in the happy world to be!

FIRST ANGEL. The plan is good, so we may serve

Both gods and men; and as we tell
Blind man to see, that he may dwell
In power through progress, he will spring
Toward the higher goal, and quickly gain
The fruits of human knowledge, and attain
The conquest of the fertile fields of earth!

SECOND ANGEL. We'll hasten forth, and thus will break

The fatal chain of custom and set free
The mind and soul of man, that he may see
The future spread before his raptured gaze.
What joy is his to fully know his power,
What rapture comes to him in this glad hour,
When we descend to serve his utmost need!

[*The three angels descend to earth to convey their message to mankind.*]

Act III. *The cave; MAMMOTH HUNTERS and others sleeping THE ANGELS appear*

ANGELS. Sleepers, waken, hear our story,
How mankind may come at last
Into power and endless glory
When the ancient night is past.
The light of dawn across the sky
With radiant beams dispels the night;
We bring a message from on high
To put your ignorance to flight!

CAVE MAN. How now, how now, what guests are these

Intruding in our cavern hall,
What mean they by their messages
Of future things that may befall?

FIRST ANGEL. We speak of power, when you shall know
The strength you have to strike a blow.

CAVE MAN. The strength we have, we know it well,

Know *you* the thing that just befell,

How went it with the king of beasts
Who fell before our mighty band;
His flesh we have for winter feasts
Our fame is spread throughout the land.

FIRST ANGEL. One mammoth killed! A little thing

Compared with future deeds of strength
When mighty armies forward fling
Their battle lines throughout the length
And breadth of all the land!

CAVE MAN. To meet a mammoth multitude!
To slay a thousand ev'ry day!
To raise a mountain height of food!
Is this your golden way?

The mammoths do not thus abound
Nor could we use the mighty hoard,
Take note of nature, look around
And see what gains these lands afford!

FIRST ANGEL. Oh, foolish man, I did not mean

A war against the mammoth race;
The greater war, a prize to glean
By those who go the pace!
By those who on their fellows fling
In mighty wrath the sword and spear—
By bloody deeds thus conquering
And filling all the world with fear—
To such the plaudits of the song
And glowing praises shall belong.

CAVE MAN. My wits are dazed, I know not
how

The meaning of your tale to read.
Shall wholesale murder us endow,
While all the world shall bleed?
Pray, say to us, where is the gain,
What compensates for all this pain?

FIRST ANGEL. The gain it is to win the
world,

To lord it over all the earth,
To see your flag of war unfurled
Wherever men have birth—
And doing this heroic thing
To live as heroes in the fight,
And culture to the nations bring
With heavy hand of might.

CAVE MAN. I see it now, you are possessed
With seven devils in your soul,
You cannot stop, you cannot rest,
While any mind is whole—
The gods above would us destroy,
To make us mad they you employ;
But we discern your evil plan
To make a devil out of man!

SECOND ANGEL. Let me explain another
thing:

You love the cave's protecting dome:
Forget the war, and let us bring
The tidings of a better home,
In city streets there shall arise
Vast piles of caverns made by man,
The roofs ascending to the skies:
And all this wondrous plan
Shall crowd into a little space
A million members of your race.

CAVE MAN. We love the forest, and to roam
Here and there from out our home,
We love the wide expanse of land
Surrounding us on either hand;
We love the sunshine and the air,
The woodland sounds and blossoms fair—
What have you in exchange for this?
What hidden good for all our bliss?

SECOND ANGEL. You live but poorly, could
you know

The power of wealth, the use of gold;
How some may live, and daily grow
More wealthy, till on growing old
They own the fruits of thousands' toil,
And claim as theirs the very soil,
Which may be bought or sold.

CAVE MAN. Our gains are ours, and hard we
strive

To keep the natural man alive,
We know not what you mean by wealth
If it be neither strength nor health.
What gain to any one to own
The earth, though it is his alone?

No man there is among our band
Who would be lord of all the land,
And thrust us forth in dire distress
That he might then the world possess.
Should any wish to do this deed
We should esteem him mad indeed!

SECOND ANGEL. We note your drawings on
the wall

Of bison, mammoth, horse and deer;
The work is crude, yet you may call
The Muse of Art, and she will hear,
Will show you how on cloth to paint
Fine pictures you may frame with gold,
To show a sinner as a saint
(That's why the picture's sold).
Your labor will your pockets swell
With cash from those you serve so well.

CAVE MAN. What pockets are we do not
know,

Nor do we understand your plan:
But we would ask if you could show
Such canvas images of man
To those in ages yet to be
That they might almost seem to see
The strivings of antiquity?
Our drawings on the wall of stone
Our figurines of bison bone
In days to come will yet survive:
So shall we almost seem alive
And give our message from the past
To those who find them out at last.

THIRD ANGEL. A better story I will tell,
Of Nature conquered by the mind,
Of knowledge that may serve you well
Of secrets you may find
By seeking out the laws that hold
The universe within their sway,
The laws that make the leaf unfold
And send the night to follow day.
So knowing these you may command
The mighty forces of the earth
And from them all in time demand
Whatever is of worth.
Such power is gained in peaceful ways
Nor need to any bring distress;
To science then we give our praise
Who know its power to bless!

CAVE MAN. We know the time the wild
birds fly,

We know the bursting of the flowers,
The autumn tints, and when must die
The summer's golden hours.
Such simple knowledge guides our way,
But you would tempt us to aspire
To godly wisdom, such as may
Befit the angels; brave the fire
Of heavenly wrath that mortal man
Has dared to lift the sacred veil
That since the morning time began
Has stood to warn us lest we fail—
For man is heir to man's estate
Nor may he enter Heaven's gate.¹

[The angels leave, baffled and perplexed.]

¹ Man today is midway in the development urged upon him by the Angels of the drama, there is still "the future, and through much error and travail man may yet realize his true mission on earth." Thus the "message" of the drama is clear.—THE EDITOR.

THE SEASON OF WILD FLOWERS

WITH REPRODUCTIONS IN DUOTONE AND SUGGESTIONS REGARDING
CERTAIN SPECIES NEEDING PROTECTION



THE BIRD'S-FOOT VIOLET

If only for the sake of the little children of future generations, let us give personal care to the wild flowers of America. They are fast disappearing through reckless picking and uprooting. Possession in the hand is a satisfaction, but if we stop to consider, there is a greater satisfaction. All the beauty of field and woodland, the color, the fragrance, the song of birds, the wind—these are our possessions. We do not need to imprison the wind or kill the bird. We do not need even to own the land on which the sun shines and the flowers bloom. No power can dispossess us in this heritage or remove us from this intimate relation, for by right of the life in ourselves, we are part of the whole.

The bird's-foot violet (*Viola pedata*) grows in sandy places (exposed to full sunshine; compare its leaf with the leaves of shade-loving species) and is the largest of the violet family in America. It has already become extinct in many localities. The common blue violets (*Viola palmata*) may be picked without compunction, for, like the fringed polygala, they produce seeds in the late fall from underground flowers



IN THE HOLLOWES OF THE WOODS

Wild flowers occur always in association, and the associations make their appearance one after another in succession. He who has been much afield, especially when a child, has vivid memories of some of these seasonal associations. In early summer, for instance, when painted cup still flames red from the center of the marsh and wild roses begin to hedge the margin, he expects to catch fragrant whiffs from white elderberry, while he is certain, even if his eyes have lost their sight, that blue flags are somewhere near. He remembers kneeling in the rank grass and fern to gather long-stemmed wild strawberries ripening among sweet white violets and blue-eyed grass. And just beyond, in a boggy spot, how distinctly he remembers the pitcher plants' red umbrellas above cranberry and sundew. Then—memories of the flavor of tender young wintergreen leaves beckon him to the woods, where he used to gather Indian moccasin flowers, and where the strange white Indian pipes push up among the dead, brown leaves of the ground



APRIL DAWN—AND THE WORLD'S FOOD SUPPLY

At dawn each plant begins its daily work of manufacturing starch. We cannot sufficiently glorify plants. Where do we turn in this food crisis of the world war in 1917? To the divine gift in our hands; to the plants of our gardens and the wild plants of the field. And we have no fear but that sufficient will be obtained to feed many millions of people. How is so stupendous a miracle accomplished? As mysterious as the life powers that reside in us is this life power of plants, which we do not possess. They can make starch and proteid out of water and air. We cannot, nor have our wisest chemists been able even to approach a method. But certain unpretentious grasslike plants—we call them corn and wheat—in just one of the states of our Union, have been known to manufacture one to two hundred million bushels of corn and nearly as many of wheat in one short summer. Starch is made up of carbon, hydrogen, and oxygen ($C_6H_{10}O_5$), which elements the plant therefore must have if it is to make starch. Water consists of hydrogen and oxygen (H_2O). Carbon dioxide of the air has carbon united with oxygen (CO_2). The steps in the process are not known but might possibly be as represented in the equation: $5(H_2O) + 6$ parts of carbon dioxide ($6CO_2$) = 1 part of starch ($C_6H_{10}O_5$) + 6 parts of free oxygen left over ($6O_2$). Whatever the process, the work is done in the living green part of the leaves of plants and only in sunlight. The conversion of this starch into sugar for transportation through the plant, and into proteids (by the addition of nitrogen, etc.) for growth and storage for later growth, makes a fascinating chapter in botanical study



THE GOVERNMENT ALONE CAN SAVE MOUNTAIN LAUREL FOR ALL THE PEOPLE OF AMERICA

Nothing but protection by law will save—at this late day in their destruction—such plants as mountain laurel (*Kalmia latifolia*), rhododendron, pink azalea, and dogwood. They have been made practically extinct within a wide radius of large cities. The first two are now being shipped in carload lots from the mountains of Pennsylvania and the southern Alleghenies. They appear at markets, groceries, fruit stands, and florists, all the year round, and at Christmas are used to decorate churches and hotels. They should be protected by law and then artificially propagated for the markets. But not until the free supply from Uncle Sam's garden retreats is cut off, will there be a demand for this artificial propagation.

Imitate the action of the visiting insect by touching the arched stamens (they have their heads buried in small pockets in the corolla), and watch them spring into a reverse position, vigorously throwing their pollen



A RELATIVE OF WILD ROSES

Pink meadowsweet flowers (*Spiraea latifolia*) reveal at a glance that they have developed through the ages from the same ancestors as peaches, cherries, blackberries, roses, strawberries, etc. Flower structure shows all stages from flowers in which the parts are separate to marvelous irregularities and complex unions. The plant world is very old, older by many millions of years than ourselves. Flowering plants were blooming and fading, pollinated by the ancestors of our present bees and butterflies, far back in Cretaceous times, when reptiles were the recognized lords of the world. During these ages they have struggled for their existence, and many have become extinct. Those left are the plastic ones that kept the power to vary and adapt themselves to new conditions of climate, to new insect visitors, or to changes in themselves from intercrossing. Some are very complex and different from those they started out with as close relatives, but always there are certain fundamental likenesses to give the clue to their relationship.



AMERICAN WILD IRIS

Our marsh flag (*Iris versicolor*), or "fleur-de-lis" ["Fleur-de-Louis," it is the national flower of France and perhaps something besides mere chance has dictated that the cultivated fleur-de-lis should be so popular in America this summer of 1917], is of the "truest blue," and has "a sword for its leaf" — a flower of chivalry.

Bees cross-pollinate the blue flag. They are said to be always partial to blue. Self-pollination is prevented both by the position of the parts in the flower and the too early maturity of the pollen. Watch a bee alight on a drooping outer leaf and follow its guiding lines upward and then downward toward the nectar cup, pushing its body under the leaflike roof above, and leaving by the same route. Butterflies reach the nectar with their long "tongues" without entering the chambers where the pollen lies—but there is a bountiful supply, enough for all



THE RARE LARGE
PURPLE-FRINGED
ORCHID

Flowers and insects—especially bees and butterflies—evolved side by side, and each is dependent on the other. Many wild plants, removed to the garden from woods or marsh, cannot make seeds because of the lack of their insect agents. The orchids advertise their nectar and pollen (for bee-bread for young bees) by color and fragrance. The latter is probably the more potent, for a bee does not see well except when very near the object, but it smells a flower at a great distance and will go unerringly even to a hidden flower, which, moreover, seems but faintly fragrant to us. In the summers of years past, these large fringed orchids have stood erect like purple shadows of the dark tree trunks in the woodland marsh. Today they are too nearly extinct to be seen frequently. Butterflies and moths cannot draw up nectar from the long spurs of the purple-fringed orchid (*Blephariglossis grandiflora*) without transferring the pollen, decorating their eyes and heads with sticky pollen masses again and again



THE SHOWY LADY'S-SLIPPER, WHITE AND ROSE-RED

These fairest of America's wild flowers (*Cypripedium spectabile*), together with the yellow lady's-slipper, the small fragrant yellow, and the stemless pink moccasin, are certain to be among the first of our wild flowers to become extinct. The showy lady's-slipper may grow in the darkest, most impenetrable part of the tamarack swamp, yet one ruthless hand after another is sure to find it out. The right conditions for this species are found but rarely, growth is very slow, seed-making is not always successful. Such plants should no longer be picked. They should never be used for classroom study in any grade of institution. Some of our native cypripediums might be domesticated. It would be good to study the question of domestication of wild flowers, instituting a system and fashion for "wild flower gardens," with supply stations for plants and seedlings corresponding to our nurseries and hothouses for cultivated plants



GRASS PINKS FROM THE BORDER OF THE MARSH

Where all is motion and life and comradeship, wind swaying the grasses, bobolinks singing, bees flying from flower to flower, grow the rose-purple grass pinks (*Limnorchis tuberosum*). They are often accompanied by one or both of two other small orchids, the rose pogonia and arethusa—all three too easily uprooted from the moss. Each grass pink flower has a cup of pollen with a hidden hinge which the bee swings open. The species seems to be an isolated record of a previous and more simple state of the orchid family, where the lip was above in the flower and the seed pod not twisted; if it is this, all intermediate forms have become extinct. These beautiful small orchids should be eliminated from all lists of supply for botanical study in schools



SYMBOLIC OF THE QUIET OF SUMMER WOODS

Small "wild flower reservations" should be set apart by the government in the haunts of the choicest species, and laws against picking wild flowers should operate in all parks and forest and game reservations. The delicate waxy pipsissewa, or prince's pine (*Chimaphila umbellata*), is typical of the low, woods flower which children pick by the handful thoughtlessly and scatter withered along the way home. If schools will but emphasize the really important things in botany, boy and girl scouts and all children will enforce protection of rare wild flowers



WELL WORTHY OF CULTIVATION

The groundnut (*Apios tuberosa*) is a climbing annual vine having maroon and lilac flowers of velvet texture and with the fragrance of the English violet. The groundnut (it has an edible potato-like tuber) belongs to the pea family—a family of unusual interest because of its fodder value in clovers and alfalfas, and food value in beans and peas, seeds in which starch, sugar, and proteids (manufactured by the plant) have been stored in such stable form that they can be shipped to all quarters of the globe. Members of the pea family have the wonderful power of collecting nitrogen from the air of the soil. The work is done by millions of bacteria which live in minute protuberances on the roots. Farmers are learning to enrich the soil by growing clover or cowpeas and ploughing the crops under, or they alternate various crops with some member of the pea family; also they increase their clover, bean, or pea crop tenfold or more by wetting the seeds before planting with a culture of the bacteria



FERNS BY THE COUNTRY ROADSIDE

The interrupted or Clayton's fern (*Osmunda claytoniana*) attains a wonderful growth in June, having come up slowly in picturesque colonies, while anemones, jacks, and trilliums were blooming. It has never been estimated how much water such a fern bed evaporates into the air—evidence of the starch manufacture going on; probably many thousand gallons in a summer. (A single oak tree is said to evaporate 130 tons during its growing season.) The water current pushes up from the roots faster than it can be used in the leaf, and the excess is given off as vapor. Ferns were the first plants in the history of life on the earth to develop a division of labor among the cells of the stem, setting apart a system of vessels especially to carry sap. The walls of these vessels are "wood," which, as such, makes the plant strong to stand erect, even to rise into tall trees, as in the tree ferns of the tropics.



IN SUMMER WHEN DAYS ARE LONG AND WARM

Look over any list of American flowers needing protection; not one is in the aster family (*Compositae*). Scan a list of our food and fodder plants; very few indeed are members of the aster family—lettuce, oyster plant, artichoke, chirocy. Yet the aster family has some twelve thousand species, more than one tenth of all flowering plants. It is the highest family considered from the standpoint of evolution, the youngest, a hardy, highly adaptable race, outcome of the plant world's past ages of struggle. The individual flowers are always united into communities with a division of labor among them; there are the most effective arrangements and movements for cross-pollination with always the possibility of self-pollination as a last resort; their seeds seem infinite in number. That the family is dominant and successful in winning its way against odds can be judged by the fact that its members completely cover the country. They are not rare and few and hidden away in impenetrable swamps. Instead, millions strong they flaunt their beauty even under the eye of their greatest enemy, man, the agriculturist



FLOWERS OF THE CHESTNUT TREE

They are unendurably sweet, but beautiful to the eye, drooping above the leaves instead of underneath as among the oaks. The trees (*Castanea dentata*) bloom in July (Massachusetts) and the nuts (note the five or six young burs toward the upper part of the branch) do not ripen until late fall; they are prisoners on the trees until November frosts open the burs—unless perchance some foresighted squirrel bite off the branches a few weeks earlier. Botanists have scarcely begun what is possible in nut tree breeding from the standpoint of food production. Experiment, however, has already obtained, by grafting the chestnut of Japan upon our native chinquapin (which though small is very sweet), an extremely prolific chestnut with all the requirements for commercial handling—and immune to the chestnut blight. The secret to remember is that nut trees are living individuals, no two being alike in rate of growth, tendencies regarding time and amount in fruiting, and size and flavor of nuts, and that a wise selection, with grafting, is certain to revolutionize our ideas as to what can be expected of a nut tree



FLOWERS IN PREPARATION FOR BEECHNUTS

Beechnuts, though most delicious, are small and seldom marketed in this country. Some day the woods will be explored for the beech trees (*Fagus americana*) with superior nuts (they vary greatly in size) for special propagation. The beechnut has rich food and mast values, while yielding a high grade of oil. With the increasingly high cost of meat, we are importing more nuts. American nut culture should be looked into. There is no reason why a tree cannot be grown for many annual harvests of nuts and a final harvest of wood also, making a farmer's wood lot or even a steep hillside as valuable as the best agricultural land. If a hickory with poor nuts be cut for lumber, graft on the best shagbark. Transplant young nut trees (hickory, walnut, chestnut, etc.), and graft on the finest of their kind. Then multiply this crop by planting an understory (keeping it cut low) of locust, or annual crops of cowpeas—in either case a member of the pea family to gather nitrogen and share it with the nut trees. Nut culture in America will undoubtedly receive a strong impetus as one of the results of the food crisis and war of 1917



MIDSUMMER ALONG A NEW ENGLAND RIVER

In field work let us replace the collecting can and our old desire for possession with notebook, sketchbook, and camera—especially with “detective work” to see what plants are doing. How do they overcome mechanical obstacles in their way, how attract and receive insects, how scatter seeds? How do they vary in shade and sun, with what other plants are they struggling for space, into what communities are they organized? What are the most striking examples of plants in process of migration, marching year by year toward the center of pond or moor, filling up hollows, making soil in rocky places—everywhere slowly changing the face of the earth? What are some of the wild flowers especially endangered by man’s drainage of swamp land, removal of forests, and cultivation of new land? Man has “dominion over all the earth.” Think what we shall do with that dominion

Weird Diseases of Africa

THE STORY OF STRANGE PARASITES WHICH TRAVEL FROM MAN TO
MAN THROUGH THE AGENCY OF TSETSE FLY, MOSQUITO,
OR OTHER "INTERMEDIATE HOST"

By WALTER B. JAMES

President of the New York Academy of Medicine

FROM earliest times the "Dark Continent" has been known as the home of peculiar men and beasts. Modern science, especially medical science, now teaches us that the minute, even microscopic, life of Africa is no less individual and remarkable, especially its parasitic life, while the symptoms these parasites produce in the unfortunate human beings infested by them are equally weird and generally extraordinarily unpleasant. Many of the diseases produced by these microscopic parasites have been known to physicians—at least as far as their symptoms were concerned—for many years, but only lately have the wider settlement of Africa and the progress of medical science, with the establishment of schools of tropical medicine like those at Liverpool and Harvard University, made the nature of these important diseases clear to us.

In the slavery days in America it was noticed that often in a shipload of slaves who had been captured in the interior of Africa and sent here, a large number would sicken in a peculiar way and then die. They first became dull and listless, then so drowsy that they could be roused only with great difficulty. They refused to eat and then died. Other and subtler symptoms were overlooked. It was natural that illness and death should be ascribed to homesickness. These people, we now realize, had the "sleeping sickness." In their jungle homes they had been bitten by the tsetse flies that had previously bitten persons, or perhaps animals, having this disease, and had conveyed the parasite in this way. For the germ—a worm, not a bacterium—inhabits the blood of its victim, and multiplies there.¹

When the blood containing them is

taken into the stomach of the fly, the germs multiply there (the fly acting as the intermediate host between the two human beings) and go through a phase in their lives that may be likened—to use a comparison familiar to us all—to one of the stages in the life of a butterfly. The progeny find their way to the salivary glands of the fly and lie there, ready to be injected into the blood of the next person to whom the tsetse turns for a meal. If we take a drop of blood from the finger of a person who is in the advanced stage of sleeping sickness, and put it under a powerful microscope, a remarkable situation is evident. Enormous numbers of the parasites (trypanosomes) are seen rushing about, apparently aimlessly, knocking the blood corpuscles about like so many ninepins, and one wonders that a man could live at all with such weird things going on in his blood.

Whole tribes of blacks in Africa have been annihilated by this disease and, as one of the methods of controlling it, it has been suggested that in the parts of Africa most affected, the wild game should be killed off, for it has been shown that animals, too, may be hosts for such parasites and thus help to preserve them. The laws that secure the perpetuation of these minute enemies of man are just as effective as the corresponding laws that seem to us to work for our benefit. Nature is impartial. To be sure she has given us an intelli-

¹ This parasite is the *Trypanosoma gambiense*, and is generally called the trypanosome of sleeping sickness. Such a parasite generally has to live in two different kinds of animals in order to round out its complete life, and for each variety of parasite the two hosts are always the same. One is called the "intermediate host," the other, the "final host." In the case of the trypanosome of sleeping sickness, the tsetse fly is the intermediate host, man (or in some cases the antelope) the final host.

gence that leads us, or ought to lead us, to the use of microscopes, laboratories, and through these to a successful combat with disease; but as an offset to this, she has, as a rule, made us more susceptible to disease than are the lower animals. As far as we know the antelope with trypanosomes in the blood is not made ill by them. The killing of the vast herds of buffalo that once ranged our own western prairies was necessary in order that these lands might support great herds of cattle; and so perhaps when the Dark Continent comes to be settled, it may be necessary to kill most or all of the wild game animals in order to eliminate this terrible disease.

One of the most peculiar of all tropical diseases, and one that is very common in some parts of Africa, is filariasis, caused by a parasite called the filaria. In the blood of persons suffering from it there are found innumerable little worms that can be seen only by the aid of a microscope. These are present only at night in the blood that is circulating. At about five o'clock in the afternoon they begin to appear in the blood, having been hidden away in the body until this time, and they remain in the circulation until about midnight when they begin to diminish. By eight or nine o'clock in the morning they have all disappeared, and a search of the blood under the microscope after this fails to reveal any. They are now collected in certain large blood vessels deep in the body, especially in the lungs, where they remain hidden until they go out on their next nocturnal excursion.

The parasite is conveyed to human beings by the bite of certain kinds of mosquitoes. The mosquito bites, and takes from a man (or from some animal as the case may be) blood which contains these small worms. In the stomach of the mosquito (the intermediate host) the parasite goes through certain definite changes or metamorphoses which are just as necessary to its complete life as are the different phases in the lives of butterflies, moths, and a great many insects. First it escapes from a skin or shell in which it has

existed. Then it bores its way through the wall of the mosquito's stomach, and travels forward through the body until it arrives at the base of the bill or proboscis. Here it curls itself up and waits until its host begins to feed upon a warm-blooded animal, when it passes out and finds its way into the circulation of the animal. These filariæ behave in a curious way which has the same effect as though dictated by intelligence; that is, when the mosquito, in the absence of animal food, feeds upon fruit, such as bananas, the filaria does not leave its comfortable berth but continues to wait until it has the chance to enter the circulation of a warm-blooded animal. A possible explanation of this, however, is that when a mosquito bites a human being, it first injects a small amount of fluid secreted in its salivary gland. This fluid prevents the blood from coagulating and stopping up the very small bill through which it is drawn. This poisonous substance is the cause of the swelling and itching that follow mosquito bites. It is not known but that the filaria is injected along with this, for it is fair to assume that the insect would not need to inject the secretion when feeding on bananas, as banana juice does not coagulate.

When the parasites find themselves injected into the blood of a man, the "final host," they travel about in the circulation until they find a resting place in one of the larger main lymph vessels, and here they settle down for the rest of their lives, one or more males and one or more females coiled up together. From this point they send out into the blood current every evening innumerable broods of young which are the ones that rest by day and circulate by night; and so the life cycle is run, over and over again. Their nocturnal activity is supposed to be related to the fact that their intermediate hosts, the mosquitoes, carry on their predatory excursions after dark, and therefore it would be of no avail for the little parasites to get into the circulation in the daytime. This is an evidence of Nature's thought for the preservation of a species that, from our point of view, is useless.

When the parent worms have selected a large lymph vessel at the base of a leg or an arm, for instance, and have started in raising a large family, we find that in entire disregard of the comfort of their host, they have soon completely blocked up the vessel, and so produced a slow chronic congestion of the whole limb below. The limb then becomes of enormous size, and from its supposed likeness to the shapeless leg of an elephant, the disease is now called "elephantiasis." When we travel in the tropics, especially in Africa, and see—as one often does—a person with enormous enlargement of one arm and hand or one leg and foot, we may be quite sure that it is a case of filariasis, and that there is a colony, as above described, living in the armpit or groin. These cases occur also in other countries, indeed in almost every tropical and subtropical land into which the disease is introduced through travel. It, like malaria, is to be prevented only by getting rid of mosquitoes, the intermediate host.

There is another species of filaria, the *Filaria loa*, very common in Africa, which is transmitted to man by the mangrove fly, a common blood-sucking insect in that country. This worm settles in some of the tissues just beneath the skin, often in the lower eyelids, where it produces uncomfortable swellings.

Another peculiar African parasite is the guinea worm. This, too, has an interesting life history. Little or nothing is known of the male worm, but the female, very slender in diameter although attaining a length of three or four feet in adult life, is found immediately beneath the skin usually of the lower limbs. It has probably been fertilized before entering, and, lying immediately under the skin of its host, when fully grown it pierces this skin and through the minute aperture extrudes countless minute young or larvæ, in successive crops.

By this time it has caused much irritation and suffering and perhaps disability to the host. The larvæ find their way into the water as the natives walk through streams and puddles. In

the water they are taken up by a minute aquatic creature called *Cyclops*, which becomes the intermediate host, and within its body they go through one of their life phases.

The *Cyclops* later is taken into the human being's stomach in the drinking water, where it perishes and its minute body is dissolved in the gastric juice. This sets free in the native's stomach the contained living larvæ, one or more of which may then succeed in boring through the stomach wall into the body tissues. Now an imperative instinct urges the developing worm to find its way through the body toward the skin in order that it may place its numerous young on the surface, as in this way only can they find the *Cyclops*, necessary to the completion of their life cycle. For this reason, too, apparently, the female worm seeks the native's lower limbs, for these come most in contact with puddles of water, and it is in puddle water that the *Cyclops* especially abounds. In India, water carriers bearing skins of water on their backs are subject to guinea worm of the skin of the back, for in them the parasite's instinct leads it to seek this part of the body.

In all of these organisms and their behavior we see Nature's wonderful methods for the continuation of life of even the lowest species. Design, and successful design, is just as surely seen in the lives of the trypanosomes, the filariæ, and the guinea worm as in the wonderful strength of the elephant, the tough hide of the rhinoceros, or the fleetness of the antelope and the ostrich. We realize that we are not Nature's chosen children but must take our chances with the rest of life; that Nature cares just as much for the parasites that plague us as she does for us who are plagued by them; that she looks to us to take care of ourselves with the weapons she has put into our hands or else perish and make way for others who use her gifts to better purpose. It behooves us, therefore, to use our intellects, our only real weapon in the fight against disease, and to turn for aid to science, which offers us the only hope of victory.



SHAGGY-MANE AND INK-CAP

If we knew more about the many edible varieties of mushrooms, which now rank among our table luxuries, they could be made a valuable addition to our food supply. In protein value mushrooms rank about the same as the potato.

These two familiar examples are common in the rich soil of lawns and elsewhere in late summer and autumn, ink-cap (*Coprinus atramentarius*) being the more abundant. Shaggy-mane (*Coprinus comatus*), which is considered one of the very best and most digestible of the mushrooms, is conspicuous on account of its shape and its striking pinkish, reddish, and purplish tints, all often seen at the same time on one plant. Ink-cap is less attractive in appearance, and is more available for catsup than for other food purposes.

Wild Mushrooms as Food¹

By WILLIAM A. MURRILL

Assistant Director of the New York Botanical Garden

THE immense importance of the food question at the present time naturally suggests the use of wild foods; and many of the wild mushrooms might be made a valuable addition to our food supply if the public knew enough about them. Fresh specimens are available throughout the summer and autumn, and the surplus might be canned or dried for winter use.

The popular and widespread interest in mushrooms of all kinds is almost phenomenal. This is due to their beauty of form and color and the supposed mystery surrounding their origin and growth, as well as to the use of certain kinds for food. Their nutritive value is not very great, being about equal to that of cabbage, but they afford variety in flavor and add greatly to the relish for other foods.

Mushroom eating is much more common in Europe than in America. The struggle for existence is greater there, and the edible and poisonous varieties are better known by all classes of people. In China it is almost impossible for a botanist to get specimens on account of the thorough manner in which all wild food is collected by the natives. The use of mushrooms in this country is confined chiefly to our foreign-born population. Even in New York City, many excellent kinds go to waste every season because they are different from kinds known in Europe.

All knowledge regarding the edible and poisonous properties of mushrooms is based on experiments, either intentional or unintentional. The only safe rule is to confine oneself to known

edible forms until others are proved harmless. If one is a beginner, he is like an explorer in a new country with an abundance of attractive fruit near at hand, which may be good or may be rank poison.

Any writer on this subject undertakes a very responsible task, owing to the vast number of similar forms among the mushrooms which are distinguished with difficulty by those not accustomed to fine distinctions: but it should be possible with the aid of figures to describe a few striking kinds in such a way that no serious mistakes will be made.

Pale Yellow Coral Mushroom.—Bushy, seven to fifteen centimeters high, five to ten centimeters wide; base thick, fleshy, white, dividing abruptly into a dense mass of erect, pale yellow branches, the tips more deeply colored but fading with age; flesh white, mild, of good flavor.

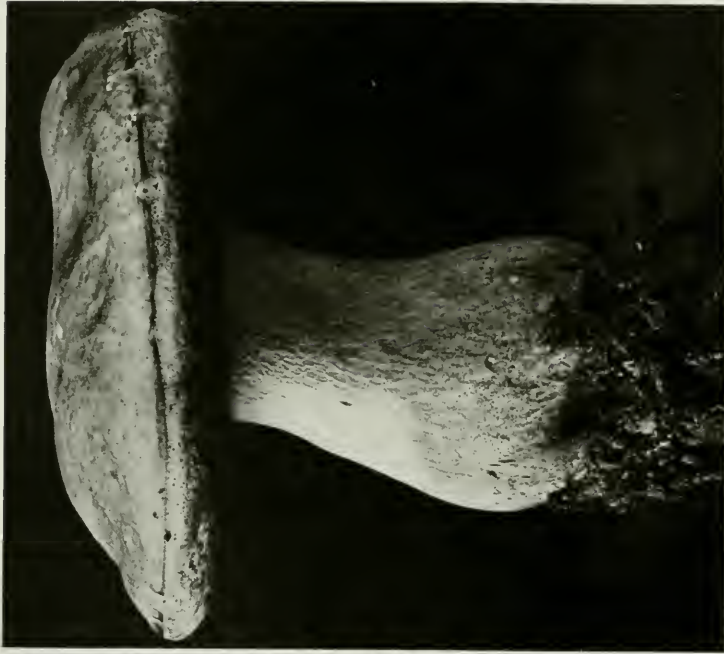
This excellent, as well as beautiful, coral mushroom occurs rather abundantly in woods during warm, wet weather. In collecting it, the base should be examined for insects, which might give a disagreeable flavor to the whole plant.²

The coral mushrooms are easily known by their striking resemblance to clusters of branched coral. They grow on the ground or on rotten wood in dense shade, and are usually whitish or yellowish in color. When tender and of mild flavor, they make a delicious dish. None of them are known to be poison-

² The golden *Clavaria* is similar, but more deeply colored. The rarer red-tipped *Clavaria* has red-tipped branches, the color of which fades out with age. There is also an unbranched, club-shaped species which is often eaten.

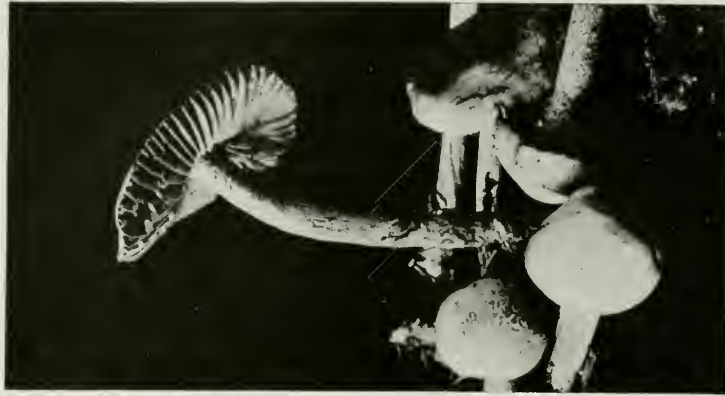


Pale yellow coral mushroom (*Clavaria flava*).—This beautiful variety, which occurs rather plentifully in woods during warm wet weather, is easily known by its striking resemblance to branched coral. The flesh is white and the taste agreeable



FOODS ATTRACTIVE TO THE EYE AND DELICIOUS IN FLAVOR

Edible *Boletus* (*Cortinarius erassus*).—The large reddish brown cap of this well-known mushroom may be seen in July and August in woods, and at the borders of woods, and sometimes in open waste places. It has a pleasant nutty flavor even when raw



Fairy-ring mushroom (*Marasmius oradea*).—Easily recognized by its habit of growing in circles. When young and moist it is yellowish red in color, becoming paler with age

ous, although a few are insipid or bitter. Coral mushrooms may be cooked as other mushrooms are, or escalloped, or stewed slowly for half an hour with the usual seasoning and a little lemon juice, then thickened and cooked longer until tender.

Edible Boletus.—Convex, six to twenty centimeters broad, three to four centimeters thick; surface smooth, varying in color from ochraceous brown to reddish brown, sometimes paler; flesh compact, two to three centimeters thick, unchanging, white or yellowish, taste sweet and nutty; tubes white and stuffed when young, yellow or greenish yellow when mature, changing to greenish ochraceous when wounded, about two centimeters long; stem stout, becoming bluish or discolored when wounded, wholly or partially reticulate, solid, yellowish within, five to ten centimeters long, three to four centimeters thick.

This excellent species of *Boletus* is abundant, well-known, and widely distributed in thin woods throughout temperate regions. The cap is large and usually yellowish brown, while the stem is more or less reticulate, especially above. In one variety, the stem is reticulate to the base, and in another the stem, as well as the cap, is brownish lilac in color. It may be distinguished from the bitter *Boletus* by its mild flavor and differently colored tubes. This species is much used in Europe, and is often sliced and dried for winter use. Large quantities are shipped to this country from Russia and elsewhere. It is best baked in a covered dish for an hour, after removing the tubes and stem and cutting it into small pieces.

Fairy-ring Mushroom.—Convex to expanded, slightly striate at times when moist, fleshy-tough, drying easily, two to five centimeters broad; surface buff or tawny, fading with age or on drying; flesh thin, white, of pleasant odor and taste; gills yellowish white; spores white; stem slender, tough, yellowish white, villose-tomentose, five to eight centimeters long, two to four millimeters thick.

The very excellent little fairy-ring mushroom is to be looked for in pas-

tures during spells of wet weather in late summer or autumn. Its habit of growing in circles will aid one in recognizing it. It should be cooked for some time, owing to its tough texture.¹

Oyster Mushroom.—Convex or nearly plane, irregularly fan-shaped, clustered, five to twelve centimeters broad; surface smooth, variously colored, usually white, yellowish, or brownish; flesh white, mild-flavored, somewhat tough; gills white; spores white tinged with lilac when shed on paper; stem eccentric or lateral, short or wanting, varying according to position in the cluster, strigose-hairy at the base.

The oyster mushroom is very common on dead trunks of deciduous trees, especially elm, from June to November. In Hungary, it is cultivated on sections of elm logs. The sapid mushroom is confused with it in this country and for our present purpose need not be distinguished, as its properties are similar. Both species are rather tough and lack flavor, but they occur in such large masses and are so readily recognized that they are to be recommended for general use as food. The young and tender caps should be selected and cooked slowly in a saucepan for at least twenty minutes.

"Masked" Tricholoma.—Thick, firm, convex to expanded, five to twelve centimeters broad; surface moist, lilac or purple, fading to grayish, becoming slightly brownish on the disk; margin inrolled and frosted when young; flesh white, firm, pleasant to the taste, becoming dull-colored with age; spores dingy white, dull pinkish in mass; stem short, solid, often bulbous at the base, lilac or violet, three to six centimeters long, one and one half to three centimeters thick.

The "masked" *Tricholoma* is exceedingly valuable, of excellent flavor, and not easily confused with dangerous species. It may be found in open woods or among weeds or long grass in rich fields during the autumn months.

¹ One should be very careful in picking small fungi growing on lawns for table use, to avoid getting *Inocybe infida*, a dangerous species with yellowish brown spores; and certain species of *Panvolus*, having black spores.



Oyster mushroom (*Crepilopus ostreatus*).—So named on account of color and shape, rather than for its flavor. It is common on dead tree trunks, especially of the elm, but does not rank as a mushroom of first quality on account of its toughness



"Masked" *Tricholoma (Leptia personata)*.—This large, lilac-tinted mushroom is of excellent flavor and not easily confused with dangerous species



"Perplexing" *Hypoloma (Hypoloma perplexum)*.—The striking reddish clusters of this variety appear on stumps and roots of deciduous trees in autumn. Although the quality is inferior to some it is useful on account of its late appearance

THREE WILD FOODS FOR THE TABLE IN SUMMER AND FALL

Its large size and the violet or lilac tint of all its parts should distinguish it from most other species. In large, mature specimens, the flesh becomes soft and readily absorbs water during wet weather, which somewhat changes the appearance of the mushroom and lessens its value for edible purposes.

“Perplexing” Hypholoma.—Convex to nearly plane, clustered, five to eight centimeters broad; surface smooth, dry, brick-colored to bay, the margin cream-colored to ochraceous; flesh usually of mild flavor, sometimes bitter, white or nearly so, becoming yellowish with age; gills sometimes slightly greenish, and finally purplish brown; stem straw-colored above, ochraceous or reddish below, six to ten centimeters long, five to seven millimeters thick.

The “perplexing” *Hypholoma* occurs abundantly on stumps and roots of deciduous trees in autumn, appearing in conspicuous reddish clusters of considerable size. It is edible, but not very good in quality, being useful because of its late appearance. In collecting this species for food, young and fresh specimens of mild flavor should be selected, and they should be cooked for at least thirty minutes. Soaking in water with a little vinegar for twenty minutes before cooking improves the flavor.

Common Mushroom.—Convex to expanded, five to nine centimeters broad; surface dry, silky, and whitish, or floccose-squamulose and light reddish brown, the color being chiefly in the scales; flesh white, thick, solid, of mild flavor, sometimes becoming reddish when broken; gills white when young, becoming salmon-pink, and finally brown or blackish; spores dark brown; ring delicate, inconspicuous, formed from a thin, white veil, which covers the gills in their younger stages; stem smooth, white, three to six centimeters long, one and one half to two centimeters thick.

The common mushroom occurs in low grass in meadows or on rich, moist, upland pastures, being common after rains from August to October in this latitude. The “spawn,” or vegetative portion, is hidden in the soil and feeds upon the dead organic matter found

therein. In the cultivation of this species, bricks of spawn are planted in suitable soil and the conditions of growth attended to with great care.¹ This is the mushroom usually found in market, either in the fresh stage or in cans. Most persons who collect fungi for food in the fields limit themselves to this one species. Great care must be taken not to get young plants of the deadly amanita when collecting “buttons” of the common mushroom at the edge of woodlands. Also beware of the poisonous *Panavolus* which may appear in mushroom beds.

Common Ink-cap.—Ovoid to bell-shaped, finally expanding and deliquescent, densely clustered, three to six centimeters broad; surface smooth or slightly scaly, especially on the disk, grayish or brownish, often with a yellowish tint, blackening with age; flesh white, quickly deliquescent; gills white when young, soon becoming black and dissolving; spores black; stem slender, smooth, white, five to ten centimeters long.

The common ink-cap is an excellent edible species and is quite common in rich soil on lawns and elsewhere during late summer and autumn. As it appears in close clusters, it may usually be obtained in greater abundance than the shaggy-mane. Owing to its deliquescent character, it must be cooked very soon after it is collected.

Shaggy-mane.—At first oblong, expanding and deliquescent with age, four to six centimeters in diameter; surface shaggy, white, with yellowish or brownish scales, tinged with lilac in places, grayish black on the margin, blackening with age; flesh white, tender, of nutty flavor; gills white when young, soon changing to pink, then to black, and finally melting away into an inky fluid; spores black; ring white, small, movable or slightly adhering, often falling away at an early stage; stem slender, smooth, white, seven to twelve centimeters long.

The shaggy-mane is a very conspicuous object on lawns in autumn, although it is not always so abundant as

¹ The United States Department of Agriculture at Washington, D. C., will gladly furnish information regarding the cultivation of mushrooms in cellars during the winter months.



From midsummer to October, the common mushroom (*Agaricus campester*) may be seen springing up everywhere among the low grass in meadows or on rich, moist, upland pastures. This is the mushroom usually on the market, fresh or in cans. In collecting it at the edge of the woodlands great care must be taken not to get young plants of the deadly amanita



Common pasture puffball (*Lycoperdon cyathiforme*).—Although this puffball occurs commonly in the eastern United States in meadows and pastures, its excellent food qualities are little known. Puffballs are the safest of all fungi for the beginner and are easy to obtain. Being tender, they cook quickly and are easily digested. (See also figure on opposite page)

might be desired. On account of its peculiar shape and decided colors, a single specimen rarely fails to attract attention. It is considered one of the very best and most digestible of the fungi, and is often eaten raw by foreigners. At times, this species occurs in enormous quantities in rich, loose earth by roadsides or in weedy places, and it then becomes an important source of food supply. It requires little

to be so abundant as to injure lawns seriously.

The giant puffball may be readily recognized by its large size, usually about the size of a man's head, and its smooth, white appearance. It occurs infrequently in fields, pastures, or woods throughout most of the United States.

Puffballs are the safest of all fungi for the beginner, none of them being poisonous; and they are at the same time excellent and easy to obtain. Being tender, they cook quickly and are easily digested. They should as a rule be cut open before cooking to see that they are not too old and that they are really puffballs. If they are white and firm like cream cheese inside, showing no yellow or brownish discoloration, they are of the right age to use. If the interior shows no special structures, but is smooth and homogeneous, then one may be sure he has a puffball. The "egg" of the deadly amanita contains the young cap and stem inside, which are readily seen when the "egg" is cut; and the "egg" of the stinkhorn shows the stem and a green mass inside surrounded by a layer of jelly-like substance.



The "egg" of the poisonous stinkhorn mushroom (*Dictyophora duplicata*) in section, showing how it differs from a puffball. The stem and a green mass inside are surrounded by a layer of jelly-like substance, while the puffball in section is smooth and solid.

cooking, and is best broiled and seasoned simply.

Common Pasture Puffball.—Large, rounded, five to fifteen centimeters in diameter, the base short and thick; surface smooth, whitish gray or brown, becoming purplish with age; spores purplish brown.

This puffball occurs commonly in the eastern United States in meadows and pastures where the common mushroom may be expected to grow, but its excellent qualities appear to be unknown to most persons. It is the largest puffball in this region except the giant puffball, which is much rarer. It sometimes grows in circles, and it has been known

Puffballs may be cooked alone in various ways, or used in stews and omelets, and for stuffing roast fowls. When used in omelets, they should be stewed first. All kinds except the very small one should first be peeled and cut into slices or cubes, after which they may be fried quickly in butter, or dipped in beaten egg and fried like egg-plant, or cooked in any of the ways recommended for the ordinary mushroom. The smaller kinds are much inferior in flavor to the larger ones and need a few specimens of some good mushroom to make them attractive.



DEADLY AMANITA, THE CAUSE OF MOST
CASES OF MUSHROOM
POISONING

This mushroom (*Amanita phalloides*) is the most dangerous of all fungi, and to it most cases of mushroom poisoning may be attributed. White, yellow, brown, and green forms may be found growing in woods, groves, open places, and bushy pastures, from July to October. It may easily be distinguished from the common mushroom, however, by the fact that the radiating gills underneath the cap are persistently white, those of the common mushroom being pink. The right-hand picture shows the cap bursting from the "egg," and the formation of the so-called "death cap." The veil still covers the young gills but will fall to the stem later, to form the "ring" which is shown in the other figure.



FLY AMANITA, OR FLY POISON

A showy and attractive plant, the fly amanita (*Amanita muscaria*) is our most common poisonous species of mushroom. The color is bright red, scarlet, or orange in the young plant, fading to yellow on the margin in the mature specimen, while the cap is adorned with numerous white or yellowish warts. It grows both in woods and in open places from June until the freezing weather of October or November.



From the painting by Cary

"THE GRIZZLY BEARS IN THEIR DENS"

When in 1805 Lewis and Clark made their memorable exploration of the Northwest, penetrating to the head waters of the Missouri and to the mouth of the Columbia, the grizzly bear had not yet learned to fear the white man's noisy implement whose bite stung so sharply. Tradition says that these powerful and ferocious animals could bring down even a bison. Now they have become the shyest of game and are well-nigh extinct

Recollections of the Old West

APPRECIATION OF THE HISTORICAL CANVASES OF INDIAN
AND PIONEER AMERICAN LIFE PAINTED BY
WILLIAM DE LA MONTAGNE CARY

By GEORGE BIRD GRINNELL

With illustrations from photographs of a selected series of the paintings

THE swift passage of current events drives from the mind of the average man almost everything except the incidents of today. Most of us forget that this country has a history of nearly three hundred years, of which, to the men then living, each year was as important as 1917 is to us. If there were fewer people in those years, and interests were less diverse, yet the age-old questions of daily work and daily food existed then as now.

For the people who today inhabit the trans-Mississippi West, the period extending from the journey of Lewis and Clark up the Missouri River to the completion of the first transcontinental railroad, ought to possess a stirring and romantic interest. President Jefferson ordered the explorations made by Captains Lewis and Clark, but long before they ascended the Missouri, the prospect of securing the skins of wild animals—with the beaver always in the lead—had been beckoning the explorer westward into unknown lands. In the dry Southwest in the early part of the nineteenth century an attraction was the hope of profitable trade with the Spanish settlements, but for all the Northwest up to the time of the discovery of gold in California, beaver was the lure that led on the explorer as relentlessly as ever fabled gold mines drew the Spanish conquerors.

Recently there has been on exhibition in the American Museum of Natural History a collection of paintings by

William de la Montagne Cary, which is of much historic interest. Most of the scenes were painted between the years 1861 and 1875, and present faithful pictures of many phases of plains life before the coming of the railroad.

Mr. Cary and his two companions, Messrs. W. H. Schieffelin and E. N. Lawrence, left New York in the spring of 1861, made their way to St. Louis, and from there up the river by steamboat toward Fort Benton. One may imagine how the places and the people and the methods of getting about impressed these city boys. We can picture the slow progress of the steamboats up the river; the way in which the vessel walked on her "stilts" over the sand bars; the stops at the different forts with their motley gatherings of Indians and of capoted and brass-buttoned fur traders hurrying to the landing to see the boat come in and depart; the tying up to the bank to cut wood for the furnaces; and the hunting excursions made by the young men during these stops, while men felled and split the wood and carried it aboard.

Few military posts existed in the Northwest in 1861; those that were famous in the Indian wars a few years later had not yet been established. In 1861 a fort was a place for storing goods to be used in the fur trade, and such forts must be strong to resist possible attacks by Indians. As noun, adjective, and verb the word "fort" had a wide currency in fur-trading days.

although it is now obsolete in this old sense.

An important place at which they stopped was old Fort Berthold, named after Bartholomew Berthold, the Tyrolese, that early trader who had a share in one of St. Louis' early fur companies and who in 1812 erected the first brick warehouse in St. Louis. Fort Randall was one of the few military posts which our travelers saw; Fort Abraham Lincoln was not established until 1872.

Above Fort Union, at the mouth of the Yellowstone, the "Chippewa," freighted with goods for the Blackfeet Indians, and carrying among her passengers two or three English people seeing America, Andrew Dawson—the agent for the Blackfeet—and the three young travelers, was set on fire through the carelessness of one of the hands, and, having burned nearly to the water's edge, a large quantity of powder at length exploded and completed the boat's destruction. The Indian goods were scattered far and wide and lost, as was most of the baggage of the passengers. Young Cary, whose pencil had been busy ever since he left New York, lost eighty sketches. There was no loss of life. The passengers and crew returned to Fort Union and waited there for weeks. Mr. Dawson and Mr. Carroll went to Fort Benton, about four hundred miles up the river, and succeeded in bringing down to Fort Union wagons to take up the trading goods and annuities to the Blackfeet Indians.

Fort Benton was then the metropolis of the Northwest—the point where all the furs to be sent to St. Louis were brought together and shipped down the river. It was the great center of the fur trade for the northern United States. At Fort Benton they saw not a little of

the Blackfeet Indians, met the famous chief Little Dog, hunted buffalo, and finally, carrying their baggage in a Red River cart drawn by two horses tandem, they set out on horseback for the Pacific Coast. When they reached the broken mountains, it became necessary to abandon even so rough and ready a vehicle as the Red River cart, and from there they went on with pack animals.

On their westward way they stopped near Hell Gate, at the camp of Captain John Mullan, who was then building the famous Mullan Road through the northern Rockies. Serving under him, and doing the road-building work, was Lieutenant Phil Sheridan, later to become the cavalry hero of the war between the States, and finally in 1888 General of the United States Army. They passed the Cœur d'Alene Mission, went on to The Dalles, and finally reached the town of Walla Walla, and from there by stage and steamer went to San Francisco. As far as the wilds were concerned, this was the end of their journey. From here they made their way south and east, and by way of Panama ultimately reached New York.

It is not easy for us now to realize how long it is since this journey was made, but if we remember that a territorial government was given to Dakota in March, 1861, just before Mr. Cary started from New York, and that the territory of Dakota included the present states of North and South Dakota and parts of Montana and Wyoming, we have a suggestion of the changes that have taken place since then. Nebraska was a territory and did not become a state until 1867—six years later. Railroads were unknown in the country west of the Missouri. The old bull team still made its slow way across the plains, and the individual immi-



From the painting by Cary

"A CROW HUNTING CAMP"

This picturesque camping scene, which might be on a tributary of the Big Horn or of the Yellowstone, is typical for the Plains Indians of the early days. The hunters are bringing back from the buffalo hunt their loads of meat, the food by which they supported life. The horseman in the foreground is not one of the hunters, as evidenced by the war shield carried on his back



From the painting by Cary

Watching the Fire Canoe.—We are outgrowing the possibility of being greatly surprised at any mechanical marvel, since the past half century of progress in invention, and it is impossible for us to appreciate fully the stupefaction of the Indians at their first sight of a steamboat. It was to them a great boat on fire, which moved without being paddled, and so was alive



From the painting by Cary

Crossing the Plains in '49.—Travel on the plains in the days of our grandparents and great-grandparents was not without its threats of peril. There was the excitement of hunting the buffalo, antelope, and grizzly bear on the way; and especially to be considered was the danger from encounters with Indians



From the painting by Cary

The Prayer to the Rainbow.—The rainbow, a great mystery to the Indian, was explained by him in various ways. He knew that when the bow appeared the rain usually ceased, so he called the rainbow a trap which caught the rain. An interpreter will sometimes call it a fishing line, meaning really a device to catch something



From the painting by Cary

Winter Supply Train.—A stout heart and a firm purpose went together in the makeup of the pioneer, and they were both needed to sustain him during the hours of the long night when he rode through snow and cold at the head of a supply train



From the painting by Cary

The Trapper's Christmas Carol.—This painting of wolves howling around the snowed-over cabin recalls the many tales which have been told of experiences with ravenous droves of these animals in winter when their food was scarce



From the painting by Cary

Return of the Northwest Boundary Survey, 1874, which marked the boundary line between the United States and the British possessions to the north as defined by the international convention of 1818. Among those in the nearest boat are Major Twining, who was in charge of the survey, Capt. F. B. Greene, and Mr. Cary

grant sometimes piloted a wagon drawn by a mixed team which might include a pair of horses, a cow, and a steer. Until a year or two before, the wagons of toiling gold seekers had borne the legend "Pike's Peak or Bust," and it was not until after this party had started on its journey westward that the first daily stages had begun to run to the Pacific Coast—between Atchison and San Francisco.

Not long before, gold had been discovered in what are now Idaho and Montana, and the troublous times were about to begin in those mining camps when stern necessity compelled the adoption of the code of "Judge Lynch," since, except the law of might, no law existed. Of those who took part in these stirring scenes, were such strong and good men as former Senator Wilbur F. Sanders, Honorable N. P. Langford, and former Governor S. T. Hauser, of Montana.

In the years 1864, 1865 and 1866 there were wars with the Indians of the Plains, which cost many lives and a vast amount of treasure, and about 1868 the United States Government established a number of military posts through the western country, at which were stationed small bodies of troops which tried to control the Indians. On Mr. Cary's later trips to the West, he stopped and was entertained at certain posts which in their day were famous, but have long been abandoned and are now forgotten. Each one of these military posts contributed its mite to the quieting of the aboriginal population and to the development of the great country that lies beyond the Missouri.

The artist's visits to the West in those early days brought him in contact with a multitude of men then active and later famous, most of whom have long since passed away. Of the army there

were General Sheridan, General Custer, Captain Mullan, Major Twining, General Greene. Dr. Elliot Cones, the ornithologist, represented science, while among pioneers who may fairly be called empire builders were Andrew Dawson, Mat Carrol, George Steele, Broadwater, Kipp, and not a few others.

In 1874 Major Twining, who was in charge of the Northwest Boundary Survey, invited Mr. Cary to accompany the Survey. He was unable to accept, but he was in the West when the Survey returned, and, in fact, came down the river with Major Twining and General Greene as far as Bismarek, North Dakota, to which point a railroad had then been built. An effective picture of the procession of the Northwest Boundary Survey boats is in the collection lately on exhibition. General Custer invited Mr. Cary to accompany him on the Terry expedition in 1876, but Cary did not go.

Mr. Cary has a keen eye for the picturesque and striking, and to the old-timer many of his pictures call up thrilling memories. Today those who can recall such scenes as his "Crossing the Plains in Forty-Nine" are few in number, but many men have witnessed Indian ceremonials akin to that shown in "The Prayer to the Rainbow," while those who were much in the West in early days will recognize the fidelity to nature of the "Crow Hunting Camp" and the picture of the little Indian boy feeding his pet crow. Mr. Cary paints things as they were, not as he thinks they ought to be. He does not insist that all his Indians wear war bonnets, after the method of so many of the modern painters. His efforts are to represent what he saw, and his scenes of western and Indian life possess a real historic value.

Travel on the plains and in the mountains between 1861 and 1874 was not without its adventures and its thrills. Hunting experiences were many; buffalo hunts and stalks for smaller game were exciting; grizzly

bears and wolves threatened, and sometimes Indians captured. He who had a part in such events cannot forget them, and it is a joy to have one's recollections stirred by paintings of these old-time scenes.



From the painting by Cary

Indian Boy Feeding His Pet Crow (a portion only of the painting).—Indian children, like all others, are fond of pets. Besides their puppies, they often had young magpies, crows, antelope, foxes, rabbits, and perhaps even a buffalo calf

EDITORIAL NOTE.—The JOURNAL counts it a privilege to print this article by Dr. George Bird Grinnell, who writes so charmingly of the time depicted by the Cary paintings, yet lets fall no word of his own experiences of the Early West and of his authority as a writer on that period of America's development. For those not acquainted with Dr. Grinnell we give the following brief account of his years in the West and activities there, and also of his very notable achievements in the direction of conservation of our forests and wild life.

His western experiences began immediately after his graduation from Yale when in 1870 he set out under Prof. O. C. Marsh on a six months' expedition in search of fossils. Four years later he accompanied General Custer's expedition to the Black Hills of Dakota, and in 1875 he accompanied Colonel—afterward General—William Ludlow on his survey of the country from Carroll, Montana, to the Yellowstone National Park.

In 1885, and in subsequent years, he explored the region, then unknown, which is now the Glacier National Park, making the first sketch map and naming some of the natural features. About 1895 he took up, together with Senator T. H. Carter, of Montana, the question of setting it aside as a national park, and in May, 1910, the Glacier National Park was finally established. It was in 1895 also that he was appointed United States commissioner to treat with the Blackfeet and Fort Belknap Indians for the cession to the United States of a portion of their land.

Dr. Grinnell not only was connected with the development of the West in this public way, but also identified himself personally with the pioneer life there to the extent of owning and managing a horse and cattle ranch in Wyoming from 1882 to about 1900.

For many years he has been interested in forest preservation and the conservation of wild life, and he worked long in behalf of the establishment in New York City of a zoological park—an establishment finally accomplished by the energy of Mr. Madison Grant in founding the New York Zoological Society. He organized the Audubon Society for the protection of birds as early as 1886, and it was while president of the Forest and Stream Publishing Company and editor of its magazine that he used his opportunity through that journal to conduct a long fight for the preservation of the threatened integrity of the great Yellowstone National Park.

Dr. Grinnell is the author of many books dealing with the early history of the West and with Indians—and the editor of others. In 1870 and the years following he spent much time in the Old Pawnee earth-lodge village on the Loup Fork, where the town of Genoa, Nebraska, now stands. In 1872 he accompanied a camp of four thousand Pawnees, Omahas, and Otoes on their summer buffalo hunt, and some of the incidents of this trip are described in his early book on the Pawnee Indians. Later he saw much of the Blackfeet, the Cheyennes, and certain branches of the Arapahos. Dr. Grinnell has recently become connected with the American Museum of Natural History as research associate in ethnology.

Forestry and the Paper Supply

By BARRINGTON MOORE

WE have all suffered and are still suffering from the high price of paper. Forestry, the science of wood production, can remedy this evil by increasing the supply of raw material used in making paper, for wood is now almost the only paper material used in this country. Forestry offers two ways of increasing the supply of paper pulp; first, through increased forest productivity due to the application of forestry to the management of timberlands; second, through research on the paper-making possibilities of woods hitherto not used for paper. Although the discovery of new woods will yield quicker measures of relief for overcoming the present shortage, forest production must in the long run be our main reliance. Productive forests require not only the skill of the forester, but also popular understanding and support of his point of view and aims. Everyone knows that the forester must "make two trees grow where one grew before."—but how?

There is only one sure way: by bringing his methods into complete harmony with the forces of nature, which, in the last analysis, must grow the tree. The first step is, then, to gain an understanding of the natural forces which control the forest. This is by no means a simple matter, for not only are the controlling factors themselves difficult to measure, but also there is the exasperating yet fascinating problem of the response of the living tree to each of these factors separately and to all acting together.

Knowledge of all the forces on which the forest depends will be acquired only by the most earnest and painstaking research. The influence of varying degrees of moisture, of heat and of light,

and of different kinds of soil, upon the growth and reproduction of each kind of tree must be studied. In these studies the accumulated knowledge of meteorologists, physicists, chemists, plant physiologists, agronomists, and others, is brought into full play. Research often appears to the general public to be but remotely connected with the immediate object, growing trees. Quick results are demanded, and research is confused with invention. Let us not forget that research precedes invention. Thus we owe aeroplanes to Langley, who studied the lifting powers of moving planes; wireless telegraphy to Maxwell and Hertz; and our freedom from many forms of disease to Pasteur. If forestry is to have a secure foundation the public must accept the fact that the fundamental researches are the things that count. They must not be swept along by the all too prevalent desire for something "practical," but must know that the most fundamental is the most practical in the long run.

In forestry the foundation is pitifully weak. Not only do we lack the data needed for devising the best methods of cutting the forest, but we lack even the knowledge on which to base experiments designed to secure these data. Why? Because forestry has been subjected, even more than most professions, to public pressure for these supposedly "practical" results. Foresters have been compelled to spend all their time and energy in showing the wood-using industries and the general public the need for forestry, and in devising and applying methods for handling such timberlands as fell under their care.

Circumstances have, perhaps, made

this unavoidable. In this country forestry is different from what it is in Europe. The demands are different. In Europe every part of the tree, even to the twigs, can be sold at a profit. In the United States only the large logs from the more valuable kinds of trees can be profitably utilized. A large percentage of the felled tree is left to rot in the forest, and an enormous quantity of wood is wasted at the sawmills because it cannot be marketed except at a loss. The waste of our sawmills represents not only a dead loss, but actually costs the lumbermen of this country \$6,000,000 a year to destroy.¹

Thus economic conditions have hitherto permitted the practice of forestry in this country only in the more thickly settled regions possessing good markets for forest products, and on lands owned by the Federal Government, by states, by large institutions, and by corporations which can afford to wait for their returns. American forestry has therefore required building from the ground up, so to speak. It has required ingenuity and business acumen rather than science. But the opportunities for research are increasing, especially on the vast areas of government-owned forests, and it behooves both foresters and the general public to see to it that a solid foundation of scientific knowledge is at hand in advance of the demand for a practical application of this knowledge.

Our pulp lands are now growing less than half, probably not more than a quarter, of the raw material they are

capable of yielding under intensive forestry management. The results of any measures taken to increase forest production cannot, however, be felt for a number of years, for it takes a long while to grow a tree.

The Forest Products Laboratory at Madison, Wisconsin, established in 1910 under the United States Forest Service, has been working on the principles involved in the manufacture of paper pulp, and on the possibilities of various woods. It has a staff of experts and equipment for carrying through any process from beginning to end on a semicommercial scale. In addition, tests of ground pulp have been carried out on a commercial scale at another laboratory. It has been found that fifteen woods in addition to red spruce are suitable for the manufacture of a grade of ground wood that can be used for news print. Tests in running the paper from these woods through commercial presses have been entirely satisfactory. The significance of this will be realized when we consider that the bulk of the news print now comes from red spruce, a tree less abundant than several of the suitable trees, and insignificant in quantity when compared with the total volume of all the available woods. For the sulphite process eleven woods have been successfully made into pulp on a semicommercial scale; and fifteen new woods have been found suitable for the soda process. The Forest Service has found that practically all coniferous woods can be manufactured into kraft pulp.

Forestry can, with public support, remedy the shortage of paper. It can do the same for all other forest products. Last, but not least, all this can be done without diminishing in any way the value of the forest as a protector of stream flow, and as a source of health and pleasure for humanity.

¹ Forestry does not appeal to lumbermen because it involves sacrificing part of their present returns for the sake of the future. The holding of forest lands costs money in taxes and fire protection, the taxation alone being a sufficient discouragement in many states, even though there were not the ever present risk of destruction by fire. Obviously it pays better to "cash in" and invest the money in stocks and bonds, which yield just as much as a permanent forest and are far less trouble and risk.

A Buffalo Bullfight

By ED. D. CRABB

Formerly of the United States Forest Service

This fight occurred in the Wichita National Forest and Game Preserve, near Cache, Oklahoma, in September, 1916. There are 61,640 acres in this forest and game preserve. Of this number of acres there is an enclosure of eight thousand acres constituting the so-called "buffalo pasture." The fence, of heavy woven wire, around this pasture is about six feet high with two heavy wires above it, and is supported by large oak or round steel posts. This fence is sixteen miles long, and encloses mountains and flats, timber and prairie, as well as some beautiful stretches of creeks that afford an ample supply of sparkling cold water. The native grasses form the richest and most luxuriant pasturage that Oklahoma affords.

During the breeding season most of the buffalo bulls are segregated from the herd¹ in a two-hundred-acre bull pasture, and here are staged some great free-for-all fights. On one occasion during a fight nearly a quarter of a mile of woven wire fence was torn down, not even one of the steel posts remaining upright after the bulls were finally separated. It was in this pasture that the younger bulls of the herd killed "Quannah Parker," a twelve-year-old bison shipped here from the New York Zoölogical Park and named in honor of the late chieftain.—ED. D. CRABB.

THE large, surly, nine-year-old buffalo bull, "Black Dog," was turned into the field with the herd one morning late in September, and when he was a short distance from the herd another bull, named "Comanche," challenged him to a fight. After but a few short, sharp rounds, however, "Comanche" agreed to let "Black Dog" share the herd's company with him. Such was not the decision of "John Kerr," a powerful bull of five summers, who immediately attacked the visitor savagely. As a result of his last encounter, "Black Dog's" spirits were high, but his wind was short, so "John Kerr" had little difficulty in thrashing him soundly in less time than it had taken the former to whip "Comanche." After this unwelcome reception, the panting "Black Dog" repaired to the farthest side of the pasture. Early in the afternoon when he had rested and regained his wind, the mighty wrath which had been kindled in his heart

that morning goaded him on to another encounter with his victorious rival, "John Kerr."

When "Black Dog" topped the hill and started down the slope toward the herd, he gave a mighty snort and bawl which were answered by "John Kerr" in a way which seemed to bristle with defiance. This reply, however, did not frighten "Black Dog," who answered by viciously tossing his great shaggy head, then wallowing and violently thumping his hump on the ground and kicking his feet in the air. This formal announcement being over he ambled leisurely toward the herd, emitting powerful "bravps," that sounded as if they were coming from the throat of a locomotive, while pawing the dust over his back as if he were master not only of the herd, but of the whole world. When "Black Dog" was about two hundred yards from the herd, he began threatening battle in dead earnest. Wallowing in the dust, the powerful brute would strike the turf mighty whacks with his hump, kick up his feet, roll his eyes, and toss his great,

¹ The fifteen bison that formed the nucleus of the herd in the "buffalo pasture" of the Wichita, were presented by the New York Zoölogical Society from its Zoölogical Park herd.—EDITOR.



The eight-thousand-acre buffalo pasture in Wichita National Forest and Game Preserve—with part of the herd coming to be fed (photograph made in January). (The woven-wire fence, six feet high and sixteen miles long, is heightened by two wires above and supported by large oak or steel posts)



His Majesty, "John Kerr."—Since his desperate encounter with "Black Dog" last September, in which he badly worsted his antagonist, this powerful five-year-old buffalo has been absolute monarch over a realm of eight thousand acres and a herd of eighty-two buffaloes

shaggy head. It was not long before "Black Dog" advanced to within about one hundred yards of the herd, then halted, and again pawed up the earth, while facing his adversary. After he had thumped his hump harder and tossed his heels higher than he ever had before, he arose and shook his head more fiercely than he had at any other time, and advanced in a trot toward his opponent. During all this time "John Kerr" had likewise been threatening

battle, and now he trotted out of the herd to meet his adversary.

Then began as fierce a battle as ever took place on the plains between two members of the cow family. The two maddened brutes clashed with the force of a long line of freight cars bumping together, and each received the other on his horns. It was then very apparent that each tried to receive the other's blows on his horns and the top, or poll, of his head; also, that those curved,

short, stout horns, instead of being placed too high up, as had seemed, and too far back on the bison's head to be of any use, are placed just right. When the horns are brought into play, the sensitive nose is far back out of harm's way. Vicious thrust was followed by skillful parry, and the blows fell fast and heavily. "Black Dog" beat down "John Kerr's" guard and gored him in the neck and shoulder. "John Kerr" stepped sideways, and right lively too, but "Black Dog" kept up with him, and for several seconds "John Kerr" was unable to get away from those merciless, twisting horns of ebony. The veteran fighter seemed to feel victory ahead, but his adversary, who was younger, longer winded, and more nimble, evaded the weapons of his opponent, and charging, beat past his guard and gave him a vicious side thrust in the neck that brought a handful of hair. This made the old monarch still more angry, and he charged savagely while "John Kerr" nimbly warded off the blows with his horns. "Black Dog" charged again and again, but each time his opponent received the blows on his horns. Finally "Black Dog" tried to push his adversary backward by means of sheer brute strength and weight, and

made some progress—but at what fearful cost! Tearing up the turf as they went, the mighty brutes traveled southward about a quarter of a mile.

"Black Dog's" tongue was lolling; his feet were leaden weights. He had entirely given up the offensive and tried only to defend himself. "John Kerr's" horns tore off bunch after bunch of the kinky, chocolate-colored hair. Finally his horns found "Black Dog's" shoulder and he gored him mercilessly, but so thick is the old bull's hide that "John Kerr's" horns failed to bring the blood. Poor old "Black Dog," with lolling tongue and heaving sides, offered no further resistance. He was hopelessly whipped and "John Kerr" was master of the herd.

Even to this day "Black Dog" leads the life of a hermit, and "John Kerr" is absolute monarch over a realm of eight thousand acres and a herd of eighty-two buffaloes. But the monarch of the herd today will be the hermit of tomorrow. A younger and more powerful bull will succeed "John Kerr," just as he succeeded "Black Dog." The herd may have a new leader with the advent of this coming season, and "John Kerr" will have passed into oblivion.



Crocker Land Party Safe

CABLEGRAMS VIA COPENHAGEN FROM LEADER OF THE EXPEDITION

DURING the past three years, while many millions of men, crowded into the relatively few square miles which constitute the seat of war in Europe, have been reducing the reserve resources of the world with incredible speed, it is reassuring that a few other men in the Arctic far to the north of us, a mere handful in the million and more square miles of unexplored land and sea, have been adding to the world's resources. They have made discoveries of coal and metals and rich animal life, even of new lands, and while these are not available for civilization today, there is no doubt that they will be made available, as have those of Alaska, when needed in the future.

On June 4 Henry Fairfield Osborn, chairman of the Crocker Land committee,¹ received a cablegram from the leader of the Crocker Land Expedition, through the American Minister in Copenhagen, as follows:

"Spring trip, 1916, very successful. Reached Finlay Land. Mapped unexplored shores North Cornwall. Museum records left at many important points. Many specimens secured. Plan for further exploration in March [1917]. Would advise good steamer be chartered for relief."

The announcement that the men are safe and have had a large measure of success was a matter for rejoicing. The good news counterbalanced the disappointment of 1915 when Peary's "Crocker Land" was proved to have been a mirage, and ended the fear felt in many quarters, especially for Dr. E. O. Hovey, of the American Museum, who was in poor health when the last word came, about one year ago. The satisfaction was increased by a second cablegram giving many details. The relief ships of 1915 and 1916 failed to reach Etah, but Dr. Hovey and Captain George E. Comer, of the first vessel, succeeded in covering the distance from North Star Bay to Etah in a motor boat. Thus all had been together and well, with a "good warm house, plenty of fuel and an adequate supply of food to last until August, 1917."

The trip to Finlay Land passed over "excellent sledging surfaces throughout," and

¹ Composed of representatives of the American Museum of Natural History, American Geographical Society, and University of Illinois.

through a "wonderful game country, with wolf, caribou, musk ox, seal, hare, ptarmigan, lemming, fox, and polar bear." There was "much coal all through the region." Finlay Land was reached on April 19 after twenty-nine days' sledging. It seems that game failed west of the ninety-seventh meridian and so when Finlay Land was reached "lack of dog food compelled retreat."

On returning toward Etah, North Cornwall Island was visited and its shore mapped along the north, east, and southeast; also five islands, not heretofore recorded, just off the coast of North Cornwall, were put on the map; also discovery was made of an island off the eastern coast of Amund Ringnes Island. Return to Etah showed "1250 statute miles covered in 56 days"—which means the very high average for Arctic travel of twenty-four miles per day. The return was made in considerably less time than the advance, in 24 days as against 29, allowing for the stay on Finlay Land of the 3 days mentioned in the cablegram. The message further makes mention of various lines of scientific investigation, and speaks confidently of success. This word was sent out from Etah² during the Arctic night, 118 days after the disappearance of the sun.

The Crocker Land committee will proceed with all rapidity in its plans for sending the steam sealer "Neptune" as a third relief ship. If this ship fails to reach the men, they will be compelled to resort to "Eskimo methods of living—an igloo for shelter, skins for clothing, and meat for food." The "Neptune" will be in charge of Captain Robert A. Bartlett, of fame in connection with the Peary expeditions. The cost of the expedition has been heavy, but the scientific results, added to the possible commercial and industrial advantages coming from it in the future, are more than sufficient in value to balance the monetary expense.

² Dr. Harrison J. Hunt, surgeon of the expedition, carried the cabled letter from Etah to Copenhagen, whence he is returning to New York soon. The perilous journey across Melville Bay and southward along the western coast of Greenland was made by sledge. Dr. Hunt was accompanied by Mr. W. Elmer Ekblaw, geologist and representative of the University of Illinois, who also will probably soon find an opportunity to sail from southern Greenland to Copenhagen and thus reach civilization.

“The Bird Study Book”

REVIEW OF A NEW BIRD BOOK OF GREAT CHARM

IT IS well known to all who have tried to popularize science how difficult it is to write in such a way that the advanced student as well as the beginner finds the reading so interesting that he enjoys every word from beginning to end. To condense the greatest amount of information into the smallest compass and make it also entertaining is an art. Mr. Pearson not only possesses this art, but also knows how to season it with a strain of delicious humor. His own enthusiasm is so strong that it transfers itself involuntarily to the reader, making of the merest tyro in ornithology both a well-informed student and an ardent bird lover.

The work covers in its twelve chapters a very large field of bird knowledge, and discusses in a comprehensive way, although concisely, the relations of bird to man. Through it we learn how to identify birds in the field by characteristic movements of various families and even of genera and species, how to study birds in close proximity by erecting blinds, and how to locate bird nests and study them. Particularly fascinating are the stories of bird domestic life, which seems as full of joy and sorrow as that of the average human being. We are told of the tragic fate of a bluebird's nest, of the faithfulness of mated birds, of the large number of unmated birds, of certain polygamous kinds, and of the domestic relations of the parasitic cowbird. In the story of the migration of birds surprising facts, such as the long annual flight of the ruby-throated humming bird across the Gulf of Mexico, are brought out; and the reasons for such long flights, the perils attending them, and the gathering of the birds, with rustling wings “falling dreamily through the sky,” are but a few of the many subjects charmingly discussed by Mr. Pearson.

Contrary to ordinary opinion, the author tells us that winter is a good time for the bird student to go afield; that if bird life is less abundant then, so is the human life, and one has the country almost to himself for undisturbed observation. We learn that man is not alone in suffering hardship during the cold season from lack of shelter and

food, and attention is called to ways in which we may help our feathered friends.

Most people are in these days aroused to the economic value of birds in destroying the insects which attack our orchards and gardens, but the truth is considerably more vivid after reading Mr. Pearson's pointed statements. Those who believe in the extermination of hawks and owls on the supposition that it would be in the interest of game birds, are admonished that just the contrary seems to be the case. Birds, like all creatures, are subject to sickness, and the quick removal of diseased birds prevents spreading of contagion, which would do more harm than the occasional capture by a predatory bird. The author is backed by all naturalists when he says, “All birds have their part to play in the great economy of the earth, and it is a dangerous experiment to upset the balance of Nature.” The harrowing tale of the slaughter of thousands of our most beautiful song birds in order to secure feathers for commerce, creates a renewed interest in the list of the seventy bird reservations which have been established by the Government since March, 1903. The history of the beginning of bird study in the public schools, together with the growth of the movement and its present status, is followed by instructions for forming a “Junior Audubon Class” for bird study.

The Bird Study Book is particularly well fitted for use in school work. It is a volume which will prove most useful to all who are interested in acquiring a greater familiarity with the habits and activities of wild birds, and we believe that no other book supplies general ornithological information in such concise and readable form. Mr. Pearson, to whom the world already owes so much for the immeasurable good he has done and is still doing in connection with the Audubon Societies of the country, has added greatly to his service by this new spread of bird knowledge, and by contributing through this means to the conservation of what we are all drawn to consider the most beautiful and gentle life in Nature's realm—that of our wild birds.

OTTO WIDMANN

Fellow of the American Ornithologists' Union



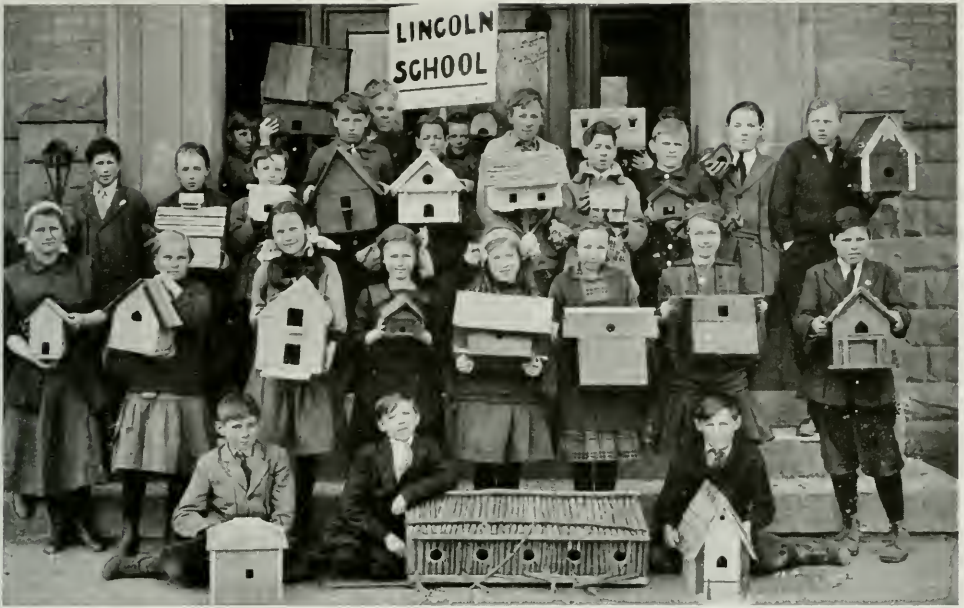
Courtesy of Doubleday, Page & Company

The illustrations in Pearson's *Bird Study Book* are well chosen for suggestiveness and help enforce upon the reader a new friendly intimacy with birds and a new desire to protect them. The student of nest architecture is impressed by the assortment of materials used and the diversity of situations chosen even among closely related species. The nest of the wild bird is merely a cradle for its young; birds have never evolved the habit of building nests for their personal protection, even for the cold and snowy days of winter. (Photograph of male plumbeous gnatcatcher feeding young, by William L. Finlay)



Courtesy of Doubleday, Page & Company

Ice and snow make food getting a serious problem for the wild bird. The smaller birds gather more closely around the farmhouse, while even the wary ruffed grouse often comes to the orchard. So many are the fatalities wrought by cold snowy weather that only the stronger and more fortunate individuals of a species survive. Much can be done to bring birds about the home or the schoolhouse by placing food where they can readily get it. (Feeding station for birds on the grounds of R. G. Decker, Rhinebeck, New York)



Courtesy of Doubleday, Page & Company

In May, 1910, Mrs. Russell Sage sent to the National Association of Audubon Societies a check for \$5,500 with which to inaugurate a plan for bird study, with special reference to the protection of the robin, in the southern schools. So successful did the experiment prove that the system was extended into all the other states in the Union and into the various provinces of Canada. Up to June 1, 1916, there were 559,840 children enrolled under the standard bearing the inscription "Protect the Birds." The photograph shows members of a Junior Audubon class at Fergus Falls, Minnesota



Courtesy of Doubleday, Page & Company

A snowy egret that came home to die.—The most shameful blot on the history of America's treatment of her wild birds is in connection with the white egrets, now entirely killed out in many states. The "aigrettes" so often seen on the hats of the fashionable are the nuptial plumes of the birds. In obtaining these, the hunters kill the adults, exposing hundreds of young birds to die of starvation—a method of killing which history shows has never been followed by even the most savage race of men dealing with their most hated enemies



The Conservation of Wild Flowers

Decoration from photographs (by Mary Cynthia Dickerson) of a few wild flowers which stand in need of our greatest care; hepatica, trailing arbutus, Indian moccasin flower, partridge berry, azalea, and fringed gentian are in desperate need, for they are already nearly extinct over large sections of the country where previously abundant

THESE appeared in the *New York Tribune* of May 5, 1901, the following unsigned notice: "Now that spring is really here, the picnicking parties are invading the woods north of the Harlem, and have begun the annual systematic destruction of a large proportion of all wild flowers within reach. The authorities of the Botanical Garden are on the lookout for them, and within their own precincts will guard the blossoms as thoroughly as possible under a well-planned system; but the rest of the Bronx will be at their mercy, and that means death to many a poor little plant. It is not that these ruthless explorers fail to appreciate the beauty of flowers—they 'just love them' in all probability. The trouble arises from their ignorance of the extent of the damage they do, and from an utter inability to comprehend that a flower or anything in the vegetable world has rights which the lord of creation himself is bound to respect. Thanks to the picnickers and alleged botanists, the *arbutus*, loveliest of spring

blossoms, has been almost exterminated in the Bronx region. Its delicate pink and white used once upon a time to hide under the leaves all through the northern woods in that part of the suburbs; now it may be found only in spots where it commands less enthusiastic admiration. The mountain laurel has shared a similar fate."

In July of the same year, *The House Beautiful* had several notices on this subject. As there appeared to be considerable interest aroused and many questions asked, I compiled all the notices I could find, including some English ones from the *Daily Mail* and the *Journal of Botany*, and printed in *Torrey* for August, 1901, an article on "Vanishing Wild Flowers." Immediately following the publication of these notices the Misses Olivia and Caroline Phelps Stokes, who had been members of the New York Botanical Garden since 1898, presented to that institution a sum of \$3000 to be used for the "investigation and preservation of our native plants." In April, 1902, Dr. N. L. Britton,





director of the New York Botanical Garden, gave an illustrated lecture at the Smithsonian Institution, Washington, on the preservation of our native plants, and immediately following this, the Wild Flower Preservation Society of America was organized and has ever since coöperated with the Stokes Fund work at the New York Botanical Garden, the writer having acted as secretary of both for many years. In the same year the Society for the Protection of Native Plants was organized in Boston. It not only has distributed leaflets and posters free in all parts of New England but also has coöperated with various horticultural and botanical societies.

The interest on the Stokes Fund has been used in various ways: first, to secure essays, leaflets, and posters that could be distributed to those wishing further information, or to protect their own property from depredation; second, for illustrated lectures to be delivered to schools and colleges in various cities and towns; third, to reproduce in colors, paintings by Miss M. E. Eaton, of some of the rare wild flowers needing protection, accompanied by descriptions; duplicates of these were distributed free to libraries, schools, colleges, and museums; fourth, to frame sets of these as Arbor Day prizes to the schools that agreed to compete and pledge themselves to coöperate in the work of conservation; fifth, to prepare a set of colored

lantern slides for use in Arbor Day and conservation talks.

In the fifteen years since this work was systematically begun, the active coöperation of nearly all the schools and colleges of Greater New York has been secured, also that of various towns in the vicinity of New York. The Federation of Women's Clubs has expressed its approval and these clubs are carrying on local conservation projects in various parts of the United States. The Garden Clubs of America proclaim as one of their objects, "to aid in the protection of native plants and birds," and many of them have been giving a series of lectures on both these topics as part of their programs. Chapters of the Wild Flower Preservation Society of America have been established in Washington, Baltimore, Philadelphia, Chicago, Cincinnati, and Milwaukee, and have had a far-reaching and beneficial influence in each of these cities. Conservation of the birds and plants has been accepted as part of the nature work of the board of education of many towns, and the relation and interdependence of birds, insects, and plants has been emphasized in all our lectures; but thus far no simple and practical leaflet has been printed, that would emphasize the balance of life between these groups.

The *Nature-Study Review*, which is dedicated "Primarily to all Scientific Studies of



Nature in Elementary Schools," is devoting eight of its current numbers to animals, birds, butterflies, trees, flowers, and school garden work. In the May number they have adapted the Stokes Fund pledge to read:

"Please help to save our native plants by promising

To protect our native plants,
Not to destroy rare wild-flowers and ferns,
Not to injure any shrub or tree and
Not to set fire to the fields or woods."

The *National Geographic Magazine* has also issued two sets of colored illustrations of "Common American Wild Flowers" with descriptions. All wild flowers in the suburbs of New York City may become as scarce as trailing arbutus, unless all people unite to preserve them; and this is true not only of the suburbs, but also of the parks of Greater

New York, and of the New York Botanical Garden and the New York Zoölogical Park. Signs forbid picking or carrying through the parks any plants whatsoever, and persons who disobey are liable to arrest and fine for a statutory misdemeanor.

The attention of visitors to the wild parts of the New York Botanical Garden has been called to the preservation of our native plants by the sign

Do not pick or break leaf or flower.

People must realize that although they are "tax-payers" and "this is a free country" they have no more right as individuals to the flowers in the parks than multitudes of other people have, and that if all of the millions of Greater New York were selfish there would be no flowers for anyone to enjoy!—MRS. NATHANIEL LORD BRITTON, NEW YORK BOTANICAL GARDEN.

Mirages in the Lower New York Bay

A RECENT article on mirage in the AMERICAN MUSEUM JOURNAL¹ recalled to my memory some very remarkable mirages, which I saw about ten years ago from my house at Sea Gate (Norton's Point). From my house which faces south, the West Bank Light lies somewhat south of southwest at a distance of nearly three miles. The northern entrance to the Ambrose Channel is on a line from my house to that light, about a mile and a half distant. The Romer Shoals Light lies almost due south, at a distance of four miles, and Sandy Hook Light is a little to the eastward of Romer Shoals and about seven miles off. The highlands of the Navesink are on a line with, and some four miles south of, Sandy Hook Light, and several miles behind the West Bank Light is the southern end of Staten Island.

It is a very common occurrence to see the east shore of Sandy Hook and the coast line beyond (the Seabright shore) raised above the horizon, and occasionally this loom will carry the sky clear under the Navesink Highlands. On a still, hot afternoon, some large houses, towers, and chimneys on the shore

of Staten Island will be raised in the air by a mirage, which occasionally is very beautiful, and very suggestive of the picturesque descriptions of the desert mirages. Occasionally even the New Jersey shore, inside Sandy Hook, is raised with a bright line between it and the water.

Frequently the two lighthouses, Romer Shoals and West Bank, which are surrounded by water, undergo a peculiar change of appearance, the lighthouse tower showing clearly through the mirage of the lower part of the lighthouse, but being also raised very considerably. This kind of mirage lasts sometimes for a couple of hours, varying in clearness and size. The water is always smooth, and there is, of course, no wind in the neighborhood of the mirage.

On the day I refer to above, there were two spaces in the Lower Bay in which mirages occurred, separated by a clear space. One of these mirage spaces was on a line with the West Bank Light, the other on a line with Romer Shoals. The air was a little hazy and very still, and the water was very smooth, with lines of different shades of blue and silvery gray on it. The sun was west of south—it was about two o'clock. It was very hot. I first noticed that the West Bank Light was distorted, and then,

¹ Reeds, Chester A., A Perplexing Phenomenon—Mirage, AMERICAN MUSEUM JOURNAL, December, 1916.

as a steamer came along and entered the Ambrose Channel, she underwent strange changes. The part of the hull that was not in the mirage space was of a natural color. The distorted portion was a silvery gray. It was just as if a filmy screen rose up in front of the ship, enlarging her height (not her length) until she was twice her actual height or more. Again, the curious effect was noticed of the funnel showing through the mirage. The vessel passed out of this area, steamed for a while in a clear area, and then passed through another mirage area, undergoing the same distortion. And a number of other steamers going to sea underwent the same changes. As the afternoon wore on, far more beautiful mirages were seen, for to the southeast of us were several sailing vessels becalmed. Of these, a few were reflected upside down, more or less perfectly, but one, a schooner, about two miles offshore, was reflected in two perfect images, the lower one reversed, the upper one right side up. Mrs. Davis and I examined the mirage with a powerful glass, and it was astounding to see how clear the mirrored vessel was. Where the two upper mirages met, the line was hazy, but the upper part of the hull, the masts, sails, and spars were as clear and sharp as in nature. This is the only double mirage I have seen on the Lower Bay in thirteen years, and this schooner was the only vessel that happened to be in just the right spot. I have always regretted that I had no camera handy to photograph this mirage. The single-reflection mirages have occurred on other occa-

sions, but I never saw so wonderful a display again. Later still a gentle breeze sprang up, and the mirage effect vanished.

One other curious effect of the condition of the atmosphere should be mentioned. To the west of the first mirage area, and quite a distance off, two or three schooners lay with their sails, including several jibs, set. Now, these sails, especially the jibs, appeared crinkled, very much like the surface of a glass negative on which the gelatine has frilled. This effect I have seen several times, just as the enlarging of the lighthouses and vessels is not uncommon. A very perfect reversed-image mirage Mrs. Davis observed the next summer on a similarly still, hot day. I have seen it clearly but once.

Another curious effect of the mirage-producing condition of the atmosphere I noticed on another occasion: vessels coming in from Ambrose Channel Lightship had their masts lengthened out to an extraordinary extent. I remember particularly one of the American liners (the "New York" or "Philadelphia") whose funnels appeared to be hundreds of feet tall, and whose masts were lengthened out like immensely tall, wavy rods. The hull was not distorted at all. This lasted for a period of about a quarter of an hour. The effect was rather uncanny.

It will be seen that it is not necessary to go to out of the way places to see mirages. They can be witnessed in the Lower New York Bay just below the Narrows, although the reversed mirage is far from a common occurrence.

GHERARDI DAVIS

Museum Notes¹

SINCE the last issue of the JOURNAL, the following persons have become members of the Museum:

Life Members. MRS. CHARLES ALBERT PERKINS and MESSRS. E. C. CONVERSE, LEWIS L. DUNHAM, MARSHALL FIELD, HARRY S. HARKNESS, ARTHUR F. LUKE, JOHN A. SPOOR, and WILLIAM M. WOOD.

Sustaining Members. MESSRS. SAMUEL BIRD, JR. and THEODORE H. LAMPRECHT.

Annual Members. MRS. CHARLES W. COOPER, MRS. GEORGE ROSE, MRS. FELIX T. ROSEN, MISSES ELIZABETH A. ACHELIS and HELEN A. DE WITT, the REVEREND KARL

REILAND, DR. SAMUEL M. EVANS, DR. FRANK C. HOLLISTER, DR. S. E. MEZES, and MESSRS. CHARLES W. BALLARD, EDWIN BEACH, RANDOLPH BEADLESTON, J. ARTHUR BROOKS, JAMES BYRNE, F. KINGSBURY CURTIS, MORTIMER B. FOSTER, ELLERTON JAMES, J. R. MCGINLEY, CLIFFORD L. MILLER, STUYVESANT F. MORRIS, EDWIN H. MULFORD, FANCHER NICOLL, H. S. PAINE, DAVID PATON, JAMES H. PERKINS, SINCLAIR RICHARDSON, JOHN S. ROGERS, RICHMOND TALBOT, CHARLES C. WALKER, SPENCER WATERS, and C. WEIDENFELD, and the Parish School of the Evangelical Lutheran Church of St. Matthew.

¹ Because of the delay in this issue of the JOURNAL, it has been possible to include certain notes which otherwise would not have appeared until the first fall number.

SINCE the morning of the announcement of the death of the Honorable Joseph H. Choate, last survivor among the founders of the American Museum of Natural History, the life-size portrait painted by the Princess Lwoff-Parlaghy, taken from its permanent place in the Members' Room of the Museum, has hung conspicuously in Memorial Hall above the tablet bearing the names of the founders. It will be remembered that Mr. J. Pierpont Morgan died only four years ago, in April, 1913, and on that occasion Mr. Choate, as the sole survivor, in speaking at the memorial service in the Museum, touched feelingly upon the relations these founders and early promoters had borne to the young Museum. Now with the passing away of the last of this noted assemblage of men, the institution feels itself swept forward into other generations and unknown forces. Building on the impetus that came from this early time, it can only loyally shape its work more and more to meet the scientific and educational needs of the new generations wherever history leads—which today is, unbelievably, into the national problems and personal sacrifices of a world war.

FUNERAL services for Mr. Anson Wales Hard, a trustee of the American Museum since 1894, were held at 10 o'clock on Friday morning, June 22, in St. Bartholomew's church, Madison Avenue and Forty-fourth Street. Mr. Hard not only served on important committees of the Board of Trustees of the Museum but also made notable additions to the collections of the institution. The American Museum was represented at the funeral by President Henry Fairfield Osborn, Trustee Charles Laurier, and Assistant Secretary George H. Sherwood.

A SPECIAL meeting held by the president and trustees of the American Museum on the evening of May 23, in the interest of food values and economics and the conservation for war, aroused great interest and drew a large audience. President Henry Fairfield Osborn presided, making a brief preliminary address in which he called attention to the fact that this movement is nation wide and is eminently necessary whether the war continue for some years or end soon.

Dr. Graham Lusk, professor of physiology at Cornell University, who was the first speaker, gave a very energetic address on "The Conservation of Food Resources,"

bringing out some new and interesting facts. He stated that the less a man weighs the less food his body requires, so that by taking thought a community may support itself for a long time on a restricted diet. Since the value of all food depends on the number of heat calories which it will produce, Dr. Lusk strongly advocated the labeling of all food packages with the cost per thousand calories, and demonstrated his argument with packages of different kinds of food which he so labeled. He also suggested the payment of bounties to men who enlist for farm work, in order that the farmer may be sure of getting needed help for the harvesting of his crop. The need of body fuel is the dominant factor today, and the food question should have the immediate attention of the authorities. Following Dr. Lusk, Dr. Hermann M. Biggs, New York State Commissioner of Health, spoke on "The Waste of Disease in France in Wartime." That modern science has in a large measure overcome the ravages of the diseases that in former times beset armies was brought out, and it was shown that where these means have failed, it has not been because of their inadequacy but from lack of proper application. The alarming increase of tuberculosis in France was discussed, and the statement made that if the war should cease now there would be no fewer than 500,000 cases of this dread disease to be dealt with in that country. England suffers less in this respect because of better sanitary conditions both before and during the war. We must face the same problems, and must use the means which science has provided to solve them. Mr. George W. Perkins, chairman of the Mayor's Food Committee, was the next speaker. Mr. Perkins emphasized the waste of our food resources, discussing the many kinds of waste and possible means of controlling them. The waste in milk bottles alone in this city is \$250,000 a year. Dr. Walter B. James, president of the New York Academy of Medicine, in a talk on "Our Duty of Life Conservation," called attention to the great prevalence of mental diseases and the large number of soldiers who have been sent to the hospitals on this account alone. Lack of proper preliminary examination, as in the case of tuberculosis, is at the bottom of the situation. Dr. James concluded his remarks by urging all present to use their influence toward the diffusion of human knowledge, and toward the encouragement on the part

of the state of all those institutions helping along such lines.

At the close of this address, the audience was invited to inspect the display in Memorial Hall, prepared under the supervision of Dr. C-E. A. Winslow, curator of the department of public health in the Museum, with the assistance of Dr. T. G. Hull, and arranged for the purpose of suggesting to the general public various ways and means by which it may have good food at as low a cost as possible.

In connection with the health and food exhibits at the American Museum there has been issued by the Museum departments of public health and public education a fifty-page *Handbook of Health in War and Peace* by Dr. C-E. A. Winslow. It deals with the problems of personal preparedness in the matters of health, cleanliness, and food. In a foreword Professor Henry Fairfield Osborn says: "There has never been a period in American history when diffusion of knowledge of the laws of nature was a more immediate and a more imperative duty than at the present time. Hundreds of thousands of young men and young women are ready to offer their services and, if need be, their lives. . . . But let not a single life be lost needlessly. Let no constitution be broken by disease through ignorance. The patriotic opportunity of all men of science is to spread the truth, and to spread it as quickly as possible. Let us speak plainly of all the dangers and enemies which surround the soldier and sailor, of those that kill the soul as well as those which destroy the body. The loss to the world of the finest strains of manhood is the most awful curse of the many curses attending war. . . . It is a scientific, no less than a religious principle, that to serve one's country one must be sound in body, sound in mind, and sound in spirit."

THE American Museum is beginning to feel the effects of the war in the loss of some of the members of its working force. Mr. Barrington Moore, associate curator of woods and forestry, Mr. Carlos D. Empie, assistant in the mammalogy department, and Mr. Charles Camp, assistant in vertebrate palæontology, have been called to Plattsburg for military service. Mr. Moore has since gone to France in a forestry regiment. Mr. James P. Chapin, assistant in ornithology, also responded to the first call for volunteers, but was obliged to return, tem-

porarily, owing to the reappearance of a physical disability contracted through six years' residence in the Congo region in the service of the American Museum. Mr. Karl P. Schmidt, assistant in herpetology, has gone to engage in patriotic work as a member of the New York State Food Commission with headquarters at Ithaca. Mr. Laurence Ferri, of the Seventy-first Regiment of the National Guard, has already joined his regiment "somewhere in New York State"; Mr. John J. Finn entered a cavalry regiment on the 1st of May; Mr. Charles Schroth and Mr. Charles Connelly, both of the Sixty-ninth Regiment, Mr. Henry Ruof, of the 1st Artillery Regiment, and Mr. Albert J. Kelly, of the 12th Infantry, will go out on July 15.

At the request of General George T. M. Bridges, of the British Commission, a "forestry regiment" is being sent to France from this country to supply for the army of the Allies the timbers necessary in the construction of trenches, dugouts, bridges, and railroads. Vast quantities of wood are consumed for these purposes, the demand being so urgent that men have been taken from the firing line to assist in procuring it. In England, where the greater part of the wood used has thus far been obtained, the work has been in the hands of Canadian battalions, as many as 75,000 men having been engaged in it. One sawmill to a company has been employed, together with donkey engines and railroads, after the usual Pacific Coast custom. Whether the English forests are becoming exhausted, or the shipping facilities are lacking, is not known, but the supply seems to have given out, and France is now offering her forests to be cut. These have hitherto been untouched, perhaps because they were deemed necessary for military purposes, in the way of screening artillery, for instance, and now that they must be used, it is the desire of the government that the work be carried on under the direction of trained foresters.

The forestry regiment is under the command of W. B. Greeley, who has been in charge of the silviculture of this country for a number of years and is one of the ablest men in the United States Forest Service. There are three majors and three staff captains, each of the latter in charge of a different line of work. Each company of the regiment will be a complete working unit in itself, able to handle the whole work

alone if need be. High grade foresters will act as noncommissioned officers. Most of the enlisted men will be lumbermen, millmen, and road engineers. The appropriation provides for twelve specialists, two high grade engineers, and a number of first class sawyers. These last are particularly important, since on the sawyer depends the amount of lumber to be obtained from the tree. It is now thought that three of the small portable mills (of about eight thousand feet capacity) to a company, will produce the best results. Before this forestry regiment begins active work, it will be under strict military discipline for two months. It will then go armed with rifles and in every way equipped as a fighting unit. This is probably only the beginning of the transfer of our scientific forestry experts to Europe, as at least five such regiments will be needed in France, and the work may have to be extended to Russia.

In response to a cable from the French Government that two officers familiar with French conditions be sent over in advance of the regiment, Henry S. Graves, chief forester of the United States, and Barrington Moore, associate curator of woods and forestry in the American Museum of Natural History, sailed for France on June 9. Their purpose is to look over the forests, determine the final details of the needed organization and decide definitely upon the equipment, so that when the regiment arrives there will be no loss of effort.

SINCE April, 1917, the New York Botanical Garden, in coöperation with the International Children's School Farm League, has been conducting training classes for teachers of school gardening. A tract of land near the Arboretum entrance on the eastern side of the grounds, about nine hundred feet south of the Mansion, has been set apart and is now being cultivated by these classes. Instruction is given by means of lectures, practice work, and reading, in those subjects needed by teachers in school garden work, a certificate being awarded to students satisfactorily completing the course. Lectures cover the following subjects: planning the garden; soil and fertility; selection of seeds, germinating, planting, transplanting, and related subjects; also insects to be dealt with in the garden. Elementary forestry and soil conservation are likewise included.

Classroom work is supplemented with the spading, hoeing, cultivating, planting, weeding, in fact, all of the work from the entering of the crop to the harvesting. The work is maintained by public subscription.

THE centennial meeting of the New York Academy of Sciences and Affiliated Societies was held at the American Museum of Natural History on the evening of May 28. Professor Michael I. Pupin, Honorary Serbian Consul General and president of the Academy, spoke on the "Relation of Pure Science to the National Crisis," emphasizing what we are all beginning to realize, that scientific research is one of the most valuable assets this country possesses. He made special mention of the work of the National Advisory Committee on Aeronautics appointed by President Wilson some two years ago, with a continuing three-year program which will give the United States as good an aerial service as there can be by that time in the world, the Naval Consulting Board, appointed by Secretary Daniels a little more than a year ago, with the splendid result of an appropriation of several million dollars for the organization of a naval research laboratory, and the National Research Council for mobilizing all the scientific research facilities of the country. Among the problems which press most urgently upon the scientists of our country are the making of optical glass, and the making of nitric acid.

Dr. Nathaniel Lord Britton, of the New York Botanical Garden, gave a summary of the work done by the Academy's scientific survey of Porto Rico during the last few years, in which many of the American Museum's scientists have made investigations. The study of the material gathered is progressing rapidly, and many of the results are now ready for publication. Some of the collections are being returned to Porto Rico to aid in the founding of a natural history museum at San Juan; the rest will be divided among the coöperating institutions. It is hoped to extend the work of the survey into the newest purchase of the United States, the Danish West Indies.

Dr. John Hendley Barnhart gave a summary of the Society's first hundred years of activity; from the time of the formation of the Lyceum in 1817, by about twenty young men connected with the College of Physicians and Surgeons, under the leadership of Dr. Mitchell, with its first home in the old almshouse.

house in City Hall Park and a library of two hundred books, on through the long years of discouragement and financial difficulties and the annoyance of moving from place to place, through the connection with Columbia University—both on Forty-ninth Street and after the removal to Morningside Heights—to 1902, when it accepted the invitation to make its permanent home in the American Museum building, to the mutual profit and satisfaction of both the Society and the Museum.

A TIMELY bulletin on the subject of "Corn in Montana," in which the history, characteristics, and adaptation of this cereal are discussed, has been prepared by Professor Alfred Atkinson, of the Experiment Station of the Montana Agricultural College. Through it we learn that corn, which is native to this continent and therefore more distinctly American than any other of our farm crops, is today the leading crop of the nation. Corn not only produces a crop of highly nutritive grain but also fodder for the stock, and at the same time leaves the soil in excellent condition for planting small grain without further cultivation, thus providing that rotation of crops so necessary in economical farming.

For some years the notion has prevailed that corn could successfully be raised only within the limits of a certain area along the valleys of the Ohio, central Mississippi, and lower Missouri rivers known as the "corn belt." A study of corn-growing by the Indians, however, proves that maize has been cultivated by them for many centuries in nearly all sections of the United States and even as far north as Montreal, Canada—where Jacques Cartier observed large fields of it growing in 1534. There is now a gradual northwestern corn movement. Few crops show adaptability to so wide a range of conditions as corn, some varieties maturing in eighty days and others requiring two hundred, while corn may be raised successfully by dry farming as well as by irrigation. The limits of possible corn culture are therefore by no means yet fixed.

The Indians were not only the first corn raisers, but also they developed a really remarkable corn culture. According to the Rev. Gilbert L. Wilson, who began work among the Hidatsa Indians in North Dakota in 1907 as an anthropological collector for the American Museum, the Sioux brought

the culture from their first home in North and South Carolina, and spread it by means of the various groups into which the original tribe finally broke up. Some of these groups, as the Mandans, Arikara, and Hidatsa, became great corn growers and gradually carried the culture farther west and north in Dakota and Montana. In the Southwest, archaeological discoveries would indicate that corn raising has been carried on for thousands of years, and it is still the main crop of the Pueblo Indians of that region—as well as the occasion for many of the picturesque ceremonies prevalent among them.

Through Mr. Wilson's studies among the Mandan and Hidatsa Indians, the first incentive was given to the work of experiment in corns adapted to short seasons. He found that these Indians had several varieties of corn, some of which they were able to grow successfully much farther north than the white farmer had done. The Montana Agricultural College became interested and began a series of experiments which have been followed by such favorable results in corn growing as to create a wide interest. The American Museum has received many inquiries from people in the New England states, where the corn raised by the Indians formed the basis of the varieties developed by the colonists. Some of the results of the important studies made by Mr. Wilson among the Mandan and Hidatsa Indians by permission of the American Museum of Natural History, will appear in a report published by the Montana Agricultural College under the title: "Agriculture of the Hidatsa Indians, an Indian Interpretation."

Of the many visitors who stand daily before the food display in the cases in Memorial Hall of the Museum, few realize that they are looking upon a purely artificial exhibit. Among the materials used in these reproductions of beefsteak, lamb chops, potatoes, beans, ice cream, etc., are paraffin, plaster, and a kind of Japanese seaweed known as agar-agar. Some of the articles are cast in molds, others, such as the very realistic cake "napoleon," must be made entirely by hand. After the mold is made the specimen is cast in wax; then the minute defects of the cast are "tooled" into shape, and finally the perfect casts painted with oil colors, the real article being before the artist as a model. Sliced tomatoes and hard-boiled eggs present great difficulties in re-

production on account of their peculiarly translucent texture. Ice cream is made by boiling wax and flour together, molding into shape, and then cutting into portions and coloring. Chocolate creams, looking temptingly real, are made of paraffin. About two months' time was spent in the preparation of this exhibit, which is designed to bring before the public the caloric and protein values of the various foods commonly used. The artist, Miss A. M. Renaud, has been only three years in this country, having taken special training for her work in Europe. She has been connected with the American Museum for about two years.

FROM the battlefields of Europe, where he was wounded and gassed in the trench warfare of the western front, Captain A. Radclyffe Dugmore of the English army comes to America to tell us something of the exact situation and needs of our English and French Allies. Captain Dugmore was an active participant in the battle of the Somme, in which nearly the whole of his brigade was wiped out. He himself was overcome by gas on the fifteenth day. After six months in the hospitals of France and England, he rejoined his regiment in England, but broke down again some two months later from the effects of the Somme gas injury and was obliged to give up the idea of active military life. Captain Dugmore is sent to this country by the British Foreign Office. He says: "I shall lecture everywhere in the country on the conditions on the other side, what the thing stands for, and what the ultimate aim is. I want to show what we are up against, and why. I want to show England's position, and particularly to remedy certain wrong impressions, due to German propaganda." When asked what he had been doing at the front, Captain Dugmore answered: "What all the other fellows are doing—trying to miss bullets. Sometimes one succeeds very well. Sometimes one does not. The men are splendid. It is almost incredible what they are doing there. We do not have to get behind them and push them to the front, nor look back to see if they are coming. There is no need of urging the men. They come right forward even when they know death is certain." He further said: "If the war crushes the menace that has been hanging over the liberty of the world for all these years, it is worth the sacrifices. Germany is fighting hard still;

but the most gratifying thing is that since the battle of the Somme opened she has failed in every counterattack. She has never succeeded in driving a counterattack home. We drove her out of positions in France which she had planned years before the war. Even gas cylinders we captured bore the date 1912." In his lectures throughout the country Captain Dugmore will also tell of the great part taken by the women of England, of their sacrifices, and absolute unanimity of purpose—in order that the men may be released for military duty or government work. Nine tenths of the mail carriers are women, there are hardly any men left in the banks, even the porters at the railway stations are women.

Captain Dugmore is not unknown to the readers of the JOURNAL. In March, 1916, an article appeared in which was described his trip to Africa when he secured for America his wonderful photographs of African game. Some of these pictures have appeared in the JOURNAL, and duplicates of all the negatives secured on the trip are stored in the educational department of the American Museum.

EACH member of the staff of the American Museum has been presented, through the courtesy of President Henry Fairfield Osborn, with a copy of a handbook entitled *Hints to Housewives*, which has been issued by Mayor Mitchel's Food Supply Committee. The book is opened by a patriotic call to housewives to do their bit toward solving the food problem, and contains recipes for cooking, for canning fruits and vegetables, preserving eggs, and much useful information in general on how to buy and care for food.

WORK is in progress on the elephant group for the center of the African hall planned by Mr. Carl E. Akeley. Surely there never has been a scene in the past history of taxidermy and sculpture quite comparable with that today in the elephant studio of the American Museum. The beasts are so gigantic, so vast in their proportions, that the whole visible space of the eighty-foot studio, with thirty feet to the ceiling, is dominated by them and the scaffolding and other paraphernalia for their preparation. There are to be four of these giants of the African jungle in the group. The calf and young bull are practically completed (photographs of them

will be reproduced in the first fall issue of the *JOURNAL*). Work on the old bull, whose head will tower twelve feet above the pedestal on which he is to stand, is well under way. At present one of the immense sides of the mammoth for him has been clothed in one half of his skin and is now encased in plaster until the skin hardens. The other side is undergoing the process of having the remaining half skin carefully molded over soft clay into all the intricacies of the natural folds and wrinkles and suggestions of tense muscles underneath. Work on the head is begun. The pose, depicted by Mr. Akeley, is one that carries conviction as to the elephant's massiveness and majesty. The measurement from the eye to the tip of the trunk is nine feet and the spread of the ear is more than ten feet. Just now is the very best time to see and understand the process which Mr. Akeley has perfected in the mounting of animals, since each step is in sight—except the final one of reinforcing the inside of the skin with composition and wire netting. So difficult of accomplishment and so vast in amount is the detailed work required that it will be almost a year before the four elephants stand on their feet in the finished group.

MR. HENRY P. DAVISON, treasurer of the American Museum, has been appointed by President Wilson as chairman of the Red Cross War Council, a body of seven members created within the Red Cross for the purpose of responding to the extraordinary demands which will arise from the present war.

DR. FRANK M. CHAPMAN also has been called to Washington as assistant director, Bureau of Publications, for service in connection with the Red Cross. At present he is acting as editor of the *Red Cross Bulletin*, a newly established organ designed to keep subscribers informed of Red Cross activities.

Of the members of the Crocker Land Expedition who returned to civilization in the summer of 1916 by way of a 1300-mile sledge trip across Melville Bay and through Danish Greenland, thence by boat to Copenhagen, Ensign Fitzhugh Green, who was in charge of the cartographic and magnetic work of the expedition, is again in the service of the United States Navy on the steamship "Texas." Also Mr. Jerome Lee Allen, the electrician who was in charge of the wireless, has reënlisted for government service and is at present at Washington, D. C.

THE "Neptune" (see pages 284 and 346), which is to be sent as a third relief vessel to the members of the Crocker Land Expedition in northwest Greenland, is the largest of the Newfoundland sealers. Although built in 1873 she is sound throughout. Her sides consist of sheathing of four inches of greenheart over four inches of oak, covering heavy oak timbers, with a three-inch lining. The space between the inner and outer skins and the timbers of the ship is solidly filled with rock salt, so that the sides of the ship will be practically eighteen inches thick in all parts where contact with the ice is expected. The bow is further reinforced by a heavy sheathing of iron plates, and is backed inside with deadwood. The "Neptune" measures about 190 ft. long by 30 wide and 18 deep. She will carry about 450 tons of coal. Five tons of food will be carried to the expedition to provide against the contingency of another year's detention in the north. Owing to the present scarcity of ships, it was only after the greatest difficulty that the "Neptune" was secured. The charter price per month is \$15,000.

THE women of the American Museum have formed a definite organization for preparedness under the name of the "American Museum War Relief Association." Committees have pushed forward the work to be done by the organization, and sewing and knitting are proceeding rapidly. Mrs. Henry Fairfield Osborn very generously contributes funds to the extent of thirty dollars a month for the purchase of the necessary materials. While certain hours are granted by the Museum for this work, each employee engaged in it donates additional time as her own personal sacrifice to the cause. Red Cross funds collected to date contain 205 subscriptions, with the work of collecting still going on.

At a special meeting for the adult blind of New York City, held at the American Museum on the evening of June 8, Dr. G. Clyde Fisher spoke on "Wild Flowers of Summer." Boy Scout guides were provided for all those who wished such assistance. The doors were opened early in order that the visitors might have opportunity to handle the grasses, daisies, buttercups, clovers, and various other "wild flowers" so abundant in the fields of New York's suburbs that picking them for this occasion could not possibly have any influence toward extermination of the species.

THE Liberty Loan Bond committee, appointed by President Osborn some weeks ago, reports that 167 of the employees of the Museum have subscribed to the bonds, a large percentage purchasing outright and others paying by the month. The subscription already amounts to \$12,850, mostly for fifty-dollar bonds. The arrangement by which the Museum is enabled to receive the subscriptions in installments was financed through the generosity of Mr. Adrian Iselin, Jr., and Mr. Felix M. Warburg, members of the board of trustees of the American Museum.

REGISTRATION for the New York State Census for the Fifteenth Assembly District was carried on at the American Museum. The work was done by the fifty-three members of the American Museum War Relief Association, under the supervision of Miss Ann E. Thomas, chairman of the committee on census. The clerical assistants worked in three shifts, the Museum giving the time of the employees during the regular hours, and the employees volunteering for the extra service. The American Museum War Relief Association is a recognized chapter of the Red Cross and also a branch of the Navy League, working daily in its workroom at the Museum on garments and equipment for soldiers and sailors.

DR. MARJORIE O'CONNELL, who has been engaged by the department of geology and invertebrate palæontology of the American Museum to work on the collection of fossil sponges as a special assistant during the spring months, has been awarded the Sarah Berliner Research Fellowship of \$1,000 for the year 1917-1918, beginning June first. This fellowship was founded by Mr. Emile Berliner of Washington, D. C., in memory of his mother, and is designed to encourage gifted women who have already made a noteworthy beginning in some special field of science. Dr. O'Connell's subject for investigation will be the ecology of the European and American graptolites, extinct Hydrozoa whose habitats have heretofore been little known. In this connection she will study the large collections of these forms at the American Museum of Natural History and Columbia University.

DR. ROBERT H. LOWIE, associate curator in anthropology in the American Museum, leaves in August for California, where he will act as associate professor in anthropology during the academic year 1917-18 in the University of California at Berkeley.

AT a recent meeting of the California Academy of Sciences, Dr. Frederic A. Lucas, director of the American Museum, was elected an honorary member, together with Dr. Robert S. Woodward, president of the Carnegie Institution at Washington, and Dr. John A. Brashear, a trustee of the Carnegie Institute at Pittsburgh, Pennsylvania.

THE twelfth annual meeting of the American Association of Museums was held in New York City from May 21 to 23, with an attendance of about one hundred and fifty members representing a large number of widely scattered institutions. On May 21 and 23 the sessions took place at the American Museum of Natural History, and on May 22 at the Metropolitan Museum of Art. The guests were entertained at luncheon by the host institutions on the three days of the meeting. Chief among the topics discussed was the relation of museums to industry and education. On the evening of May 22, a reception was held at the New York Aquarium, when Dr. C. H. Townsend gave an address on the administration of a public aquarium. The week was rounded out with inspections of the other museums in the vicinity. At the business meeting for the election of officers, Mr. Paul M. Rea, of the Charlestown Museum of South Carolina, was reelected secretary, Miss Laura L. Weeks, of the same institution, assistant secretary, Dr. W. P. Wilson, of the Philadelphia Commercial Museum, treasurer. Mr. Roy W. Miner, of the American Museum, and Miss Anna B. Gallup, of the Children's Museum of Brooklyn, were elected councilors for a term of three years. The president and vice-president of the association, elected last year for a term of two years, are Dr. Henry R. Howland, of the Buffalo Society of Natural Sciences, and Dr. Newton H. Carpenter, of the Art Institute of Chicago.

AN exhibit of the Ceramic Society of Greater New York, held at the American Museum from April 25 until May 6, showed pottery and chinaware of design inspired by the Museum's collections of the primitive art of the Americas. The society, with a membership of one hundred, meets regularly in the Museum, under direction of Mr. Marshall Fry, to study design applicable to ceramics. At the last business meeting of the Ceramic Society, Dr. Frederic A. Lucas was elected honorary president.

The American Museum of Natural History

Its Work, Membership, and Publications

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

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

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

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

The educational work of the Museum is carried on also by numerous lectures to children, special series of lectures to the blind, provided for by the Thorne Memorial Fund, and the issue to public schools of collections and lantern slides illustrating various branches of nature study. There are in addition special series of evening lectures for Members in the fall and spring of each year, and on Saturday mornings lectures for the children of Members. Among those who have appeared in these lecture courses are Admiral Peary, Dean Worcester, Sir John Murray, Vilhjálmur Stefánsson, the Prince of Monaco, and Theodore Roosevelt. The following are the statistics for the year 1916:

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

Membership

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

THE AMERICAN MUSEUM JOURNAL

The various Classes of Resident Membership are as follows:

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

They have the following privileges:

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

Associate Membership

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OUR NATIONAL COLORS IN THE ARCTIC
OSTRICH FARMING — EXTINCT GIANT BIRD
WHALING SOUTH OF THE EQUATOR

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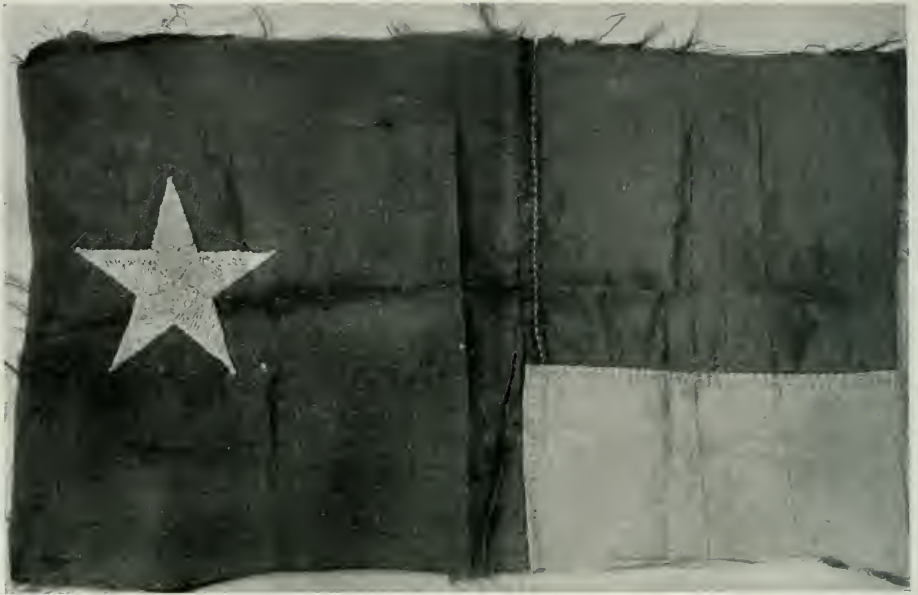
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MARY CYNTHIA DICKERSON, *Editor*

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

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FRAGMENT OF HISTORICAL AMERICAN FLAG

This portion of an American flag (above) was found by the Crocker Land Expedition in a cairn on the highest of the three summits at Cape Thomas Hubbard, in the Arctic, and is now on view at the American Museum. In these days when Americans feel a quick patriotism at sight of the flag, we can well appreciate the thrill that came to the leader of the Crocker Land Expedition when he found the red, white, and blue with its one embroidered star in the distant north.

This silk flag (below), now in the United States National Capital, was made for Admiral Peary by his wife and carried on the expedition which reached the North Pole. Peary cached portions cut from it at different "farthest north" places: Nos. 1 and 2 at Cape Morris Jesup, 3 at Cape Thomas Hubbard, 4 at Cape Columbia, 5 at Peary's "Farthest North" at $87^{\circ} 6'$, and 6, the long diagonal strip, on the ice at the North Pole. The portion brought back by the Crocker Land Expedition is No. 3, from the upper middle section; a complete American flag was left in its place

The Crocker Land Expedition Home¹

FROM the dangers and difficulties of exploration in the Far North, Providence has granted a safe return to Donald B. MacMillan, leader of the Crocker Land Expedition, and to all the members of his expedition, as well as to all members of the relief parties sent out during the last two years. As the world bade these men a sympathetic Godspeed four years ago, it now gives them a warm welcome. Their safe return, expertly piloted home by Captain Robert A. Bartlett, with the loss of not a single man and with the great measure of success attained in geographical, geological, and zoölogical discovery, is a matter for rejoicing to all interested in polar exploration. It stands for the triumph of the intellect of man in the contest with opposing physical forces—with bitter cold, and storm, and the long Arctic night.

It is a cause for congratulation to the American Museum of Natural History, the American Geographical Society, and the University of Illinois, organizations which sent the expedition out and have borne the two burdens always incumbent on the organizers and supporters of exploration work in Arctic or Antarctic, namely, continual fear for the safety of the men, and financial backing for whatever may come, unexpected events and delays which may mean wreck to the ships and disaster or death to the men, while prolonging the years of residence in the North far beyond that planned for. As chairman of the Crocker Land Committee, representative of the three organizations supporting the expedition, I can congratulate the members of that body on their unswerving faithfulness to the work devolving upon them.

The Crocker Land Party left in 1913. At the end of two years it had accom-

plished the intensive scientific work planned and the main exploratory journey of 152 miles northwest from Cape Thomas Hubbard, a hazardous expedition over the moving sea ice, in search of the land which had been prophesied to lie there. The two years since that time, enforced upon the members of the expedition by ice conditions which kept the relief ships of 1915 and 1916 from reaching them, have added vastly to the total results of the work. Especially valuable is the geographical work accomplished on the expedition to Finlay Land and North Cornwall, and in mapping the western coast of Ellesmere Land from Cape Sabine to Clarence Head. The news of the richness of the fauna of large food animals in this uninhabited part of our globe is of unusual interest at a time when study of food conservation is in everyone's mind; and in view of the fact that our fuel resources are being dangerously reduced, we can foresee that the future will, by some method, make available the enormous veins of coal discovered throughout Axel Heiberg Land and the eastern of the Parry Islands.

Aside from the scientific results, there is added much of human interest in the pleasant and helpful relations established with the Esquimo, and in the relics found of previous Arctic expeditions. The large collection of these relics now on view at the American Museum tells many a long past story of the triumph of discovery of new land, the drear lonesomeness and isolation of the work, and the failure of rescue when rescue was sorely needed.

It is a pleasure to extend greetings and congratulations to Mr. MacMillan and his companions and a cordial welcome home.

HENRY FAIRFIELD OSBORN.

¹ It will be the pleasure of the JOURNAL to publish in the next issue an illustrated article by Mr. MacMillan describing some of his experiences in the Arctic.—EDITOR



Note in this breeding cock ostrich (see hen in background) the black body feathers, the two-toed foot and naked tarsus with large scales along the front, the long neck covered with downlike feathers, and the small head. The head and tarsus of the breeding cock are bright scarlet. He is very vicious, many fatalities having occurred from his attacks. Breeding pairs have sold for as much as \$5000



The cock bird may sit on the nest, and also take care of the young chicks when hatched. The eggs are turned over and rolled about with the beak before the bird crouches. As many eggs are placed in the nest as the bird can cover, usually from twelve to twenty. The hen sits by day and the cock takes duty by night

DOMESTICATED OSTRICHES OF SOUTH AFRICA



Some of the barbs of the natal down feathers are continued beyond the rest of the feather, and this gives the bristly appearance to the plumage of the young chick

Ostrich Farming in South Africa

SUCCESSFUL RESULTS SUGGESTING THE POSSIBILITY OF SAVING
OTHER WILD BIRDS THROUGH DOMESTICATION

By J. E. DUERDEN

Professor of Zoölogy, Rhodes University College, Grahamstown, South Africa¹

IN times past the two-toed ostrich (*Struthio*) ranged over all the habitable parts of the continent of Africa, and extended into Arabia, Palestine, Asia Minor, and probably as far as southern India. Any specific distinction within the genus is questionable. In recent times it has become practically restricted to Africa, a hardy "left over" from a more ancient fauna, in which brain power counted but little. Its graceful plumes have been employed for decorative purposes from time immemorial, and frequent references to the giant bird occur in Biblical and classical writings. The plumes were obtained from the hunting of the wild bird, and so valuable are they that the creature would have become extinct ere this had not its domestication been undertaken. As it is, ostriches in South Africa have rapidly increased under

farming conditions, until in 1913 they were estimated at near 1,000,000, a noteworthy instance of an animal saved from extinction and increasing greatly in numbers through man's agency.

For generations the Arabs and natives of North Africa have kept the ostrich in captivity in small kraals, and ruthlessly plucked its feathers. These birds are captured as chicks from the nest of the wild bird, restraint and handling of the wild adult being impossible. Chicks are never bred in captivity, and the term "ostrich farming" can scarcely be applied to the crude conditions under which the bird there exists. Fifty years ago serious attention was first directed to the possibilities of ostrich farming in South Africa. Under suitable management the bird proved itself amenable to the restraints of farm life and bred freely, and in a

¹Dr. Duerden holds also the position of Officer-in-Charge, Ostrich Investigations, Grootfontein School of Agriculture, Middelburg, South Africa.



The "hair" in the feathers on the neck and head of an ostrich is the greatly elongated barbless shaft of the feather



The growing plume is highly sensitive to any changes in the nutritive condition of the bird. In this plume the tip or crown is well-grown, but, because the bird became reduced in condition, the rest of the feather is deeply "barred," tapers strongly toward the butt, and is otherwise defective. Defective growth renders the plume almost valueless commercially

short time ostrich farming became one of the leading pursuits of parts of Cape Colony. In 1913, the year before the beginning of the World War, the industry reached its zenith, when feathers to the value of \$15,000,000 were exported overseas, mostly to Europe and the United States. An article of luxury, ostrich plumes have naturally suffered with the advent and continuation of the war.

Although the ostrich is indigenous to Africa, it has been established that the domesticated bird will thrive and reproduce under varied conditions, and the remunerative nature of ostrich farming has led to its introduction into other parts of the world, particularly Arizona and California in the United States, and also Australia and New Zealand. The plumes produced in these parts are, however, by no means the equal of those grown in South Africa; and, as the bird is farmed only for the feathers it provides, it seems doubtful whether the industry can be made a success beyond the confines of Africa, especially since the exportation of birds is now prohibited by the Union Government. As in so many other highly specialized animal and vegetable products, peculiarities of soil, climate, and the general environment have much influence upon ultimate success; and even in ostrich areas in South Africa great differences obtain in the degree of plumage perfection attained.

It is no small achievement for the South African farmer to have reduced within fifty years a wild, highly nervous bird to a thorough state of domestication, to have worked out the details of management required for the production of successive plumage crops of the highest perfection, to have combated the many parasitic diseases to which the bird is subject, to have elaborated methods of chick rearing, and, by selective breeding, to have improved the plume to the high state of excellence it has now reached.



CLASSIFIED COMMERCIALLY AS A "HIGH GRADE NATURAL PRIME"

Plumes are graded and valued according to the possession of a large number of "points," among which are included size, shapeliness, density, and luster. The best plumes have usually a natural curliness at the crown and sides and are highly lustrous. A single plume like the above would be worth from five to ten dollars to the farmer. For millinery purposes two or three such feathers are laid together to give sufficient fullness



A full clipping of the prime feathers from an ostrich cock may weigh from ten to fourteen ounces, and be worth from fifty to one hundred dollars

A fact which is most impressive to the physiologist is the extraordinarily sensitive nature of the feather growth. Unless the bird is maintained in the highest nutritive condition throughout the six months required for a feather crop to grow and mature, the character and quality of the plumage suffer. Any imperfection of growth greatly depreciates the plume in value, often to the extent of one half or three quarters. The feather is an epidermal product, nourished from a long



These are wing plumes from the first, second, third, and fourth clippings. The plumes of the first clipping, termed "spadonias," are not of much value. Plumes usually continue to improve to the third or fourth clipping, and with proper management the bird will yield the same quality of plumage for many years

dermal medulla, and like all epidermal structures—hairs, nails, hoofs, and horns—is delicately responsive to nutritive variations and changes in external conditions. Even the normal variations in blood pressure between the night and day periods often leave their mark upon the growing plume in the form of night and day rings. These represent alternating differences in density in the new feather growth, and are the foundation of the prevalent defects technically known as bars, the nature of which has been investigated for several years by the writer. The longest plumes have a growth at the rate of a quarter of an inch a day, and all the feathers are so many projecting cylinders full of blood capillaries, closed at the outer end and open below to the blood supply. To maintain the uniform blood pressure necessary for the growing feather to attain its highest perfection demands a constant supply of highly nourishing food, such as alfalfa, rape, mangel, and all kinds of grain. It can safely be said that no animal is so highly cared for, and leads such a pampered existence, as the high-grade domesticated ostrich. The farmer, however, has no option in the matter. The difference in returns from a perfectly grown, high quality feather crop and one defective in growth is often the difference between prosperity and failure.

The method of securing a full, complete, and even feather crop is a matter of some interest to the zoölogist. In North Africa the entire plumage is usually plucked from the body, wings, and tail, which leads to rapid deterioration in the successive crops; but in methodical ostrich farming, only the three main rows of wing feathers are taken, along with the tail. With care the normal character of the plumage may be preserved year after year, maybe for fifty or more years. In farming, the object is to maintain all the commercial feathers at the same stage of growth at

the same time, in other words, to keep the crop even. The natural method does not suffice, for the moulting of the various plumes is irregular; some are only partly grown while others are ripe or overripe. Further, to allow the plumes to remain on the bird until natural moulting takes place would result in a serious deterioration and depreciation in value, as a result of the wear and tear during the two or more months after the plume is ripe. Hence all feathers are clipped as soon as the plume part is fully developed, and then the quill is allowed to remain in the socket until it ripens also, the process requiring at least two months after clipping has taken place.

The first clipping occurs when the chicks are six months old, and all the commercial feathers, technically called *spadonas*, are removed. The quills remaining are then fully ripe in about two months' time, that is, all the medulla, with its blood and nerves, is withdrawn, and the tip of the quill rounded off. Left to natural moulting, these fully grown quills would be pushed out at different times, and the second crop of feathers would begin to grow in an irregular manner. To prevent this all the quills are drawn by hand when ripe, the chicks being then about eight months old; and invariably the withdrawal of a quill acts as a stimulus to the germ of the new feather at the bottom of the socket or follicle. All the old quills being drawn simultaneously, the new feathers begin their growth together, and a second full and even crop is secured. This also requires six months to ripen from the time of drawing the quills, so that the second feather crop is ready for clipping by the time the bird is fourteen months old. Two months later the second crop of quills can be drawn, and the third feather crop starts its growth, to be completed by the time the bird is two years old. The third clipping usually represents plumage maturity, that

is, it is the best crop the bird will produce. With care and good management, however, little depreciation follows for a number of years.

The ostrich plume owes its success as an article of adornment throughout the ages to its intrinsic grace and beauty and, in these later times, when humane principles are in the ascendancy, to the fact that no cruelty or destruction whatever is involved in its production. The clipping of the ripe plumes involves no more to the bird than cutting the hair or trimming the nails does to man, or shearing the wool does to sheep. Feathers, hairs, nails, and wool are all epidermal structures, devoid of nerves and blood vessels, and no pain is connected with their removal once growth is complete. The drawing of the ripened quills is only performing for the bird in advance and simultaneously what would take place more slowly and irregularly in the natural process of moulting. It is this knowledge which in all recent legislative enactments devoted to the prohibition of trade in plumage has led to the exemption of ostrich plumage from any repressive regulations.

The wild ostrich breeds when four or five years old, but the domesticated bird from two to three years of age, or even before two years, a remarkable instance of the influence of high feeding in hastening the physiological processes of reproduction—combined with a certain amount of unconscious selection on the part of the farmer. The six-week period of incubation is undertaken in the nest by the cock at night and the hen by day, or is carried out artificially in the incubator. There is no support for the myth that the eggs are left to be hatched by the sun.

In a dry climate and free from parasitic attacks the chicks are hardy, and their rearing presents no difficulty. But with each succeeding generation the primitive wild nature of the bird tends to assert itself and needs to be

overcome, the tameness attained by the parents being in no measure transmitted to the offspring. Left for a few weeks to themselves, or even with the parents, the natural wildness would become established, and during their subsequent career it would become practically impossible to handle them. To overcome this instinctive tendency to wildness, chicks for their first year or so have to be reared in close and constant association with people on the farm, when their nervous fear at the presence and approach of human beings remains in abeyance. Familiarity breeding contempt, the natural fear of man in the ostrich turns to aggression at the breeding season; and many a prancing cock in the full glory of its sexual vigor has stricken terror into the heart of the hapless person who has, unwittingly and unarmed, intruded on its territory, whether veld or camp; and many a violent kick has been received from its flattened foot, or a cut from its sharp powerful claw, resulting in serious injury or even fatality.

The domesticated ostrich also affords much that is attractive to the student of animal behavior. Along with other old-time African animals, such as the giraffe, rhinoceros, and hippopotamus, it combines a maximum of bulk with a minimum of brain. Like these and the big Mesozoic saurians and early Tertiary mammals, its nervous activities are mainly reflex in character, not mental. If intelligence be defined as the ability to profit by experience, then the ostrich is deplorably lacking in this desirable quality. Even in such remote times as those of the patriarch Job, aspersions were cast at the mentality of the bird. For do we not read: "God hath deprived her of wisdom, neither hath he imparted to her understanding."

Its oft-quoted proverbial stupidity in burying its head in the sand when pursued, believing itself thereby hidden from view, has however no foundation in fact, unless the instinct of death-



Group of chicks about five months old showing the mottled juvenal plumage, practically alike in both sexes. The chick in the foreground is half crouching on its ankles and toes

During their first year the chicks require constant handling and continual association with the people on the farm to prevent the development of their instinctive wild nature. It is impossible to handle an ostrich when it becomes adult, if it has not been thus tamed



In this group of plucking birds in an alfalfa camp, the black body plumage of the adult cock birds and the gray plumage of hen birds can be distinguished. The wing plumes are pure white in the cock, but usually have a small amount of gray pigment in the hen



BREEDING COCK OSTRICH WITH FAMILY

When the adult birds have hatched their chicks, they will take charge of any number of others in addition to their own, so long as those added are younger. In the plumage of the chicks note the bristly mottled feathers, and the bars and patches of dark color along the neck

feigning in the chick, when on sudden alarm it flops down with its long neck and head prone on the ground, can be regarded as the origin of the opprobrium. In handling the bird, as during the operations of clipping and quilling, the eyes are hooded and its nervous restlessness is thereby overcome.

Personal attachments and responsiveness, such as are manifested by all domesticated animals toward those who care for them, are wholly lacking in the ostrich. A glimmering of distinction between the familiar and the unfamiliar person, and a feeble tendency to the formation of the simplest habits, such as coming at call to be fed or traveling more readily along frequented directions, represent practically all the education of which the bird is capable. Attachment between mates, even after being camped together season after season, seems nonexistent; and the regard and care of offspring have manifestations of only the simplest character.

The success which has attended the domestication of the ostrich as a means of plumage supply has stimulated

thought in South Africa in the direction of the domestication of other plumage birds. It is held that just as one bird has been rendered amenable to farming practice, and done much to adorn the world, so others may be adapted according to their own particular instincts and needs. His own industry conducted on the highest humane principles, the South African farmer has no sympathy with the ruthless destruction of wild bird life for millinery purposes. Rather, however, than follow a wholly repressive or prohibitive policy, he would inquire if birds suitable for the purpose could not, as in the case of the ostrich, be brought to render legitimate service to the decorative needs of mankind. No personal adornment is so attractive as that of plumage; peoples of all lands and in all times have been held in sway by it—the ostrich plume has been transported from the native kraal even to the thrones of kings and queens; and, if secured under circumstances in harmony with the highest humane considerations, a high service is rendered the aesthetic nature of man.





SKULLS OF HUMAN INFANT (ABOVE) AND YOUNG CHIMPANZEE (BELOW)

The elements of the human skull are homologous with those of the ape, the differences between the two arising from the great expansion of the brain and the deepening and shortening of the face in man

Evolution of the Human Face

CHIEF STAGES IN ITS DEVELOPMENT FROM THE LOWEST FORMS OF LIFE TO MAN¹

By WILLIAM K. GREGORY

I SUPPOSE if you have talked to people about evolution they have said: "Well, if monkey-like animals evolved into men at one time, why did not all monkeys evolve into men, and why are there any monkeys alive at the present time?" They ask me to explain it, and they regard it as an insurmountable objection to the theory that man has evolved from lower mammals. Now I do not know why all the monkey-like animals did not

evolve into men instead of changing only a little and remaining monkeys, but I do know that evolution, besides proceeding in different directions, also proceeds at different rates at different times. I know that just as there are many very advanced and progressive races, such as the horse and the humming bird and the whale, which have undergone a very great modification during the vast period known as the Age of Mammals, so there are also many conservative and backward races, such as the tapir and the opossum and the tuatara, which have undergone very little modification during the same period. These backward and primitive races are of the greatest use to us in deciphering the evolutionary history of past ages. They are living relics, or living fossils. A great many such relics are living today. That is what furnishes the material for comparative anatomy. It is by the dissection and study of these extant fossils and by comparing them one with the other, that we can trace out the stages by which structures have changed slowly, one into the other, and by which types have changed, one into the other. Now the monkeys and apes are relics of the middle periods of the Age of Mammals, and we know from the fossil remains that they have changed but little during that period. A possible reason is that most of them have continued to live in the forests and have therefore kept their primitive tree-living habits unchanged, while only a few, such as



Young chimpanzee which has a short face and an exceedingly large forehead much like that of a young child (see page 376). Photographed by Herbert Lang on the American Museum Expedition to the Belgian Congo

¹ Lecture delivered before the Linnean Society of New York, February 27, 1917.

the baboons and the early predecessors of man, have left the forests and taken up wholly new habits on the plains, so that under the pressure of new conditions of life they have changed profoundly. But although other factors may be involved in the final answer to the question why have all the monkeys not evolved into men, it is true that by saving these relics of long past ages Nature has provided us with materials for elucidating the evolutionary history of human structures.

In considering the evolution of the human face, we gain a better perspective by beginning with the lowest animals and working upward. It seems that in the course of evolution the oldest part of the face is the mouth. The primary business of the face, in fact, is to direct the mouth toward the food. Some of the lowest, one-celled animals show this first essential of a face, which leads into a cavity that serves as a stomach, and among the anemones and corals and their relatives we find a well developed mouth, surrounded by sensory organs (tentacles).

The flatworms show the presence of eyes in a very primitive condition, another structure which goes to make up the face of higher types: that is, there is a concentration of nervous tissue sensitive to light at one end of the animal, which is shaped so as to progress in a forward direction, with the beginnings of a head and of a tail. In *Peripatus*, a wormlike animal, there are little tubercles on the skin equipped with hooks which help to pull the food into the mouth, and a number of paired limblike appendages on either side behind the mouth. These appendages become of importance in insects and crustaceans, those at the front end of the series becoming modified into sensory structures and also in many cases

serving to get food and convey it to the mouth.

In some insects the tough skin which covers these appendages has been modified into a sawlike edge, and here we have a suggestion of jaws, which are the next great element to be added to the face.

Finally we see in many ordinary insects, such as a grasshopper, a rather high type of face for this grade of animal. It is completely armored on the surface with a tough skin. In many lower types of vertebrates also the head is armor-plated like the rest of the body so that the head is protected by a helmet and the body by a cuirass. Insects naturally evolved a kind of face with a number of the characteristics of the face of higher animals, because some sort of face involving a mouth and jaws and paired sense organs is necessary at the front end of any animal that goes after its food in a fore-and-aft direction.

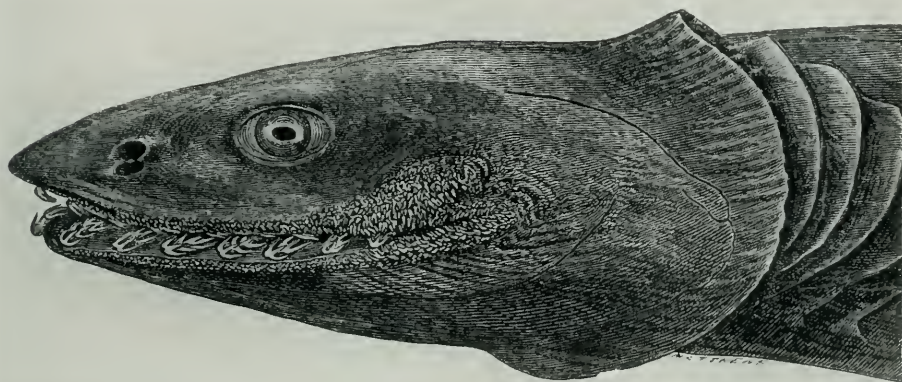
The very ancient fishlike vertebrates of the Silurian and Devonian ages also had a head covered with a bony skin which formed a cuirass and a helmet, and in some (*Bothriolepis*, etc.) the eyes were on top of this helmet much as they are in the grasshopper. The jaw parts of this vertebrate are likewise made up of bony plates on the surface, and no doubt the muscles pulled these jawlike plates back and forth much as they do in the insects. I do not mean that this fishlike animal with its grasshopper-like face has been evolved from the insect plan of organization: I am merely suggesting that general resemblances of this sort are frequently evolved in widely different groups in response to similar functional needs.

It is not until we reach the sharks, which are the most normal and typical

of the fishlike vertebrates, that we see the vertebrate face in its typical form and that we see all the elements which are characteristic of the face of mammals. Even the familiar landmarks of the human face are all present. We have the nostrils, which are only indefinitely foreshadowed in earlier types; we have the eyes, the mouth, the tongue, and the lips. But in the shark

teeth of vertebrates has had a great influence upon the evolution of the face.

In the shark the face is very distinctly the directing part of the animal, at the front end of the backbone. We may say that all the elaborate locomotive organs (the backbone, the fins, and the muscles which move them) exist chiefly for the purpose of bringing the



In sharks we see for the first time the vertebrate face in typical form, with all the elements of the face of man—mouth, tongue, and lips to be brought into contact with the food by the locomotive organs, and nostrils and eyes to direct the locomotive organs. In the frilled shark (*Chlamydoselachus*) figured we see a suggestion of how teeth were formed in the higher vertebrates. The teeth within the shark's mouth are enlarged shagreen denticles such as grow on the skin outside the mouth. *After Garman*

the whole face is covered with a tough skin.

In certain sharks (*Chlamydoselachus*) we see a suggestion as to how the teeth were formed in higher vertebrates. The tough skin, covering the head and body, is everywhere thickly studded with minute teeth, or denticles, the whole forming the "shagreen" of commerce. Now the teeth in the shark's mouth are nothing but enlarged shagreen denticles. At the sides of the mouth the denticles gradually become larger and the skin that bears them becomes drawn over the margins and on to the inner side of the jaws. I need hardly say that the evolution of the

mouth into contact with the food, and that the higher elements of the face, namely the eyes and the nose, exist for the purpose of directing the locomotive apparatus toward the prey. In order to consume the food and transform its potential energy into action, the shark must of course have oxygen, which among fishes is extracted by the blood from the water surrounding the gills. These gills are supported by cartilaginous arches which are of the greatest importance in the later evolution of the face, since there is good evidence tending to show that the upper and lower halves of one of these gill arches actually gave rise to the upper and lower



ANCIENT FISHLIKE VERTEBRATE WITH HELMET AND CUIRASS

Just as many highly developed types of invertebrates, such as the grasshopper, have the head completely armored with a tough skin, so in many low types of vertebrates the head as well as the body is armor-plated. Such was true of *Bothriolepis*, an extinct "fish" from the Devonian of Canada. The bony shell covering the head and thorax served the same purpose as the chitinous armor of insects. The internal skeleton, if developed at all, must have consisted chiefly of connective tissue. General resemblances of this sort are frequently evolved in widely different groups in response to similar needs. *Restoration and longitudinal section after Patten*

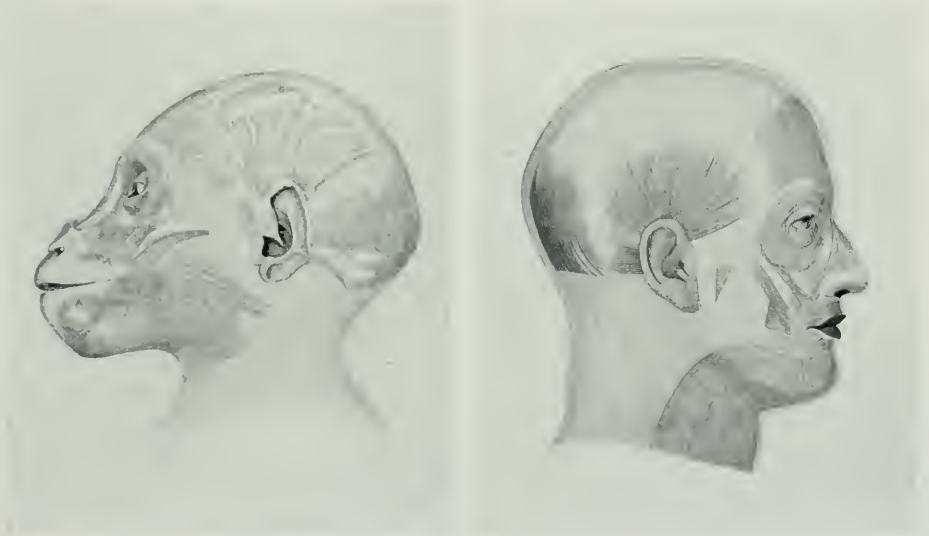
jaws of the sharks, which are equivalent to the cartilaginous core of the upper and lower jaws of all the vertebrates above the sharks.

The fishes called "ganoids," of many different varieties, show a shiny surface armature covering the face, as also the body, recalling the insects with their hard outer shell. But the noteworthy thing about this ganoid sort of face is that the hard covering of the face and jaws has a bony substratum which completely invests the primary, underlying brain case and the primary or gill-arch jaws. This bony skin even extends forward along the roof of the mouth, forming the primitive hard palate, and along the inner as well as the outer side of the primary lower jaw, forming the sheathing bones of the jaw, which are typical of fishes and higher vertebrates. In this early stage of vertebrate evolution this bony mask lies fully on the inner and outer surfaces, but in the later evolutionary stages of

all classes of vertebrates, these sheathing bones gradually sink below the surface, in proportion as a new layer of skin is generated on *their* surfaces, and as this new surface layer becomes thicker the original sheathing bones finally come to be buried deeply under the skin and often tightly appressed to the still deeper primary brain case and primary jaws.

There have come down to us from the Age of Reptiles a great many fossil reptiles and amphibians which show this shell of bone still on the surface, or very near the surface. Even in the modern alligators and crocodiles and turtles the bony mask lies immediately below the tough skin.

An aggressive looking amphibian (*Cacops*) from the Permian of Texas has the general type of face which was destined to give rise by diverse modifications to the characteristic faces of reptiles, and indirectly to those of the higher types. It still has the mask of



All mammals have facial muscles, producing a more or less mobile face. These muscles are very highly developed in man. In a comparison of gorilla (young) and white man (adult), homologous groups are seen, such as the muscles surrounding the eyes, the nasal muscles, and the muscles that lift the lip. One of the greatest gaps in the evidence of the evolution of the face is that there has been found no intermediate type between the immobile nonmuscular face of reptiles and the mobile muscular face of mammals. Comparative anatomy, however, shows how one may have evolved into the other. *Figure after Ruge*

bone. It has a special interest, besides, since it possessed another very important structure in higher vertebrates—namely, an eardrum, which was doubtless stretched upon the bony rim behind the eye-sockets.

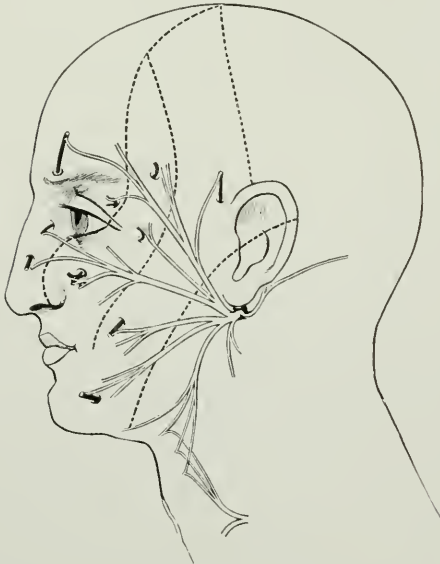
The Teju lizard represents a still higher grade of organization, the next step toward the mammals in one direction and toward the birds in another. It is an active, carnivorous animal, and its face is well protected by a mask of scaly skin. The bony mask is also still there, under the skin; but here is a point most important to remember, that if you took off the scaly skin of the face in this reptile, you would not find any facial muscles beneath the skin, such as are present in our own face. It is only on the under side of the jaws and throat that you would find a layer

of muscles beneath the skin. In the absence of true facial muscles all reptiles are inferior in rank to the mammals, where facial muscles first appear. Birds have the immobile nonmuscular face of reptiles, further masked by a horny beak or bill; but the mammals have soft muscular lips and a muscular layer about the nose, eyes, forehead, and ears.

One of the greatest gaps in the whole record of the evolution of the face consists in this, that in spite of the relative abundance of living relics that preserve successive stages in the evolution of the skull itself, there is no animal known which has an intermediate type of face between the immobile nonmuscular face of reptiles and the mobile muscular face of mammals. In spite of this, comparative anatomy furnishes fairly clear evidence as to the exact process by which the one did evolve into the other.

The facial muscles of a typical mammal, a lemur (*Propithecus*), for instance, correspond with the facial muscles of man. They include the platysma covering the throat, the orbicular muscle around the eye, the muscles of the nose, the muscles that lift the lip, the muscles that draw back the corners of the mouth, and the buccinator, which is of great use not only in blowing a trumpet, as its name suggests, but also in protruding the lips and in pushing the food about inside the mouth.

All these various muscles of the face in man are innervated by branches of the seventh or facial nerve. The facial nerve comes out from behind the ear, and turns forward, one branch going to the platysma muscle on the surface of the throat and the other in numerous branches and sub-branches, like a vine and its divisions, passing forward to supply the muscles of the face. This



The facial muscles are supplied by branches of the seventh or facial nerve, which issues from the skull behind and below the ear. It is believed that the throat muscle in remote ancestors of mammals spreads upward between the bone and the skin, carrying the seventh nerve with it, and that as the muscle branched, the nerve also branched again and again, producing the highly mobile sensitive face of man. From Cunningham's *Anatomy*

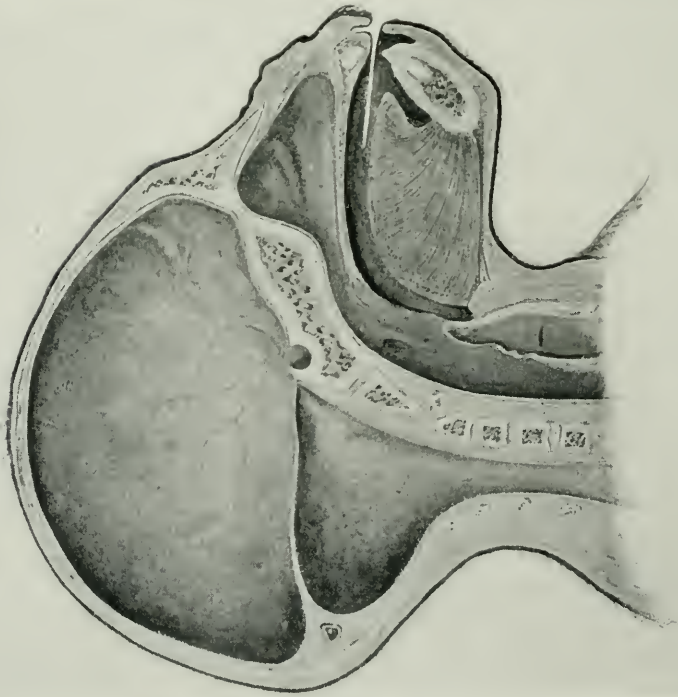
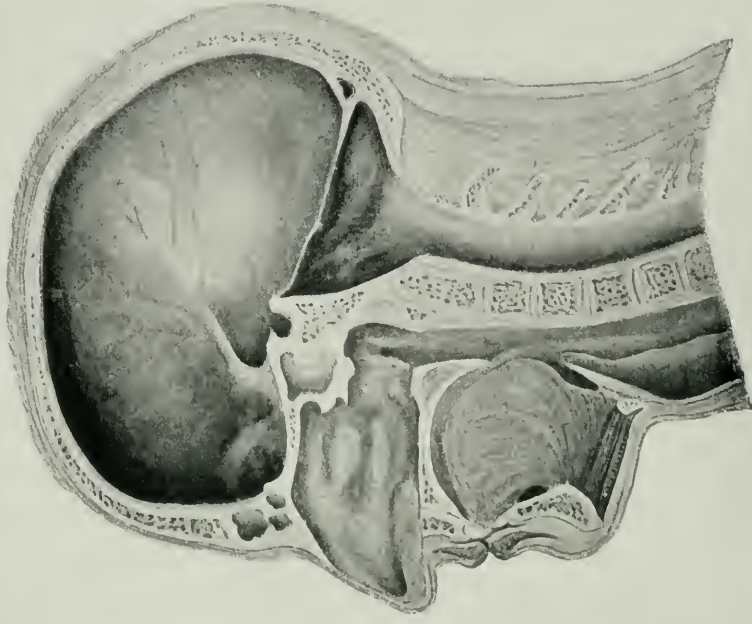
fact gives the clue¹ to the origin of the facial muscles. In the remote ancestors of the mammals only the platysma and the immediately underlying sphincter colli muscles were present; it is highly probable that this sheet of nerve tissue gradually spread from the under side of the throat upward and forward

¹Theory put forth by Ruge. This is generally accepted by anatomists as the true explanation of the origin of the facial muscles of mammals.

along the sides of the face, by degrees creeping over the old bony mask and beneath the skin, carrying with it the seventh nerve, and dividing and subdividing into numerous branches and layers; at the same time the nerve branched and branched again, as nerves have frequently been known to do when muscles became subdivided. Several analogous cases of the spread of a muscle layer into a new region are known



The photograph shows the tense lips of a trained chimpanzee who is in the act of threading a needle. The action of the muscles of the human face is coordinated (especially in the child) with that of various other muscles of the body, and the same is noticeable in apes, which use the facial muscles much as we do but often with rather more emphasis than is usual in polite society. Courtesy of Professor W. T. Shepherd, of Washington, D. C.



BRAIN CASE AND FACE IN APE AND MAN

In the ape (young gorilla, at the left) the brain case is comparatively low, and the face is shallow; in man (adult white man, at the right) the brain case and the face are both very deep; the face has been retracted beneath the brain case. *Figure after Ruge*

or suspected, as in the case of the mammalian diaphragm which is believed to have arisen in the neck region and to have migrated backward, dragging its nerves with it.

The facial muscles in man not only correspond with those in other mammals, but they also show special detailed resemblances when compared with the facial muscles of apes. Darwin and other investigators found that apes use these muscles much as we do, but with rather more emphasis than is usual in polite society. When a child first takes lessons on the piano, the teacher sometimes has to remind him or her that the piano should be played with the hands and not with the face—and sometimes it takes considerable repression on the part of the beginner to keep the facial muscles still, while striving to do anything with the hands that requires intense concentration and effort. A trained chimpanzee, trying very hard to thread a needle, has an intent expression and very tense lips, reminding us of the familiar human trait.

A gorilla in anger lifts the lips so as to expose the canine teeth and swells the muscles that run to the corners of the mouth so that they can be seen standing out on the side of the face. The arrangement of the wrinkles on the face in apes as well as in man, seems to have a definite relation to the facial muscles, often forming across the pull of the underlying muscles. Perhaps the principal difference between the facial muscles of man and those of apes, apart from differences in relative size, is that in man the upper lip is full and protruded while in the apes it is a thin "hard" lip, very muscular, but tightly drawn.

The human nose is hardly an inspiring subject from an anatomical point

of view: internally it is decidedly degenerate, as compared with that of other mammals, and externally it has nothing very wonderful about it, like the nose of the elephant or those of various bats. The adult human nose, at least in the higher races, differs from that of apes chiefly in the following characters: the bridge of the nose is higher; the whole nasal cartilage is produced forward and downward, often ending below in a well-shaped tip; the nose is narrower at the base in proportion to its height, and the nostrils face downward rather than forward. Now, however important these differences may be from an æsthetic point of view, they are rather small from the standpoint of evolution, the more so since the nose of the human fetus in its earlier and less differentiated stages is decidedly more apelike than human. Even in babies the nose has by no means approached its adult human form. Among living apes the gorilla makes by far the nearest approach to the human condition in the shape of its nose, although the great width and the forward facing of the nostrils give it, according to human standards, a repulsive appearance.

In the face of the Australian black man we find some primitive gorilla-like characters along with others that are typically human. The nose is excessively wide at the base and the bridge between the eyes is very low, but the nostrils point downward and the tip of the nose is distinctly human.

A wonderfully well-studied restoration¹ of the extinct ape-man of Java (*Pithecanthropus*) shows a very wide nose, with the nostrils facing partly forward and partly downward, and with a deep depression above the nose.

¹ By Professor J. H. MacGregor, of Columbia University.

between the eyes: it also has a very thin upper lip and a partly everted lower lip; so that this mingling of human and apelike characters fully carries out the "missing link" idea which is so unmistakably indicated in the excessively low forehead and high brow ridges of this celebrated relic of a pre-human stage.

An interesting and grotesque caricature of certain human styles of nose is seen in two closely related genera of Asiatic monkeys, the "retroussé-nosed monkey" (*Rhinopithecus*) and the "proboscis monkey" (*Nasalis*). The former has the nose turned up at the tip and the nostrils facing forward, somewhat after the manner of a human fetus, while the male proboscis monkey, as its name indicates, has its nose produced into a long downwardly directed tube with the nostrils facing downward. In the mandrill the inflated nose is made more striking to the eye by the addition of intensely blue and red pigments.

It has long been suspected that these variations of the nose in the higher Primates, including man, may have been brought about through sexual selection and that the form of nose has been determined by its decorative value, in accordance with the varied standards of beauty in the different races. Certain modern investigators, however, deny the potency of sexual selection to produce such results. Those who prefer to believe that differences in form are associated with differences in habit would perhaps favor the suggestion¹ that the downwardly pointing and hooded nostrils of man are primarily adapted to hunting habits and an upright gait, while the forwardly facing and open nostrils of the apes were adapted to frugivorous habits and a

stooping gait. It may be also that the covered nostrils were better adapted for the rigorous, arid climate of the open plains, which according to my own view constituted the earliest habitat of men after they had abandoned their ancestral home in the forests.

Passing to a consideration of the origin of the human eyes, we find in the Primates many intergradations from the condition where the eyes are more lateral in position, to the anthropoid and human condition, in which the eyes are shifted together near the mid-line in front and can both be focused on an object near by in front of the face. This process of bringing the opposite eyes near each other has been carried even further in the orang-utan than in man, so that the bony partition between the eyes in the orang is excessively narrow.

The eyes of all the anthropoids are very human in character, but especially those of the young gorilla. The back of the eye of the chimpanzee as viewed through an ophthalmoscope,² is extremely human in appearance, much more than that of the orang, so that this human character of the chimpanzee eye extends even to the arrangement of the blood vessels and the appearance of the pigmented areas.

As every one knows, the forehead of adult male apes is very low as compared with that of normal men; but the young, both of men and apes, have a swelling forehead. The baby orang-utan shows the domelike forehead of the human infant, and the young chimpanzee³ has an exceedingly large forehead much like that of a young child. The inference has accordingly been drawn by some authors that the common ancestor of apes and men did not

² According to the beautiful colored plates of Dr. Lindsey Johnson. The gorilla is not figured among them.

³ See illustration from photograph on p. 377.

¹ Dr. George F. Stevens (*in litteris*).

have a sharply retreating forehead but a domelike one and a relatively very large brain case. Although space is lacking to discuss this question, I may be permitted to record my conviction that this inference is quite wrong and that the human race has been derived from large, powerful apelike forms with heavy jaws, massive jaw muscles and a sharply retreating forehead.

The evolution of the human forehead is well suggested if we examine a series of skulls. In an adult chimpanzee skull the forehead is very low and there are heavy ridges over the eyes. In the skull of an Australian black man also the forehead is low and there are well-defined brow ridges. In a modern European skull the forehead is high and the brow ridges are lacking. In the shape of the forehead the extinct ape-man of Java was almost exactly intermediate between the chimpanzee and the lowest known human forehead, that of the Neanderthal race of the Old Stone age. The brain case accordingly has progressively deepened in its vertical diameter, as we pass upward from an apelike stage.

These changes in the contour of the brain case merely reflect the more fundamental changes in the form of the brain which in the higher types becomes excessively voluminous and, as it were, presses out the forehead and skull top in all directions so that in short-headed races of men the head becomes almost spherical in form.

Every part of the bony face of Primates has no doubt been molded in the long run by the action of the facial muscles that press upon it. The partition of bone behind the eyes, for example, has grown downward and outward between the eye and its muscles which lie in front of it, and the powerful jaw muscle (temporal) lying be-

hind it. The cheek bone has been deepened to give a strong support for the outer jaw muscle (masseter). The nasal bones have perhaps been molded to some extent by the muscles on either side of them.

In comparing men and apes one of the greatest differences is seen in the form of the front part of the upper jaw, which is associated with the marked differences in the form of the lips already alluded to, and with certain no less important differences in the character of the teeth and in the movement of the lower jaw. It seems very well established that as the primitive ape-men passed from the semi-erect to the fully erect posture, and as the rapidly expanding brain case became balanced at the top of the progressively up-tilted backbone, the whole front part of the jaws and lips was drawn backward beneath the overgrowing front part of the brain case; meanwhile the lower jaw and the whole head increased greatly in vertical height, but shortened equally in fore-and-aft length; the width across the brain case increased, the sockets of the lower jaws moved apart and the opposite halves of the jaws became sharply inclined toward each other, so that the front teeth were all drawn backward; the palate and the lower jaw were thus shortened, and the dental arches assumed an archlike curve, the crowding of the front part of the jaw being partly associated with the marked reduction in size of the canine and premolar teeth.

A multitude of minor changes and readjustments took place at this critical time, but they were nearly all the direct result of the general tendency to shorten the face and draw it inward beneath the overgrowing, forward expansion of the brain case. Among other important consequences of this general retreat of

the face and its bony substructure, were the downward and outward growth of the nose and the forward growth of the chin.

The evolution of the chin has given rise to an extensive literature. Some writers ascribe its existence to the excessive development of the genioglossus muscle, which runs from the hinder surface of the chin into the lower part of the tongue and which throws the tongue into the rapidly shifting positions assumed in articulate speech. Other writers ascribe the outgrowth of the bony chin to the withdrawal backward of the dental arch, to the increased pressure in the chin region, and to the turning outward of the lower rim of the jaw. Others regard the chin, like the nose, as a direct outgrowth, of no great functional importance, but linked in some way with the progressive improvement, according to human standards, in the appearance of the whole face. The present writer has sought to connect all these changes, including the reduction in size of the canines and bicuspid, with a profound change of food habits from the omnivorous-frugivorous habits of forest-living apes to the predatory carnivorous habits of plains-living men.

The profound disturbances and readjustments in the brain, brain case, and face were accompanied by equally far-reaching changes in the backbone and in the pelvis and in the bones and muscles of the limbs. The forearms,

no longer used in the stooping posture, shortened, while the legs rapidly lengthened, so that men very early became fast runners on the open plains.

In conclusion, if we compare the skull of a young anthropoid ape with that of a young human being we shall find that every bone in the ape skull may readily be identified in a slightly different form in the human skull; the number and kinds of teeth are the same, both in the milk and permanent dentitions, and even the crown-patterns of the molar and bicuspid teeth are fundamentally similar in primitive apes and men. In spite of all the readjustments following the assumption of the fully upright gait and the change in food habits, the differences between the primitive ape skull and the human skull are essentially differences of proportion and of degree rather than of kind.

From the paleontological viewpoint these numerous and fundamental resemblances can only mean that living apes and men have evolved from a remote and as yet undiscovered common ancestor that lived perhaps in the middle period of the Age of Mammals. I believe also that the living apes, because they have stayed in the ancestral habitat, have retained the greater part of the ancestral man-ape characters, and that the ancestral pattern of the human face may still be seen in a little changed state in the faces of young female gorillas and chimpanzees.

Photographs of American Sperm Whaling

TAKEN ON BOARD THE NEW BEDFORD BRIG "DAISY," IN 1912 AND
1913, DURING THE SOUTH GEORGIA EXPEDITION OF THE
AMERICAN MUSEUM OF NATURAL HISTORY
AND THE BROOKLYN MUSEUM

By ROBERT CUSHMAN MURPHY



THE WHALEBOAT

Constructed of flawless cedar, seaworthy and graceful, sharp at both stem and stern, the whaleboat when ready for service is a marvel of order and efficiency compacted within thirty feet of length. A whaleboat rows lightly and sails like a yacht; it spins smoothly on the sea following the terrific dodges of a harpooned whale; and it withstands the severe stress of being raised and lowered by its ends when laden with a crew of six men and sometimes half-filled with sea water



LOWERING AWAY

At the word of command the cranes swing back, the falls slacken away, and the second mate's boat drops to the water, the crew following by way of the slide-boards and tackles. Each man takes his place, with the harpooner at the bow oar and the boat header at the helm. Unless there be no breeze, or the whales lie to windward, the mast is soon stepped and the chase made under sail



A few strokes put the little craft safely away from the ship. This photograph shows the mast and sail, two of the keen toggle irons resting on the gunwale, and the manila whale line which passes out through a notch in the bow. The men follow directions signaled to them by the captain



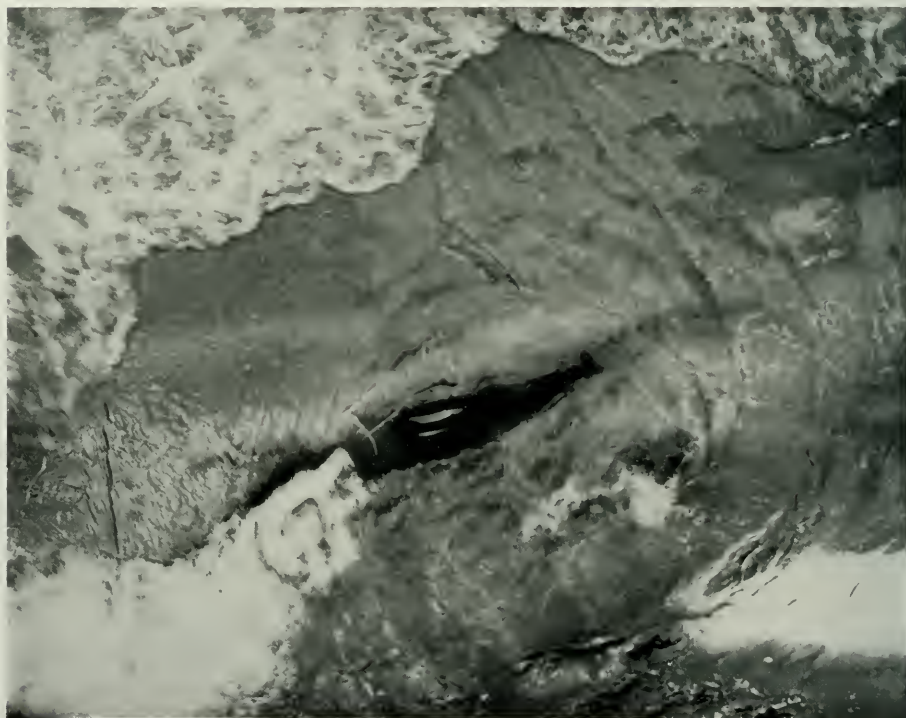
From his lofty perch at the masthead, the captain can see movements of the whales quite invisible to the harpooners, and by a system of signals with waifs and the clews of the square sails, he directs the course of the boats



A chain passed through a starboard hawse pipe is fastened around the whale's "small," and when drawn in snugly, the victim lies with his flukes near the bow and his head stretching along past the waist. The operations of bringing a whale alongside and of making it fast are called sweeping and fluking. The boat hanging on the forward davits is the writer's dory, not part of the regular whaling equipment of the brig



Here the main parts of a small sperm whale's head—the "junk" and the jaw—are being hoisted aboard by the cutting tackle. An iron blubber hook is caught in the whale's single nostril, or blow-hole, which is on the left side of the snout. The great block of head tissue includes the "case" containing the spermaceti, but none of the skull

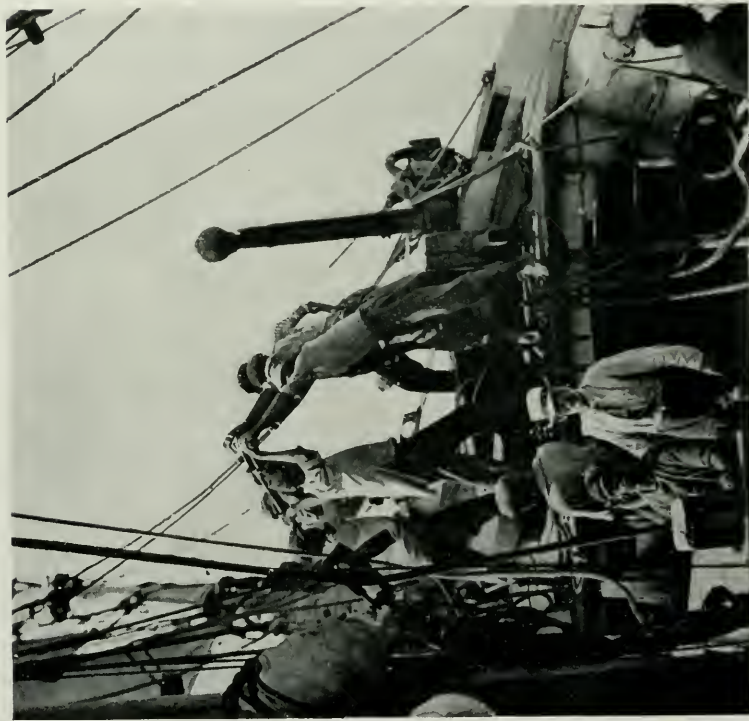


Sperm Whale's Eye.—The camera was pointed directly downward from the quarter-deck. The huge carcass lies on its side—just awash—limberly yielding to every swell, with the great blunt head stretching to the quarter, the closed eye and the infinitesimal ear-opening breaking above the surface



CUTTING TACKLE AND BLANKET PIECE

A cluster of gigantic blocks, hung by hawsers as thick as a man's leg from the head of the mainmast—through these are rove the ropes which raise the tons of blubber from the water to the main hatch. The blanket piece now attached includes the whale's flipper



"Blow, Blow, Blow the Man Down!"—The double hawsers from the cutting tackle run to the windlass on the topgallant fo'c'sle, and here, under the eye of the "Old Man" himself, the greater part of the crew rock the windlass, and so haul in the strips of blubber as they are loosened from the whale. This is the cheery part of the business, which cannot be done without song



Peeling the Blackskin.—The fibrous, gristly blubber of the upper head is cut off in squarish blankets, an operation known as "peeling the blackskin." These chunks are as elastic and resistant as so much rubber, and they make excellent chopping blocks or mats on which the solid, oleaginous blubber of the "junk" may be cut up without danger of chipping the keen edges of the deck spades



BAILING THE CASE

A large sperm whale's head is too heavy to be hoisted on deck, and it is necessary to bail out the spermaceti while the "case" is partly buoyed up by the water. A long, narrow bucket, suspended on a pole, is lowered into the huge cistern of oil. The pole pushes the bucket down, and then the latter is hauled out, as from a well, filled to the brim and dripping with liquid spermaceti. The operation is repeated again and again, until the long pole pushes the bucket down fifteen or twenty feet, and drains the last few gallons



Filling the "Blubber Parlor."—The blanket pieces are reduced to small blocks by men with short-handled blubber spades, and these blocks are stored between decks during the cutting-in. Everyone is hustling, hauling, chopping, lashing, stowing, and sliding "galley-west" on the greasy planks. Night does not put an end to the work on board. At sea one can be sure only of the present, and it is to everybody's interest to complete the cutting-in, and the boiling of the blubber, before signs of a storm appear



The Try-pots.—A view from the rigging. Strips of blubber called "horse pieces" are minced so that the heat may penetrate every part. Each strip is cut transversely into thin slices, but these are not severed completely; enough of the tough outer layer is left so that the slices cling together, like bacon on the rind, and the whole "hibble" can be manipulated on a blubber fork. Boiling goes on until the bibbles, crisp, shriveled, and of a golden brown color, rise to the surface and float like clinkers. They then constitute the "scrap," which is the fuel of this self-supporting process



DECK VIEW OF THE TRY-WORKS

The try-works comprise two iron pots in a brick support, situated on the forward deck. Beside them stands the iron cooler, into which the boiled oil is ladled before passing to the tanks and casks below. Above is the smoke sail, intended to keep at least a part of the sooty smoke out of the cabin. Between the chimneys hangs an iron cresset, the "bug-light"; when filled with burning scrap it throws a weird glare over the deck during the night shift



Photograph by C. Hart Merriam

MANZANITA FOREST OF CLEAR LAKE, CALIFORNIA

The Clear Lake manzanita forests in a state of nature are almost impenetrable, but where thinned by man, they form open groves of surprising beauty. The ground is carpeted with the dry leaves and large dark red berries, while the smoothly polished trunks of deep red support an arbor-like canopy of light green foliage, through which a lattice of flickering shadows is projected to the path beneath. So great are the charm and the quiet restfulness of these Clear Lake forests that one is tempted to return to them again and again

The Giant Manzanitas of Clear Lake, California

By C. HART MERRIAM

IN the warmer parts of California hundreds of square miles of hill slopes are densely covered with a continuous mass of rigid bushes or brush of many species, usually wind-trimmed to a common height, and collectively known as "chaparral." The component shrubs vary locally, but as a rule consist mainly of species of wild lilac (*Ceanothus*), manzanita (*Arctostaphylos*), chemisal (*Adenostoma*), serub oak (*Quercus*), buckthorn (*Rhamnus*), and toyon or Christmas berry (*Heteromeles*), with representatives of many other genera.¹

Of these, the manzanitas, because of their smooth red branches and in some cases also because of the pale color of the foliage, stand out most conspicuously. In dense chaparral they conform in height to the associated species (say four to six feet), but in more open situations they grow in compact clumps ten to twelve or even fifteen feet in height. This is particularly true of the green-leaf species known as *Arctostaphylos manzanita*, which often becomes the dominant social type over areas of considerable extent.

In places along the west flank of the Sierra Nevada, on certain slopes of Mt. St. Helena and Mt. Konokti in Lake County, in the upper valley of Russian River, and in a few other localities, the manzanitas attain still larger size, while on flat ground on the west side of Clear Lake near its junction with Upper Lake,² they reach their highest development, forming a veritable forest about

twenty-five feet in height, although many of the slanting limbs measure thirty feet, with hundreds of trunks whose diameters exceed a foot and some that attain the extraordinary thickness of upward of two feet.

Owing to the closeness of stand of the individual trees and the persistence and rigidity of the dead trunks and branches, this wonderful forest in a state of nature is almost impenetrable, but where thinned by man it is converted into an open grove of surprising beauty. The ground beneath is carpeted with the old dry leaves and large dark red berries, while the smoothly polished trunks of deep red, suggesting the madrones of the coast belt, support an arbor-like canopy of light yellow-green foliage which overarches the paths and roadways with a lattice of flickering shadows, affording welcome protection from the hot summer sun.

There are dwarf forests in other places—some on the coast, some in the interior, some on the bleak summits of lofty mountains, some on the warm bottoms of fertile valleys, but none like the manzanita forests of Clear Lake. The others attract the attention because of their stunted size; the Clear Lake manzanitas because of their large size—large in contrast with the usual bushy form characteristic of manzanitas elsewhere. But the effect is the same, both types resulting in dwarf forests whose branches and foliage form a canopy low down over our heads. In both cases there is a something about them—an intangible something—that makes them peculiarly attractive. Is it their rarity and unfamiliar aspect? Or is it the fact that they are nearer our own size, bringing us in closer touch with their

¹ Among the other genera of rather widespread distribution are *Cercocarpus*, *Eriodictyon*, *Dendromecon*, *Xylothemia*, *Lonicera*, *Lupinus*, *Diplacus*, *Chrysona*, *Hosackia*, *Baccharis*, *Garrya*, *Rhus*, *Ramona*, and *Sphaeola*.

² Particularly on the ranches of R. S. Rodman and Dr. W. Barclay Stephens.



Photographs by C. Hart Merriam

The light green of the low manzanita forest on the edge of the clearing contrasts with the background of black oaks

One of the largest Clear Lake manzanitas; it has a spread of nearly forty feet



Photograph by Dr. W. B. Stephens

A GIANT MANZANITA

On the flat ground on the west side of Clear Lake, near its junction with Upper Lake, manzanitas form veritable forests averaging twenty-five feet in height and with trunks often attaining a thickness of upward of two feet

branches and foliage? Be this as it may, they always stimulate the imagination, giving rise to feelings one does not experience elsewhere. And as they differ widely in geographic position, climatic surroundings, and component species, so they invite different emotions and call up different thoughts. Thus the groves of dwarf live oaks on the steep wind-swept slopes of some of the coast ranges of California, and the low forests of mountain buckeye on Roan Mountain in Tennessee and North Carolina, both bathed in driving fogs and heavily draped with lichens, present weird fantastic shapes that appeal strongly to the imagination; the timber line tongues of dwarf whitebark

pinus and alpine hemlocks that clothe the upper reaches of many of the higher mountains of the West, produce a sense of exhilaration and rugged vigor; the stunted forests of piñon, juniper, and mountain mahogany of the elevated borders of some of our western deserts prompt many a traveler to seek them for the night's camping place: while in the warm balmy atmosphere of the beautiful valley of Clear Lake, the manzanita forests have a peculiar charm, their glowing red trunks, light overhead foliage, and rich carpet of dark red berries creating a warmth and depth of color and a feeling of quiet restfulness that tempt one to return again and again.



Photograph by C. Hart Merriam

Two species of manzanita (*A. canescens* and *A. stanfordiana*) against a sparsely wooded hill slope in the mountains north of Clear Lake

"Back to Nature" Scientifically as Well as Emotionally

THE CASE FOR MORE FIELD WORK IN BIOLOGY¹

By W. M. E. RITTER

Director of Scripps Institution for Biological Research of the University of California

I WISH to set before you some of the grounds of my conviction that the future's progress in the biological sciences will be accomplished by a far closer, more vital interdependence between researches out in nature and researches in the laboratory; between data gathered in the field and those secured in the laboratory either by observation alone or by observation coupled with experimentation. The "natural history mode of philosophizing" will have to be taken far more seriously, I am persuaded, in years soon to come, than it is now.²

Laboratory learning when uncoupled with field work is very defective in the development of the powers of observation. For example, laboratory teaching rarely if ever even pretends to make use of the sense of hearing for acquiring an understanding of animals. Yet the whole province of sound presented by numerous mammals, most birds, and many insects is open to cultivation and contains much that is highly educative and pleasure-yielding, and, furthermore, is the vestibule to biological problems of great interest.

Again the sense of smell, so well-nigh completely neglected as an avenue through which knowledge of plants and

² Having taken a leading part in bringing into existence two biological laboratories, one at Berkeley, a teaching laboratory primarily, another at La Jolla, a research laboratory primarily, I hardly can be charged with inexperience of the methods and scope and possibilities of such laboratories either as instruments of research or of teaching. I yield to no one in appreciation of laboratory work, not only for the magnificent things already accomplished by it, but for the greater things yet to be accomplished by the same means. But in the face of this, I express, very deliberately, the conviction that exclusive reliance on laboratory and experimental methods has gone so far in biology as to work great harm to the biological thought of our day, not alone among professional biologists, but also on the part of the general public.

animals may be obtained, is in reality full of possibilities for penetrating into some of the most recondite provinces of life phenomena. For instance, our noses brought systematically to bear on the odors of flowers would constitute a method of qualitative chemical analysis, as one might call it, for determining some aspects of the chemistry of plants the delicacy of which cannot be approached by ordinary chemistry. Chemical natural history ought to and undoubtedly will sooner or later address itself seriously to odors in both zoölogy and botany, for it is an open and beckoning door to the fundamental problem of chemical distinctions of species. Considerable attention to the matter has convinced me that very many blossoms usually accounted odorless are not really so, and that in the greater number of cases each species is distinguishable from every other by its odor. Something of the meaning of this as touching species differentiation in chemical substances and processes is readily perceived when one remembers that according to present views the sense of smell is a chemical sense, responding to chemical stimuli.

Even the cultivation of the sense of sight, depended upon virtually alone in laboratory observation, is exceedingly lopsided. Alertness of sight is encouraged hardly at all. The complete passivity of the anatomical preparation fosters deliberateness and slowness and inclines toward sluggishness and finally dullness of seeing; nor is the set-up and controlled physiological experiment much if any better in this respect.

How different the attitude of the lab-

¹ Extracts from an address given before the California Academy of Sciences, San Francisco

oratory student and that of the field student occupied with, let us say, the breeding habits of any one of the many species of birds which can be studied only in nature! The field student, in the midst of a complex of phenomena which he has not set up, and cannot control in any degree, is under the necessity of being ready all the time to catch whatever particular element in the complex may turn up at any instant. Readiness and quickness and sensitiveness are observational qualities of primary importance for him while they are of little importance to the laboratory student.

Nor is the defectiveness in laboratory training as compared with field training restricted to the sensory side of the knowledge-getting process. Students trained exclusively in the laboratory face nature in the open not only with ears and eyes unpracticed and dulled, but with minds and imaginations similarly impaired.

But the lopsided result from the exclusively laboratory method comes also from the sole reliance on what is known as the "type method" in botanical, zoölogical, and physiological instruction. Elementary instruction in zoölogy too often encourages the conception that the animal types studied in the laboratory, namely, amoeba, paramecium, hydra, starfish, earthworm, crayfish, shark, frog, pigeon, and rabbit—traditions in laboratory instruction—are fundamental, and that all else is more or less incidental and of secondary importance; as though the foundation of a mansion were so solid and durable and important as to make a superstructure unnecessary. The actual animal world consists of individual living animals first, foremost, and always; and any scheme of instruction which does not take due cognizance of this fact leads inevitably to conceptions of that world which are narrow, distorted, and predominantly false. . . .

Using the building figure, the point

to be decided is: given a small amount of money to be expended on a dwelling, which would be better, to spend it on a good basement even though there should be no funds for erecting the superstructure: or to build as much of a house as possible with the money available, although both foundation and superstructure must be small and cheap? Education in the biological sciences has been largely a process of digging cellars, walling them in strongly, and then living in them.

The biology which we have been calling foundational but which more truly would be called basement or cellar biology, has served the ends of sanitation, medicine, agriculture, and other physical interests well, and to this extent has been very useful and noble. But as superstructural biology, as biology for the liberal education of our young people, for the enlargement of their outlook upon life, particularly upon human life, it has achieved only a dismally small measure of the success possible to it. But there is a way out, as I see it, from our unfortunate condition: and institutions of the type of this one.¹ it appears to me, are likely to play a large part in the renovation of this province of natural knowledge.

Let me call your attention to an almost unbelievable thing which has happened during what may well be called biology's period of laboratory incarceration. A large number of biologists have actually held the view, apparently with sincerity, that nothing of primary importance about organic nature can be learned except in the laboratory and by experimentation. The old anthropocentrism which conceived everything outside of man to have been created for his especial benefit, has been replaced by a new anthropocentrism according to which man would subject all nature to his control. . . . What makes this particularly amazing has been the fail-

¹ Museum of the California Academy of Sciences, San Francisco, California.

ure to see its implications as touching the other descriptive sciences. That living nature is in essentially the same case with geology, and physical geography, and meteorology is obvious. Where would these sciences be today had their leading investigators depreciated field work and insisted that the method of inference based on laboratory experiments would yield all the understanding needed for strictly scientific purposes about the earth and the atmosphere? . . .

There have been counteracting influences fortunately in such undertakings as the great oceanic and continental exploring expeditions and the “surveys” prosecuted by our national and state governments. Probably the most potent compensatory influence in our country has been the work in agriculture carried on by the nation and the several states. The vast importance of this for the material welfare of the people is sufficiently recognized; but its importance to biological science *as such* is understood not half well enough. What I wish to bring out particularly does not concern the enrichment of botanical and zoölogical knowledge, greatly important as I regard this, but rather the enlarging and liberalizing influence on the public mind generally. It seems to me probable that the total educative value in natural science of the national and state agricultural departments, including the experiment stations and the agricultural colleges, is greater than that of all other school and university effort combined.

I can do no more than refer in the briefest way to the larger, the philosophic effect of the influence of agricultural enlightenment on man’s understanding of his own dependence upon nature. Innumerable peoples in all ages and countries prior to the development of agriculture *as science* have conceived the organic products with which their lives have been inseparably identified to be dependent upon supernatu-

ral or unnatural agencies of one kind and another. The transformation that has taken place and is taking place (for it is far from complete) in ideas and beliefs because of the demonstrations of nature’s ways and laws here is of truly enormous importance. It touches vitally the whole gamut of human life, esthetic, philosophic, and religious, no less than hygienic, economic, sociologic, and political.

And consider a trifle more fully another aspect of the same matter; that, namely, of the problem of overpopulation. With advance in civilization, entailing as it must man’s ever-growing reflectiveness on the conditions of his race’s continued existence and progress on this earth, questions of the competency of the lands and the waters to support the ever-increasing populations inevitably press more and more upon him. Now, beyond all question, of all agencies which may be invoked against this cloud on our mental horizon the most potent is scientific agriculture. Civilization seems to carry with it the termination of its own progress unless science be invoked speedily against this result. . . .

Remedial measures all along the line—philosophical, investigational, and educational—are demanded. My efforts toward building a research institution for studying nature with all the rigor of modern methods instead of with only such fragments of it as can be brought into the laboratory, testify to the great importance I attach to the first and second of these. In the third we are confronted with very difficult questions, especially in elementary education. . . .

The difficulties, however, are not insurmountable. The main thing for a beginning is a conviction of the importance of what is aimed at. Let the leaders in biological thought and research once become convinced that field work is as fundamental to life-science as a whole as similar work in geology and the other sciences of the earth is to

earth-science as a whole, and the proper training of investigators will come about promptly and with no great difficulty.

The relation of floras and faunas to latitude, and to elevation above sea level on land and depth below it in the ocean, presents as fundamental problems to biology as stratification and the topographic character of a region present to geology, and it is as absurd to think of solving the one class of problems as the other by laboratory experiment, prosecuted without any serious study of the phenomena themselves. Geologists would not be recognized as geologists at all if they had received no other than laboratory training, while training in the laboratory is held to be all that botanists and zoölogists need. . . .

Let the molders of public opinion in the chief subjects usually called humanistic—history, sociology, economics, politics, ethics, religion, once come to see how fundamentally soundness of view and healthfulness of life in all these domains are dependent upon correct elementary information about nature, and innumerable students of educational problems, teachers, and public-spirited and philanthropic persons will concentrate their thought and ingenuity upon surmounting the practical

difficulties in the way of securing the contact with nature which is indispensable to such information and attitude.

The only specific expression as to procedure which I now make is such as concerns the part which it seems to me institutions like this ought to play in the educational reformation demanded by the times. The greatly extended elementary education in living nature which it is to be hoped the future will see, will be accomplished through a judicious working together of parents, schools, botanical and zoological gardens, city parks, aquaria, and particularly endowed foundations, which, like this California Academy of Sciences, combine researches on the natural history aspects of biology with public museums. Underpinned by a clear perception on the part of a much larger proportion of scientific men themselves, of educators, and of leaders of opinion as to what it all means, such educational undertakings as those by the American Museum of Natural History in New York City¹ and the Field Museum of Natural History in Chicago have possibilities for good that are simply incalculable—and it is with the utmost satisfaction that I witness the splendid beginning in the same direction being made for San Francisco by the California Academy of Sciences.

¹ In connection with this paper by Dr. Ritter, we would recall that the American Museum has for many years conducted field expeditions on a large scale in this country and other countries, and bases the greater part of its laboratory researches directly upon its field researches. Also large educational work in connection with the secondary and high schools of New York City was begun by the American Museum a considerable number of years ago. This work has been further organized and expanded under the personal administration of Mr. George H. Sherwood into a most efficient system of lectures and class instruction at the Museum, and classroom study in the schools on loaned sets of birds and many other kinds of specimens. In addition, the Museum has had the policy of constructing permanent exhibits, like the bird and reptile groups, which show animals in their home environment, setting forth their life history, and their relations to food and enemies as in nature. Thus, for the schools of the congested parts of New York City, the American Museum has come to serve as both "laboratory" and "field." Institutions of this type have a great work before them for the future, in that they stand peculiarly and particularly as interpreters between the scientific workers of the country and the people.

That field work has not been always highly rated in the past is partly explained by the fact that biology is just coming out of the period when laboratory work was so exalted by its merit as a method that any other method was undervalued by contrast. This sort of thing is always to be expected because of the method of development of science. Growth of biological science, for instance, from the beginning through the centuries, has come about by the exploration step by step of a vast unknown province of knowledge. At any given moment in its history we should be certain to find that scientists are putting the emphasis unduly on some partial phase of the work or some temporary method. Progress, however, comes only by specialization: because of the briefness of any man's life, if he is to accomplish anything worth bequeathing to science, he must specialize, and leave to the men in the generations after him the task of fitting his contribution into its place in the developing body of knowledge. It is by these side branches of profoundly serious, accurate, although not fully comprehensive investigation that the main line of advance is assured.

The point of Dr. Ritter's paper cannot be emphasized too often or too strongly,—that for the sake of knowledge, training, and liberalizing influence, increased amounts of field work should be combined with the classroom and laboratory work in all elementary courses for the study of plant and animal life.—THE EDITOR.

A Glimpse into the Quichua Country of Southern Bolivia

By LEO E. MILLER

Leader of the American Museum's South American Expedition, 1915-1916

THE boundaries of the Inca Empire had gradually been extended until within five hundred years after the arrival of Manco Capac and Mama Occlo, supposed Children of the Sun, it covered nearly one third of the South American continent. Near the middle of the sixteenth century, when Pizarro and his insatiable band invaded the sacred precincts of Atahualpa's dominion, the star of the Inca seemed to have reached the apex of its ascendancy. Under the beneficent rule of their venerated sovereign, the several tribes lived contentedly, if not always peacefully; agriculture thrived; arts and crafts were encouraged; and, responsive to the efforts of many thousands of laborers, numerous mines poured a constant stream of precious metals into the kingdom, adding to its wealth and splendor.

We are all familiar with accounts of the advanced state of civilization, governmental organization, and fabulous riches of the ancient nation. Temples,

palaces, and forts—stately edifices of hewn stone—dotted the mountain-sides and crowned the eminences; beautifully constructed highways connected many of the remote districts with the capital; countless herds of llamas fed on the slopes, and streams of water, flowing through a system of aqueducts, poured into the heretofore arid wastes, and transformed them into fruitful fields capable of supporting a numerous population. The present-day republics of Ecuador, Peru, and Bolivia, as well as



Quichuas of the large towns, who have come into contact with the Bolivians, no longer wear the original native costume (see page 412). Their highly varnished straw hats, for instance, are a radical change from the skin headgear of the highlands. They have not, however, lost their habits of thrift, and trudge along the roads spinning industriously

a part of Colombia and Chile, were included within the limits of the vast empire.

Suddenly a dark cloud appeared on the horizon and omens of evil import

presaged the downfall of all this greatness and splendor. The fatal apparition quickly assumed the form of bearded strangers, some of whom were mounted on terrible beasts which filled the ranks of the Indian warriors with panic, and who seemed to have succeeded in harnessing the lightning and thunder for the furtherance of their wicked designs. Suffice it to say that before the avarice of the Spaniards had been abated, eight million subjects of the Inca perished and the organization of the nation was destroyed. With the single exception of the Aztecs of Mexico, who were practically exterminated by the same people, there has never been another example of such rapid and complete devastation in the history of the world.

The Quichua of today is a cowed, almost pathetic individual: he has been kicked about by the descendants of the *conquistadores* until he has learned to become reconciled to his lot: but while it seems as if this resignation might, in many instances at least, give way to despair, such is not the case.

During the year 1916, the writer and his companion, Mr. Howarth S. Boyle, spent a number of months in the highlands of Bolivia; and while engaged, primarily, in zoölogical researches, it was impossible not to take cognizance of the Indians populating the higher valleys and table-lands.

The high plateau of Bolivia is naturally arid; but the Quichuas are masters in the art of husbanding the scant supply of water coming from the melting snows of the high Andean peaks, and thus irrigate extensive areas for cultivation. In most instances the dwellings of the Indians are scattered about some distance apart in sheltered little valleys, and the fields lie on the slopes higher up; to these fields the men, and

often the women also, go each day to work, while the children care for the flocks of sheep which nibble on the sparse vegetation growing in the waste places. The density of the population is surprising; the number of individuals to the square mile is greater than that in the hot, tropical lowlands.

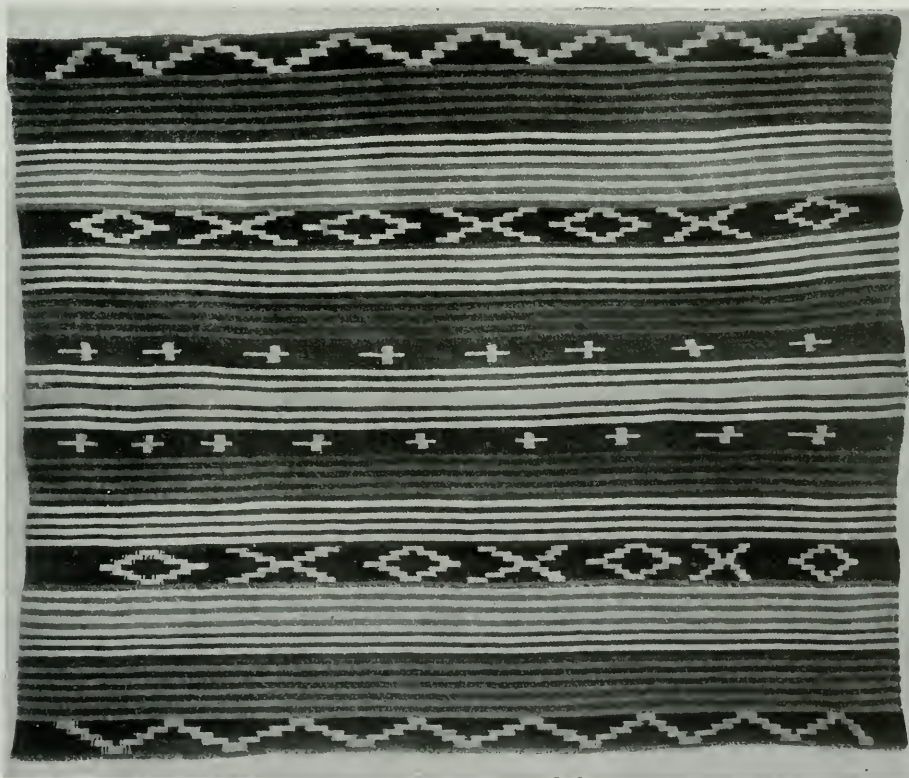
Ignoring the fact that Indians comprise the larger part of the inhabitants of practically every Bolivian town and city, there are nevertheless many strictly Indian settlements, some of considerable size; these consist of rows of low houses crudely built of stones or of blocks of adobe: the roofs are of grass thatch, or, where this is not available, of a mixture of earth and chopped straw covered with pebbles. Little shops are scattered here and there, but usually the variety of articles offered for sale is small. *Chicha*, or corn beer, however, is to be had almost everywhere, and even after the traveler in this country is aware of the process of its manufacture, he is invariably glad to stop at some small wayside hut where a white rag fluttering from a tall pole announces to the passerby that the national refreshment is for sale within.

At least one day of each week is set aside as market day. The Indians then come from far and near, driving a few burros or llamas, or carrying packs on their backs. They bring beans, oats, potatoes, milk, cheese, and many other products: also apricots, strawberries, and flowers. Arrived at the place, each woman squats on the ground and spreads her wares out in front of her, waiting for customers. Apparently this is a most enjoyable procedure; for, if stopped on the way to market, she invariably refuses to sell anything, even though it might save her a long walk and relieve her of a heavy burden.

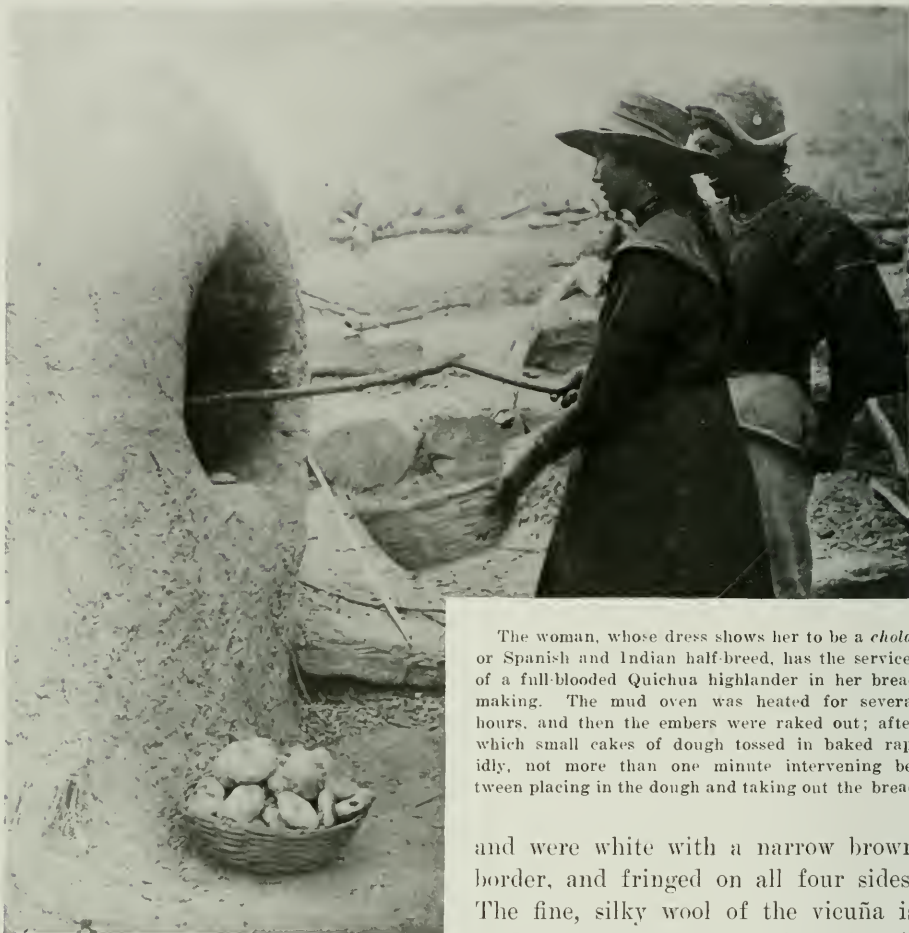
Among the things that appealed to



Quichua farmers raise sheep, cattle, and pigs instead of the llamas of olden times. They keep their cattle from straying by means of fences of mud, there being a great scarcity of timber



In the olden time when subjects of the Inca rulers were called together from widespread parts of the kingdom to enjoy a feast, they were expected to wear as a means of identification, blankets woven at their native place in a certain pattern and coloring. These patterns have persisted until the present, blankets of various localities differing widely from one another. This specimen (5 ft. 8 in. by 4 ft. 7 in.), from Cghilka near Sucre, is woven in green, red, orange, pink, and white



The woman, whose dress shows her to be a *chola*, or Spanish and Indian half-breed, has the services of a full-blooded Quichua highlander in her bread making. The mud oven was heated for several hours, and then the embers were raked out; after which small cakes of dough tossed in baked rapidly, not more than one minute intervening between placing in the dough and taking out the bread

us most strongly were the beautiful blankets which were sometimes offered for sale. It seemed as if these differed in each locality, conforming perhaps to a custom of bygone days. The blankets we saw near Totorá were of coarse weave, very heavy, and with wide stripes of subdued colors merging into each other and giving a pleasing rainbow effect. At Sucre the stripes were very narrow and of many brilliant colors, and in one restricted locality beautiful geometric designs added greatly to the attractiveness of the pattern. In the vicinity of La Quiaca on the Argentine frontier, most of the blankets were made of llama's wool,

and were white with a narrow brown border, and fringed on all four sides. The fine, silky wool of the vicuña is made into squares or ponchos of such close texture that they are practically impermeable to rain; they are greatly esteemed by their owners, who will part with them only for an exorbitant sum.

When market day is over, and all the produce from the uplands has been sold, the greater part of the proceeds is spent for coca leaves from the lower country. The Indians then abandon themselves to a night of singing, dancing, and drinking. The song always begins in a very high key, and the shrill, penetrating voices of the women rise clear and piercing above the low drone of the men. There is only one tune, as far as I could discover, and an interminable number of verses are sung to

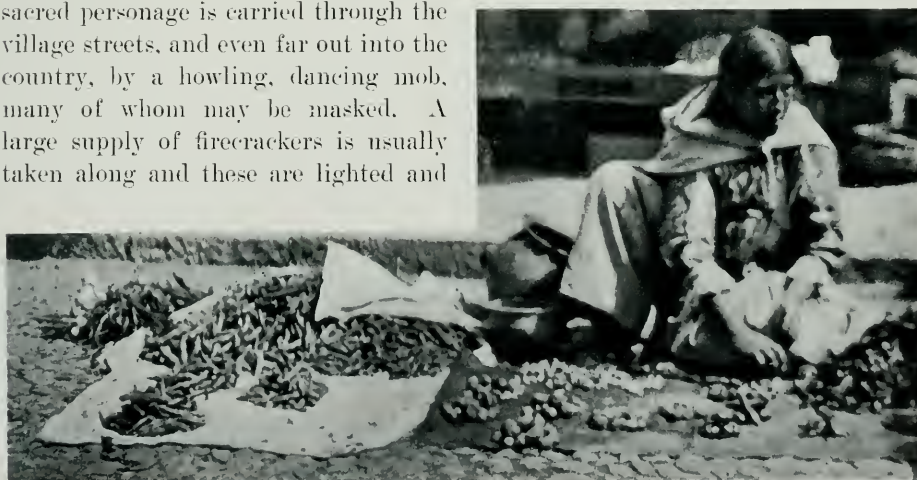


The vender of coca leaves squats close to her supply of the drug with her scales at hand, eyeing prospective customers and looking forward to the haggling that is sure to ensue. The Quichuas consume enormous quantities of this drug, and use vast areas in the cultivation of the plant

it. Upon reaching a certain point in each stanza, all the singers clap their hands in time with the music and keep it up until the end of the refrain.

The Quichuas enjoy few events so thoroughly as a religious festival. Should the celebration be in honor of some favorite saint, the image of the sacred personage is carried through the village streets, and even far out into the country, by a howling, dancing mob, many of whom may be masked. A large supply of firecrackers is usually taken along and these are lighted and

thrown into the air to explode about the saint's head. We frequently met the fanatical processions on the otherwise deserted trails, and it was always difficult to prevent our entire pack train from bolting down the steep mountain-side, and to protect ourselves



A common market scene. The women squat on the ground, spread out their store of beans, potatoes, or other produce, in neat little piles of five centavos' worth apiece, and wait for customers. In weighing their wares, they use a balance with a small stone as a unit of measure

from the shower of rockets and exploding missiles. The band halts at each hovel for a drink of *chicha*, and then continues along the dusty way.

In the vicinity of Cochabamba the Quichuas are rather civilized, comparatively speaking, owing to their



Quichua woman from the Upper Pilcomayo, who daily carried goat's milk to the expedition's camp. The front of her loose dress is tucked up for the walk down the mountain. Her shawl is fastened with spoon-shaped pins, the only jewelry common in the Quichua country

constant association with the Bolivians. As one goes farther toward the south, however, a marked change is noticeable. This reaches its climax in the regions bordering the Upper Pilcomayo.

On one of our excursions we left the expedition's base at Sucre, and following the Potosí road for a distance of thirty miles, made camp on the river bank. The bed of the Pilcomayo is several hundred feet wide at this point, and is spanned by a suspension bridge anchored at each end to picturesque towers. At the time of our visit the water was very low; the shallow, muddy stream, wending a sinuous course through the rock-strewn floor of the valley, was not more than fifty feet across. I could not fail to be impressed with the difference in character of the river in the upper and the lower stretches of its course. Here it was hemmed in by towering peaks of rock upon which such a light growth of vegetation obtains a foothold that it can support only a few flocks of goats, and these find great difficulty in eking out a bare existence; lower down, it sweeps through the steaming *pantanales* of the Gran Chaco, and finally enters the Paraguay almost opposite to the city of Asunción, a majestic, awe-inspiring river.

As frequently occurs in semi-arid country, birds were very abundant; but there was little else to indicate the close proximity of other forms of life, unless one took into account the herds of goats clambering about on the ledges and seeming to delight in bombarding every one who passed below with showers of small stones; or the caravans of burros and llamas passing along on the broad highway. A visit to the top of one of the neighboring mountains, however, revealed a different story. Patches of green dotted the

isolated little depressions to which the name "valleys" can hardly be given, and thin pillars of smoke ascended from them straight into the cloudless sky. After long and patient looking a small, stone hut set among rocks would invariably be discovered, and sometimes we could even distinguish minute, moving forms which we knew were Indians. There, tucked away between the towering peaks they love so well, they were living a life of peace and plenty, apparently unmolested, and caring little about the existence of the outer world. It was as if one tore a page from the history of bygone centuries, or found himself suddenly transferred into the midst of a contented, pastoral community such as must have existed throughout the vast empire before its despoliation by the gold-crazed invaders.

These Indians seldom come down into the lower country; their partiality for the high *puna* is well known—some of the ancient dwellings having been discovered at an elevation of more than seventeen thousand feet—and they are doubtless happier in their almost inaccessible fastnesses than if they lived nearer to their Bolivian neighbors.

In appearance and dress these Indians differ greatly from the other members of the tribe living in the more populous sections of the country. Instead of the more or less conventional attire adopted by the latter, they still adhere to a form of dress at least a part of which may date back to the days of Atahualpa. The women wear a quantity of clothing—short, full skirts of dark blue, and shawls of varied colors. The men are garbed in loose, white knee breeches, a gray or blue shirt, and belts which are neatly embroidered in gay colors and are very wide at the back so that they form a kind of sash; also they wear the inevitable



Quichua man from the Upper Pilcomayo, wearing a typical native costume: helmet-like hat of skin, blouse woven in a peculiar Indian pattern, wide loose trousers of coarse cloth, and sandals. His hair is braided in a long queue

poncho, a large square of heavy cloth with a hole in the center through which the head is thrust. Strange as it may seem, the small children always wear very long clothing, and the little girls waddling along in their full, almost

trailing skirts resemble dwarfed, aged women. All the wearing apparel is made of woolen cloth of home manufacture. The men permit their hair to grow long and braid it in a queue which hangs down the back. Both sexes wear peculiar little hats made of some kind of skin prepared by a process which renders it very hard: these hats reminded us of steel helmets. With the exception of huge, spoon-shaped pins of copper, which the women used

to fasten their shawls, we saw no ornaments of metal, nor jewelry of any kind.

The home life of these Indians is tranquil and uneventful. Usually the little stone huts contain two or three rooms: potatoes and other produce are stored in one of them, and the rest are used for cooking and sleeping quarters. In very cold weather a fire is kept burning day and night and all the occupants of a house burrow into piles of sheep skins and blankets close to the smouldering embers.

We persuaded one of the women to bring goat's milk to camp each morning, but to do this we had the greatest difficulty. Only by payment for a week's supply in advance could she be induced to perform this service. From past experiences with his fellow countrymen, the Quichua has learned to regard all strangers with apprehension. On frequent occasions we had the opportunity of observing how the average *paisano* treats the Indian. Should night overtake him on the trail, he stops at the nearest hovel and demands food and shelter for himself and his animals. In the event that the owner has nothing to offer, he draws his rifle or revolver and shoots any fowls that may be running about, or lacking these, a sheep or goat, and seizes whatever else he can find. Should he see an attractive blanket, it is also taken. In the morning a few *centavos* are thrown on the ground and he continues on his journey.

As a rule we found that if the Indians were treated in a frank, honest manner, they were most amiable. The little woman we had engaged to bring us milk trudged down from the mountain-top daily in faithful compliance with her obligation. She brought cheese also, and occasionally a few eggs. As it gradually dawned upon her that



The *piscomanchachi* is one of the official bird killers of the Quichuas. Armed with a sling, he spends the days in field and orchard, keeping up a continuous fusillade upon the birds which come to feed on fruit or grain. Posing for the camera was a new and mysterious experience for this lad

we were to be trusted, she became talkative and seemed to take an interest in our occupation. She spoke Quichua only, in common with the entire tribe, who make no attempt to learn Spanish; or if they are able to understand it, will make no effort to speak it.

Upon seeing a number of woodpeckers which we had collected, she expressed a great deal of satisfaction: for, according to the Indians' belief, if a pair of these birds makes a nest near one of their houses, a member of the family will die within a short time. The ovenbirds (*Furnarius*) are looked upon with favor and are encouraged to remain in the vicinity of the dwellings. Should a pair of the cheery singers place their huge, domed nest of mud near by, good fortune will follow in their wake; the abandoned nest is used in making poultices which are said to be a certain cure for a variety of ailments.

Any one guilty of robbing a bird's nest will, it is supposed, become violently ill; but as birds flock to the plantations in such great bands that an appreciable amount of damage is done to the fruit and ripening grain, their increase in numbers is discouraged by filling many nests with small stones. After the seeds have been planted, a network of strings is stretched across the fields, and a dead hawk suspended from a post in the center serves as a scarecrow to frighten away the marauding visitors. When the crops ripen, a small boy called the *piscomanchachi* is stationed in each plantation. He is armed with a sling and keeps up an incessant fusillade of stones; fortunately his aim is poor, but he succeeds in killing a few birds each day.

The Quichua of today leads a sedentary and pastoral life. His fields supply potatoes which are turned into

chuño by simply allowing them to freeze and dry. From the wheat which he has learned to cultivate, a splendid quality of bread is made. His flocks provide flesh and milk, and the wool so essential to his well-being in the high altitudes; and the *tola* bushes and peaty growth known as *yareta* furnish an adequate supply of fuel. The demands of civilization, however, will alter his mode of existence until little will remain to remind us of the contented nation which at one time willingly bowed to the beneficent rule of the Children of the Sun.



Cases of scientific specimens on one stage of their long journey from Bolivia to the American Museum in New York. The three boxes weighed nearly two hundred pounds, but the Indian carried them without difficulty.



EXTINCT GIANT BIRD OF WYOMING, CONTEMPORARY OF THE FOUR-TOED HORSE

Restoration of the *Dinornis*, the skeleton of which was the most important discovery made by field parties of the American Museum's department of vertebrate paleontology in the summer of 1916. This bird was much larger than an ostrich, although not so tall, with a huge head and very powerful beak. It was found in the Lower Eocene of Wyoming by Mr. William Stern. Restoration by Mr. Erwin S. Christman

A Giant Eocene Bird

By W. D. MATTHEW and WALTER GRANGER

IT is not often that a really important fossil discovery is due to sheer good luck. Generally speaking it is the result of a prolonged and arduous search in a formation which earlier reconnaissances had shown to promise good results. Sometimes it is found early in the campaign, more often after a long series of disappointments or partial successes that try the patience of the collector. Time and again he discovers fragments—teeth or jaws or parts of the skeleton—that buoy up his hopes and give warrant for his expectation that sooner or later a complete specimen will come to light if the exposures hold out and he sticks stubbornly to his search. Sometimes in the end his persistence remains unrewarded; at the close of the campaign he finds himself with but a poor return for diligent work, and must seek to retrieve his reputation in some other fossil field. Once in a while fortune befriends him, and he can place to his credit some new and splendid find which had, so to speak, no right to be there.

Such a discovery, to speak frankly, was the giant bird skeleton¹ found by Mr. William Stein last summer in the Bighorn Bad Lands of Wyoming. But let no one suppose that it was a find that anybody might have made. Only a trained fossil hunter would recognize such a find if he came across it, or having recognized would know how to explore and collect it properly. Mr. Stein is an able and expert fossil collector of many years' experience.

The Bighorn basin has been a well-known fossil region since 1881 when its riches were first discovered by Dr. J. L. Wortman, at that time collecting for the late Professor Cope. In 1891 Doctor Wortman headed a fossil hunting expedition to the basin for the American Museum, and again in 1896.

¹The principal parts of the *Diatryma* skeleton have been temporarily arranged for exhibition in the case in front of the elevator on the fourth floor. It is intended later to exhibit the original specimen as a panel mount in the dinosaur hall, next the skeletons of *Hesperornis* and moa and other fossil birds. The skeleton was mostly disarticulated and scattered when found, and the bones are considerably distorted by crushing. It does not appear advisable to articulate the original specimen as an "open mount," but the bones can be cast and remodeled for this purpose.

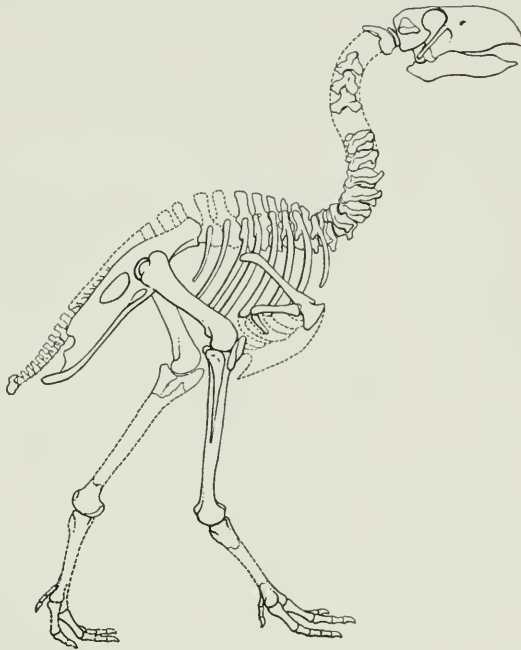
In 1904 it was explored by the Amherst party under direction of Dr. F. B. Loomis. In 1910 Mr. Granger began a thorough and systematic exploration of the basin for the American Museum, and continued it for several successive seasons. Practically every exposure of the Eocene formations had been thoroughly gone over in this search, except for two or three small areas, and the Museum collections were enriched by over one thousand specimens important enough to catalogue and record individually, besides innumerable teeth and other fragments not catalogued. Practically all these fossils were mammals, the best of them being skulls and partial skeletons. By far the most abundant fossil is the *Eohippus* or four-toed horse, and of this the best specimen is the skeleton secured by Mr. Stein, which was fairly complete. Doctor Wortman in his early explorations secured two skeletons of the *Phenacodus* which are still the finest mammal skeletons that have ever been found there; and incomplete skeletons of several other interesting animals, *Oxyaena*, *Coryphodon*, *Pachyaena*, *Vassacyon*, etc., have been found. But on the whole, skeletons are rarities in the Bighorn fauna, more so than they are in the later Eocene formations, where fossils are usually better preserved.

Fossil birds moreover are exceedingly rare in our Eocene formations. Among the thousands of specimens secured by Mr. Granger's parties only a half dozen or so belonged to birds of any kind, and of these only two represented birds of gigantic size. One consisted of two toe bones, the other a fragment from the end of the metatarsus or "cannon bone." These were duly described by Dr. Robert W. Shufeldt and referred to the same genus as a couple of equally fragmentary remnants found in 1874 by Professor Cope in New Mexico, and named by him *Diatryma gigantea*.

In order to finish the work in the Bighorn basin, Mr. Stein was directed to search the small areas left unvisited, and spent about two months last summer in completing their exploration. He secured, as we expected, a fair collection of fossil mammals, which added something to our knowledge of certain

scarce species, and was in itself worth the expense of the expedition. But he was also so fortunate as to discover a practically complete skeleton of this giant bird, which previously had been known only from the fragments above mentioned.

The skeleton is of gigantic size, equaling all but the largest of the extinct moas of New Zealand, and much exceeding any mod-



Reconstructed skeleton of *Diatryma steini*.
The missing portions are dotted

ern bird in bulk. It is also of very extraordinary and striking proportions, with a huge head and massive neck, quite unlike any existing bird, and with an enormous high compressed beak. These proportions at once suggested that it was a relative or ancestor of those extinct giant birds of South America, *Phororhachos* and its allies, which it resembles in size and general proportions and especially in the great beak. A more careful study of the skeleton led to the conclusion that in spite of this very singular resemblance it was not a relative of *Phororhachos*, although perhaps of similar habits.

The skull of *Diatryma* is about 17 inches

long, the beak $6\frac{1}{2}$ inches high and $9\frac{1}{2}$ inches long. It is very short behind the beak, the back of the skull broad and adapted for powerful jaw and neck muscles, and the jaw also is very heavy and deep. The back part of the skull is much shorter relatively to the beak than in *Phororhachos*, and the beak does not have the strong down-curving tip; the jaw is much heavier and the whole construction shows a far more powerful bill.

The vertebrae are extremely massive and comparatively short, as one might expect from the size of the skull. The shoulder-girdle is very like that of a cassowary, and the wings were reduced in about the same proportion—more than in the ostrich or rhea, but not so much as in the moa, where there is no trace of them left. The body and hind limbs had much the same general proportions as in the moas, much bulkier but not materially higher in the back than a big modern ostrich, and on account of the short neck the head was not so high.

Our *Diatryma* must have been a truly magnificent bird—much bigger than an ostrich though not so tall, and more impressive because of the huge head and thick neck.

The discovery of this skeleton, practically complete and for an Eocene fossil unusually well preserved, is one of the few really important discoveries which have been made among fossil birds. Its exact relationships and the evidence that it affords as to the evolution and phylogeny of the birds, are discussed in an article in the May, 1917, *Museum Bulletin*. It does not appear to be closely related to any other known bird, living or extinct, but, like *Phororhachos*, it belongs to the Enornithes or modernized birds, and is not related to any of the great ground birds, living or extinct, although resembling them in body and legs. Its nearest living relative appears to be the seriema of South America, which in its turn is related to the cranes.

Museum Notes

SINCE the last issue of the JOURNAL, the following persons have become members of the Museum:

Life Members, MESSRS. JAMES H. BARR and MOREAU DELANO.

Annual Members, MRS. AUGUSTINE J. WILSON, the REV. JAMES B. NIES, Ph.D., DR. H. R. HARDTMAYER and MESSRS. JAMES LANE ALLEN, LEROY V. ALLEN, T. B. DE VINNE, G. PAGENSTECHER, PHILIP B. RICE, CHAS. J. STEVENOT and EMIL WINTER.

DR. EDMUND O. HOVEY, curator of the department of geology and invertebrate palaeontology, has returned to the American Museum after an absence of two years in the Arctic with the Crocker Land Expedition, which he joined in 1915. During his residence in the north Dr. Hovey carried on a valuable series of observations on the action of glaciers and the sea ice; on the physiography of the country, particularly of the region from Cape York to Etah; and on the geology of Parkersnow Bay and the vicinity of Cape Parry. Five months and two days were consumed in the return trip from Etah to New York City, although every possible means was used to hasten the journey. Delays were due wholly to weather and war conditions. Dr. Hovey arrived in this city on the same day that the "Neptune," commanded by Captain Robert A. Bartlett, reached Sidney, Nova Scotia, bringing the remainder of the exploring party and the collections from Etah. The four hundred boxes of specimens were forwarded by rail from Sidney to New York, where they are now in process of distribution in the American Museum. They comprise a rich series of zoölogical, botanical, ornithological, ethnological, and archaeological specimens.

AT a meeting of the executive committee of the board of trustees of the American Museum held on June 20, Captain Robert A. Bartlett was made a life member of the American Museum of Natural History, in appreciation of his contributions to science through his Arctic work. Captain Bartlett has brought to a successful and speedy termination the hazardous voyage of the "Neptune," which was undertaken early in July as a third attempt to rescue the members of the

Crocker Land Expedition, so long marooned at Etah.

EXCEPT for some prospecting work in a new section of the great quarry at Agate, Nebraska, no field expeditions were undertaken this summer by the department of vertebrate palaeontology. In lieu of field work preparation and researches upon the collections were continued through the summer. A fine series of skeletons of duck-billed dinosaurs has been prepared and the specimens are being made ready for installation, to add to the exhibit of this group. Mr. Barnum Brown's recent explorations in the Cretaceous formations of Alberta and Montana have brought to light an unsuspected diversity of types among the dinosaurs belonging to this group. The common duck-billed dinosaur *Trachodon* had long been known to science, and is represented in our exhibits by the group of two skeletons and the "dinosaur mummy." Eight different genera of this group, very diverse in the shape of the skull, are represented in the skeletons and skulls now being prepared or already on exhibition.

A census of the skeletons of extinct animals in the Museum shows that there are at present on exhibition *ninety-three* original complete skeletons of fossil vertebrates exclusive of fish besides five casts of skeletons. There are in preparation or ready for mounting forty-six additional complete skeletons, besides others that have not yet been extracted from the matrix but are believed to be more or less complete. Of these 144 skeletons, 91 are extinct mammals, 40 are extinct reptiles, 10 are extinct birds, and 3 are amphibians.

MR. ROLLO BECK, who has been in charge of the Brewster-Sanford Expedition, has just returned from South America, where he has been collecting birds since the fall of 1912. Nearly eight thousand bird specimens were secured, including some rare species not previously collected. Among his many photographs, a series of the shearwater, a bird common off the coast of California and as far north as the Aleutian Islands, was taken near Cape Horn.

A NEW habitat group just placed on exhibition portrays a buck, a doe, and a fawn at

the edge of a clearing in the Adirondack forests. They stand in tall grass near a clump of alders, with a suggestion of woodlands beyond. A skillful adjustment of lighting gives the effect of fading sunset. The specimens of Virginia deer, used by the courtesy of Colonel Franklin Brandreth and Mr. Frederick Potter, were obtained by Mr. Roy C. Andrews on the preserve of these gentlemen in the Adirondacks. They were mounted by Mr. Walter Escherich. The foreground was planned and executed by Mr. Albert E. Butler, and the background, showing the locality where the animals were taken, was painted by Mr. Hobart Nichols after a sketch by Mr. Courtenay Brandreth. A description of the field work for this group was given by Mr. Andrews in the December JOURNAL, 1915. A photograph of a portion of the group is presented as the cover design for this issue of the JOURNAL.

SINCE the last issue of the JOURNAL several names have been added to the list of American Museum men in military service. The department of mammalogy and ornithology feels particularly crippled in the loss of five of its assistants, Messrs. H. E. Anthony, James P. Chapin, Ludlow Griscom, L. E. Miller, and Carlos D. Empie, all at present in the officers' training camp at Plattsburg. Mr. Russell S. Matthew awaits appointment after seven weeks of training. Mr. Howarth S. Boyle has already left for France in a Red Cross contingent, expecting to be assigned to some naval base hospital. Mr. Joseph S. McGarty is in the 71st Regiment of the National Guard.

PROFESSOR C-E. A. WINSLOW, curator of the department of public health, left New York for Russia on June 29 with the Billings Red Cross Commission. The headquarters of the Commission are at Moscow.

THE value to the country of the corn crop is being emphasized in the food exhibit in the foyer of the Museum by presenting scores of ways in which this chief of American cereals may be used in the home. The Corn Products Refining Company has presented to the Museum twenty-two products made from corn. Among these are various starches used for jellies, puddings, pie filling, and sauces; the syrups and sugars for confectionery, preserves, jams, and jellies; and the oils used

for general cooking, pastry, and salads. Great quantities of gluten and oil cake, besides corn meal, are used for feeding cattle, thus indirectly contributing to our food supply. Aside from their food value, corn products have a large place in the arts and industries. From corn oil are made leather, rubber, paints, and varnishes; the starches are used for laundry purposes, for "sizes" in textile and paper industries, and for soaps and adhesives; the syrups and sugars are used in tanning, in shoe polishes, hair tonics, chewing tobacco, and in the manufacture of lactic acid and vinegar.

AN attractive addition to the food exhibit in the foyer of the Museum has been donated by Mr. M. J. Roth, of the Plastic Art Novelty and Specialty Company, New York, in the form of 74 models of 100-calorie portions of food. The models were made by Mr. Christian Jaeger.

A REVISED and popular edition of the handbook issued in connection with the Food and Health Exhibit has been brought out under the title *Health in War and Peace* and has been placed on the news stands for distribution at a nominal price. It is designed to acquaint the soldier, and also the general public, with all the proper precautions against the various causes of poor health.

AN addition to the handbook series of the American Museum is *Ancient Civilizations of Mexico and Central America*, by Herbert J. Spinden, assistant curator of anthropology. As stated in the preface, the book is intended as a general commentary on the history of the Indians of Mexico and Central America, and an explanation of the more important phases of their ancient life and arts. The book covers 238 pages and contains 44 plates and 222 text figures.

MR. RUSSELL J. COLES, who has recently returned from a ten weeks' motor boat cruise off the coast of North Carolina, spoke in the Board Room of the American Museum on September 1, before Colonel Theodore Roosevelt, Dr. F. S. Luther, president of Trinity College, Hartford, Conn., Dr. F. A. Lucas, director of the American Museum, and others interested in food conservation, on the

subject of the high nutritive value of sharks, rays, and other varieties of fish not hitherto consumed by man on account of long standing prejudice against them. Mr. Coles made exhaustive tests of the dietary uses of many kinds of fish during his cruise. He found in all eighteen species of sharks and rays which he pronounced delicious in flavor and very digestible. The average shark is not the scavenger and eater of human flesh that many believe it to be, but leads an exemplary life and is sometimes very fastidious in its choice of food, as in the case of the hammerhead shark, which subsists almost entirely on Spanish mackerel. Another variety follows the great schools of sting rays, which are themselves excellent food. The results of these experiments were sent to the United States Bureau of Fisheries, Washington, D. C., together with samples of the fish, both salted and fresh. Through a new process for tanning, the hide of sharks can now be made into leather, an important consideration in these days when the problem of shoes for our soldiers is becoming more serious.

THE first reports on the fishes of the American Museum Congo Expedition are now in proof. These include a systematic account of the fresh-water species, in which twenty-nine new forms are described and figured. Thirteen characteristic Congo fishes are illustrated in color from sketches made in the field by Mr. Chapin. It is seldom that life colors of fishes from remote regions can be shown so authoritatively, and both artist and engraver have contributed to make this one of the most attractive features of the reports. Some very interesting structures have been discovered in the skull of *Hydrocyon*. The tooth form of that genus seems to link it with Cretaceous fish-teeth, the relationship of which up to now has been a riddle. The rich material of the Congo fish collection offers fields for morphological and other studies as yet untouched. Fossil material from twelve hundred miles inland forms the basis of an interesting short paper.

To the collection of eggs in the bird hall of the American Museum has been added that of a gigantic ostrich (*Struthiolithus chersonensis*) of the Pleistocene period. This egg was found in the province of Honan, China, in June, 1915, by a Chinese peasant who saw it protruding from the bank of the

Yellow River. The specimen is in perfect condition, the best of its kind in the world, there being but two other eggs of this fossil ostrich in existence. Of the great bird which laid the eggs not even a bone has ever been found. The shell has a capacity of more than two quarts, equal to about forty hen's eggs.

THE delicious small food fish, *Leiostomus xanthurus*, called "lafayette" near New York City, and which in occasional years like the present invades the harbors and rivers in such numbers that thousands of metropolis dwellers obtain pleasure in angling for it, belongs to the drum or weakfish family. Members of this family—among them the esteemed kingfish and big channel bass—frequent sandy shores, being especially plentiful southward, and almost without exception are good food fishes. They make grunting or croaking sounds, from which characteristic several have received their common names. Lying at anchor on a quiet evening in some southern bay, one at times hears the "wop," "wop" of a school of the big sea drum, as though they were calling to one another as they swim under the boat. The family has a single fresh-water species in the Mississippi Valley.

THE demand for the three series of public health charts illustrating "The Spread and Prevention of Communicable Disease," "Insects as Carriers of Disease," and "Bacteria and Their Work in the World," prepared by the departments of public health and public education of the American Museum, has been so great as to necessitate publication of a new edition in order to supply all the public schools of the city. The set consists of fifteen wall charts, made on heavy white paper backed by cloth and bound with tin at top and bottom. The charts are fully labeled, and in addition a booklet of information accompanies each set. These will be loaned to the schools of Greater New York without charge.

THE Nicaragua Expedition, in charge of Mr. W. DeW. Miller, assistant curator in the ornithological department, left New York February 18, arriving at Corinto on the Pacific coast of Nicaragua March 7. Mr. Ludlow Griscom accompanied the expedition as assistant. Mr. William B. Richardson, who

has lived in Nicaragua for twenty-five years, met the expedition at Corinto and remained with it throughout the trip. The various faunal regions of Nicaragua were visited, including the pine forest of the northern highlands, the tropical forest, and two volcanoes, Mombacho and El Viejo. A collection of 1170 bird skins was made. This adds about ninety species to the Nicaragua collections in the American Museum, received in former years from Mr. Richardson, and includes thirty species not heretofore recorded from Nicaragua. The American Museum now has the most complete collection of Nicaragua birds in the world.

MR. ROY C. ANDREWS reports to the American Museum that the Asiatic Zoölogical Expedition will return to New York about the end of September, bringing the largest collection of rare animals which has ever been assembled from China. Special features of the collections are the gorals and serows, strange mammals resembling the goat and the antelope. The expedition, of which Mr. Andrews is in charge, has been working in the province of Yunnan, China—in remote regions where no white man had ever been seen before the explorer and his party arrived. In Yunnan, two thousand miles have been covered on horseback and camps have been made in 107 different localities, varying from fifteen hundred to seventeen thousand feet elevation. Mrs. Andrews, who accompanied the expedition as the official photographer, has obtained natural color photographs, including views of the great gorge of the Yangtze River, which in some parts can be compared for grandeur with the Grand Cañon of North America.

DR. J. BEQUAERT has resumed his former work in the department of invertebrate zoölogy, after an absence of three months, during which he crossed the continent as a member of the Cornell Biological Expedition. This trancontinental tour was arranged by Prof. J. Chester Bradley of Cornell University, with the coöperation of Dr. A. H. Wright, for the purpose of collecting and studying the fauna and flora of the country. The expedition was unique inasmuch as it was the first attempt to use automobile transportation for a collecting trip on a large scale. The expedition left Ithaca, New York, May 24, and reached San Diego, Cali-

fornia, August 14. More than six thousand miles were covered by the three cars and the two-wheel trailer of the expedition. The party included, at its maximum, thirteen members.

DR. HERMAN K. HAEBERLIN has been appointed assistant in anthropology in the American Museum. He holds at the same time a position in the department of anthropology of Columbia University and is to act as guide to the Museum for anthropological students at Columbia and Barnard. The appointment was made through a desire to bring about a closer coöperation between anthropological instruction in the two institutions and a wider use of the wealth of illustrative material in the American Museum.

THE initial number of the *International Journal of American Linguistics*, a quarterly edited by Franz Boas and Pliny Earle Goddard, appeared in July. This journal, which is of particular importance to students of linguistics, will be devoted to the study of American aboriginal languages.

A SERIES of lectures delivered by Dr. Robert H. Lowie for the department of anthropology of the American Museum during the early part of 1917 has been published in book form under the title *Culture and Ethnology*. The object of the work is to acquaint the layman with some of the results of modern ethnological work.

IN recognition of his gifts of moving picture films covering zoölogical subjects, Mr. Raymond L. Ditmars was elected by the board of trustees as a life member of the American Museum. Mr. George B. Hopkins was made a patron for his generous contribution to the building fund.

A COMPLETE revision of the lecture courses given under the direction of the department of public education of the American Museum is planned for this season. Instead of condensing the work into the short period of six weeks according to previous practice, lectures will be given twice a week through a period extending from the middle of October to the middle of January. On Mondays the subjects will be taken from geography and natural history, on Thursdays from

United States history. The geography and natural history course will include the following: Chief Cities and Countries of the World, 5 lectures; Natural History Stories, 4 lectures; Physical Geography and Astronomy, 3 lectures. Subjects for the United States history course will be: Discoverers of the New World, 2 lectures; Old and Modern New York, 4 lectures; Colonial History, 4 lectures; Current Events, 2 lectures.

MR. ROY W. MINER, of the department of invertebrate zoölogy, spent the greater part of July and August in the marine biological laboratory at Woods Hole, Massachusetts, for the purpose of studying marine invertebrates with especial reference to procuring observations, sketches, and other data for the construction of a "sound bottom group," based upon the invertebrate fauna and sea flora of the bottom of Vineyard Sound, in the neighborhood of the Devil's Bridge, off Gay Head, Massachusetts. This is to be another unit in the series of window groups which are being installed in the Darwin hall. Mr. Miner was assisted in this work by Messrs. Shimotori, H. Mueller, and C. E. Olsen, as preparators.

A SERIES of indoor and outdoor gatherings for the purpose of discussing the conservation of New York State's natural resources, particularly the vast forests of the Adirondacks, was held at the Lake Placid Club from September 4 to 8. This "forest week" was conducted under the auspices of the New York State Forestry Association, of which Mr. Herbert S. Carpenter is president, in coöperation with the State Conservation Commission, the New York State College of Forestry at Syracuse, the forestry department at Cornell University, and the Lake Placid Club. An interesting prelude to the business of the conference was an Indian council fire on the first evening, followed by "Indian Day" with speeches by Seneca and Iroquois Indians. The afternoon sessions of the conference were devoted to field trips to places of interest in the vicinity under the direction of well-known botanists, foresters, and geologists.

THE American Museum War Relief Association in its Red Cross and Navy League branches has made a creditable showing for the three months ending August 31, as the

display in Memorial Hall attests. During this period sewers and knitters turned out 245 separate pieces, consisting of 61 surgical shirts, 55 pairs of pajamas, 12 sweaters, 16 scarfs, and 23 pairs of wristlets. An appeal made to the men of the Museum by the Soldiers' Aid Committee brought a generous response from many, and with a portion of the funds thus secured three of the soldiers from the American Museum have been supplied with small outfits of useful articles. It is the wish of the Association to keep in touch with all of the American Museum men who have been called into military service and to supply them as far as possible with things they may need.

AN important exhibit of human crania, with much information of value to students and those interested in anthropology, has been installed in the southwest wing of the Museum on the second floor, under the supervision of Mr. Louis R. Sullivan, assistant in somatology. This exhibit aims to point out some of the principal measurements and indices in which the various races of man differ from one another. The method of procedure for taking each measurement is indicated and the differences illustrated by typical skulls. One section is devoted to the descriptive features and elementary anatomy of the skull. Two charts introduced into the exhibit give a short history of craniometry and an explanation of the measuring points on the skull.

MR. HARRY WATKINS, a member of the American Museum's recent zoölogical expedition in Peru, which, in coöperation with the National Geographic Society and Yale University, made a biological reconnaissance in the Urubamba Cañon, is continuing the work of this expedition in an attempt to discover whether the divide between the Titiacacan and Amazonian drainage at La Raya exercises any influence on the distribution of bird life in that region. In prosecuting his researches from La Raya to Urubamba, he will complete the survey of the Urubamba region.

AN American Museum exhibit of international fame is the series of horse skeletons mounted by Mr. S. H. Chubb and installed in the hall of the age of man. The series at present includes the skeletons of the draught

horse at rest and in motion, the full-grown Shetland pony grazing, the Arabian stallion on the alert, and the race horse in action, all of which show a spirit and vivacity resulting from the most painstaking and exact attention to all niceties in the mechanics of bodily movement. It is now proposed to make the series more complete by the addition of the skeleton of a trotter, the distinctive American type of fast horse. In this connection Mr. Chubb recently spent three weeks at Cuba, New York, on the estate of Mr. Frederick B. Simpson, making a large series of photographic studies of the motions of "McKinney," a well-known trotting horse, which has been presented to the Museum by Mr. Simpson.

In 1904, the late Dr. Daniel Giraud Elliot published in the zoölogical series of the Field Museum of Chicago *A Check-List of the Mammals of the North American Continent, the West Indies, and the Neighboring Seas*. Shortly before his death in 1915, he prepared the manuscript for a supplement to this work, carrying the subject to about the end of the year 1914. This manuscript, submitted by his daughter, Miss Margaret H. Elliot, to the authorities of the American Museum of Natural History for publication, at her expense, has recently appeared as a Museum monograph, a volume of 192 pages, issued under the editorship of Dr. J. A. Allen.

A MONOGRAPH of 215 pages recently issued by the American Museum contains a bibliography of the scientific publications of Dr. Joel Asaph Allen. A photogravure frontispiece shows Dr. Allen as he appeared in 1855, the year in which he became associated with the Museum. The first forty-three pages of the volume are devoted to brief autobiographical remarks: the story of his boyhood days, with interesting personal experiences leading up to his life work, followed with descriptions of collecting trips taken in the period from 1865 to 1873, embracing expeditions to Brazil with Agassiz in 1865, to the Middle West in 1867, to eastern Florida in 1868, to the Great Plains and Rocky Mountains in 1871, and to the Yellowstone in 1873. The extensive bibliography which occupies the rest of the volume shows the results of his researches to have been published under 1453 titles covering: mammals, 271; birds,

966; reptiles, 5; zoögeography, 22; nomenclature, 35; biography, 134; miscellaneous, 20.

THROUGH the generosity of Mr. Ogden Mills, the Library of the Museum has been enabled to purchase additional monographs by John Gould needed for the completion of the series. The volumes included in the purchase are: *A Monograph of the Macropodidæ, or Family of Kangaroos*, 1841-2; *Supplement to the Monograph of the Trochilidæ*; *The Birds of Asia*, in seven volumes, 1850-83; *Mammals of Australia*, in three volumes, 1845-63; *A Century of Birds from the Himalaya Mountains*, 1832; and *A Monograph of the Pittidæ*, 1880-81. The volumes are handsomely illustrated with many hand-colored plates. They form a valuable addition to the resources of the Library, inasmuch as they are now exceedingly rare.

A REMARKABLE mummy, which was discovered in 1903 in an ancient cliff dwelling in the Tularosa Mountains of western New Mexico, has recently come into the possession of the department of anthropology of the American Museum, presented by Dr. S. M. Strong, now of the Medical Corps of the United States Army at Atlanta, Georgia. The cliff dwelling from which the mummy was taken was situated in a cave some two hundred feet above the bed of a cañon. The finder dug down into this cave to a depth of about nine feet, through six feet of loose débris above three different house floors, denoting successive periods of occupation. Under the third floor he came upon the body, which was in almost perfect condition, lying with head to the east and hands crossed upon the breast, the thighs bent upon the abdomen and the legs flexed. The mummy was wrapped in three blankets woven of rabbit skins, and beside it were thirteen pieces of decorated pottery, some stone axes, spear and arrow heads, and a gourd containing a handful of parched corn. In one hand the mummy held a stone pipe and in the other a tobacco pouch, while on the wrists were bracelets of bone and shell. An earthen pot had been inverted over the head, which is covered with reddish brown hair about eleven inches long. The fur blankets are said to illustrate one of the very oldest known forms of weaving.

The American Museum of Natural History

Its Work, Membership, and Publications

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

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

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

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

The educational work of the Museum is carried on also by numerous lectures to children, special series of lectures to the blind, provided for by the Thorne Memorial Fund, and the issue to public schools of collections and lantern slides illustrating various branches of nature study. There are in addition special series of evening lectures for Members in the fall and spring of each year, and on Saturday mornings lectures for the children of Members. Among those who have appeared in these lecture courses are Admiral Peary, Dean Worcester, Sir John Murray, Vilhjálmur Stefánsson, the Prince of Monaco, and Theodore Roosevelt. The following are the statistics for the year 1916:

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

Membership

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

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The various Classes of Resident Membership are as follows:

Annual Member	(annually)	\$10
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Associate Benefactor		10,000
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They have the following privileges:

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

Associate Membership

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

- Current issues of the AMERICAN MUSEUM JOURNAL—a popular illustrated magazine of science, travel, exploration, and discovery, published monthly from October to May (eight numbers annually), the volume beginning in January
- A complimentary copy of the President's Annual Report, giving a complete list of all Members
- An Annual Pass admitting to the Members' Room. This large tower room on the third floor of the building, open every day in the year, is given over exclusively to Members, and is equipped with every comfort for rest, reading, and correspondence
- Two complimentary tickets admitting to the Members' Room for distribution by Members to their friends
- The services of an Instructor for guidance when visiting the Museum

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

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

Publications of the Museum

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

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

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MARY CYNTHIA DICKERSON, *Editor*

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

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



A MOLTING ROCK HOPPER

In the latter part of January the penguins in the Falklands begin shedding their feathers and remain on shore until the new feathers have replaced the old. The unkempt, ragged looking specimen above is shedding his old suit in patches, and bears little resemblance to the clean, trim figure he will present two weeks later. Soon after the birds have finished molting and the young have their feathers fully grown, the rock hopper penguins go to sea, and the greater number do not return until the following spring, which begins, in the latitude of the Falklands, about October. Some of them travel hundreds of miles from the place where they were hatched, and how they find their way back is still a mystery

Bird Photographing on the Falkland Islands¹

By ROLLO H. BECK

Illustrations from photographs by the Author

INTRODUCTORY NOTE.—The birds of the order Tubinares, or tube-nosed swimmers, comprising the albatrosses, fulmars, shearwaters and petrels, pass their lives at sea, usually some distance from land, except when they visit the land to nest. They are, therefore, preëminently pelagic. Certain species may abound off our coast, but, unless blown ashore by a severe storm, or attracted to the littoral by the exceptional abundance of food, we may be unaware of their existence. While distributed over the oceans of the globe, the Tubinares are more abundant in the southern Pacific, to which region many species are restricted. Here they breed on islands often so remote and inaccessible that the nesting places of numbers of species are as yet unknown.

The facts thus briefly stated render it obvious that in order to secure specimens of Tubinares one must cruise in distant and tempestuous waters and encounter hardships, dangers, and difficulties such as do not confront the collector of land-inhabiting birds. Here, in a few words, we have the reasons why these birds, which exist in incalculable numbers, are still, generally speaking, so rare in collections.

It was this same rarity, in connection with our accompanying ignorance of the habits of these winged wanderers of the high seas, that influenced Dr. L. C. Sanford and Mr. Frederick F. Brewster to make an especial effort to fill this gap in ornithological collections, as well as in ornithological biography. To this end they fortunately obtained the coöperation of Mr. Rollo H. Beck. Mr. Beck not only has an extended experience in collecting Tubinares, chiefly in the northern Pacific, but he has established a record for marine bird collecting which has placed him in a class by himself as the most successful worker in this branch of ornithology that the world has ever known.

In December, 1912, Mr. Beck was dispatched by Messrs. Sanford and Brewster to the west coast of South America. He began his researches off the coast of Peru, engaging coasting vessels, small boats, or steamers to take him far enough from shore to find the birds which were the especial objects of his expedition. During the succeeding five years he extended his explorations southward, visiting the Juan Fernandez Islands, passing a year in the Cape Horn region, going to the Falkland Islands, and stopping at various points on the Atlantic coast of South America. He also visited certain West Indian islands and in Santo Domingo, Haiti and Cuba ascended to the summits of mountains before unsealed by a naturalist.

To present, even in barest outline, a record of Mr. Beck's discoveries and additions to our collections of birds as well as to our knowledge of their distribution and habits, would require a volume. Here it need be said only that as a result of his labors the Brewster-Sanford collection now contains a larger and better representation of the Tubinares inhabiting the regions visited by Mr. Beck, than any other collection in the world; while his collections in other families of South American water birds, notably the gulls, terns and ducks, also are unexcelled. All these specimens are deposited in the American Museum, where, through the generosity of Messrs. Sanford and Brewster, they are available for scientific investigation, as are the Museum's own collections.

Mr. Beck tells here of some of his experiences, and in due time it is designed to present a complete narrative of his explorations, as well as technical reports upon his collections.

FRANK M. CHAPMAN.

FULLY equipped for a summer's work in the Falklands, we left Buenos Aires in October, 1914. On reaching the islands, however, the unsettled conditions there due to the

still cruising German high seas fleet caused us to go on to Punta Arenas, Chile, from which place we started for a two months' cruise among the islands in the vicinity of Cape Horn. On our

¹ Article and illustrations copyrighted, 1917, by Rollo H. Beck

return from Cape Horn we found the high seas fleet reduced to one vessel and

While awaiting action on my bird collecting permit, I arranged to go



Some of the most accessible colonies of penguins are robbed yearly of their eggs. While the colony shown above was robbed of more than 25,000 eggs in 1914, a more fortunate colony three miles away was not disturbed and many thousands of young birds were reared. Wholesale robbery of these colonies for a number of years in succession would soon exterminate the penguins



The nest of the black oyster catcher is scratched in the gravelly beach above high tide, and one can find the two eggs merely by walking along the highwater mark

that one being carefully searched for, but the season was too late to attempt the Falklands then, and it was not until the following October that we finally landed at Port Stanley, the only town in the archipelago.

across the harbor, some five or six miles, with the captain of a small cutter to visit a gentoo penguin rookery. He was going for eggs to eat, while I took my camera—two cameras in fact, hoping to get some clear pictures of this

species which I had not yet seen. We landed in a barren-looking cove and

started over the rolling hills in the direction of the colony. I had made the



The numerous rock hopper penguins and king shags on Kidney Island were apparently not at all averse to having their pictures taken. One does not need a blind to conceal his operations while photographing penguins or shags in the Falklands. A good raincoat, however, is desirable, as sudden snow or hail squalls are likely to drop out of some flying cloud



While the greater number of the rocky penguins will move aside for one passing through their colony, there are always some pugnacious individuals that rush boldly forward to hinder or hasten the visitor

acquaintance of the pugnacious rock hoppers and the secretive jack-ass penguins on Ildefonso Island to the westward of Cape Horn the preceding summer, but as we neared the first colony of gentoos and the birds began to move leisurely away from us. I was impressed at once by the marked difference in their size and the entirely different character of their nesting ground. On Ildefonso Island one had to select the second or third day of successive calm days even to land, and then had to climb with careful footsteps over slippery rocks to the muddy cliffs where the two species of penguins nest in the thick tussac grass. In the Falklands one lands by launch at the wharf from the Royal Mail steamers; and it is possible to mount a horse, visit the three species of penguins on their nesting grounds, and return the same day to the

steamer. This, I imagine, is seldom if ever done, however, as few of the passengers know of the proximity of birds in such numbers.

Although we entered the harbor on a bright sunny day and there were tens of thousands of penguins within ten miles of our anchorage, the only ones seen were a few dozen birds basking on a sandy beach near the entrance to the harbor. We found some of the nests of the penguins well lined with an abundance of twigs and small sticks, while others were merely shallow holes scratched in the ground. The common sea-bird trait of stealing its neighbor's nesting material was practiced whenever opportunity offered. Some birds more timid than others left their nests before we came near. Their bolder neighbors quickly took advantage of this action and began to rob the deserted nests of all the nesting material. There was a vast difference between the hurried snatching of a mouthful of twigs near by in a neighbor's nest, and the calm, judicial, unhurried selection of a desirable stick when an old penguin would stroll out from the rookery to gather additional lining for his nest.

When the birds of the entire colony were driven from their nests, some of them started off down the long lane toward the broad sandy beach a mile away. Others moved off a short distance and stood about until the egg gathering was over, and then promptly returned to their despoiled nests. When the sailors left for the boat, I went down to the beach where the penguins landed, but in a couple of hours returned to the rookery and observed four fresh eggs laid during my walk. I heard some weeks later that not a single egg was hatched in this colony, all being gathered by some one of the several eggers that visited it during the season.

The absence of land birds in the day's walk was quite noticeable, but the

lack of trees on the islands accounts in large measure for that. The close cropping and destruction of the tussac grass by sheep on all but outlying islets has driven the wren and tussac birds particularly away from the inhabited areas. On Kidney Island, fifteen miles away from Port Stanley, both these species were common although they were never seen about the town, and the wren especially was described to me as very rare by the Colonial Secretary when he delivered my collecting permit to me.

Hearing in Port Stanley of the numerous swans, grebes, ducks, geese, penguins, and various other birds that inhabited Bleaker Island about seventy-five miles to the southward of town, I determined to run down there, and hired a sloop for that purpose. The first night out of town we anchored at East Island, where I obtained fine sets of eggs of the beautiful pink-breasted black-headed gulls and the many skuas, and discovered also two turkey vultures' nests tucked away down at the foot of clumps of tussac grass each within a few feet of jackass penguin burrows. One little knoll harbored several tame rabbits which the owners of the island had liberated, and adjoining the rabbit knoll was a rocky headland which a colony of black-necked shags was using for nesting purposes. It was the most accessible site of that species I had ever discovered. Although hundreds of nests had been noticed on various islands, they were almost invariably over the water on sheer or overhanging cliffs, frequently in caves and virtually unapproachable. I took photographs of several nests; I also collected one or two birds, simply by grabbing the neck of the desired specimen and gathering him in as does the market man his caged poultry.

We left next day and reached our destination late in the afternoon. Bleaker Island, about twelve miles long by one wide, is devoted wholly to sheep raising,



NESTING SITE OF THE GENTOO PENGUINS

Our headquarters were at East Falkland for about three months, trips being made from that place to the various localities where work was to be done. Thousands of penguins were within a few miles of our anchorage. We found some of the nests well lined with an abundance of twigs and small sticks, while others were merely shallow holes scratched in the ground. After being robbed of their eggs the penguins return to their nests and guard them as carefully as though the eggs were still there.



A SUNNY MORNING IN THE PENGUIN COLONY

On Bleaker Island, seventy-five miles south of Port Stanley, we found a large colony of gentoo penguins. The sitting birds are all facing the sweeping wind. In spite of the wind the young penguins like to get out from under cover and enjoy the sunshine



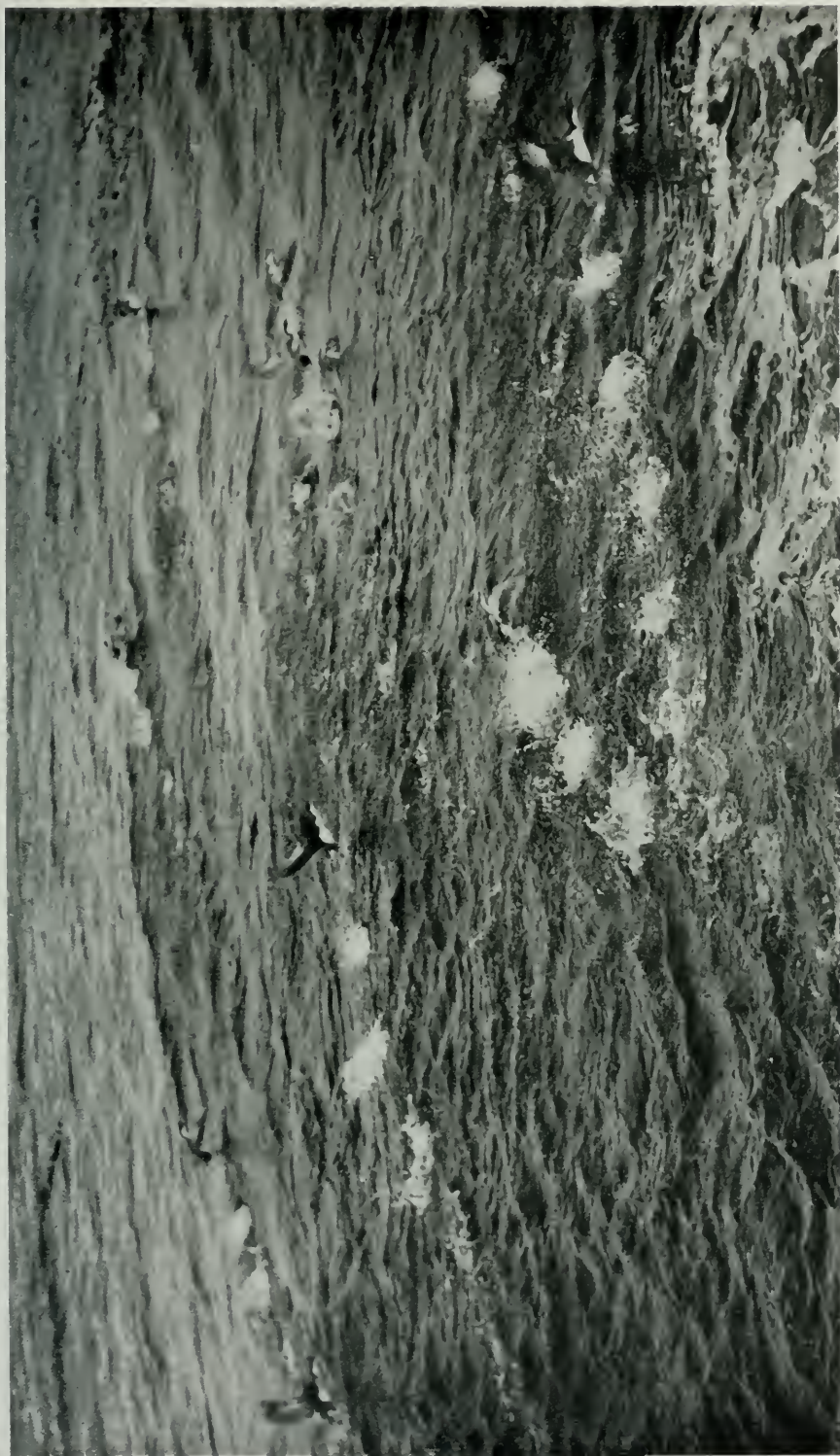
STUDY OF THE HOME LIFE OF THE KING SHAGS

It is not difficult to study bird habits in the Falklands because the birds are so little afraid. Mrs. Beck sat down beside a family of shags, and although they somewhat resented her doing so at first, they soon calmed down and appeared as much interested in her as she was in them.



A KING SHAG ROOKERY

A thousand or more pairs of the handsome blue-eyed shags were nesting at the extreme west end of the island. White below and a glossy bluish black above, with a bright blue space about the eye, they far exceed our North American cormorants in beauty. The king shags usually nest among the rocky penguins, but occasionally an isolated colony is found. Snowy sheathbills nearly always are present and clean up the small bits of fish that may be dropped by the shags.



KING SHAGS PREPARING FOR FLIGHT

The shags must paddle a few feet when rising out of the water, unless they are facing a strong wind.

The presence of tens of thousands of penguins, as well as great numbers of fulmars, shags, skuas, gulls, and smaller birds, makes the Falkland Islands an exceptionally fine field for bird photography



During the summer season many of the penguins that are not nesting come ashore and spend hours on the beach, a short distance above the water



In some places it requires a shovel and a couple of hours' digging to collect the eggs of the jackass penguin, while elsewhere, in walking over the ground of a colony, one breaks through into the nest without trying; for unlike the gentoo and rock hopper penguins this bird nests underground



While some of the black-browed or spectacled albatrosses nest among the penguins on top of West Point Island, many of the birds prefer to build on the cliffs where they can drop into the air as they step from the nest. On the overhanging cliffs a hundred feet or more above the tempestuous sea several night herons also were seen



Crested and teal ducks, and the brant and upland geese swim about together well within camera range in some ponds on Bleaker Island

supporting about three thousand sheep. Mr. F. A. Cobb, the owner, and his hospitable wife, insisted that we live ashore during our stay there. Being a bird lover himself, we found much in common to discuss.

The first day I started out with mag-

azine and plate holders full, headed for an upland goose's nest which Mr. Cobb had found a few days before, only a mile from the house. Before reaching it I flushed one of the pretty brown-breasted plovers from its nest under a diddle-dee shrub. After photographing



This pair of penguins (nesting about half a mile from the house on Bleaker Island) resent intrusion on the foot or two of soil immediately about the spot they have chosen for a nest and are ready with wing and bill to chastise any bird coming within reach



On Sea Lion Island a colony of giant fulmars was nesting. This bird, which is as large as some albatrosses, lays its single egg on the bare ground. The period of incubation lasts more than a month

that I walked on and saw the goose leave her nest before I neared it. She stopped a hundred and fifty yards from the nest and was at once joined by her mate who had been watching me from a distance. A skua, who also had been watching me as he circled about, sailed straight for the uncovered nest. While I stood watching the geese, the skua dropped to the ground about six feet from the tempting eggs. This was seen at once by the gander, who flew rapidly to the nest, evidently considering me a less dangerous enemy than the poaching skua. The nest was nicely lined and made an attractive picture with

diddle-dee leaves and blossoms all about it. Later in the day a crested duck was flushed from an open nest in a similar location. As the nest contained but two eggs I did not take them, but glancing back after I had passed a few feet, I saw a skua drop to the ground, pick up one of the eggs and fly swiftly away with it.

Tramping on to the eastward, I reached a bushy slope where the dominican gulls were brooding eggs. The nests were all well built, mostly of dry kelp which was abundant on the beach. I could not decide which was the best one to photograph, so went forward

again, intending to return later. I found more gulls' nests scattered along the coast line. One, close to the shore line, was placed in the hollow of a whale's bone that had been thrown on the beach in a storm. Along the high-water mark in one lonely cove a few terns had built nests, which contained eggs, and in the same cove a black oyster catcher called my attention to his nest scratched in the gravelly soil. Some sections at the east end of the island were so riddled with burrows of the jackass penguins that the shepherds could not ride their horses through the colonics. I more than once broke



The gentile king penguin builds his nest of tussac grass and roots, often bringing in from the sea a long piece of kelp to add variety to its lining. This bird is in the act of stealing his neighbor's nesting material, a common sea-bird trait practiced wherever opportunity offers

through the peaty soil into a penguin burrow, always extracting my foot therefrom with alacrity for fear of the powerful beaks of the penguins. At the far end of the island a pond was discovered which the ducks and geese used as a refuge while molting their wing feathers and bringing up their young. A small flock of teal and another of gray ducks swam about on friendly terms with the diminutive brant geese, although the latter were not on very friendly terms with an aggressive upland goose and his family that were also using the water as a safeguard against my too close approach.

As I rounded one of the points that jutted into the sound, a female kelp goose was seen ahead with four downy young birds, quite a distance from the shore. She saw me at once and started for the water with her goslings, while I hurried to head her back out on the open hillside, and reached the beach just in time to do so. After getting the young birds a safe distance from the water, I attempted repeatedly to set up the camera and get a picture of the group. The young birds would have stood all right, I think, but their parents (the male having joined us soon after he saw the tripod and camera a part of the landscape) would persist in leading them off. Sometimes the male would take one, two, or three of the youngsters and stride off in a different direction than that headed for by his companion; then I would herd them back together again. Finally I discarded the tripod and took a snap or two with the camera in my hand as the little family hurried away from me.

Returning along the other shore where rugged cliffs kept back the sea, several night herons' nests were seen. The locations were those usually selected by boobies or terns, duck hawks or bald eagles, rather than spots which night herons in the temperate region of the Western Hemisphere usually select for placing their eggs. They were all on

the overhanging cliffs a hundred feet or more above the tempestuous sea. Below, or near them, the black-necked shags were rearing broods. One pair had hollowed out the top of a tussac mound within thirty feet of the top of the cliff, and by using the long focus lens a photograph was obtained for a record, this being the only chance offered by this species that came to my notice. I was surprised to find it was four o'clock in the afternoon when the night heron's nest was left behind, and being three miles from the house, I set out for there without searching for other nests.

The next day began with a high wind which continued blowing all day, but it proved, I think, the finest day photographically I ever enjoyed. Starting toward the west end of the island, as eastward had been the course the day before, about two miles from the house the gentoo penguin colony was reached. Here young birds creched under the sitting parents, all faced toward the sweeping wind. Over the hill from the south shore, birds were continually coming into view, walking along their accustomed track, passing through flocks of feeding sheep at times, and usually finishing up the long walk with a hurried little run as they came down the sloping pasture to the rookery. It seemed very strange to me, as it does to other humans, that the birds should land on the south side of the island, walk a mile up a slope and down on the other side to place their nests within a hundred yards of the water on the opposite side of the island from where they land. One small colony of a few dozen birds had perhaps seen the folly of this procedure, for they had walked back only three hundred yards or so and built nests; but the overwhelmingly greater number spent an hour or more every time they left the beach to cross the intervening space between water and nest while beautiful landing places with deep water were within

two minutes' walk right at their back doors.

A short distance beyond the penguin colony a group of gulls was examined, and just beyond them, on a gravelly bar overspread with dry kelp, the darting terns had placed their eggs. A little higher on the beach and just back of the terns' nest an oyster catcher's nest revealed itself. From this spot I walked a long way over the closely cropped pasture, sometimes following the shore a short distance, in which case a screaming gull or else a beguiling oyster catcher, or perhaps both, would endeavor to distract my attention from their easily found nests. On one of these dips to the water I flushed a kelp goose from her nest close by the water's edge. It contained only four eggs but was heavily lined with white down which completely concealed the eggs when the bird walked away from it. Being placed between great bunches of decaying tussac roots, I could not get a view of the bird with the nest, but she and her mate were nearly as tame as the pair encountered the previous day with young. Back among the diddle-dee again one of the little white-chinned plovers was started from a nest containing two eggs and a newly hatched young bird. This nest was very similar in composition to that of the brown-breasted plover found on the east end of the island.

But it was at the extreme west end of the island that one of the most interesting sights met my eyes. There a colony of a thousand or more pairs of the handsome blue-eyed shags was nesting. Being white below and a shiny bluish black above, with a bright blue space about the eye, they far exceed our North American cormorants in beauty. Close along the windward side of the nesting birds sat more than a dozen skuas ready to snatch the eggs from any nest a negligent bird should leave uncovered. Just beyond the rookery along the edge of the cliffs sat about

twenty-five of the snowy sheathbills. In appearance they look slightly like winter ptarmigan, although in flight resembling pigeons. In summer they live principally on offal picked up about the nesting shags and the penguins. In winter small shellfish constitute their food. In the Falklands they are not known to nest, the breeding birds going south to rear their young. Several of the cormorants from the extensive colony were collecting material for their nests as I came near the site. They flew a short distance to the decaying tussac heaps and rapidly pulled out mouthfuls of the dead grass roots. Their quick nervous pulls at the tough roots were quite different from the leisurely style of the gentoo penguin in picking out its nesting material. Both, however, use the same furtive grasping method when it comes to helping themselves from a neighbor's nest.

On the journey back to the settlement in the afternoon, we visited a pond where several dozen geese were wading or resting. When they saw me swing toward them, all started for the beach, which was a short distance away. The entire flock swam out some distance from shore and waited until my departure before returning to land again. The greater number were molting birds and unable to fly, but they were joined by several others that flew toward them from some distance away. Although the English have occupied the Falklands since about 1832, and probably have been killing geese ever since, the birds at the present time show much curiosity toward mankind. I repeatedly saw geese that were feeding two hundred or more yards distant fly toward me and alight, frequently within gunshot. At one settlement near Port Stanley where I shot several geese for specimens, a whole flock walked up to within sixty yards of me, the feeding birds scattered over the hillside flying down to join them. This occurred with both upland and the smaller brant geese.

In several cases birds flew toward me to examine fallen companions, immediately after a gunshot and within plain sight, sound, and range of the gun.

I saw a half dozen swans and several grebes on Bleaker Island, but they were too wild to spend time on, so an extra trip to Sea Lion Island fifteen miles to the southward was planned. On Sea Lion Island a colony of giant fulmars was nesting, in addition to the penguins, shags, skuas, gulls, and smaller birds. A warm, sunny day favored me in taking pictures and several satisfactory results were secured. The nesting Scoresby gulls, placing their eggs in clumps of tussac grass so easily approached by penguin trails, were a delight to me after having gazed at nesting colonies from afar the preceding season, one colony on Hoste Island

being on top of a pinnacle rock, and another at Ildefonso Island approachable only by a seal or one clad in seal-skin moccasins and gloves to climb the slippery waterworn rock.

Although the day had been so pleasant, an increasing swell on the rocky reefs surrounding the islet warned the captain to be gone, and he sailed as soon as we were aboard. Stopping a day at Bleaker Island, while a shrieking gale blew over, an abbreviated visit was made by steamer to West Point Island, where the black-browed albatrosses nest, but our stay on the islands was cut short by a rumor that after the steamer in February called another would not appear before May. We left with regret the finest ground for bird photography that I have ever encountered in my wanderings.



The low rolling hills of the Falkland Islands are denuded of vegetation by large flocks of sheep. Just over the hill behind this sheep farm on West Point Island is a large colony of penguins from whose nests the farmer gathers his supply of eggs

BIRD LIFE IN THE FALKLANDS¹

REPRODUCTIONS IN DUOTONE FROM PHOTOGRAPHS TAKEN
DURING THE BREWSTER-SANFORD EXPEDITION
TO SOUTH AMERICA

BY ROLLO H. BECK



GULLS ASTERN

Dominican gulls that flock about the steamers traveling up and down the South American coasts are especially abundant at Port Stanley, Falkland Islands, where the Royal Mail steamers call. In the middle of the day a flock is always sitting astern of the steamer or flying alongside to pick up the pieces of waste food thrown overboard. Gulls' eggs are used in the Falklands for food, and when fresh are considered rather better than those of the penguins. The sheep farmers destroy the nests whenever found, as it is said gulls pick out the eyes of sheep that have become helpless by rolling on their backs and are unable to regain their feet again

¹ Illustrations and text, together with the preceding article, copyrighted, 1917, by Rollo H. Beck



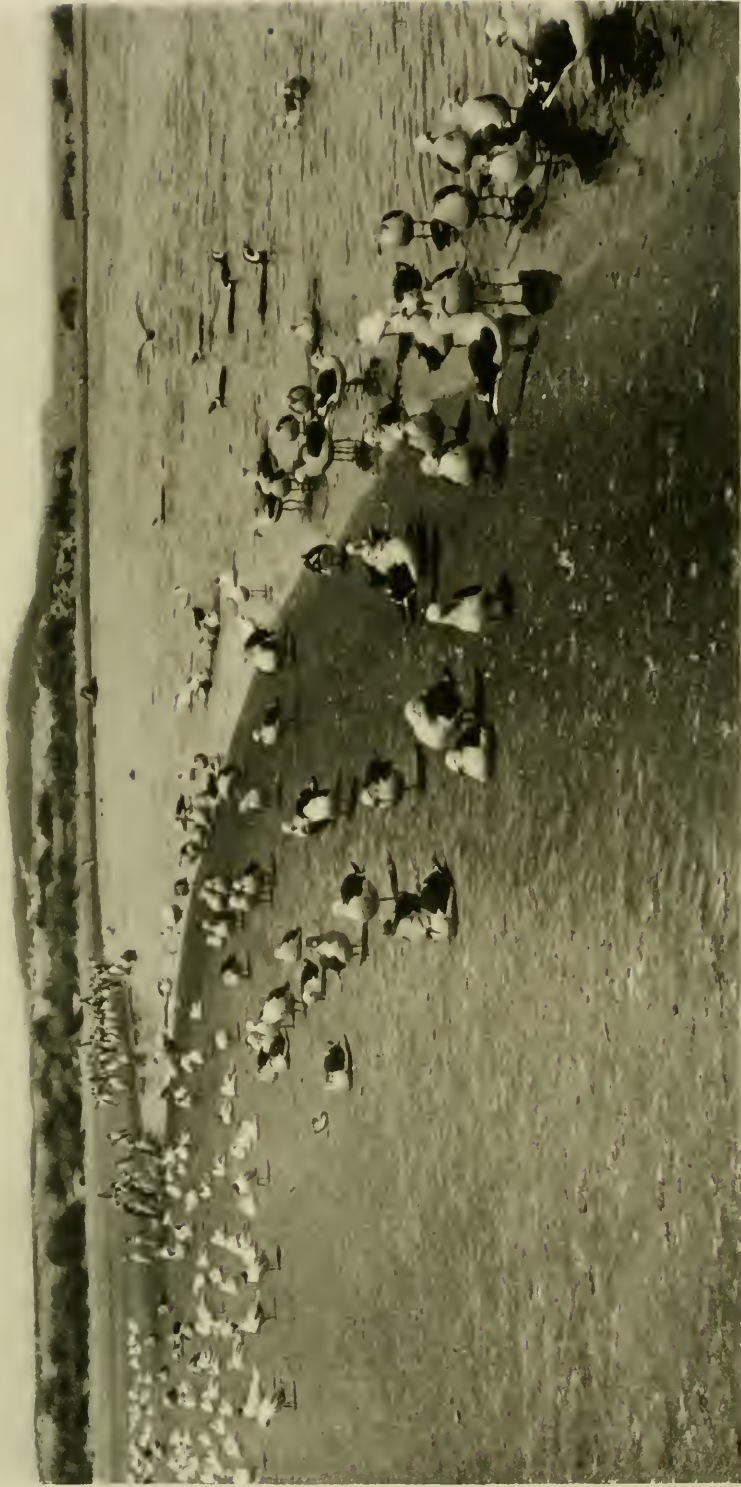
UNUSUAL NESTING SITE CHOSEN BY A COLONY OF SHAGS

The black-necked shag, which with its larger relative the king shag, is found commonly about the Falkland Islands, builds its nest as a rule on the perpendicular cliffs over the ocean, often in dark caverns above the water, where, were it not for its white breast gleaming out of the surrounding blackness, it would never be discovered by the person rowing past in a boat. In this photograph, however, the birds are shown nesting on the top of a rocky cliff, a most unusual situation. This species generally fishes nearer the shore than does the king shag, and nearly every kelp patch along the rocks will have one or more birds of this kind in it, fishing for the numerous small fish that each protuberance within the long, flexible lower jaw of the bird.



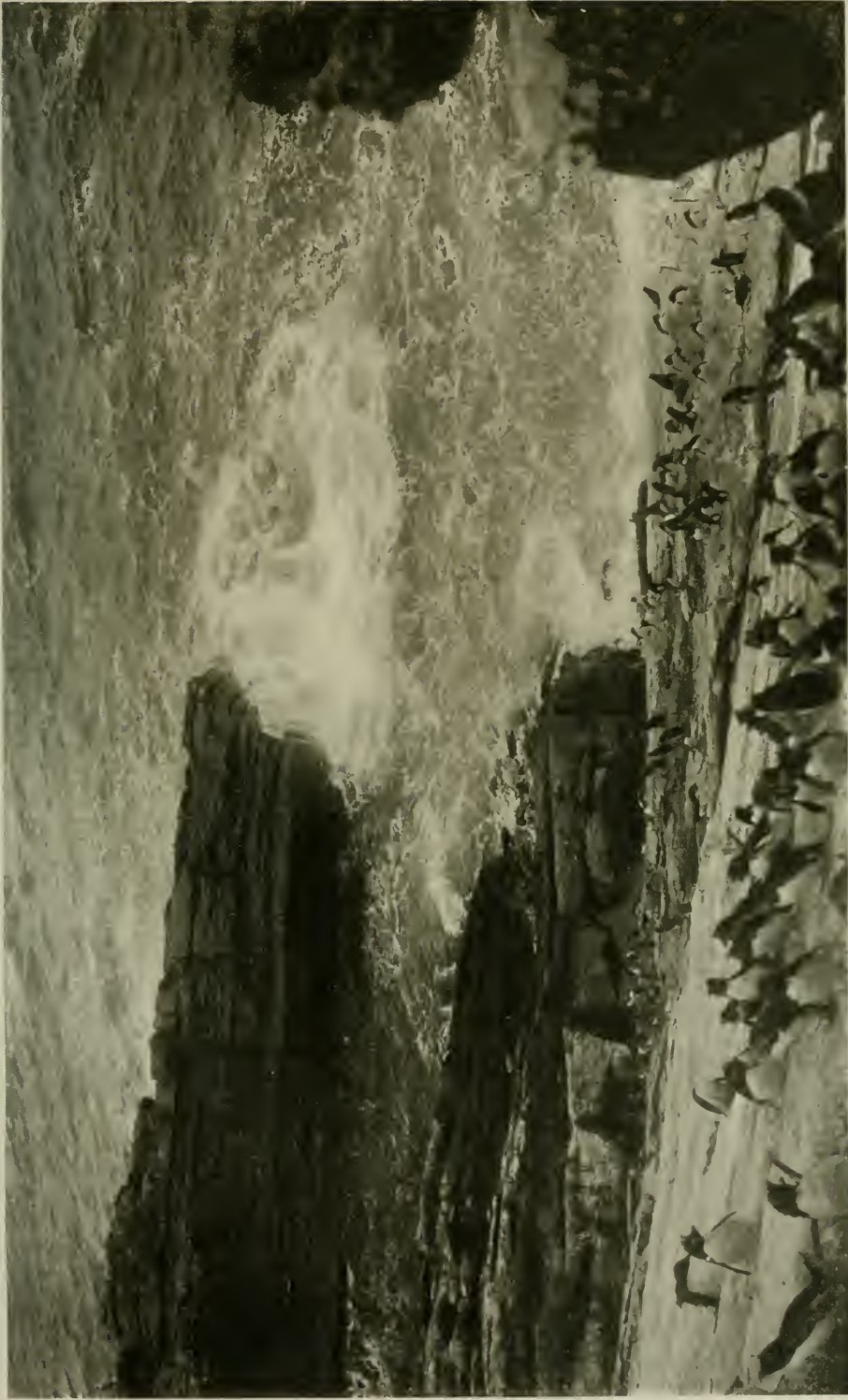
EARLY BROODING KING SHAGS IN CROWDED QUARTERS

Although the king shags of the Falkland Islands are not so abundant as their cousins, the valuable guano birds of Peru, an occasional colony may be found containing upward of a thousand pairs. As in most large island colonies of sea fowl, the earliest nesting birds begin building close together, and by the time the late comers have built their nests, the first families have young birds hatched. The eggs of the king shag, because they are easily broken, are not gathered for eating, as are the penguin, gull, and albatross eggs—although small colonies of shags are often found associated with penguins in their rookeries



FAVORITE FEEDING GROUNDS OF DOLPHIN AND PINK-BREADED GULLS

The dolphin and pink breasted gulls shown above are not as plentiful in the Falkland Islands as their larger relative, the dominican gull. The bluish gray dolphin gulls may be encountered usually along the beaches, where they pick over the pieces of kelp for small animal life, or more likely can be seen out on the rocky ledges exposed at low tide, hunting for sea worms, and small crabs and other shell fish. The delicately colored pink-breasted gulls prefer feeding on live fish, darting down with the terns when a school of small fish approaches the shores. Both species of gulls begin to lay about the second week of December, while the dominican gull begins somewhat earlier.



A ROUGH LANDING BEACH

The rocky or rock hopper penguins, when coming in from the open sea to land on the islands where they are nesting, pay little heed to the selection of a quiet landing place. They come from the water with a rush, jumping on to the rocky ledges, and often are swept back into the foaming swirl by an overwhelming wave before they can hop up out of its reach. Several hundred landed daily from the boisterous water shown in the photograph, and when safely ashore, usually would rest a few minutes before beginning to climb the nearly perpendicular cliff to the top of the island where their nests were placed



JUST BEYOND REACH OF THE SEA

The kelp goose which nests throughout the Falkland Islands, builds its nest close to the shore line, quite often just above high water mark. At the right of this nest can be seen a piece of dead marine growth thrown up by a storm. The nest, when first seen, was a mere bundle of down which completely concealed the eggs, the bird having noted the approach of the camera man and hurriedly arranged the down over the eggs before she left the vicinity of the nest. The eggs rank higher as

HIGH NESTING SITE OF THE BLACK-BROWED ALBATROSS

From the time that a steamer leaves Valparaiso on the west coast on its return voyage to Europe around the southern shores of South America and up as far as Buenos Aires on the east coast, there is probably not a day during the winter season that albatrosses may not be seen from its decks. While the magnificent wandering albatross, with his incomparable flight, is often seen, the commonest species is the black-browed albatross. There are several colonies of the black-browed albatross to be found in the Falkland Islands, and one or two about Cape Horn. The illustration shows a typical nest placed hundreds of feet above the tumultuous sea, close to the edge of a cliff on West Point Island in the Falklands. The bowl-shaped nest of the albatross resembles that of the flamingo, being built mostly of mud picked up near by. Many nests are used year after year and are built up gradually to a considerable height. The young albatross grows slowly, and it is some months before it can step from its nest and sail away over the wide ocean





CHOOSING NESTING SPOTS ON CUCHON ISLAND

This small outlying islet about ten miles to the westward of Port Stanley in the Falklands, furnishes a breeding spot for a large colony of rock hopper penguins. Egg laying was just beginning when the colony was visited on November 6, 1915. Scattered pairs of king shags, which often lay their eggs among the rockies, were already brooding the two or three eggs which constitute the average clutch of this family in the far south. The above photograph was taken just at the top of a steep rock-strewn trail, and shows a pair of nesting shags, as well as the spot selected by several pairs of penguins, although but a single penguin egg is visible just behind the shag's nest.



AN UNUSUALLY LARGE COMPANY OF SHEATHBILLS

The sheathbills, or kelp pigeons as they are known in the Falklands, are seldom seen in flocks of any size, the couple of dozen birds shown above being the most observed in any one spot. The presence of a large king shag rookery near by attracted these birds. In the nesting season the kelp pigeons hang around the penguin and shag rookeries, finding there bits of desirable food, but at other seasons they feed on the numerous small shell fish that are abundant everywhere along the rocky shores at low tide. The few kelp pigeons that remain in the Falklands through the summer are not known to nest there, the breeding ground of the species being on the islands further to the southward



JACKASS PENGUINS IN A WIND-WHIPPED RESTING SPOT

In windy weather, which is frequent about the Falkland Islands, many of the penguins come ashore and spend hours resting on the beaches near the water. The above photograph was taken on a very windy day, the photographer approaching the birds on his knees, as this species is much wilder, for some reason, than the two other species which are common there also. At this same spot, on days less windy, the jackass penguins were seen darting to and fro like swallows in the curling breakers only a few yards from shore



PENGUINS AT PLAY

An unusual sight in the Falkland Islands is to see a flock of playing penguins darting back and forth in a fresh-water pond. The birds shown above were dozing on the shore of a tussock-bordered pond when first noticed, but they entered the water and swam close along the sandy shore as their disturber walked alongside. The "melancholy bray" of the jackass penguin is heard most often about nightfall as he sits at the edge of his tussock-covered home. When the young birds are nearly grown, they join their parents at the entrance to their burrow, and if an intruder comes suddenly upon the family group, the scurrying hurry into the protecting shelter is most amusing to witness.



SANDY BROODING PLACES OF THE GIANT FULMARS

About a hundred pairs of birds were nesting on the flat sandy top of Sea Lion Island only a few hundred yards from the beach. Many of the birds from this colony made trips along the coast of East Falkland Island in search of food, a dozen or more being seen at times at least seventy-five miles from their nests near the harbor at Port Stanley. Birds of this species may be seen in winter in the harbor at Valparaiso, Chile, feeding with the gulls close along the rocks where the city garbage is dumped. They vary a great deal in color, many of those nesting farthest south in the Antarctic being white, while the birds seen along the Chilean coast



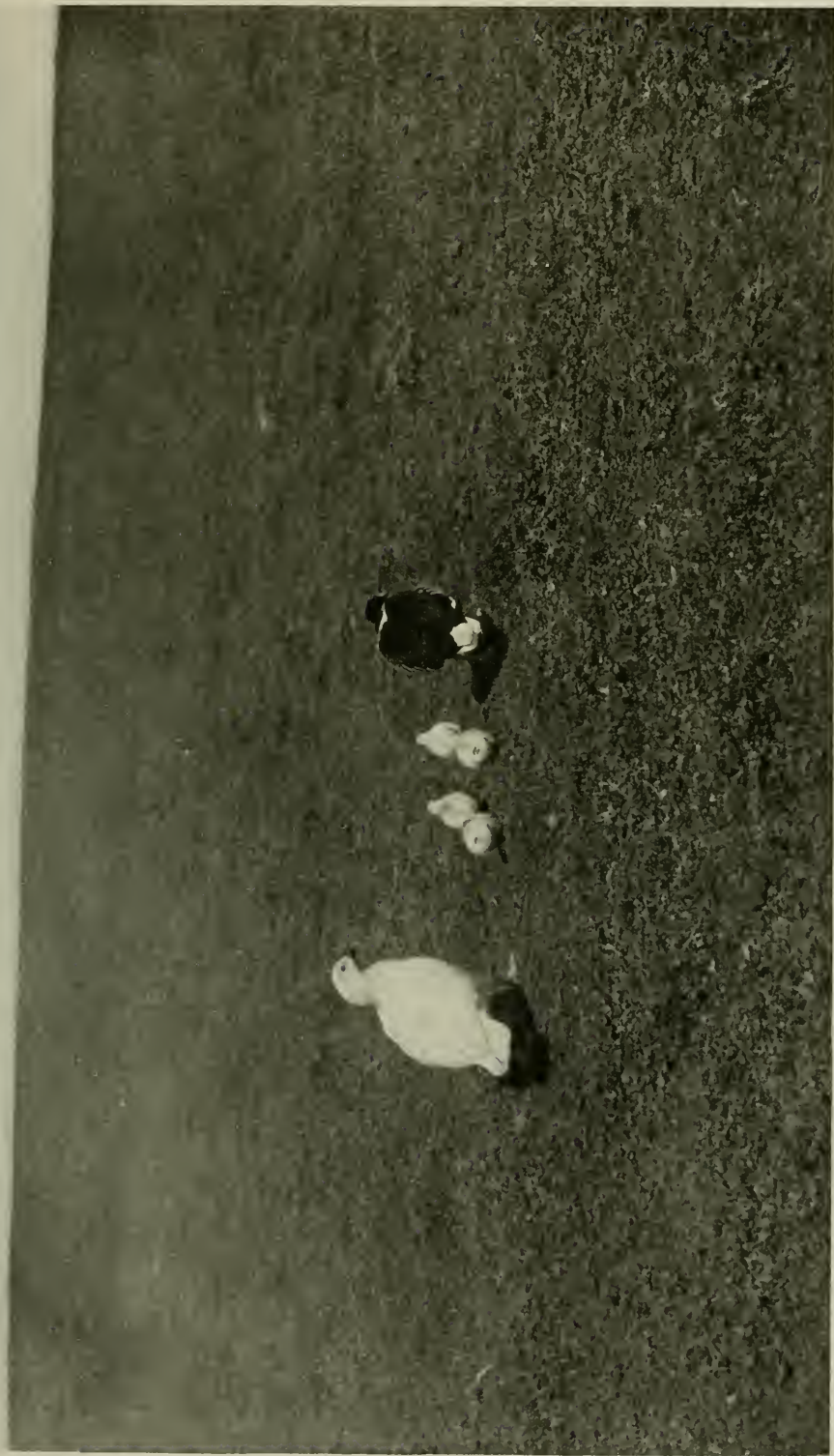
NEST BUILDING IN A FRESH-WATER POND

On Sea Lion Island a colony of the bluish colored dolphin gulls was discovered building nests along the edge of a fresh-water pond. A settler's house was about a mile from the pond, and his wife, who had a few chickens, was compelled to keep a close watch on the thieving gulls whenever food was thrown to the fowls. While we sat at lunch in the cabin, the roof was covered with gulls waiting for bits of penguin eggs which the lady of the house was giving to her chickens in lieu of other feed. These gulls are found about Cape Horn and the Straits of Magellan also, but they do not go so far north along the coasts of South America as the dominican gulls



A SOURCE OF EGG SUPPLY IN THE FALKLANDS

By far the commonest birds to be found in the Falkland Islands are the penguins, and of the four species occurring there, the small rock hoppers are probably as numerous as the other three combined. The above illustration shows the east end of the colony on Kidney Island about the middle of January, 1916. Many young birds can be recognized in the photograph, notwithstanding the fact that more than twenty-five thousand eggs were taken by eggers early in December from this same colony. When the young birds are perhaps two thirds grown, they leave their nests and gather in little bunches over the rookery. One sometimes can see a dozen or twenty of the youngsters huddled together. How the parents can select their own young from the mixed up assembly, when returning from the sea with food, is inexplicable to a human observer. The penguins' eggs are widely used in the Falkland Islands, many thousands being pickled and preserved for winter use. As a government license is necessary to collect the eggs, and as some colonies are seldom disturbed, it is likely that this excellent and inexpensive food will long continue to form a welcome change from the steady diet of mutton



FAMILY OF THE KELP GOOSE

Kelp geese usually keep their young near the beach line where, on the appearance of danger, the little ones may be taken into the water. The family shown above was surprised some distance from shore and was induced to walk away from the water for a few minutes that its photograph might be taken. The female kelp goose is beautifully barred with black and white on the fore parts; her companion is snowy white. The showy male is betrayed at a great distance by his color, while the broken pattern of the female renders her invisible at even a short distance on the dark rocks where the birds usually are found



HOME OF THE DOMINICAN GULL

The nest of the dominican gull usually is placed near salt water in the Falklands—the one figured being in a typical location. The nests are well built with an abundance of grassy material, and it is often surprising to see how closely they blend with the surroundings, the birds being adepts in the art of *camouflage*. Three is the usual number of eggs laid. Since these eggs are decidedly larger than hens' eggs and as good eating, the nests are eagerly searched for about Port Stanley in the nesting season

Explorations in New Mexico

FIELD WORK IN THE LA PLATA VALLEY DONE BY THE AMERICAN MUSEUM—UNIVERSITY OF COLORADO EXPEDITION, 1916

By EARL H. MORRIS

IT is now more than forty years since attention was first called¹ to prehistoric ruins in the valley of the La Plata River, northwestern New Mexico. Soon afterward, following in the wake of Ute and Navaho, white settlers found their way into the valley, and with their coming began the destruction of the aboriginal remains which for unnumbered centuries had held their own against the unbroken siege of time and weather. In preparing new fields for planting, grave after grave was ripped open by the plowshare, and the bones of the occupants tossed out to bleach in the sun, or to be pawed over during winter nights by coyotes. In the same way literally thousands of pottery vessels were exhumed. Some of them were smashed to bits on the plow beam to test their hardness, many of them were sent by the ranchmen as curiosities to friends and relatives, and the remainder passed into the hands of chance collectors who scattered them to the four winds.

By 1890 the discovery of the famous cliff dwellings of the Mesa Verde and the consequent awakening of interest concerning the ancient peoples of the Southwest created a market for so-called "Aztec" pottery. Because of the richness of the graves found by the ranchmen, relic hunters were attracted to the La Plata, and for the next ten years not a winter passed that one or more parties were not at work along the valley, turning burial mounds topsy-

turvy, and trenching back and forth through the remains of dwellings. During all this time not once was pen put to paper to set down the observations of the excavators, nor was any record kept of the specimens unearthed.

The problems of the archæologist have not been rendered incapable of solution, however, although the deplorable havoc wrought by agriculturists and relic hunters has done much to complicate them. A few groups of ruins stand on land unfit for cultivation, and some of them are still relatively well preserved owing to the fact that their formidable bulk discouraged even the most enterprising pottery diggers. One of these groups is situated on a high mesa ten miles above the mouth of the La Plata. From the summit of the mesa one beholds a magnificent panorama of the surrounding country. Far to the south a bold escarpment beyond the San Juan River looms brown and blue against the horizon. To the northwest, above a wilderness of rugged cliffs, a black-green carpet of timber crowns the eastern rim of the Mesa Verde, while to the north the snow-clad crests of the La Plata Mountains rise, brilliant as frost crystals in the sunlight, or masked at times by banks of frowning clouds, from behind a chaos of clayey hills. In the immediate foreground to the east and south a silvery ribbon of river winds back and forth across a fertile valley. Fully six acres of the mesa top are strewn with remains of buildings and the black earth of refuse and burial mounds.

¹ By Dr. W. H. Holmes, of the United States National Museum.

The more compact of the two relatively large ruins stood on the very brink of the mesa. It had weathered down to a mound 8 feet in height covering an area 75 by 100 feet. In some places walls of cut sandstone were visible at the surface, indicating roughly the outlines of the building. From an estimate of the cubic contents it was thought the entire structure could be cleared in four weeks, but this calculation served only to reveal the impossibility of foretelling from surface indications what lies beneath the soil. Under the building which the mound concealed were the remains of two other dwellings, the walls of the most ancient extending twelve feet below the general level of the mesa. Before the last of these was uncovered four weeks had lengthened into nine.

The three superposed buildings differed greatly in age and construction, and belonged to three distinct periods of occupation. The homes of the first inhabitants were subterranean in character. To construct them rectangular pits with rounded corners were excavated to the desired depth, and lined with a wattlework of sticks. Adobe mud was applied over the wattlework and gravelly floor until both walls and floor were smoothly plastered. From analogy it is to be supposed the roofs consisted of a number of heavy beams placed across the excavations, surmounted by a transverse layer of smaller poles, and rendered water-tight by a thick covering of earth. At some point, probably near the center of each roof, an opening was left which served the double purpose of an entrance for the inhabitants and a vent for the smoke which rose from a bowl-like fireplace in the floor.

In the course of time the builders of the pit houses abandoned the mesa,

leaving behind their household utensils where some of them were found, meal-stones leaning against the walls, stone axes and bone awls scattered over the floors, and occasionally a crude bowl or globular pot reposing in a sheltered corner. More perishable materials such as wood, basketry, and matting had completely decomposed. For perhaps a century or two the elements labored to obscure all traces of the subterranean dwellings, and succeeded in filling them up partly or in some cases completely.

Then another group of people took possession of the mesa and erected above the ruins of the pit houses a compact, thick-walled community house of cobblestones and mud. The ground plan of this structure seems to consist of about forty rectangular rooms, and from the amount of fallen masonry there may as well have been twenty more in a second story. In front of the building, which faced south, four circular chambers, averaging fifteen feet in diameter, were dug down through the remains of the pit houses, and carefully walled with stone. From a study of Pueblo tribes as described by writers who accompanied the Spanish conquerors, we know the significance of these circular structures, and their relation to the rest of the village. The main dwelling belonged to the women, while the men of each clan owned an underground kiva or clubhouse in which they slept and spent most of their time when not engaged in agriculture and the pursuit of game. These kivas were the ceremonial centers in which councils were held and ritualistic rites performed. Upon such evidence may be based the conclusion that four clans built and maintained this village of the second period.

If one may judge from the enormous



GENERAL VIEW OF THE LA PLATA RUIN

From a shapeless mass of cobblestones and earth it is difficult to visualize a terraced dwelling, but the spade soon brings order out of chaos and reveals not only the lower walls of the building but also many manufactured articles left behind by the departing inhabitants. Many of these heaps dot the La Plata Valley, marking the former homes of a people who raised their corn along the river and hunted deer in the hills. The fortress-dwelling here illustrated contained twenty-five rooms and two subterranean council chambers. One of these chambers, seen in the foreground, was part of an older structure built on this same site. Beyond this ruin a heap of stones marks another one. In the distance rises the eastern rim of the Mesa Verde



A RUIN UPON A RUIN

Features of two of the three superposed buildings may be distinguished in this picture. The few courses of faced stone represent the lower portion of the south wall of the most recent structure, while below them, to the right of the shovel, a wall of the cobblestone house runs at an oblique angle beneath the later ruin. Sixteen feet of earth was removed in reaching the floor of the circular chamber in the foreground. Much of the success of an archaeological expedition depends upon the interest and devotion of one's helpers. For thirty years Bill Ross has worked among the ruins, developing a positive genius for locating specimens in unpromising places

quantities of sweepings, ashes, broken implements, and potsherds with which they filled all the depressions about their town, and heaped up considerable mounds beside, these four clans continued long in residence. When eventually the building was abandoned, everything inflammable was destroyed

years, the Pueblos returned to build again upon the mesa, they brought with them a skill undreamed of in earlier times. On the slight elevation resulting from the decay of the cobblestone house, they marked off an area eighty-six by fifty-four feet and erected upon it a two-story structure of faced sand-



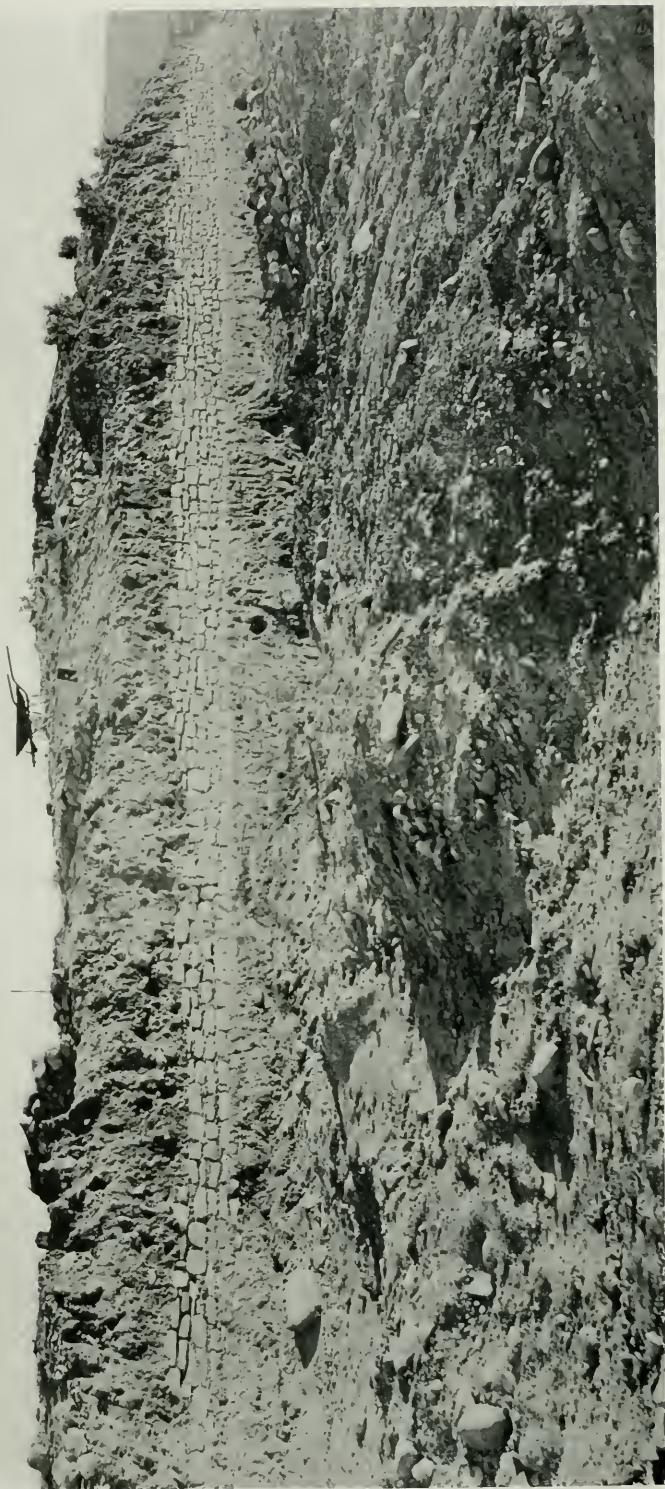
The circular subterranean clubhouse owned by the men of each Pueblo clan, from which the women were excluded except on special occasions, served as sleeping quarters and council chamber. The round pit seen in the foreground is a fireplace, while the rectangular area slightly above and to the left of it is the opening through which fresh air entered the room. A tunnel connects this opening with a shaft outside the curving wall which leads to the surface

by fire. Previous to the conflagration, however, all manufactured articles except a few corn mills, half a dozen stone axes, and one broken water jar were removed, but whether by the departing population, or by looters, we shall never know.

Nature resumed her work of obliteration, while in other centers aboriginal architecture continued its slow development. When, after a lapse of many

stone blocks. So accurate were their calculations that the corners varied less than five degrees from right angles, and in spite of centuries of settling, when uncovered, the bases of the walls were as straight as if the masons had trued them in with line and level only the day before.

Enclosed within the rectangle there are twenty-five secular rooms and two kivas. Throughout the masonry is



NORTH EXPOSURE OF THE MOST RECENT OF THE THREE SUPERPOSED RUINS

So skillfully were the walls constructed that they called forth exclamations of surprise from masons who came to inspect them. The débris beneath the base is that resulting from the decay of the older ruin upon whose remains the sandstone structure was erected

excellent, but notwithstanding their smoothness, most of the walls of the living rooms were finished with adobe plaster. One of the kivas is as fine an example of Pueblo architecture as has ever been unearthed. After the curving walls were constructed, they were rubbed and polished with sandstones till the surfaces were smooth as a planed board. A room near the eastern end of the building has a small portion of its walls ornamented with incised geometric patterns. This beginning of mural decoration marks the highest stage to which Pueblo architecture attained, and without corroboration would have shown the structure in which it occurred to have been of relatively late construction.

The only entrance to the building was through a narrow doorway in the center of the south wall. This opened into a small hall from which ladders reached to the roof of the first story. To gain entrance to the lower rooms it would have been necessary to go down through hatchways by means of other ladders, but between the rooms on each floor there were diminutive openings through which one might pass on hands and knees. With sheer outer walls and but one door, the building constituted a fort as well as a dwelling.

Like the one beneath, this edifice had been stripped of everything of value, so that the only specimens recovered were about a bushel of pottery fragments and two small pots which had been buried under a floor with the bodies of children. The fragments were enough to establish the type of ware and style of ornamentation characteristic of the pottery correlated with the sandstone structure, but as it was desirable to supplement the fragmentary material with whole or restorable vessels, the burial mounds north and south of the

village were opened. They yielded one hundred skeletons, and as many beautiful pottery vessels.

There is something indescribably fascinating about the excavation of a burial mound, and the intentness with which all of one's faculties are centered upon the work develops a surprising keenness of perception and discrimination. In a short time it is possible to tell a fragment of decayed human bone from that of another kind of animal merely by crushing it between the fingers, because a human bone reduces to a flour-like powder, while that of a wild animal breaks up into a granular, sandy substance. Some slight difference in the quality of the vibrations which travel up a shovel handle when the blade strikes a hard object, informs one whether the obstruction is a stone or a pot. Many features of the work conspire to place upon one the spell which binds the prospector and the gambler.

For weeks Bill Ross, the writer's most trusted workman, had been eager to open one refuse mound which an intuition born of thirty years' experience among the ruins caused him to suspect of containing many graves. At length he was given the opportunity, and toward noon of the first day he beat a tattoo on a shovel-blade from the pit in which he was at work. It was a signal for all hands to gather, for no one can be expected to labor when a "find" is being made. There in the side of the excavation he had uncovered a thigh bone, brilliantly yellow as fossil ivory. In a few minutes the position of the skeleton was determined. The body was that of an adult buried upon its back, with arms at the sides, and knees elevated. Resting upon the abdomen there was a beautiful bowl, within the bowl a long and graceful ladle, and beside it a little cooking pot.



Frost action and the settling of the soil have broken most of the pottery buried with the dead, while burrowing animals have scattered many of the fragments. Running the earth through a screen often results in the recovery of all the pieces of a vessel



Ornamented building stones have been found in one ruin in the La Plata Valley, and in Sun Temple and one or two dwellings in the Mesa Verde National Park. They indicate the beginning of mural decoration which marks the highest stage of development reached by Pueblo architecture



Pottery vessels, shell bracelets, and necklaces of beads and turquoise are often found in Pueblo burials. Scarcely a foot of coarse gravel covered the vessels here seen, which were so coated with lime that the painted designs were entirely obscured



In an abandoned dwelling larger pottery vessels may often be found standing where they had last been used. This fine vase was buried under eight feet of earth, the foundation of a later structure having been placed directly over it



POTTERY WAS BURIED WITH THE DEAD

Here was found an adult, buried beneath four feet of refuse. The body lay upon its back with heels drawn up against the thighs and knees elevated. Upon the abdomen had been placed a large bowl and ladle of exquisite workmanship, and beside these a small, graceful cooking pot. The decayed skull may be seen to the left of the pottery vessels

Another grave had been cut down into the natural soil below the refuse. The body was lying flat upon its back, and the pit had been roofed over with cedar logs which were weighted down with stones. Two bone awls and an arrowpoint were by the right hand, while around the head were grouped a pitcher, a bowl, and two ladles. On the extreme outskirts of the mound lay a skeleton with knees drawn close up against the chest, and arms flexed with hands at the shoulders. Although the skeleton lay near the surface, and was covered with large stones and gravel, this person must have been well thought of, for in front of the face reposed a bowl, a pitcher, a ladle, and two cooking pots. Curiously enough the three graves in this mound represent the typical positions of burial—on the back with knees elevated, on the back with legs extended, and on the side with arms and legs flexed.

Fragments of pottery from the three buildings clearly revealed the type of ware and ornamentation characteristic of each period of occupation, and from them it was possible to establish the relative age of many of the graves. Only one was found which belonged to the people of the pit houses, and but three which dated from the time of the sandstone structure, while about thirty belonged to the period of the cobblestone dwelling. The remainder of the bodies were buried without pottery, and nothing could be told concerning their antiquity, since there was no discoverable correlation between the positions of burial and the age of the graves.

To summarize the facts gathered from the La Plata excavations: three times the site was inhabited by groups of people each of which had attained higher architectural ability and mechanical skill than had the group pre-

ceding. Centuries must be taken as units to measure the time which elapsed between the periods of occupation, and other centuries must be added to allow for the great accumulation of refuse accompanying the different types of buildings. And from a comparison of pottery types, it is proved that even the sandstone structure had fallen into decay before America was discovered by Europeans. Then one may risk the statement that at least fifteen hundred years have passed since the people of the pit houses migrated into the La Plata Valley.

The dwellers in the pit houses made relatively little pottery, and rarely ornamented it with painted designs, but the people of the middle period made great quantities of excellent ware which exhibits a profusion of shapes. Of these the most typical are drinking vessels with globular bases and restricted necks, and ladles in the form of one half of a gourd which has been split longitudinally through the center. Curvilinear geometric patterns applied in black and red-brown pigment are the characteristic ornamentations.

During the third period the pottery was very little better than that of the second, but it presents several features which give it individuality. The half-gourd ladles are supplanted by ladles with tubular handles, and the pitchers with globular bottoms are replaced by the flat-bottomed mugs common among the pottery from the Mesa Verde

Such points make possible a historical reconstruction of the parallel development of architectural and ceramic types. By a close study of the evolution and distribution of these types it will be possible eventually to map the routes of Pueblo migration, and probably to tell whence the ancestors of the Pueblos came into the Southwest.



A SENTINEL OF THE NAZLINI CAÑON



Nazlini Cañon, except for the difference in size, is quite as beautiful as the Grand Cañon. Its coloring of gray, green, and red suggests the Painted Desert

Through the Navaho Region¹

By HOWARD MCCORMICK

Illustrations from photographs by the Author

WHEN we think of strange races of people, quite different from those about us, we turn to the far limits of travel. But within three days' time from New York, we can be among people whose life is as strange and as far removed from our own as one possibly could imagine.

Let us take the Santa Fé railroad to Gallup, New Mexico. Gallup is a characteristic western town. The main street is lined with stores of general character—and has several saloons. Beyond these are the trading supply stores, then we pass through the residential district into the Mexican quarter, which dwindles into the poorer quarters, thinned out to packing-box

houses built in crevices of the rocks. Still beyond we enter the characteristic Arizona landscape of sage and low hills.

Six years ago, in order to go from this point up into the Indian country, we caught the mail wagon and after a day's journey reached Ganado, the first trading post. Now, we jump into an automobile and are whisked up in four hours. The country gets higher as we proceed, extending into wide valleys between the mesas. St. Michaels, a Catholic school with its hospitable priests, is the first stop, after which we ride for fifteen miles through a beautiful pine forest, as trim as though artificially tended like a private estate. Ganado we can find marked on the map, but in reality the place consists of

¹ This trip was taken for the purpose of making sketches and obtaining materials for the Navaho group which is being installed in the American Museum as a companion piece for the two habitat groups already completed. The new group is ceremonial in character, depicting the interior of a *hogan*, with sand paintings, in which a medicine man and other Indians are going through the *yeibetsai*, a ceremony for healing the sick.



CAÑON DE CHELLY

At this point the rock wall of the cañon rises precipitously to a height of at least six hundred feet. More than 160 ruins may be seen in this great gorge, the most conspicuous and interesting of these being the "White House," which at present is practically inaccessible



THE "WHITE HOUSE"

From our camp on the opposite side of the cañon the white buildings of the ruin gleamed from out the cave like two teeth in a wide mouth. Thirty feet below the "White House" is another ruin, which is being washed away rapidly, disclosing beneath it a third

only a mission and a trading post. Indians gather here to trade, however, from miles around, coming even two hundred miles and passing through small trading posts on the way, largely out of friendship for the trader.

If one chances to be at Ganado any summer about the first of August he is likely to find from fifteen hundred to two thousand Indians gathered together for games, such as horse racing and chicken pulling. Originally a "chicken pull" was a game in which Indians on horseback tried to pull a chicken out of the sand while riding past it at top speed. Today a leather strap is substituted for the chicken, and the Indian who pulls it out gets five dollars. As soon as he succeeds in getting hold of it, he makes a wide circuit with several hundred Indians after him. If he can fight them off and return the strap to the judge, he gets an additional two dollars. This annual gathering, corresponding in a way to the Indians because it gives them an opportunity to renew old friendships.

From Ganado to the first Hopi villages is about sixty-three miles. The snake dances occur in these villages every year, two dances with four every alternate summer. If the trip is made in the fall, there is an opportunity to see Navaho dances instead, performed usually for the curing of the sick. We were so fortunate as to have these Navaho ceremonial dances given near our headquarters.

To an outsider the most interesting part of the performance is the dance which begins on the night of the last day. The dancers arrive in groups of from ten to fifteen from various parts of the country, and the whole affair resolves itself into a competition among the various groups for the best singing and dancing.

The setting of the scene is picturesque. Two lines of camp fires edge the dancing ground in front of the *hogan*; hundreds

of Indians fill an amphitheater on either side, with covered wagons for a background. The Indian dance costume is along fairly definite lines, but considerable latitude is allowed in the way of kilts, which are usually made of variously colored velvet and ornamented as the individual's fancy may dictate.

The competing groups of dancers enter the plaza one after another, always in energetic action, but always in single file. As the night wears away the violence of the action increases until at dawn it has reached the maximum. For the observer the night is one of charming and picturesque effects, but perhaps the most impressive comes at the moment dawn breaks over the mesa. The light of the day slowly overcomes the light of the camp fires, revealing the dancers enveloped in swirling clouds of dust, and all the picture near and far takes on a cool gray tone. The singing dies away and the dancers file out. The dance is over. Indians here and there rise and stretch their stiffened limbs and begin to move about. Coffee pots are pushed up to the fire for a hasty breakfast and within an hour all are on their way.

We packed our camp kit and departed with the Indians. Our route lay toward Chin Lee and the Cañon de Chelly, eighteen miles from Ganado. After traveling through forests of piñon and juniper, we suddenly came upon Nazlini Cañon—without warning the car shot out to the brink above the cañon five hundred feet below. Aside from difference in size, Nazlini is as wonderful as the Grand Cañon. The floor is a mosaic of color—green trees, gray sage, salmon-red eroded rocks, and white outcrops of sandstone. Rocks group themselves into cities with castles and towers, which the imagination peoples with busy throngs.

As we went down the steep road into the cañon, we wound in and out among the masses of rock, and crossed arroyos one after another until the cañon walls



Every turn in the cañon brings fresh surprises—a group of ruins appearing suddenly in the cliff or a cluster of trees rising from the stream bed. Salmon-red, the prevailing color of the cliffs, contrasts with silver gray deepening to black where the falling water makes long streaks on the surface



While the Cañon de Chelly is not so imposing and awe-inspiring as the Grand Cañon, in some respects it is even more interesting. At the point under the great overhanging cliff where our camp was situated, the cañon is a quarter of a mile wide, although at the next bend of the river it narrows to a couple of hundred yards



CEREMONIAL GATHERINGS OF THE NAVAHO

Annual dances are the great social occasions of Indian life. From miles around participants and spectators gather for these ceremonies, which sometimes extend over two or three weeks. The dance costume in the Navaho country is along fairly definite lines, but some latitude is allowed in the way of kilts, which are usually made of variously colored velvet ornamented according to the wearer's fancy

leveled themselves into the great Chin Lee Valley. This is one of the most remarkable valleys of the region, because of its tremendous size; it measures about twenty miles across, and ends in a great ridge of black mountains. After skirting the edge of the mesa for twenty miles, we were at Chin Lee, the school and trading post at the mouth of the cañon. Familiar pictures of the Cañon de Chelly lead one to expect it to have an abrupt beginning with high walls at the edge of the mesa; on the contrary, the guide pointed out the cañon mouth to us with difficulty, and at this point its walls are no more lofty than those that bound an ordinary arroyo.

The cañon is more or less dangerous for an automobile when there is plenty of water, although the sand is hard and the road good, because of the quicksand; and it is almost impossible when the sand is dry. Even with an Indian team there is always a certain amount of danger because of the possible sudden rise of the rivers, caused by rains. Rain may come above in the cañon without one's knowledge, and the first intimation that water is rushing down in the dry river bed is a sound like the rattling of hundreds of wind-whipped papers. There is nothing to do but pull on to high ground and stay there for a couple of hours until the water recedes. It is likely to flow for only a short time, although in great volume, not at all like the ordinary swift stream, but in long rolling waves four feet high, with power to drown the horses and carry the wagon and men along to be lost finally in the quicksands.

As the traveler proceeds through the Cañon de Chelly the walls at right and left rise rapidly until at about one mile from the mouth they attain a height of two hundred feet. Almost every turn on the winding floor discloses ancient dwellings high in the cliffs and of the same color, in some places groups of standing houses, in others merely ruin

walls. Small cañons extending back from de Chelly disclose vistas of present day Navaho homes, set in green fields, with melon patches and peach trees. One may travel up the cañon long distances without seeing an Indian, but he may be sure that many Indians, even miles beyond, know of his presence, and that many curious eyes follow his progress.

The Cañon del Muerto branches off toward the left within a mile of the prehistoric ruin known as the "White House," which is perhaps the best preserved and most widely known cliff dwelling of the locality. The cañon wall at the White House is about six hundred feet high, and the White House is recessed in a cave, having the appearance of two white teeth in a wide mouth. The ruin is without ladders and inaccessible now, and is thus protected against vandals.

Thirty feet beneath the White House ruin stands another, built on the river bank; and still below this, set in the bank, is disclosed a third ruin where, within the year, the rush of water in the rainy season has washed away the sand. The presence of this lowest ruin is of great archæological interest, and a few hundred dollars spent in temporary work would preserve the walls in place. If this be not done, another season's rain will probably wash the whole lower ruin away. When facilities for travel are better, thousands of people will go to cañons de Chelly and del Muerto and find them more interesting than the Grand Cañon itself. One's impression of the Grand Cañon is of a tremendous spectacle, awe-inspiring and impersonal. The Cañon de Chelly, while large, is more intimate. One can touch its walls and feel that he is a part of it. Every turn brings surprises, a group of ruins in the cliffs, trees rising from the bed of the river. The sun casts shadows over the walls on one side, and paints the opposite in orange, except in places where water flows down over the

rock leaving long streaks of silver-gray deepening to black.

We had planned to make our camp in front of the White House and had progressed a considerable distance up the cañon, when a threatened storm arrived. Suddenly, in turning an angle, the rain was upon us. We had just time to pull the wagon sheets around us and cover our camping outfit when the torrential downpour struck, driving almost horizontally and with great force. In ten minutes, however, the sky was clear, and we were on our way again.

We finally reached our camping ground, and pitched our tent under a six hundred foot cliff with a great overhang, where, should it rain, the water would drip fifty feet in front of us. Our camp was placed, as we had planned, almost opposite the White House ruins. At the next bend of the river the cañon narrowed to a couple of hundred yards, but at this point it was very wide, and although the opposite wall seemed only a few yards away, it was actually a quarter of a mile distant.

The first afternoon was taken up in studying the character of the cañon and in looking for locations from which to sketch. The next day I rigged my canvas and started my work under favorable light conditions, but before two hours had elapsed the sun was obscured and rain began to fall. All during the morning, even with my canvas anchored to the ground, it was necessary to hold the stretcher with my left hand while painting with the right. There were several heavy showers during the afternoon so that I had to keep my paint box covered. Trying to use oil paint mixed with rain was very much like pushing water around on a dusty floor. The next morning brought the same conditions, with occasional bursts of sunlight through the clouds, and with stronger winds than the day before. The finished sketch was so large that it would not go into the tent at night, so I had to lay it outside on the guy ropes.

This proved its ruin. We had pitched the tent at the end of a long sand bar with the opening away from the prevailing winds, and during the evening a heavy storm came up from the opposite and unexpected direction and deposited a coat of sand over the wet paint. Fortunately, however, the knowledge gained in transferring the image and coloring of the cañon to the ill-fated canvas survived, and the last day was spent in making pencil sketches and notes on color.

That evening at dusk two Navaho boys appeared at the rim of the cañon and started down, resting on a ledge near the top. We could see that they were carrying heavy sacks, so we watched their progress downward. At one place the wall is so steep that shallow steps have been cut in the rock for a distance of at least sixty feet. Down these steps, with their faces toward the wall and each carrying a two-bushel sack of piñon nuts, they descended with ease and agility. It was a remarkable feat of mountain climbing and when they came into camp we gave them coffee and tobacco and complimented them on their skill. With as much sign language as we could muster we engaged them to carry a note to the trader at Chin Lee asking for a team to take us out. So well did they fulfill their mission that in the afternoon of the next day we broke camp, and arrived at the trading post in time for supper.

Persons who have not been in this wild and little known Navaho country are afraid that there is danger from the Indians, or that the water is bad, or that they will encounter numberless difficulties and dangers. As a matter of fact, the Indians are as friendly as one will let them be, and the dangers and difficulties are not as great as those encountered in the streets of a large city. Indeed, our most thrilling adventure was risking our health by partaking of the products of our own inexperienced camp cooking.



Great Lake, in Craven county, North Carolina, was the haunt of the largest alligator I ever saw in a wild state, and he may still be enjoying his ripe old age there in spite of many attempts to capture him

Alligators I Have Known

By H. H. BRIMLEY

Curator of the North Carolina State Museum

TO ONE who has associated with alligators on more or less friendly terms for any length of time, certain incidents connected with the association stand out prominently. And the record of a few of these may convey possibly a better idea of the animal in its native haunts than more general statements would. Among those I have known, perhaps the strongest mental impression was made by "Grandpa," the largest alligator I ever saw in a wild state. "And how large was he?" you ask. I do not know, as he is still enjoying, to the best of my knowledge, his ripe old age in Great Lake, Craven County, North Carolina.

The first time I saw "Grandpa," I had followed a seven or eight-footer in shore, shooting at its head—although unsuccessfully as to result—every time it came to the surface. While it slowly and unconcernedly made its way into a small indentation of the wooded shores, there showed up the head of the largest

alligator I have ever seen, or ever hope to see—the "Old He One" I had so long wanted for our North Carolina Museum. We followed him into the little bay. I shot at something that in the shadows loomed up like the head of a sixteen-footer (but which later proved to be a cypress root), there was a flurry of water, a huge, scaly back showed for a moment in the shallows—and that was the last I saw of "Grandpa" that summer.

He was—and I hope still is—a wise old bird. In subsequent years he robbed my nets that were set for fish specimens, tearing them up scandalously. I once set for a neighbor a hundred yard net for "eating" fish. This, "Grandpa" took off the cork line for two thirds of its length, and I saw his great, rugged head moving slowly away out in the lake, while I was examining the torn-up net.

I have set baited lines for him, with a whole cormorant lashed on the big

hook for bait. He got the cormorant every time, stripping the hook clean of both bait and lashing, and bending in the point of the heavy shark hook between his powerful jaws until it was useless. He did this to two hooks, in different years, in one instance breaking off the point at the barb. At times I shot at him out in the lake, but the water was always rough enough to keep the boat rocking a little, and never a bullet went home. I did not give him up, but circumstances finally made his home waters unavailable to me.

"Will an alligator ever attack a man?" is the most frequent first question of the uninitiated on reaching the alligator country. The usual answer from those who know is "Never!" In general, the answer seems to be correct. I have, however, mended a canoe that had—while occupied—a hole torn in it by a gator's jaws. I have been bitten by a five-and-a-half-footer, and *almost* bitten by one of seven or eight feet.

The injury to the canoe came about in this way: Two young men were paddling the boat along a narrow ditch through the marsh, when one of the paddles struck a gator either swimming or lying dormant on the bottom. Instantly the animal reached up with open jaws, shut down on the curved body of the boat near the water line about four feet aft of the stem, and ripped the canvas and planking loose over a space about fifteen inches across. The canoe was overturned and the occupants thrown out. One of them found a pole on the marsh, and with that he kept the alligator occupied while his companion ran back to the camp for a rifle. They "collected" the specimen, which proved to be a large one ten feet seven inches in length. They buried the skull near the camp, where I dug it up a couple of months later, bringing it back with me as a specimen for the Museum. This is the largest measured specimen I know of from North Carolina waters in recent years.

Lake Ellis is a body of very shallow water, about two miles in diameter. It is largely marsh, and the open water is thickly dotted with small islands, most of them measuring from ten to twenty feet across. Under the banks of many of these islands the alligators have their burrows, and it is an interesting—and sometimes exciting—business to get them out. A long pole, with a stout steel hook at one end, is the main implement needed, although a spade is often handy if digging has to be resorted to. Naturally, one carries a rifle in addition for the *coup de grâce*.

Sometimes a gator can be teased to a condition of rage that impels it not only to bite the pole but also to hold on to it until the animal's head is drawn clear of the water. On one occasion I had found an owner of one of these burrows at home (one can often tell if the burrow is occupied by the condition of the water and excavated earth at the entrance) and had teased him until the pole was badly chewed. Then, the burrow being unusually large, I lost touch with the animal. I was kneeling in the water and had the eleven foot pole in the burrow to its full length, my arm also being inside the mouth of the hole almost up to my shoulder. About that time something happened! The gator had turned around and had slipped past the end of the pole on his way to the entrance when his snout suddenly grazed my hand. Instantly he grabbed it, and shut down hard, one of the sharp canine teeth penetrating a knuckle joint. Luckily for me he did not hold on, and I got my hand back to safety in short order. The slight wound amounted to nothing, although it caused the most excruciating pain for a few minutes. The incident confirmed me, however, in my desire to secure that specimen—which I did just as soon as the pain in my hand abated. He was about five and one half feet long, with exceptionally sharp teeth.

Experience shows that an alligator,



Lake Ellis is thickly dotted with small islands, under the banks of which alligators have their burrows, and it is exciting business to dislodge them by means of a long pole with a stout steel hook at one end. The three specimens in the foreground, measuring from six and one half to eight and one half feet, were secured in one afternoon



In White Lake large alligators may be found, but their presence does not prevent the negro boys from fishing there or from gathering the water lilies. Alligators construct their nests near shallows teeming with fish

when excited to rage and exertion while in his under-water den, will soon seek the entrance for a breath of fresh air, sometimes slipping away through the



A fish hawk has built his nest in the top of this moss-draped cypress tree in Great Lake

muddied water outside if the entrance is not closely watched. I once had a specimen crawl over my feet while I was standing in the water opposite his hole. It gives one rather a creepy feeling to stand perfectly motionless while an alligator of unknown size and unjudged disposition has one at such short range of jaws and tail. But this one evidently judged my feet and legs to be a part of the landscape and was as gentle with me as I with him.

To sit on the bank above the entrance to an occupied alligator hole, with one foot in the water on each side, and with body bent forward and hands open to grasp the animal's jaws when the tip of the snout slowly and cautiously breaks the surface for a breath of air—gives a rather thrilling period of expectancy. I tried it once, and it worked successfully. The burrow was a comparatively new one, which implies that it was of smaller diameter inside than a longer used one would have been. The moment the tip of the nose appeared at the surface just outside the entrance, and before it had time for the intake of breath that might carry with it the tell-tale scent of danger, I had the animal with both hands, holding his mouth tightly closed. The battle was over: his tail was harmlessly out of the way back in the hole, and his other weapons of offense, his jaws, were out of commission as long as I could hold my grip. This specimen was a little less than eight feet in length.

The largest alligator I ever collected was secured in a somewhat unusual manner. It was in October, and I was wading across Lake Ellis, returning to camp after a long and unsuccessful prowl after deer in the big swamps on the other side. The water in this lake averaged less than a foot in depth, making wading across less tiring than walking around the lake through the heavily timbered swamp.

I was carrying my 7mm Mauser rifle, and I stopped near some holes that usu-

ally contained black bass to see if I could not shoot one for supper. While watching the holes, I saw the head of a large alligator about forty yards away, but it went under before I could shoot. Wading near to the place where it had gone down, I stopped and awaited developments. In a few minutes I saw the gator crawling along the bottom only a few yards away, following the slightly deeper water of what had been the bed of a drainage ditch in years gone by. Coming opposite where I stood, he turned deliberately in my direction until he was headed directly toward me. Whether he saw me and took me for a possible protecting stump, or whether his direct move toward my feet was accidental, I do not know. But I do know that a Mauser bullet stopped his career about three feet from my legs. He was nine and one half feet long, and of the broad-jawed, heavily built type. In this connection I may say that the second largest I ever collected was of the comparatively narrow-jawed, slenderly built, racing type, a very different looking animal from this rugged old mossback.

When alligators were known to me only through the printed and illustrated page, I had the idea that they were usually seen lying sound asleep on the bank or on a log over the water. This does not hold with our North Carolina alligators, however. I have seen a great many in the last ten years but, apart from many half-views of a sliding form that disappeared with a splash coincident with the sight, I have seen only one out of the water that gave me a chance to gaze at it for more than a fraction of a second. This specimen was eight feet four inches in length, as I ascertained later in the day, and I have several articles of outdoor equipment made from his hide. One soon learns, however, to estimate size fairly well from a profile view of the head. The natives of any part of our alligator country almost always can tell of an

individual, "using" up a certain creek, that they know will measure fourteen or



Alligators always stay about the waters near this colony of cormorants. These birds—in this the only colony north of Florida—have nested along the shores of Great Lake for many years. Alligators often catch and swallow the half-grown birds as they swim about under the cypresses.

fifteen feet in length. Here is an instance of crudely recorded dimensions: I had shot, and almost certainly killed, a large specimen under conditions of wind and depth of water that made it impossible to secure it, the body sink-

side and estimated its length by the known dimensions of his boat. He reported it as fourteen feet, or more!

In August of the present year, my wife and I spent our vacation at the Onslow Rod and Gun Club, on New



Dim recesses of secluded swamps and bayous, where the trees are festooned with the gray Spanish moss, and a coating of duckweed and green algae covers the water, are favorite haunts of the alligator. Orton Pond harbors many large specimens

ing at the shot. I had a clear profile view of the top of the head from eye to snout, and I feel certain that it varied but a few inches, one way or the other, from nine and one half feet in length. As I learned later, the body floated within a day or two (I had to leave the place before this could occur, or I would have been on the lookout myself) and a passing fisherman ran his skiff along-

River, in southeastern North Carolina. We had some very interesting and familiar experiences with alligators, particularly with small ones, although several of large size were seen. On one occasion, with our canoe lying stationary in a gut deep in the marsh that reeked with alligator sign, we could hear the grunting and splashing of young ones close at hand. We saw

three, evidently of last year's brood, two of them showing up within a few feet of the boat. I tried to catch them with our short-handled landing net, but the coarse stems of the marsh grass interfered with the success of the operation. These alligators we estimated to be from eighteen to twenty inches long.

One day, in another creek tributary to New River, while resting from casting for black bass, we came across several alligators that I judged to be two-year-olds. They appeared (some being clearly viewed at full length) to measure from twenty-four to thirty inches. We followed one about in the open water for several minutes, and I amused myself with casting at him with a buck-tail bait. Finally, I hooked him in the tail, and reeled him alongside the canoe, when my wife slipped the landing net under him. But, a flirt of the tail, and his forepaws on the bow of the net, freed him just in time.

I have examined the stomachs of quite a number of specimens, with some interesting results. The information so gathered would indicate snakes, terrapins, and crawfish as the three chief articles of diet of the alligator in eastern North Carolina, with water birds and fish following. I once took a whole black duck from the stomach of a medium-sized specimen, and I have often found remains of herons, particularly in those frequenting a certain body of water that accommodates a fair-sized nesting colony of egrets and other herons.

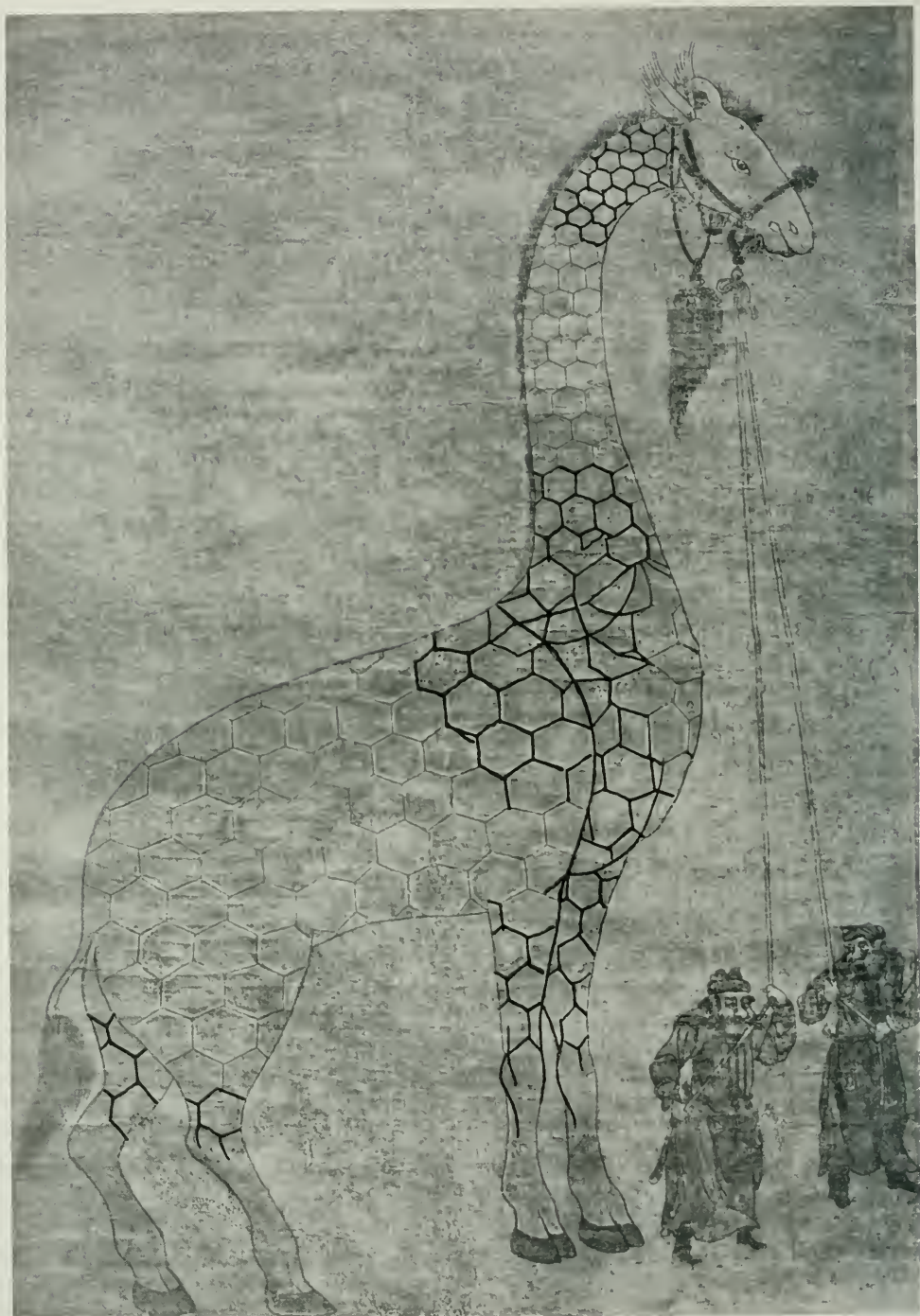
In Great Lake alligators always hang around the colony of Florida cormorants which have nested along its shores for many years, this being the only colony of these birds known north of Florida, I think. I once saw an alligator

catch and swallow—one can hardly use the word "eat" to describe the operation—an almost full-grown young cormorant, while swimming, and I believe that T. Gilbert Pearson, secretary of the National Association of Audubon Societies, had a like experience in the same waters. (I wish I dare tell of the time when Pearson paddled me within shot of a large and fast-swimming alligator, and what he said when I missed it!)

The usual assortment of gravel and pieces of wood almost always is present in the alligator's stomach, and once several pieces of brick were found. From the stomachs of two specimens collected in Lake Ellis, a famous duck-shooting ground on which many thousands of cartridges have been expended, the brass bases of shotgun shells were taken, one stomach containing three and the other four. But I never have found any diamond rings, gold watches, or other articles of intrinsic value.

Fish seem to form but a small part of an alligator's diet: in fact, I remember finding fish remains in the stomachs of only two specimens. One of these contained a grindle (bowfin, *Amia calva*), and the partly digested remains in the other indicated a sucker of some kind.

On one occasion I was coming out to civilization from a surf-fishing trip to Topsail Inlet when the information of the killing of a *crocodile* was given to me. "Yes, sir, it sure was a crocodile, 'cause its upper jaw worked," the "working" of the upper or lower jaw identifying the animal as a crocodile or an alligator, according to local legend. And I had some difficulty in convincing my fishermen friends that their "crocodile" could not have been other than our old friend, *Alligator mississippiensis*.



ANTIQUÉ PAINTING OF GIRAFFE

The original of this ancient Chinese drawing, which dates probably from the early Ming period, is a large unsigned painting in dull colors on silk. The general style of the painting, as well as the state of preservation of the fabric and coloring, would seem to indicate an antiquity of at least three or four hundred years

Giraffe and Sea Horse in Ancient Art

By CHARLES R. EASTMAN

FIGURES of ancient Egyptian and also of late fifteenth century representations of the giraffe were published in several numbers of *Nature* for 1915, and also in the *AMERICAN MUSEUM JOURNAL* for the same year. To this series of old-time drawings may now be added one from Chinese sources, dating probably from the early Ming period.

The original is a large unsigned painting in dull colors on silk, executed with considerable firmness of style and finish, the trappings and figures of the attendants having received especial attention. The general style of the painting and the state of preservation of the fabric and coloring would seem to indicate an antiquity of at least three or four hundred years. In the opinion of the owner, a dealer in Chinese works of art in New York, Mr. A. W. Bahr, the painting is even older.

Through the kindness of Miss Greene, in charge of the private library of Mr. J. P. Morgan, of New York City, the writer has had the privilege of examining a number of old manuscripts containing animal paintings, among them being one which is probably the earliest known English bestiary, dated 1170. Another is an extremely interesting Persian bestiary of the thirteenth century, which has been briefly noticed by M. Claude Anet in the *Burlington Magazine* for 1913 (Vol. XXIII, No. 24). Among the admirably drawn colored figures of this Persian manuscript is one of the giraffe, which is strikingly like the Chinese painting already referred to. One can hardly escape the conclusion, on comparing the two pictures, that one has served as a model or general design for the other, and undoubtedly the Persian is the more ancient. The inference appears warranted, therefore, that illustrations of the giraffe and other western animals were introduced into Persia through trade routes as early as the thirteenth century, and thence found their way into China, where they were copied by native artists.

The earliest printed figure of the giraffe appears in the first edition (1486) of the *Iter Palæstinum*, by Bernard de Breydenbach, who traveled in Persia and Arabia

during 1482 and the following years. This representation is much less accurately done than the early paintings. The proportions are less true to life, and the animal's head is much like that of a goat, with its beard and rather long horns. The markings intended to show color patches, instead of being laid on in more or less regular hexagonal patterns, as in the case of the two earlier ones, are indicated by irregular dots. The figure, a small one, appears on the same page with those of a crocodile, an ape, a camel, a salamander, and two goats, all, according to the author's statement, faithfully depicted as he saw them in the Holy Land.

Reproductions of early figures of the common Mediterranean species of sea horse (*Hippocampus*) have been published by Prof. Raymond Osburn in the *Zoölogical Bulletin* for March, 1915, and also by the present writer in the *Annual Report of the Smithsonian Institution* for the same year.

It is remarked in the latter of these articles that no mention is found in Aristotle of this striking form of fish life, and the term *Hippocampus* was used by the poets of classical antiquity as the name of a sea monster, half horse and half fish, on which sea divinities rode. Nevertheless, the design of the sea horse occurs not infrequently in the plastic arts of Hellenistic civilization, both in Greece and in Italy. The sea horse is figured occasionally also among the island gems, as stated by Fürstwangler, who figures one of them (*Antike Gemmen*, Vol. I, Pl. V).

Figures of animals, including fishes, represented in ancient Grecian vase paintings, have been made the subject of special study by a young French artist, Morin-Jean,¹ and a compatriot of his, P. H. Boussac, has written interesting articles on fish designs inscribed in ancient Egyptian monuments.²

Only one instance is known where the *Hippocampus* is depicted in ancient works of art from the Nile Valley. The design referred to forms part of a decorative painting

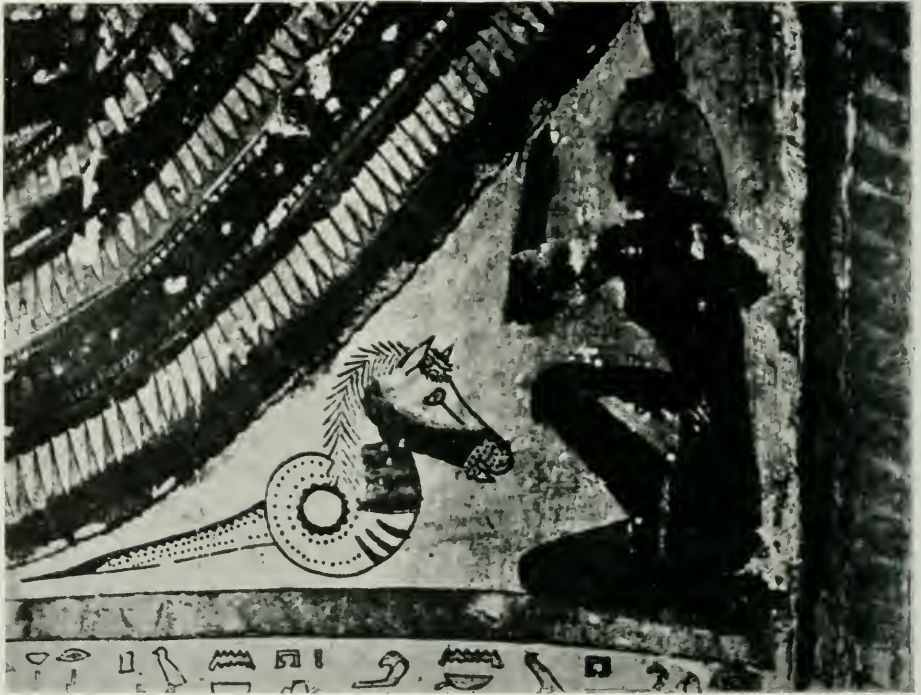
¹ Le dessin des animaux en Grèce, d'après les vases peints. Paris, 1911, p. 262.

² Les poissons sur les monuments pharaoniques. *Le Naturaliste*, Vols. XXXI and XXXII, 1909-10.

in the interior of a mummy case dating from the twenty-sixth dynasty (700-500 B.C.), now preserved in the City Museum of Gloucester. A brief description of it is given in Vol. II (1911), of the *Historical Studies* published by the British School of Archaeology in Egypt, and this is accompanied by a photograph of the original, which has been copied in the annexed figure.

Certain of the details are thus indicated in the description just referred to: "The

greater part of the *Hippocampus* is outlined in black on the white ground of the coffin; the ears, the eyes, the nostril and the mane [*i.e.*, conventionalized dorsal fin] are indicated in black; round the jaw is a wide black band edged with yellow; the muzzle is yellow with black dots; the wide horizontal stripes on the neck are alternately blue and red edged with black. . . . The date of the coffin accords well with the period of the archaic Athenian pediments."



Decorative painting of the *Hippocampus*, from the interior of an Egyptian mummy case dating from the twenty-sixth dynasty (700-500 B.C.), now preserved in the City Museum of Gloucester

The New Natural History—Ecology

By CHARLES C. ADAMS

Professor of Forest Zoölogy, The New York State College of Forestry at Syracuse University

THE study of the natural history of animals always has interested observing and thoughtful men who know nature at first hand. The degree of health and sanity shown in zoölogy can be measured accurately by the amount of interest taken in this sort of animal study and the respect and encouragement shown it.

The Old and the New

The older naturalists were interested mainly in the activities of living animals, especially those in the wild state. These men were usually what might be called "spontaneous naturalists"; they were largely self-trained, that is, they were introduced to animals for the first time not in schools or in museums but by direct contact with them as they tramped the fields and woods or while hunting or fishing. With the rise of modern laboratory instruction and research, and with the accumulation of larger collections in museums, another type of naturalist developed, the "closet naturalist." He was busy with laboratory studies in physiology, anatomy, development, behavior, and taxonomy. Here fragments of animals, biochemical problems, experiments on animals in "unnatural" controlled conditions, and the "skins and skulls" of the taxonomist were the objects of his study. This gave us a period of analysis, which has resulted in very important advances. The field naturalist was frequently only a collector, often an amateur taxonomist who did not take to the sedentary life, or one who dared to keep up his interest in live wild animals in spite of the prevailing fashion for other lines. With this specialization there developed class feelings; often the individuals of each class were inclined to feel that their group only was concerned with "fundamental" problems, and that the others perhaps might be "all right" personally, but unfortunately were on the wrong trail! The closet student often felt that he only was doing the careful "permanent" (is there such?) scientific work, while the field worker was superficial and untrained, and therefore his results were of

little value. The field worker was also often inclined to look upon his closet friend as one who devoted his time to trifles, as one who talked much and loudly of evolution, and yet had no real first-hand experience with the conditions in nature which most animals must endure. This has been the status now for nearly a generation.

During the last ten years, however, a marked change has become more and more evident. Some of the older dominating ideals of the laboratories and museums are now in the background. Public interest has asserted itself; some of the zoölogical fashions have changed to new ones; economic problems have become more prominent; some of the older dominating men with the older ideals are losing influence as leaders; some universities which at first would not endure the newer ideas of work, later tolerated, and finally encouraged them. Thus a greater variety and a broader outlook have resulted. A student is now permitted to study, in addition to anatomy and histology (which crowded aside taxonomy for a time), taxonomy, physiology, behavior, heredity, ecology, and even the application of these to human affairs. This development has not been symmetrical, but it has become vastly more varied, and permanently so, it is to be hoped.

The museums have undergone changes similar to those of the universities, because the ideals both as to study collections and as to the exhibits have changed. The "habitat" groups, particularly, show this, as well as the character of the members of the museum staff, who as a class have a much broader training. With this general liberalizing of our universities and museums the student and the public are getting a broader idea of animals in the economy of nature and of their relation to man.

Disadvantages of the Old

One of the unfortunate results which attended this period of discouragement of natural history in our universities, museums, and schools, was that many persons who already had developed an interest in live ani-

mals were repelled, and even driven from this field of activity, some temporarily and others permanently, by the narrowness of their leaders and instructors. Almost every teacher interested in the natural history side of zoölogy can recall such examples. It has been this same sort of spirit which has made many professional naturalists view with disfavor or contempt the activities and interests of amateurs. For this reason, interest in the study of live animals is felt by many persons who are out of touch with naturalists, although in a large number of cases there would be mutual benefit and respect, if points of contact and sympathy were established. Animals are a factor in a large number of our outdoor sports, among whose devotees there are many men who take a very sane and intelligent interest in fish, game, and bird life, but usually these persons get little benefit from the professional naturalist. Each goes his way independently, to the disadvantage of both; the professional ignoring the valuable results of the amateur, and the amateur unaware of the results of the professional.

In a democracy, where we look upon science as a tool to aid us in securing better human living in the broadest and best sense and not simply as a toy for a leisure class, it is obligatory that there should be widespread benefit from animals, if we are to expect intelligent public opinion to support the study of natural history as it deserves. It is coming to be recognized that there has been serious negligence on the part of many leading zoölogists in supporting the various activities intended to conserve fish, game, birds, and other wild animals. As a result there has been a tendency to allow this kind of work to fall into the hands of persons whose enthusiasm for protection, or selfish love of sport, is not always balanced by a sane and expert knowledge of live animals. Naturally grave errors have been made, and will continue to be made until additional leaders of the right kind are secured, and until naturalists come to realize that the application of ecology to these problems is the only safe basis for action.

Advantages of the New

There is now coming into control of zoölogical interests a new generation which has been trained, not only in all of the older

established methods, but also in the newest, bringing into modern natural history from every direction the training, methods, facts, and ideals of diverse fields. As previously stated, the older natural history was devoted mainly to the study of life histories and habits, but the more recent work not only has continued this excellent feature, but in addition has supplemented it by the best laboratory methods. The new natural history, therefore, is working on a higher level, with a broader outlook, and has a saner and closer contact with nature than was possible by either the laboratory or the older field method alone. It takes the laboratory problems into the field and brings the field problems into the laboratory as never before. This newer natural history of animals is now usually defined as the study of the relation (causal) of the animal to its complete environment. It is to the activities, or responses to the environment (including plants and animals), that primary attention is given. All kinds of facts which throw light upon what animals do are thus recognized as of ecological value. In the comprehensiveness of ecology lies its strength—and its weakness, in the opinion of some. To some minds it is too general, indefinite, and hazy. It includes so much, that some are confused and discouraged. To others, who delight in the outdoor study of animals, who desire a broad comprehensive outlook, who demand room for imaginative play, and who will not allow arbitrary boundaries of their field to interfere when they seek an explanation of animal activities, the new ecology is very inviting and its pursuit fascinating.

We have now sketched in the background for the new natural history. It is generally venturesome to call anything new, because again and again history has compelled us to revise our opinions on this point. It seems safe, however, to say that ecology is new not only in its recent clear-cut conception of its field and in its multiple method of attack, but also in the kind of facts and ideas discovered by the newer methods. Progress takes place by the discovery of new facts and new ideas, and of the two, new ideas are the more difficult to get. Ideas give new points of view, lead to the reorganization of the old, and stimulate the discovery of many new facts. It is not sufficient, therefore, that the public should know ecological facts only; it must have a

similar knowledge as well of ecological ideas, ideals, and principles in order to get the best results from this line of work.

At the present time, perhaps the main scientific value of the ecological standpoint is in its marked synthetic tendency. A vast number of isolated facts, ideas, and even principles, have drifted about, or have lived isolated lives, pigeon-holed in some of the allied sciences, but have not been known or fully utilized in zoölogy. Various physical sciences, with their refined methods, have made important discoveries in ideas of dynamics which are of the greatest value in animal study. The same is true of certain similar conceptions in geology, physiography, meteorology, geography, and plant ecology. In all these fields the active or dynamic phases have made great strides, and often with more clearness and intelligence than in zoölogy. From geology arrives a time perspective secured from no other source; from physiography, geography, and meteorology come ideas of the gross physical processes which furnish the only proper background for understanding chemical and physiological processes and stimuli which influence animals. The ultimate dependence of animals upon plants for food, and the indirect influence of vegetation upon the environment, are a revelation to the old school naturalists when presented to them in modern form. The laboratory contributes in a similar manner from physics, chemistry, biochemistry, physiology, and studies of behavior; and finally, ecology acts as a focusing lens which converges light from all the sciences upon its own and allied economic problems. We must remember that the economics of man is a phase of human ecology. In the synthetical relational tendency of ecology the dynamic conceptions from the allied sciences flow naturally into zoölogy when animals are properly related to their whole environment. In this manner ecology is enriched and invigorated by support coming direct from the most recent conceptions of the sciences fundamental to it.

Ecology and Human Economics

The economic problems relating animals to man have been, and are today, largely handled by the rule of thumb, although there are some striking exceptions. The reason for this is probably the fact that practice is

generally in advance of the scientific explanation. In application we are yet at work on the scientific foundations; the structure itself stands, in part, upon a temporary or "frame" support. Never will the time arrive when action always can be delayed until we have a full scientific information, and yet such must remain our ideal.

Many of the animal problems are attacked without regard to their being ecological in nature, and often without benefiting from progress already made in ecology. In spite of this disadvantage, important progress is made, although at a high cost, and we are reminded constantly that better work could have been done with the same effort had these workers utilized completely the results already obtained.

Good examples of practical ecological problems are those which deal with the relation of animals to disease, and to the production of animal crops from the fields, forests, and waters, both marine and fresh. The ecological character of many agricultural problems is realized only slightly by many of its leaders; the ecological character of aquatic problems is realized probably more clearly, but in practice it lags far behind agriculture; while the ecological understanding of animal crops from forest lands and waters—and of game in general—is only beginning to be realized in this country. The intelligent management of the animal life of our national parks and all animal preserves is dependent upon our knowledge of the ecology of these animals; and we shall succeed in their proper care and use in proportion to our mastery of their ecology and its applications.

The Future: World Leadership

The remarkably rapid rise of ecological work in America is one of the most significant recent advances of science in this country. Plant and animal ecology probably receive more attention from American universities and museums than from those of all other countries combined. The botanical side has perhaps grown more rapidly than the zoölogical, at least consciously. Since 1902, when at the University of Chicago the writer gave the first university course in general animal ecology, with lectures, laboratory and field work, this kind of study has grown up in many universities, and has become permanently established. Looking back over

this period one can see many changes in men and institutions with regard to this subject. In some cases men who were at first hostile to any disturbance of the orthodox courses (which largely ignored ecological relations), have mellowed with time; others who were agnostics, and wished to be shown that ecology was worth while—was a real subject and not merely a name—have since been convinced; many indifferent ones have felt obliged to become interested and informed; while the younger generation accepts the subject as a matter of course, in the same way as it does physiology or anatomy. Before many years we may expect similar changes in secondary instruction, because without doubt modern ecology includes, both in subject matter and in method, the materials which are of the greatest interest to young students, and are not surpassed educationally by any other aspect of zoölogy. And in case schooling is limited, ecology contains a greater amount of valuable subject matter than any other phase of zoölogy, because it is more closely connected with human economic problems.

A striking indication of the healthy growth of ecology is seen in the successful development of the "Ecological Society of America." In 1914, the agitation for an organization began to take shape on a provincial scale, but this rapidly grew to national proportions, and finally took definite form as an international organization. In the recently published list (1917) there are names of more than three hundred members who are willing to be called ecologists, persons who are interested or working in ecology. This does not mean, of course, that there are that many professional or trained ecological investigators. If, however, Prof. J. McK. Cattell's criterion of the amateur, "A man must be regarded as an amateur in work to which he does not devote more than half his time," be applied, only a relatively small number of these persons are professional ecologists, although many of them are professionals in allied sciences. They are, nevertheless, a very representative body of American scientific workers. In number, the plant and animal ecologists are rather equally divided, the subjects in which greatest interest is shown being plant ecology and forestry, and animal ecology and entomology. There is in the world no other similar large body of experienced ecological

workers. Such an outlook is certainly favorable for the future development of ecology in America, and of its applications to human problems. It is hardly necessary to remark that numbers alone are not decisive in the progress of science, but numbers and able men are decisive, and the ecological society has both of these.

Can this growth of ecology in America be merely accidental, or is it a result of our newness and our freedom from tradition, or has it an even greater significance? Can it possibly be another indication of intellectual leadership which for some time has been developing in America? A botanical friend informs me, as a result of his European travels made before the present war began, that eminent Dutch and German botanists expressed their opinion that scientific botanical leadership was passing from Europe to America. Such a statement is startling to those who have been accustomed to hear and to see American science slighted or ignored by European students. In Europe, ecological leadership has long been with Denmark, whose botanists, as well as students of marine and fresh-water animals, have been the model for all other countries. Our leading universities have been developing an excellent blend or combination of the best teaching and research ideals and methods from Europe, a fact which speaks well for the training of future ecologists. The wonderful progress made by American students of heredity already has become prophetic of what may be expected, with proper encouragement, from other branches of zoölogy. Financial, economic, and democratic leadership already have followed the course of the "Mayflower" and with such a foundation there should be, corresponding to these obligations and opportunities, scientific leadership in America.

If ecologists are equal to the occasion and see the strategic and critical period now impending, they may be able to gain an advantage for ecology which previously has not been accorded it, and which its merits deserve. There are evidences in several other lines of activity which appear to harmonize with the preceding suggestions. The important feature at the present time is alertness as to opportunities and obligations, with a desire to do whatever is best to advance a subject of so much interest and of such general usefulness.

Age-Societies of the Plains Indians

By ROBERT H. LOWIE

Since 1899, when Dr. A. L. Kroeber, now of the University of California, began his researches among the Arapaho, the department of anthropology of the American Museum has been almost continuously engaged in an investigation of Plains Indian organizations. Under the curatorship of Dr. Clark Wissler the field was parceled out among different members of the staff, Dr. Wissler himself devoting his attention to the Oglala, the Blackfoot and the Pawnee (the last with the aid of Mr. James A. Murie, a chief of the tribe), while to Mr. Alanson Skinner were allotted the Plains Ojibwa and several Southern Siouan tribes, to Dr. Pliny E. Goddard the Sarcee, and to the present writer more particularly the Crow, Hidatsa and Mandan, as well as a number of other tribes imperfectly known in this particular respect. After years of labor this work has now drawn to a conclusion and the final paper of a thousand-page volume is being issued under the title *Plains Indian Age-Societies: Historical and Comparative Summary*. Some of the more general results may be of more than merely technical interest.—THE AUTHOR

AGE-SOCIETIES occur, strictly speaking, among only five of the Plains tribes, the Hidatsa, Mandan, Blackfoot, Arapaho, and Gros Ventre, and the system of the first-named may be taken as typical. Among the Hidatsa the entire male population was divided into about ten societies, each composed of men or boys of about the same age. An individual did not belong to a society automatically by virtue of his years, however; rather was he obliged to buy membership in company with his age-mates. Thus, young boys of, say, ten would not form any organization, but as they grew up would come to covet membership in the lowest grade, the Stone Hammer Society, then held by their immediate seniors. That is, they desired to possess the privilege of performing a certain dance, of wearing the distinctive regalia of the organization, and exercising whatever other prerogatives were bound up with the native notions concerning the Stone Hammers. In order to consummate their wishes, they dispatched gifts to the older boys, whom they humbly addressed as "fathers," and these attempted to fix as high a purchasing price as they were able to extort. For possibly ten or even twenty nights the members of the younger group were obliged to feast the sellers and give presents of blankets and horses, and when the older group had made the requisite paraphernalia and conveyed necessary instructions to the buyers, the purchase was considered complete. The younger boys then paraded about the village with their newly acquired badges and performed the newly learned dance, while the "fathers" merely acted as musicians—and thereafter had no more rights to Stone Hammer membership. It was now the turn of the older boys to purchase entrance into the next grade by going through essentially the same rigmarole, and so on throughout the entire scheme of organizations.

One problem in particular aroused the interest of students in connection with this institution. What is the relation of the age factor to purchase? Organizations founded

purely on age would not involve any entrance fee; on the other hand, if the purchase were essential, why were fellow-members always of the same age? It would seem plausible that on that assumption a well-to-do youth might rapidly acquire one membership after another until he had attained to the highest rank. This puzzle becomes all the more pressing when we find that the organizations graded by age among the five peoples mentioned occur among other Plains tribes without any grading or age qualification, but that the purchase occurs only with the age factor, although it would seem that these two elements were mutually contradictory.

One of the first points that became clear as the investigation progressed was that any particular society was not essentially connected with a particular age even though all the members were age-mates. That is to say, it appeared that while, say, in 1840 all the individuals in the Dog Society were forty-five years old, in 1860 they may have averaged sixty in the same tribe, and perhaps only thirty elsewhere. The astonishing fact also came to light, that one and the same group might simultaneously hold several memberships. In 1910 an old Hidatsa informant still considered himself a member of a society he had joined at seven, of another he had entered at twenty, of a third he had joined at twenty-seven, and of a fourth he had purchased at about forty-five. Similar statements were obtained from other witnesses, and they were uniformly accompanied by the explanation that a man had a right to every society he had ever bought which for some reason he had never sold. This seemed to establish definitely the predominance of the purchase notion. If the societies had any direct relation with age, it was absurd to assume that a group or individual could be simultaneously connected with several groups.

Nevertheless this could not be the whole story, since the age of all the members of a society at a particular period was practically uniform in spite of the variations in age

permissible for one and the same organization at different times. The whole matter is cleared up only when we understand the mode of purchase, which is collective rather than individual. A group of young boys playing together and forming approximately an age-group are constituted into a definite body by jointly passing through the initial social experience of buying the lowest grade. By simply continuing together at every successive purchase, they form a permanent union of age-mates, and since all groups follow the same course of action, the association of organizations with bodies of coevals is quite intelligible.

The Plains Indian age-societies are especially interesting because of their analogies to institutions of remote areas, which, however, merely serve to throw into relief the distinctive peculiarities of the American phenomena. Thus, in Melanesia all the men are ranged about a number of fireplaces in a clubhouse, each fire being associated with a distinct grade of the order. Each degree is purchasable and accordingly the series seems comparable to the Hidatsa scheme. Yet it differs fundamentally, because in Melanesia the buying is a purely individual affair, so that most men never advance beyond the middle ranks, while only the especially wealthy and fortunate reach the top. In other words, here there is grading with purchase but no suggestion of age-societies. On the other hand, the Masai of East Africa have age-companies formed during the tribal initiation ceremonies. The principle is really very similar to the Hidatsa one, for here too the organization of a permanent social unit results from a joint social experience. But the nature of that experience is very different from that of the Hidatsa, and more particularly, there is no trace of the element of purchase which figures so largely among the North American Indians. In short, there is merely analogy not homology and the Plains Indian age-societies remain an institution *sui generis*.

The data collected on the Plains Indian age-organizations have a direct bearing on certain sociological theories that have figured prominently in ethnological literature. The late Dr. Heinrich Schurtz, of Bremen, assumed that community of age was the earliest bond that united men into definite societies and that all other forms of organization, such as societies based on religious motives, came later in human evolution. At the same time he conceived the early division of male society to be according to three distinct groups, such as boys, married men, and old men. This was a very plausible assumption since such a rough classification

might be made even in primitive times, while a more minute division would seem improbable with people who do not reckon their ages by years. The Hidatsa phenomena show that refined classification is quite possible at a primitive level. All that is needed is that a group of boys should be consolidated by jointly acquiring a certain status and that this practice should become fixed for succeeding groups of boys. Then the total number of companies in a given tribe will simply depend on the number of groups which have passed through the initial experience. Among the Plains Indians the permanence of the bond is emphasized by the fact that the same group of individuals which purchased the Stone Hammer membership will later buy the Kit Fox, Dog, and all other organizations. But this is not essential, since the Masai have permanent age classes with definite privileges but only a single social experience, the initiation ceremony, through which all tribesmen have to pass. The indispensable thing is thus merely that the first welding together should establish a permanent bond of union.

We can, therefore, understand how as many as ten or more age-groups could readily develop in a tribe without any conscious subdivision of the whole population. It is also plain that age plays an important part, since it is the bond that unites the boys before they collectively acquire the status of the lowest grade. Among the Plains Indians, the factor that unites individuals into a group is really age, as Dr. Schurtz contended, but the factor that determined that the group so constituted should become the possessor of certain ceremonial and social prerogatives, was purchase.

A very important problem is whether the age-grading is the earliest bond of organizations in human society. The Plains Indian phenomena definitely contravene this hypothesis. While it is true that some of the organizations seem to have originated among the tribes with graded schemes, other societies certainly developed elsewhere and were secondarily united with the age series. There can be no doubt that in some instances admission is based on purely social considerations regardless of years, while in others a certain form of religious experience shared by a group of men constitutes the sole bond of union. In short, age is certainly a real force in the evolution of tribal societies, but it is far from being the only socializing factor and there is no reason to think that it preceded all others, least of all, in North America, where organizations not based on age far outnumber those that are.

Two Fur Seal Problems and Their Solution¹

By GEORGE ARCHIBALD CLARK

Academic Secretary of Stanford University

A PROPERLY informed breeder of cattle would know the ultimate or average age which his breeding stock might be expected to attain, and the annual increment of young breeders. Such knowledge would be considered fundamental to successful breeding of any of our domestic animals.

The United States Government is engaged in the breeding of fur seals on the Pribilof Islands in Bering Sea, and has been for fifty years, but has not yet definitely ascertained these two important facts with regard to its seal herd; and until five years ago no real progress was made toward ascertaining them. When we consider the amount of investigation to which the seal herd has been subjected in the last twenty-five years, this seems an incredible statement, but the explanation is simple—no investigator has ever been allowed opportunity to study the herd for more than two seasons in succession, and to solve the first of these problems would require at least fifteen years of close, systematic study. The solution of the second problem is dependent upon the first and has, in addition, elements of its own which have required five seasons to solve.

These problems are not so simple in the case of seals as in that of domestic animals. A cattle man can send out his cowboys and round up his herd at any time; he actually can count the various classes of animals. The fur seals, however, get all their food in the open sea and spend the winter in a long migration far from the reach of man. They can never all be brought together at any one time. The animals do not carry upon themselves any distinctive age markings. The seal which has begun to decline ever so little in strength and efficiency succumbs to the harsh conditions of the northern winter; only those in prime condition and physically fit return in the spring.

The three-year-old females, which constitute the breeding increment, come upon the breeding grounds gradually and mingle with the adult females, being indistinguishable from them. The two-year-old females, hav-

ing no young, are even less recognizable as a class, while the yearlings of both sexes keep to the sea for the most part in the breeding season. The two, three, and four-year-old males, the animals from which the product of the herd is taken, are irregular in their movements. They frequent hauling grounds separate from the areas occupied by the breeding seals. The method of taking the quota is to have these hauling grounds driven each week during a season of from six to eight weeks. Animals of approximately three years of age only are taken; the others are returned to the sea. New three-year-old animals are found each time, and the killing season closes early in August, not because of exhaustion of the supply of killable animals, but because of an undesirable condition of the skins due to shedding. It is not possible, therefore, to determine the number of three-year-olds even by the process of elimination. Naturally no enumeration of the two-year-olds, driven and redriven as they are, can be made. Of the breeding seals, it is possible to make an exact count of the harem masters because of their large size and the fact that they do not change their positions during the breeding season. The breeding females, however, come and go in the sea, and never more than one half of them is present on land at any one time. In short, aside from the breeding males—the smallest element in the herd—there is no direct way of enumerating any class of the grown animals. Fortunately the pups of the season do not take to the water during the first month or six weeks of their lives, and at the close of the breeding season can be driven up and counted. As each breeding female has but one pup the count of pups is equivalent to a count of females, and from this known element of the pups a fair approximation of the other nonbreeding animals can be arrived at.

These problems are not merely difficult in the case of the fur seal; they are unusually important. It is vital to the life of the seal herd that the killing of the males should not be so close as to leave an insufficient reserve

¹ Read before the Western Society of Naturalists, 1917.

for breeding purposes. It should be close enough not to involve waste; sealskins are worth approximately fifty dollars apiece. A determination of the proper breeding reserve naturally requires knowledge as to the breeding life of the male, hence, of the normal life period. To maintain a safe reserve and at the same time to take advantage of the full product of the herd requires a definite knowledge of the number of three-year-old males available in any given season. The information cannot be obtained directly.

The sexes are practically equal at birth and subject to like vicissitudes. It may be assumed that they will survive in equal numbers to the age of three years. This is breeding age with the female. An enumeration of the three-year-old females would give the needed information, but these cannot be enumerated directly. A full count of the pups for two or more successive seasons would give a measure of the herd's normal yearly gain. This annual gain results from the increment of three-year-old females but is not a measure of this increment. The annual loss in adult females through natural termination of life must be added to the normal gain to give the full number of young breeders. To obtain this annual adult loss requires knowledge of the ultimate age of the female. Under the conditions affecting seal life we have no reason to assume that either male or female survives breeding capacity, and the breeding limit and age limit may be considered identical. Thus the various problems affecting intelligent management of the fur seal herd ultimately depend upon the settlement of the question of average age or normal life span.

Fortunately we have certain accidental sidelights on the problem of age. In 1891-2-3, during the *modus vivendi* covering the period of the Paris Tribunal of Arbitration, land sealing was suspended, and a large body of young males was left to grow up in these seasons. These appeared as a conspicuous body of idle bulls in 1896-7 and the years immediately succeeding, outnumbering the active or harem bulls three to one. In 1901-2-3, these idle bulls disappeared as a class so suddenly as to excite alarm lest the killing then in vogue had been too close. A movement for the setting aside of a definite breeding reserve of males resulted. But the disappearance of these idle bulls had nothing to do with killing conditions in the period

in which they disappeared. They came into existence as a class in an abrupt and arbitrary manner; they disappeared as abruptly and arbitrarily. These animals were three years of age at the time of their exemption from killing. They disappeared ten years later, suggesting thirteen years as an approximate average limit in the case of the males.

Again, in 1896 and the years following, an experiment was carried on in the branding of female pups, to depreciate the value of their skins with a view to discouraging pelagic sealing. In the years 1900-1-2, a distinctive form of brand was used, no differentiation being made for the three seasons. A considerable number of these branded females was observed on the breeding grounds in 1909, and again in 1912 and 1913, the number being greatly diminished in 1913. No record of observations on these animals in subsequent years is available to the writer, but the conditions as noted in 1913 pointed to from twelve to fifteen years as the approximate age of the female.

These two incidents in the life of the herd throw valuable light on our problem but do not give exact data. In 1912 a beginning was made toward securing more definite information. The time was favorable because the herd was then at the lowest condition in its history, and was on the point of increase owing to the abolition of pelagic sealing, accomplished the preceding year. All problems connected with the herd were in a condition to be most easily handled. The matter was somewhat urgent, moreover, as the agents of the government and of the former lessees of the fur seal industry were then under investigation on charges of illegal killing of seals, the question turning upon the yearling seals but involving considerations affecting the whole policy of land sealing. These charges were known to be untrue but convincing data were not available for their disproof. They nevertheless had their effect upon Congress, and in 1912 legislation was enacted suspending land sealing for a term of years, although this action involved an annual loss of approximately half a million dollars for five years. The annoyance and discredit to government employees and the financial loss thus entailed were due primarily to lack of adequate information on the two points we have under consideration.

First, as to the annual breeding gain in

the herd: A full count of the pups born in 1912 was accomplished, totaling 81,984. A count was made also in 1913, giving 92,269, a gain of approximately twelve and a half per cent. A third count was made in 1914, but by new investigators, and a gain of only one per cent was found. In 1915 the count was in charge of one of the government agents who found a total of 103,527. Fortunately the same agents had charge of the count for 1916, finding a total of 116,977, a gain of approximately thirteen per cent. We thus have two sets of counts each with the personal equation unchanged, and they give respectively twelve and a half and thirteen per cent for the annual gain in the herd. These may be taken as fixing with reasonable exactness the rate of growth at about thirteen per cent.

Although the settlement of this point must await the ultimate age determination to be useful finally in fixing the number of three-year-old animals, male and female, it has yielded immediately useful information. To count the pups each season as the herd grows is physically impossible, and some form of estimate must be substituted to reach an approximate determination of its condition from year to year. It will be possible always to make a close count of the breeding families. From the five seasons in which the full count of pups has been made, average harem sizes for each individual rookery, for each island separately, and for the herd as a whole, are available which, when finally averaged, can be applied to the count of harems and depended upon at any time to give a close approximation of the size of the herd.

Second, as to the final age limit or life span: In 1912 between five and six thousand fur seal pups were branded on the crown of the head with hot irons, giving a permanent and readily recognizable identification mark. It was expected that from the survivors of this branding a certain number of animals could be killed in 1913, and from very exact animal and skin weights and measurements a standard of the yearling seal obtained. A further killing in 1914 would standardize the two-year-old, in 1915 the three-year-old, and in 1916 the four-year-old. Continued observation of the remaining branded animals on the breeding grounds, season by season until their final disappearance, was then

expected to fix within reasonable limits the ultimate or average age.

The standardization of the yearlings was interfered with in 1913 by the fact that these animals did not appear on the hauling grounds in the breeding and killing season. Incidentally this disproved the charge that yearling seals had been killed, since, if they do not come to the hauling grounds in the killing season, they could not have been killed as alleged. They did appear late in the fall among the pups of the season, their natural affinities.

It is understood that enough of the branded animals were killed in 1914 to fix the standard of the two-year-olds. It may be presumed that similar data were obtained in 1915 and 1916 for the three and four-year-olds. Whether the close and painstaking observations necessary during the next ten or twelve years to determine the final disappearance of the branded animals will be made remains to be seen. The shifting personnel of government agents, already fully occupied with routine duties of administration, is not a hopeful source from which to expect satisfactory results. If such observations are not available, the whole experiment looking to a determination of the age limit fails and will have to be begun over again.

The need of reliable data regarding the fur seal herd in these respects is one long felt by those who at intervals have studied briefly its problems. The Fur Seal Commission of 1896-7 considered the matter of sufficient importance to urge, as its one paramount recommendation, that a competent naturalist be placed in charge of the herd who should make its needs and problems his life study. This recommendation was ignored until 1909, when the fur seal service was transferred to the Bureau of Fisheries. The position of naturalist to the herd was then created, but through the death, resignation, and serious illness respectively of the first three appointees, the position, at the close of the season of 1913, was still vacant and systematic work yet to be begun. In October of that year, the present Secretary of Commerce abolished the position of naturalist, on grounds of economy, leaving the herd again to its own devices, except for such desultory attention as the government agents may be able to give it.

Museum Notes

SINCE the last issue of the JOURNAL, the following persons have become members of the Museum:

Life Members, MRS. C. N. DIETZ and MESSRS. ALFRED I. DUPONT and WM. M. KERR.

Annual Members, MRS. M. G. JUSTIN ASHTON, MRS. GEORGE H. MAYO, MRS. STELLA STERN, MISS VALENTINE L. CHANDOR, and MESSRS. S. A. GOODMAN and ROBYN MACFADDEN.

THE experiment of growing Mandan maize in the tulip bed in front of the American Museum during the past summer was successful, although strictly test conditions were not followed in its culture. Many different colors were sown, and as the stalks were so close together that the pollen of the tassels intermingled, some of the new crop has produced ears in which all these colors are combined. Other ears are entirely red, or blue, or black, or white as the case may be. The kernels are larger than the seed planted, showing that if the Mandan maize were grown in this part of the country it would develop a high food value. Owing to investigations made by the American Museum under the direction of Dr. G. L. Wilson, by which the method of cultivating this hardy variety was learned, millions of bushels of corn are now raised in the mountainous regions of the West where previously none was grown. Samples of the crop grown in the tulip bed are displayed in a case in the foyer of the Museum.

AT a meeting of the board of trustees, on September 19, Mr. James M. B. Hard was elected to succeed to the patronship of his father, the late Mr. Anson Wales Hard, who was a trustee and associate benefactor of the American Museum.

DR. THOMAS G. HULL, of the department of public health, has been summoned to Washington to act as Chief of the Division of Exhibits of the United States Food Administration. His duties will consist mainly in preparing plans for food exhibits and in furnishing information to various organizations that wish to install such exhibits.

The Origin and Evolution of Life, on the Theory of Action, Reaction, and Interaction

of Energy, by Henry Fairfield Osborn, which has just come from the press of Charles Scribner's Sons, puts forward a new theory or "energy concept" as a basis for the study of the causes of evolution. The book represents the Hale Lectures delivered by Professor Osborn at Washington before the National Academy of Sciences, in April, 1916. It will be reviewed in a later issue of the JOURNAL.

AT the meeting of the executive committee of the board of trustees of the Museum held on October 17, Mr. W. Elmer Ekblaw of the University of Illinois was appointed research associate in geology for the years 1917 and 1918, this in recognition of his admirable record and services on the Crocker Land Expedition during the years 1913 to 1917.

A RECEPTION to the returned members of the Crocker Land Expedition, together with the first private view of the collections made by the expedition in the Arctic, was held at the Museum on the evening of October 10. The attendance numbered about four hundred. With the exception of one, all of the members of the scientific staff of the expedition were present. The exhibit includes the tent and the camp fittings used by Mr. MacMillan in the Arctic, various sledges and kayaks, the eggs of the strange bird known as the knot, Eskimo clothing of the eastern Arctic type, skins of rare animals, and many archaeological specimens. A series of drawings by the Eskimo attracted considerable attention. The large collections brought back by the Crocker Land Expedition will remain on display in the Philippine hall for a week or more, thus enabling the public to examine them even before they have been installed formally in the Museum.

MANY applications have been received from educational institutions to borrow the food exhibit which was displayed for several months in the foyer of the American Museum. The exhibit has been transferred for the present to the Washington Irving High School, where it is now on view. This school is ideally situated for such an exhibit, being accessible to many thousands of people in the community as well as to the nine thousand girls who attend the sessions.

DR. JUAN B. AMBROSETTI, a distinguished student and scientist of Argentina, whose death occurred in May of this year, was one of the most prolific investigators and writers in America. The literature of American archæology has been greatly enriched by the published results of the researches of this explorer, who was generally regarded as the highest authority on the archæology of Argentina. Dr. Ambrosetti was director of the Ethnological Museum of the Faculty of Philosophy and Letters in the National University of Argentina, and his reports, numbering about seventy-five, are proof of the energetic character of his work, besides serving to enhance the standing of Argentina and South America in the scientific world. His position as an authority on archæological matters brought him into touch with the leading scientists of the world, while articles dealing with his investigations appeared in nearly every journal of recognized scientific standing in Argentina. Among the magazines to which he has contributed are

the *Bulletin of the Argentine Geographic Institute*; *Annals of the Argentine Scientific Society*; *Annals of the National Museum of Buenos Aires*; *Review of the La Plata Museum*; *Bulletin of the National Academy of Sciences of Cordoba*; *Review of the Buenos Aires Zoological Garden*; and the *Review of Law, History, and Letters*. Dr. Ambrosetti was named by the Argentine government as one of its official delegates to the Second Pan American Scientific Congress, which met in Washington, D. C., in December, 1915. He was also the accredited delegate from the following learned societies and educational institutions: Faculty of Philosophy and Literature of the National University of Buenos Aires; Faculty of Agronomy and Veterinary Medicine of the National University of

Buenos Aires; Museum of the University of La Plata; National University of Cordoba; Museum of Natural History of Buenos Aires; Board of American History and Numismatics; Argentine Scientific Society; and the Argentine Geographical Institute. He was president of the first session of the congress and was an honorary vice president of the Congress of Americanists.

ON the afternoon of September 29 a large and informal gathering of friends surprised



The late Dr. Juan B. Ambrosetti, of Argentina

Professor Henry Fairfield Osborn at his home at Garrison-on-Hudson in honor of his sixtieth birthday. The visit had originally been planned for August 8, his birthday, but was necessarily deferred until September 29, which chanced to be also the thirtieth anniversary of his marriage with Mrs. Osborn. The Museum was represented by Mr. Madison Grant of the board of trustees, by the members of the scientific staff and their wives, by the members of the department of vertebrate palæontology

and of the administrative and technical staffs and their wives. The New York Zoological Park and the New York Aquarium, Columbia University and Princeton University were also represented. The weather was favorable so that the arrangements for luncheon on the lawn were enjoyably carried out. After the luncheon Professor Edmund B. Wilson of Columbia read congratulatory messages from Colonel Theodore Roosevelt, President Nicholas Murray Butler, and Mayor Mitchel, and presided at the addresses, the speakers including Mr. Madison Grant, Professor McClure of Princeton, Mr. William Church Osborn, Professor Bashford Dean, and Dr. Frank M. Chapman. Dr. F. A. Lucas gave a discourse on "Birthdays," after which he presented to Professor Osborn

an illuminated Message of Congratulation bearing forty-six signatures. The text of this message and the signatures were as follows:

TO

HENRY FAIRFIELD OSBORN

Your friends, who are bound to you by many years of treasured association, bring this Message of Congratulation upon your Sixtieth Birthday.

We have followed with increasing admiration the progress of your labors during the past forty years in an ever widening field of science. We are proud of the splendid record of your achievements: admirable researches accomplished and in progress, great institutions of science and education founded and fostered, high scientific ideals nobly illustrated and practised.

May the coming years further expand the orbit of your influence. May your spirit of high enthusiasm, thoroughness and unceasing industry, sustained by the cordial sympathy and coöperation which you have always shown toward others, become more and more characteristic of American Science.

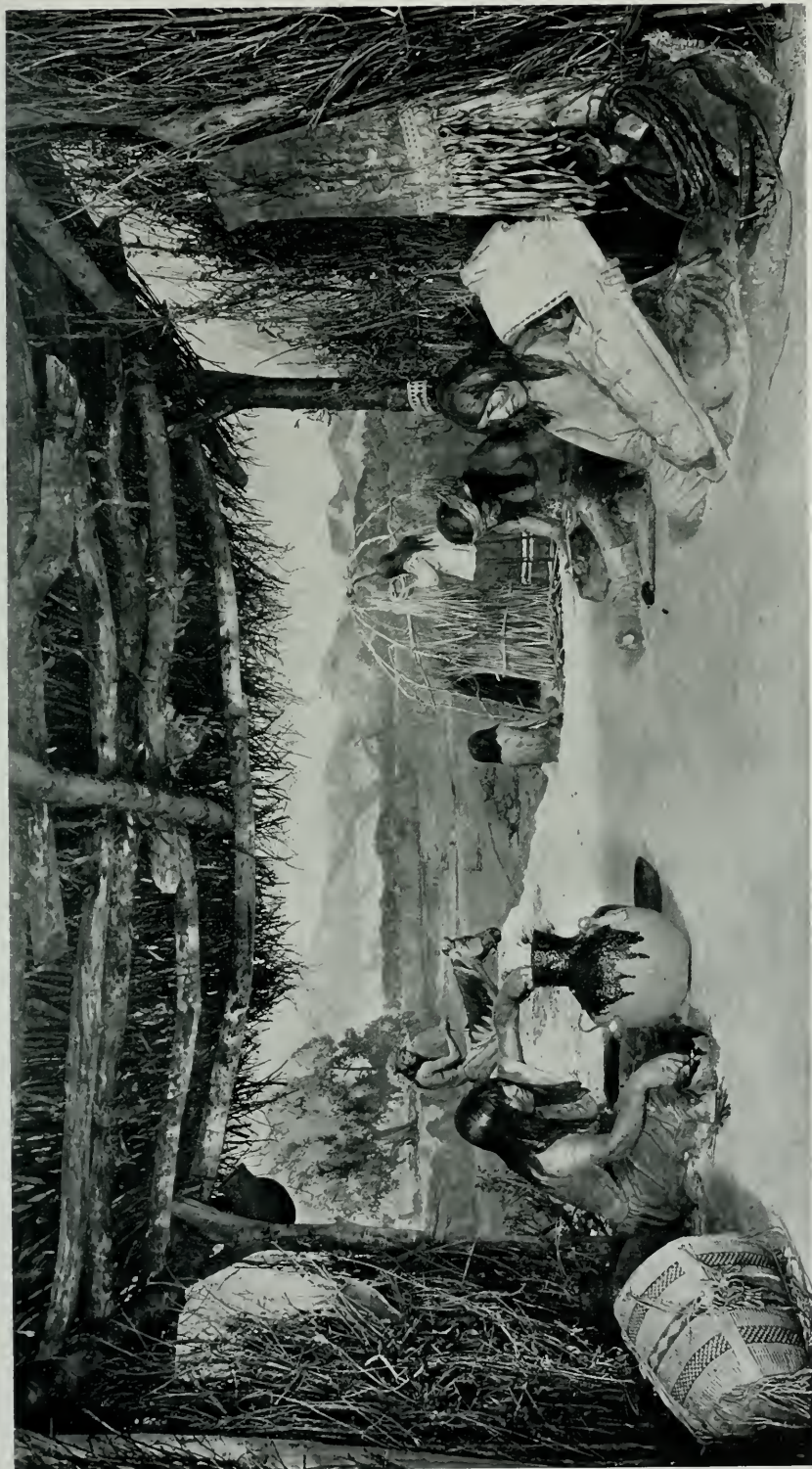
August 8, 1917.

J. A. ALLEN	EDMUND B. WILSON
L. P. GRACAP	WM. H. CARPENTER
GEORGE F. KUNZ	BASHFORD DEAN
E. O. HOVEY	HENRY E. CRAMPTON
FRANK M. CHAPMAN	T. H. MORGAN
JONATHAN DWIGHT	GARY N. CALKINS
ROY W. MINER	J. HOWARD MCGREGOR
W. D. MATTHEW	W. B. SCOTT
WALTER GRANGER	CHAS. W. MEAD
BARNUM BROWN	CHESTER A. REEDS
A. HERMANN	JOHN TREADWELL NICHOLS
WILLIAM K. GREGORY	CLEVELAND H. DODGE
FREDERIC A. LUCAS	MADISON GRANT
THEODORE ROOSEVELT	PERCY R. PYNE
N. L. BRITTON	W. T. HORNADAY
GEO. H. SHERWOOD	CHAS. H. TOWNSEND
R. W. TOWER	C. W. BEEBE
MARY C. DICKERSON	RAYMOND L. DITMARS
PLINY EARLE GODDARD	S. H. CHUBB
CLARK WISSLER	ALBERT THOMSON
FRANK E. LUTZ	E. S. CHRISTMAN
FRED H. SMYTH	A. E. ANDERSON
GEO. N. PINDAR	H. LANG

THE Apache Indian life group, which was opened in May, marks another important step in the American Museum's study of Indian life in its native environment. The scene portrays the semidesert landscape in the valley of the San Carlos River, Arizona. Indians are shown engaged in weapon and basket making and in housebuilding. The background, a canvas eleven feet high by

sixty-five feet long, was painted by Mr. Howard McCormick from sketches made by him in the Apache country; he also planned the details of the group, and superintended the arrangement of the lighting. The various figures were modeled and colored by Mahonri Young from studies in the field. The Apaches are nomadic tribes of the Southwest, inhabiting southern Arizona and New Mexico. The name has become widely known through certain divisions of the tribe who carried on warfare against the Mexican settlers for many years, until restrained by the United States government and placed on reservations. All of the Apaches west of the Rio Grande make houses having pole frames covered with a thatch of weeds and grass. The poles are set in the ground, and the tops bent over and lashed together, forming a dome-shaped structure, as shown in the group. The Apaches cultivate corn and beans to some extent. They often obtain large crops of wild piñon nuts. The bean-like pods of the mesquite are eaten when green and the dry seeds ground into flour. The amole has a banana-shaped fruit which is cooked in the ashes and afterward dried. The agave, a century plant, also furnishes nutritious food, and many species of cacti have edible fruit. Besides these, berries, seeds of grasses and sunflowers, nuts and bulbs, add considerably to the natural food supply. The Jicarilla Apaches make what pottery is required for household purposes. Their ware is undecorated, except for ridges or points modeled in low relief. Pine bark is used in the firing of the vessels, giving them a lusterless black surface, and when cool they are coated with piñon gum to make them more durable. It is in their basketry that the Apaches display greatest artistic skill. Willow and sumach are used, single twigs for the foundation and split sap portions for the sewing material. Designs are geometrical and the colors almost exclusively black and white. Basketry water jars are coated inside with piñon pitch to make them water tight.

IN early summer Dr. C. R. Eastman left on a collecting trip to South America for the purpose of making additions to the series of fossil and recent fishes from that country, and of carrying out some of the plans formed by Dr. Frank M. Chapman in the direction of increased friendly relations and coöperation with scientific institutions in



THE APACHE INDIAN GROUP IN THE AMERICAN MUSEUM

This group was formally opened in the early summer of 1917. It represents the Apache Indian in his native environment engaged in the ordinary pursuits of his daily life. The background depicts the typical Arizona landscape, as seen in the valley of the San Carlos River, while the brush shelter under which the women are working is the usual summer home of these Indians. The background of the group is a canvas eleven feet high and sixty-five feet long painted by Mr. Howard McCormick, who also planned the group as a whole and supervised the work on it. The figures were modeled and colored by Mr. Mahonri Young.

Central and South America. Among the institutions Dr. Eastman expects to visit are the following: Museu Nacional and Jardim Zoológico, Rio de Janeiro, Brazil; Museu Paulista, Sao Paulo, Brazil; Universidad Nacional, Asunción, Paraguay; Museo Nacional, Montevideo, Uruguay; and Museo Nacional de Historia Natural, Buenos Aires, Argentina. Dr. J. D. Haseman and other collectors have sent back to the Carnegie Museum of Pittsburgh sufficient fresh-water material from the regions that Dr. Eastman will visit to demonstrate the presence there of diagnostic forms, but they do not seem to have exhausted the possibilities, and it is hoped that interesting unknown species will be brought to light. As regards marine fishes, those of northern South America belong to the well-known West Indian fauna; the fishes of the east coast farther south, on the other hand, are comparatively little known, and a collection of them should not only contain many interesting species, but also furnish desirable data on the distribution of marine fishes in general. The work already done on fossil fishes in Brazil has been carried on by Agassiz, Woodward, and Jordan. Dr. Eastman expects to make collections of Ganoids from the Cretaceous of the state of Ceará, and Clupeoids from the east coast of Brazil.

MR. JAMES L. CLARK, who is cooperating with Mr. Carl E. Akeley in the work of mounting the large African mammals obtained for the American Museum by the Congo Expedition, returned during the summer from an expedition to western Alberta. This trip was made for the purpose of studying the grizzly, black, and brown bears so abundant in that section, and the early season was chosen because at that time one is more likely to find bears feeding on the young grass, and also because their coats are in their fullest and finest condition. The anatomy of the animal was studied from slain specimens, and characteristic attitudes and habits were watched through field glasses. Mr. Clark's immediate work is the mounting of the third white rhino for the African hall, one adult specimen and a calf already being finished. This animal, with its huge bulk and headlong method of attack, reminds one of nothing so much as that invention of modern warfare, the British "tank." Further work of interest for the Museum is the remounting of the Atlantic walrus group, the old and

faulty methods used having caused these valuable specimens to deteriorate to a point where they would shortly be useless. The method now used is the one evolved by Mr. Akeley, which, says Mr. Clark, "revolutionizes the mounting of pachyderms."

RECENTLY thirty-five girls from one of the largest of New York's department stores visited the Museum to study the various techniques in weaving and in decorating textiles, and especially to see the beautiful cloth of the prehistoric Peruvians, and the primitive looms in the South American gallery. It is the intention of this firm that other parties shall follow until all their employees in the textile departments have taken advantage of the educational facilities of the Museum in this line.

THE annual competitive exhibition of the Aquarium Society was held in the west assembly room of the American Museum from October 12 to 14. Of especial interest were the different species of *Barbus* shown this year, one from Japan with prettily mottled back-fin being notable. This genus comprises many closely related small fishes of the carp family, most numerous in southern Asia. Their small size, activity, beautiful colors, and distinguished markings render them attractive for aquarium culture.

THE annual exhibit of the New York Horticultural Society will be held in the foyer and adjacent halls of the American Museum from November 9 to 11. An unusually fine display is planned, which will include chrysanthemums of great size and beauty, unique orchids, and some new varieties of roses. A private view of the exhibit will be given on the evening of November 8.

THE first lecture of the children's course, which was given on the afternoon of October 15, was the occasion of the formal opening of the newly reconstructed and redecorated auditorium of the American Museum. President Henry Fairfield Osborn extended a hearty welcome to the large number of school children present, and Mr. George H. Sherwood, curator of the department of education, outlined in a brief address the features of the course. The lecture of the afternoon, on "Mexico and Central America," was delivered by Mr. Charles H. Rogers of the department of ornithology.

The American Museum of Natural History

Its Work, Membership, and Publications

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

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

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

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

The educational work of the Museum is carried on also by numerous lectures to children, special series of lectures to the blind, provided for by the Thorne Memorial Fund, and the issue to public schools of collections and lantern slides illustrating various branches of nature study. There are in addition special series of evening lectures for Members in the fall and spring of each year, and on Saturday mornings lectures for the children of Members. Among those who have appeared in these lecture courses are Admiral Peary, Dean Worcester, Sir John Murray, Vilhjálmur Stefánsson, the Prince of Monaco, and Theodore Roosevelt. The following are the statistics for the year 1916:

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

Membership

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

THE AMERICAN MUSEUM JOURNAL

The various Classes of Resident Membership are as follows :

Annual Member	(annually)	\$10
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Patron		1,000
Associate Benefactor		10,000
Associate Founder		25,000
Benefactor		50,000

They have the following privileges:

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

Associate Membership

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

- Current issues of the *AMERICAN MUSEUM JOURNAL*—a popular illustrated magazine of science, travel, exploration, and discovery, published monthly from October to May (eight numbers annually), the volume beginning in January
- A complimentary copy of the President's Annual Report, giving a complete list of all Members
- An Annual Pass admitting to the Members' Room. This large tower room on the third floor of the building, open every day in the year, is given over exclusively to Members, and is equipped with every comfort for rest, reading, and correspondence
- Two complimentary tickets admitting to the Members' Room for distribution by Members to their friends
- The services of an Instructor for guidance when visiting the Museum

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

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

Publications of the Museum

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

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

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THE AMERICAN MUSEUM JOURNAL

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MARY CYNTHIA DICKERSON, *Editor*

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



A TYPICAL GORAL CLIFF IN YUNNAN

From the top of this cliff Mr. Andrews shot a goral which was standing on a point of rock halfway down the side of the precipice. The animal leaped straight out into space and fell five or six hundred feet to the bottom of the gorge.



This serow—the first taken by the Asiatic Zoölogical Expedition—killed two of the dogs. These animals are vicious fighters, their strong curved horns making very dangerous weapons. The photograph shows a part of the short whitish mane

Little-Known Mammals from China¹

By ROY CHAPMAN ANDREWS

Illustrations from photographs by Yvette Borup Andrews

YUNNAN, to the zoölogist, is one of the most interesting spots in Asia, for in this province among the stupendous mountains of the north, the fauna is essentially Tibetan, while in the south and west, in the low fever-stricken valleys of the Tongking and Burma frontiers, the animal and native life is that of the mid-tropics. The topography of Yunnan might be likened to the surface of the ocean in a furious gale, for the greater part has

been thrown into vast mountain waves which divide and cross one another in hopeless confusion. Although this topography has caused a great diversity of tribes to be formed, nevertheless it has not affected the distribution of animals to the extent which might be expected. We found that the small mammals in the northern part of the province were very widely distributed, apparently making their way up the valleys, and that such deep swift rivers as the Yangtze

¹ Article and illustrations copyrighted, 1917, by THE AMERICAN MUSEUM JOURNAL



The camp of the expedition on the Snow Mountain at an altitude of twelve thousand feet. The tents were pitched just at the edge of the dense spruce forest, in a beautiful open meadow, not far from a torrent of snow water which poured down from the peaks above. The first goral was killed just at the edge of timber line, on the cliff shown at the left of the picture

and the Mekong did not act as effective barriers to migration.

Wherever there are main caravan roads through the province, the entire country for miles around has been deforested, and it is necessary to go far into the interior, away from traveled routes, before good collecting regions can be found. Even then the hunting localities are widely separated, and although one camp may prove an especially good one and a rich collection may be made in a few days, at other times it is necessary to travel for a fortnight before finding a place where one can catch even a mouse. It is during such days of discouragement that one realizes a field expedition is not all pleasure, and the specter of "making good" to the Museum looms large before one. But at the end all the hours of unhappiness are forgotten, and only memories of delightful days in the wilderness remain.

The Asiatic Zoölogical Expedition was fortunate in obtaining specimens of almost all the large game known in the province, with the exception of sheep and wapiti. We were never in the region where the former occur, and when hunting the latter the weather became so cold, and snowstorms were of such frequent occurrence, that our Lolo natives refused to work, and without them we could do nothing. In all parts of China wapiti are rare, because their growing horns have such medicinal value that the animals are hunted energetically during the summer, and in some localities have been absolutely exterminated. A pair of antlers in the velvet is worth about one hundred and fifty dollars Mexican.

Probably the most interesting of all the mammals in Yunnan are the gorals and serows, the so-called "goat antelopes," which are found only in Asia, and form an intermediate stage between the true goats and the antelopes. Another interesting member of this group is the takin, which, however, does not

come into this province, and probably is not found south of the Yangtze River. In America, a close relative of these animals is the so-called Rocky Mountain goat.

Although gorals and serows are common in some regions, nevertheless they are rare in museum collections, and but very little is known of their habits and systematic relationships. The Asiatic Zoölogical Expedition secured thirty-two gorals of at least two species, and seven serows of three species; without doubt no other institution in the world possesses such a representative series as that now in the American Museum.

One of our first collecting camps was on the slopes of the Snow Mountain, a spur of the southern Himalayas, at an altitude of twelve thousand feet, in early October of 1916. Our tents were pitched in a beautiful open meadow, overshadowed by the white-crowned peaks, not far from a torrent of clear water which poured down from the snow fields above, through the dense spruce forest. We had hired four Moso hunters—ragged, picturesque fellows, dressed entirely in skins—and a pack of mongrel curs led by a splendid red hound as large as a wolf. One of our hunters

was armed with a most extraordinary gun, having a barrel more than six feet long and a short stock like a golf stick. The butt was placed against the cheek, and the gun fired by holding a piece of burning rope to a powder fuse which projected from the side of the barrel.

The three other hunters carried cross-bows and poisoned arrows. They were remarkably good shots, and at a distance

of two hundred feet could place an arrow in a six-inch circle four times out of five. We found later that cross-bows were in common use throughout the more remote parts of Yunnan, and were only another evidence that we had suddenly dropped back into the Middle Ages, and with our high-power rifles and twentieth century equipment were anachronisms.

A short time after our tents were up, Mr.

Heller set a long string of traps just below snow line, and the next morning they were full of small mammals. It was a gray day, with dense clouds weaving in and out among the peaks, but I went out with the hunters to try for gorals. We were not more than twenty minutes from camp when the dogs began to yelp, and almost immediately we heard them coming around the summit of the peak in our direction. Suddenly the hounds appeared on the side of the cliff, and just in



Mrs. Andrews in front of our camp at the "White Water." The expedition rode two thousand miles on horseback through Yunnan. The tall tent at the left was a dark room for loading and developing photographic plates



Mr. Edmund Heller with a sambar killed near the Burma border.—Mr. Heller was largely responsible for the care and preservation of the small mammal collection, which has arrived at the Museum in excellent condition

front of them was a bounding gray form. I fired at almost three hundred yards, for the mist had begun to close in, and as the crash of the little Mannlicher echoed up the gorge, the goral threw itself into the air, whirling over and over on to the rocks below. It was a fine old male with splendid horns and, as it turned out, was the largest specimen which we killed during the expedition.

It may appear unsportsman-like to have hunted gorals with dogs, but in this particular region they could be killed in no other way. There was so much cover, even at altitudes of from twelve thousand to fifteen thousand feet, that a man might spend a month "still hunting" and never see a goral. They are vicious fighters, and frequently back up to a cliff, turn on the dogs, and fight the pack. At such times, if the hunter does not arrive soon, one or two of the most adventurous dogs almost certainly will be killed.

On the Snow Mountain we found the animals singly, but at Hui-yao, not far from the Burma frontier, where we hunted another species in the spring, they were almost universally in herds of from six to seven or eight. It was

at the latter place that we had our best opportunity to observe gorals and learn something of their habits. We were camping on the banks of a branch of the Swelié River, which had cut for itself a deep gorge through a range of hills from seven to eight hundred feet high. A herd of about fifty gorals had been living on one of the mountainsides not far from the village, and although they were seen constantly by the natives, they could not be killed. With our high-power rifles we could shoot across the river at distances

of from two hundred to four hundred yards.

We could scan every inch of the hillside with our field glasses and watch the gorals as they moved about quite unconscious of our presence. At this place they were feeding almost exclusively upon the leaves of low bushes and the new grass which had sprung up where the slopes had been partly burned over. We found them browsing from daylight until about nine o'clock, and from four in the afternoon until dark. They would move slowly about among the bushes, picking off the new leaves, and usually about the middle of the morning would choose a place where the sun beat in warmly upon the rocks, and go to sleep.

Strangely enough, they did not lie down on their sides, as do many other hoofed animals, but doubled their forelegs under them, stretched their necks and hind legs straight out, and rested on their bellies. It was a most uncomfortable looking attitude, and the first time I saw an animal resting thus I thought it had been wounded, but both Mr. Heller and myself saw them repeatedly at other times, and realized that this was their natural position when asleep.

When frightened, like our own mountain sheep or goats, they would run a short distance and stop to look back. This was usually their undoing, for they offered excellent targets as they stood silhouetted against the sky line. They were very difficult to see when lying down among the rocks, but our native hunters, who had most extraordinary eyesight, often would discover them when it was almost impossible for me to find them even with the field glasses. We never could be sure that there were no gorals on a mountain-side, for they were adepts at hiding, and made use of a bunch of grass or the smallest crevice in a rock to conceal themselves, and did it so completely that they seemed to have vanished from the earth. Like all sheep and goats, they could climb about where it seemed impossible for any animal to move. I have seen a goral run at full speed down the face of a cliff which appeared to be almost perpendicular, and where the dogs dared not venture. As the animal landed on a projecting rock it would bounce off as though made of rubber, and leap eight or ten feet to a narrow ledge which did not seem large enough to support a rabbit.

There were certain trails leading over the hill slopes which the gorals must have used continually, judging by the way in which these were worn. We also found much sign beneath overhanging rocks and on projecting ledges to indicate that these were definite resorts for numbers of the animals. Many of the gorals which we saw at Hui-yao were young of varying ages running with the herds, and it was interesting to see how perfectly they had mastered the art of self-concealment even when hardly a year old. The gorals usually have but a single young at a birth, which takes place during April or early May. Although at Hui-yao almost all the gorals were on the east side of the river, they did not seem to

be especially averse to water, and several times I watched wounded animals swim across the stream.

The gorals are splendid game animals, for the plucky little brutes inspire the sportsman with admiration, besides leading him over peaks which try his nerve to the utmost, and I number among the happiest hours of my life the wonderful hunts in Yunnan, far above the clouds, at the edge of the snow.

While we were at the Snow Mountain the expedition obtained four serows, and others were taken later. The serow is a relative of the goral, but is a much larger and heavier animal, and is usually almost black, with fox-brown lower legs and a long whitish mane. The natives of Yunnan call this animal *Sha-liu*, or wild cow: but in Fukien it is known as the wild donkey, because of its very large ears. When alive, the attitude and general appearance of the serow is like nothing so much as a huge goat. On the Snow Mountain we found them living at altitudes of from ten to thirteen thousand feet, in dense spruce forests, among the cliffs. The animals seemed to be fond of sleeping under overhanging rocks, and we were constantly finding beds which gave evidence of very extensive use. Apparently serows seldom come out into the open, but feed on leaves and grass while in the thickest cover, so that it is almost impossible to kill them without the aid of dogs or beaters.

Sometimes a serow will lead the dogs for three or four miles, and eventually lose them, or it may turn at bay and fight the hounds after only a short chase; a large serow is almost certain to kill several of the dogs if in a favorable position with a rock wall at its back. The animal is, of course, very much more powerful than the goral, with longer and heavier horns, and for its size it is remarkably agile. The first one captured by the expedition killed two of the dogs, including the big red



This gibbon, killed at Ho-mu-shu Pass, is quite different from the one shown below, taken on the Nam-ting River. It is a much larger animal, the male is coal-black, the female dark brown

leader of the pack. We had all come to love this fine hound because of his faithful work. He would disappear alone shortly after our arrival at the hunting grounds, and a little later we were sure to hear his deep bay from the summit of a rock pinnacle or the depths of the spruce forest. The other members of the pack seemed to depend entirely upon him to find the game, but as soon as they heard his yelps, they would string out after him at full speed. Of course, it is always the best

dogs which are killed, because they are the most adventuresome, and our first serow was dearly bought, for although it was a fine specimen, it cost us two of our best hounds. One was ripped entirely open, and the big leader was knocked over a cliff and fell two hundred feet. Hotenfa, our Moso hunter, brought him carefully into camp, but he died during the night, and the tears which his master shed were those of sincere sorrow for the loss of a faithful friend.



Several fine specimens of the yellow gibbon were collected in the Nam-ting River gorge

My first serow I killed near the village of Hui-yao while Mr. Heller and I were hunting monkeys in a precipitous river gorge. Heller was following along the water's edge, while I skirted the rim of the cañon above. I had just exchanged my shotgun for a Mannlicher rifle which my boy had been carrying, and we were climbing along the steep slope about twenty feet below the edge, when suddenly a large animal dashed from cover just in front of us.

It disappeared for a second in a little valley, but a few moments afterward I saw it running along the edge of the river gorge seventy-five yards away. I fired instantly, and the serow sank in its tracks, gave a convulsive twist, and rolled over the precipice. As it fell we heard a chorus of yells from below, and I had hopes that the animal might have been rescued from the river by the Chinese who were evidently near the water where it had fallen. Nevertheless, my heart was heavy as we searched along the precipice for a place to descend.

We discovered a woodcutter who showed us a trail so steep that I rolled for almost a hundred and fifty feet into a mass of thorns, and narrowly escaped breaking my neck. When we finally reached the water's edge, it was only to find a sheer wall of rock, against which the torrent surged in a mass of white foam, separating us from the place where the serow must have fallen.

I tried to wade around the cliff, but in two steps the water was up to my armpits; so I pulled off my clothes and swam around the corner. It was only

a short distance, but the current was so strong that it was a hard fight to gain the rocks above. I finally persuaded the woodcutter to follow me, but my Chinese boy signed that he could not swim and refused to come. We walked gingerly among the sharp rocks for a hundred yards or more, and suddenly



Civets, found only in Asia and Africa, are fairly common in China. A splendid series of these animals was collected. One civet actually walked into camp and began to eat the scraps about the cook box



This Yunnan flying squirrel, the largest known of the world, is rare except in certain places along the Burma frontier. These animals do not fly, of course, but sail from the top of one tree to the bottom of another by means of membranes connecting the fore and hind legs. Great quantities of skins are shipped to central Yunnan to be made into coats



The river "White Water" is so called because of the dazzling white stones over which it flows. At the left, in a rift of the highest peak of the Snow Mountain, may be seen a glacier. The Snow Mountain Range is a spur of the southwestern Himalayas, and at this point is eighteen thousand feet high. Serows were killed at this camp



The caravan halts for luncheon on the way to the Tibetan frontier. At such times the loads are removed and piled in a long line, the mules turned loose to graze, and fires lighted to prepare the meal



Most of the natives in the north of Yunnan use either crossbows or antiquated "cheek guns." The barrel is more than six feet long, and the stock curved like a golf stick. When the gun is to be discharged, it is placed against the cheek and the powder fuse ignited by means of a piece of burning rope



The first serow killed on the Snow Mountain fought the dogs viciously, killing the leader of the pack and one other. It was a large male



This serow is black with a whitish mane and fox-red lower legs. It is one of the so-called "goat antelopes" found only in Asia



Another serow killed near the village of Hui-yao, about one hundred miles from the Burma frontier, is coal-black and represents a very different species from those of the Suow Mountain region



A muntjac killed in Fukien Province where the expedition hunted tigers. The native is a Chinese



The muntjac, or barking deer, is a peculiar species of deer found only in Asia. It is characterized by long tusks and by antlers which rise on an elongated pedicle covered with skin. The muntjac of the photograph had shed the antlers and shows only the pedicles on which the antlers grew



came upon the serow lying half within the water. How it had been possible for the animal to fall from the overhanging cliff without landing far out in the river, I cannot imagine. My pleasure was doubled when I found that it was coal-black, and of a totally different species from those we had obtained on the Snow Mountain. It is, of course, impossible to say whether it will prove to be new to science until it has been carefully studied, but it is an extraordinarily rare animal even in that region, and none have been taken from localities within many miles of where this specimen was killed. Securing this serow was one of the fortunate occurrences which sometimes happen to a sportsman, but one might "still hunt" for even months without being able to get another in the same way.

Besides goral and serow, the Snow Mountain yielded us the blue, or crested, muntjac, the rarest specimen which we obtained upon the entire expedition. These beautiful little deer have a dark slate-blue coat and a rather bushy tail, white beneath, which, when the animal is running, is displayed as prominently as the "flag" of the Virginia deer. The first time I ever saw one of these splendid animals was when Hotenfa and I were bringing in two gorals which we had killed during the day. The big red dog, although dead tired, had disappeared alone into the heavy forest below us. Suddenly we heard his deep bay coming up the hill in our direction. Hotenfa and I dropped

The two little Tibetan bear cubs, purchased from a native at Teng-yueh, are playing about the motion picture camera. One of the cubs died when about six weeks old, but the other was brought to New York. In the lower picture Mrs. Andrews may be seen feeding condensed milk to one of these cubs when it was only ten or twelve days old

our burdens and ran to an opening in the forest where we thought the animal must pass. Instead of coming out where we expected, the dog appeared higher up, at the heels of a crested muntjac which was bounding along in front at full speed. I had one chance for a shot at two hundred yards as the pair crossed a little opening in the trees, but it was too dangerous to shoot, for had I missed the deer, the dog certainly would have been killed. I was heartbroken over losing this animal, but a few days later a shepherd brought in another which had been wounded by one of our Lolo hunters above camp, and had run down into the plains to die.

The red muntjac is one of the most common animals throughout Yunnan and is much larger than the Indian or the other Chinese species. These ani-

mals are often called barking deer because of their loud, harsh bark which may be heard for a long distance if the night is still. At one of our camps they used to bark very frequently during the day, but it is not easy to kill one without the aid of dogs or beaters, for they live in such dense jungle that it is almost impossible to force one's way through the cover without a tremendous amount of noise. In the early morning or just at evening we sometimes found them feeding in clearings on the edge of the heavy cover, but they

always kept a sharp watch and disappeared at the slightest sign of danger. The muntjac is especially interesting because its antlers grow from greatly elongated pedicles which are covered with skin and hair, instead of rising abruptly from the skull as in other members of the deer family.

On the Snow Mountain porcupines

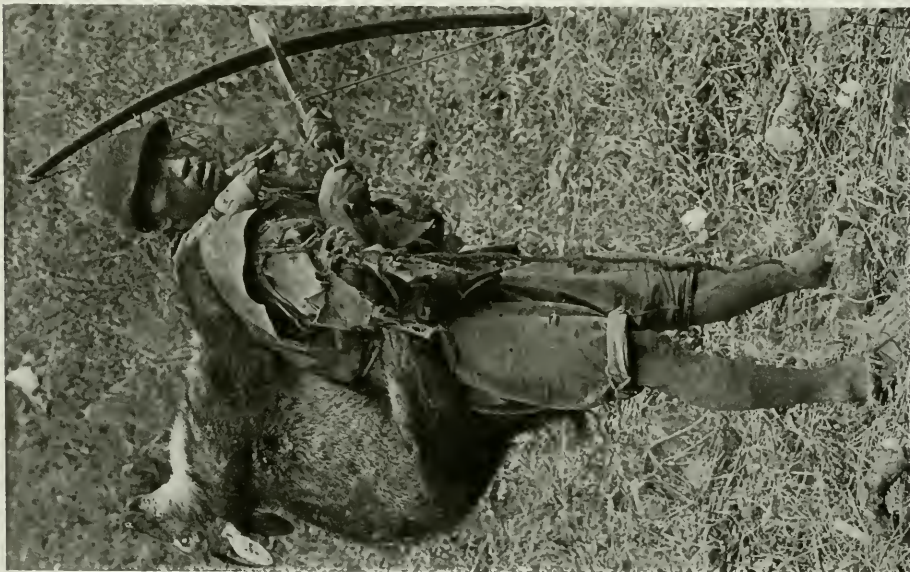
were not uncommon, and when hunting big game we often were greatly annoyed to find that our dogs had followed the trail of one of these animals. We would arrive to find the hounds dancing about the animal's burrow with excited yelps, instead of having a goral or a serow with its back to a cliff, as we had expected. These porcupines are quite different in appearance from those with which we are familiar in America, for the quills are sometimes eighteen inches in length,



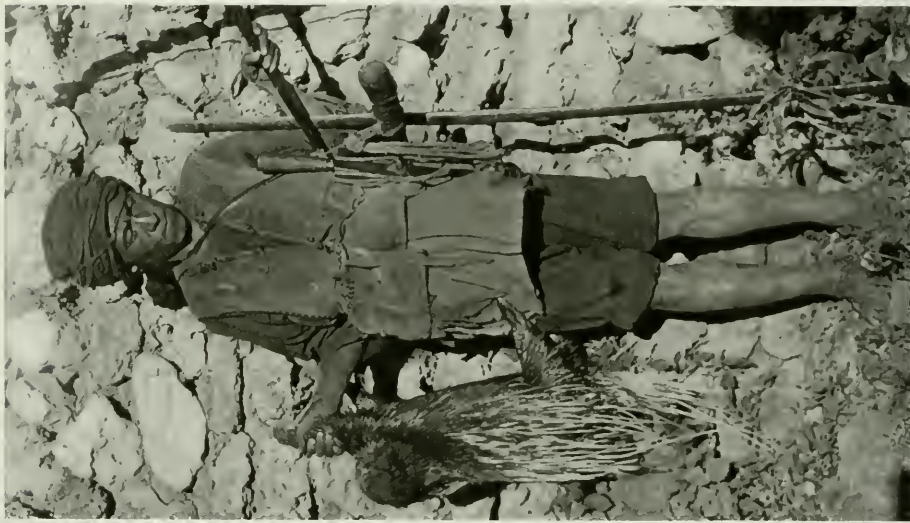
Mrs. Andrews with a pet Yunnan squirrel.— Mrs. Andrews was the official photographer of the American Museum's Asiatic Zoological Expedition

and project far beyond the back.

In the northern part of the province, it is said, bears are not uncommon, but as we were there during the winter when they were in hibernation, we were never able to find one. In the south, other carnivores are much more abundant than in the north. There are probably no tigers in the province except along the extreme southern border near Tongking. Leopards are certainly not abundant, but near the Burma frontier they sometimes are trapped by the natives.



Hoenfa, a Moso hunter, bringing in a scowl shot by Mr. Andrews on the Snow Mountain.—This was the first large animal killed in China by the expedition. The Mosos, a native tribe, at one time ruled the larger part of northern Yunnan. Their weapons are crossbows with poisoned arrows.



A Moso hunter with a porcupine.—The porcupines of Asia and Africa are quite different in appearance from those of America. The quills which project from the back are exceedingly long.



Shan hunter with gibbons found on the Namting River.—These may represent a new species. They have a remarkable sirenlike call, which we heard continually in the jungle in the mornings, especially during cloudy or rainy weather.

The small carnivores, such as civets, genets, polecats, and palm civets, are fairly common in certain localities, and at our camp on the tropical Nam-ting River we obtained a number of very interesting species. The tents were pitched under two huge banyan trees on the edge of a deserted rice clearing in the midst of the jungle. It was delightful weather, warm in the daytime, but cool enough in the evening to make a blazing wood fire very acceptable. While Mr. Heller attended to the small mammals, my wife and I put out a line of thirty-five steel traps. Every morning and evening we made the rounds, always with the pleasurable anticipation of finding some new animal. One day a civet walked into camp and began to eat the scraps about the cook box, regardless of the shouts of the muleteers, who were imploring Mr. Heller to bring his gun. They finally convinced him that there really was some cause for their excitement, and he shot the animal. It was probably ill, for its flesh was dry and yellow, but the skin was in excellent condition. This was our only experience, however, of having an animal walk into camp to be killed.

Every morning while on the Nam-ting River we heard querulous notes which sounded much like the squealing of very young puppies and which were often followed by a long-drawn siren-like wail. The natives assured us that this noise was made by monkeys, which we later found to be small yellow gibbons. These animals were in fairly large troops, and would climb into the top of a dead tree and call across the jungle for an hour or more almost every morning. As soon as the sun was well up the noise usually ceased, but if there was a heavy fog or rain, it would continue until ten or eleven o'clock in the morning. The jungle was so thick that it was well-nigh impossible to find the monkeys except when they were calling, and even then

one was by no means sure of getting a shot. The animals were exceedingly wild, and from their lookout in the top of a dead tree could see every movement of the heavy brush beneath them, so that they would be off at top speed through the jungle before one could get within shooting distance. Then it meant a wild scramble through the bushes, over rocks and logs, with the possibility of a shot at long range as the gibbons went swinging through the tree tops. Sometimes they would lie quietly along a branch, and if one remained absolutely motionless, in half an hour or so the monkeys would try to steal away without being seen.

Later, while in camp on Hu-mu-shu Pass, we hunted a large black gibbon, which is quite a different species from the one on the Nam-ting River. These animals were even more difficult to kill than the yellow ones. At the slightest sound they would throw themselves through the tree tops at incredible speed. I never have been more surprised in my life than the first time we tried to follow a troop of gibbons down hill through an open forest. Within two hundred yards the animals had distanced us by fifty or sixty yards, even though my wife and I were running at top speed. The monkeys would swing on a branch and throw themselves fifteen or twenty feet into the next tree with unerring precision. These gibbons had quite a different call from those of the Nam-ting River, very much louder, and with less of the siren-like note so characteristic of the other species. They would call only for about half an hour in the morning, and it was necessary to locate them immediately if they were to be found at all. The expedition obtained several other species of monkeys, such as baboons and big gray langurs, but the gibbons were very much more interesting to hunt than any of the others.

Although sambar must have been

fairly abundant near our camp on the Nam-ting River, nevertheless, because of the dense cover, it was almost impossible to kill them without exceptionally good beaters and dogs, and we did not get a specimen until the last month of our expedition. This fine male was shot by Mr. Heller at Watien, a short distance from the Burma frontier.

The small mammals of Yunnan are exceedingly interesting, but it is not possible here to give even a brief review of the species represented in our collections. Insectivores are always valuable, and the expedition obtained a surprisingly large number in Yunnan. Probably one of our most important acquisitions was a shrewlike animal of the genus *Hylomys*. Although extremely rare in collections, our expedition obtained a large series of two species.

Probably the most spectacular of the small mammals in this entire province is the great red flying squirrel. It is found only near the Burma frontier and must be exceedingly abundant in certain localities, for hundreds of skins are sent from Wei-shie to Tali-fu to be tanned and made into coats. The animal is nearly four feet long including its tail, and is of a beautiful mahogany

red, grizzled with whitish hairs on the back.

I am especially glad to be able to announce that our collections have reached New York and the Museum safely, and parts of them have been placed on exhibition. When we reached Rangoon and were once more in civilization we thought that our difficulties of transportation were ended, but instead we found that they had only begun. India was almost cut off from the Pacific. When we arrived at Calcutta, whence ordinarily four or five ships a week are leaving for Singapore, there had been none for two months and it was impossible to learn when another would leave. It was necessary to take our specimens across India to Bombay, and the entire collection was brought home as personal baggage. To anyone in need of excitement I would recommend traveling with forty-one cases in war time! Had it not been for the name of the American Museum and the wide knowledge of the work which this institution is doing, it would have been impossible to persuade the steamship companies to allow our collection to be put on board the ships when there were hundreds of thousands of tons of freight awaiting shipment.

AUTHOR'S NOTE:—The American Museum's Asiatic Zoological Expedition left New York in March, 1916, for zoological exploration in the province of Yunnan, China. It was financed by the Jesup Fund of the American Museum, by Mr. and Mrs. Charles Bernheimer, Mr. and Mrs. Sidney M. Colgate, Messrs. George T. Bowdoin, Henry C. Frick, Childs Frick, Lincoln Ellsworth, and Mrs. Adrian Hoffman Joline. The personnel of the expedition consisted of Mr. Edmund Heller, Yvette Borup Andrews, and myself. Mr. Heller is a collector of wide experience, and his principal work was the collection of small mammals. To his energy and perseverance was due the fact that the Museum secured an especially representative collection which has arrived in excellent condition. Mrs. Andrews, who was in charge of all the photographic work of the expedition, was especially fitted through a long study of color photography, which formed an important part of that phase of the work. My own efforts were devoted to the general direction of the expedition and the hunting of big game.

During the year spent in the field the expedition traveled 2000 miles on horseback, and camped in 103 different localities, at altitudes of from 1500 to 15,000 feet above sea level, along the borders of Tibet and the Burma frontier. About 3000 specimens were collected, consisting of 2100 mammals, 800 birds, and 200 reptiles. Ten thousand feet of motion pictures were made, 400 photographs, and 150 Paget natural color negatives.

While in the field, the expedition was assisted very materially by the following gentlemen, without whose cooperation it would have been impossible to carry on the work, and it is a pleasure to acknowledge the indebtedness of the American Museum and our personal obligations to them: the Director of the Bureau of Foreign Affairs of the Chinese government; M. Georges Chemin Dupontès, Directeur de l'Exploitation de la Compagnie Française des Chemins de Fer de l'Indochine et du Yunnan, Hanoi, Tongking; M. Henry Wilden, Consul de France, Shanghai; M. Kraemer, Consul de France, Hongkong; Mr. Howard Page, Standard Oil Co., Yunnan-Fu; Hon. Paul Reinsch, Minister Plenipotentiary and Envoy Extraordinary to the Chinese Republic; Mr. H. G. Evans, British-American Tobacco Co., Hongkong; Rev. William Hanna, Tali-fu; Rev. A. Kok, Li-chiang-fu; Ralph Grierson, Esq., Teng-yueh; Herbert Goffe, Esq., H.B.M. Consul General, Yunnan-fu; Rev. H. R. Caldwell, Yenping; Mr. C. R. Kellogg, Fuchow, China; and the General Passenger Agent, Canadian Pacific Railroad, Hongkong.

PICTURESQUE YUNNAN; TYPES OF CHINESE AND NATIVE RACES; PAGODAS, AND TOMBS¹

DUOTONES FROM PHOTOGRAPHS BY YVETTE BORUP ANDREWS

The Asiatic Zoölogical Expedition of the American Museum, 1916-1917, under the leadership of Mr. Roy C. Andrews, worked in remote parts of the province of Yunnan, China, where no white man had been before. It brought back to New York a record of the country, the people, and of the work of the expedition, in the shape of 10,000 feet of motion picture film, 150 Paget natural color plates, and 400 black and white negatives



THE GATE OF CHOU-CHOU

All of the first and second class cities in Yunnan are surrounded by high walls, and are entered through four or more picturesque gates. Some of the walls probably were built in the Middle Ages, and are still in a fairly good state of preservation. They are all loopholed for riflemen or archers, and even today offer a formidable defense, except against artillery. The gates, like the temples, almost always are surmounted by dolphins

¹ Illustrations and text, together with the preceding article, copyrighted, 1917,
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THE DEAD OF CHINA

For a distance of twenty-five or thirty miles the plain between the mountains and the lake on the way to Tai-fu is a cemetery. The graves are scattered so thickly that they appear like a vast gray blanket spread over the foot of the hills. There must be many hundreds of thousands of graves in this great cemetery, among which are those of the Mohammedans who were slaughtered by the Chinese at Tai-fu in the Mohammedan War forty-five years ago.



TWO TIBETANS WITH THEIR LEADING CARAVAN MULE

While the expedition was in the northern part of Yunnan, Tibetans were encountered continually. These men were on their way to the city of Puerh, in the south of Yunnan, where a special kind of tea, greatly favored by the Tibetans, is grown. The caravans make journeys of many hundreds of miles to and from this tea-growing region. The Tibetans are one of the few races that have come into close contact with the Chinese and have not been absorbed by them. On the contrary, a Chinaman married to a Tibetan woman adopts Tibetan ways and dress, and his children are reared according to Tibetan customs



A CHINESE MOTHER WITH HER TWO CHILDREN

Note the bound feet of the woman. The practice of binding the feet of girl children is probably declining in the coast provinces, but in Yunnan it is still almost universal. Little girls less than eight or nine years old play happily in the streets, but as they grow older, they sit on the doorsteps, their faces twisted in pain, holding their tortured feet. In Yunnan not even the women of the coolie class are exempt, and one sees them hobbling about in the fields, barely able to walk on their peglike feet



A GORGE OF THE YANGTZE RIVER

Where the Yangtze River breaks through the Snow Mountain Range, a spur of the southwestern Himalayas, the peaks reach an altitude of eighteen thousand feet. At this point, which is about twenty-five hundred miles from the mouth, the river has cut for itself a gorge one mile in depth. This gorge probably is one of the most remarkable natural sights in all China, and can be compared only with the Grand Cañon of the Colorado in North America



CHINESE PAGODAS NEAR TALI-FU

GROUP
OF HUNTERS
WITH A MUNTJAC,
OR BARKING
DEER

These men from near Fuchow, Fukien Province, are typical representatives of the southern Chinese. They assisted in driving for small game when the expedition was hunting tigers before leaving for Yunnan. Note the antiquated guns



A SUSPENSION BRIDGE IN THE INTERIOR OF YUNNAN

These bridges are durable and exceedingly picturesque. They are constructed of two iron chains firmly fastened to huge rocks on either side of the river. Although the bridges shake and spring in a rather alarming way when a caravan is passing, they are fairly safe. In the background may be seen rice terraces. Rice is cultivated in almost all of the valleys in Yunnan, but the hillsides which once were white with the flowers of the poppy grown for opium, are now yellow with corn. Since 1906 when the late Empress Dowager issued an edict prohibiting the growing of opium throughout China, there has been an unceasing warfare carried on against its production, and in Yunnan its growth has virtually ceased. Opium smoking is by no means eliminated, however, and in the southern part of the province it is carried on openly and without check by the mandarins





Chinese baby.—The Chinese are very fond of their boys, but the killing of girl children is still carried on in many parts of the republic. In Yunnan the babies wear ornamented bonnets, the fashion of which changes with the locality



PORTRAITS OF YUNNAN NATIVES

Shan boy from the Nam-ting River.—Although a part of China, Yunnan has about thirty non-Chinese aboriginal tribes who were there long before the Chinese conquered the country. One of these, the Shans, a peaceable, good-natured people but extremely lazy, inhabits all the valleys below four thousand feet, where the Chinese do not attempt to live because of the deadly fever



Chinese patriarch.—Old age in China is greatly respected, and the worship of ancestors is a vital thing to the orthodox Chinese. Custom decrees that a son must worship three years at the grave of his father



Shan girl.—The Shan women are well formed, of a light yellow complexion, and rather good looking. They are exceedingly shy, and it is only with the greatest difficulty that one secures photographs of them



Moso shepherd.—The Mosos are simple, honest people, but are considered "barbarians" by the "highly civilized" Chinese to whom custom is more important than sincerity. The Mosos invariably wear a brown felt cloak and a close-fitting felt hat



Lolo chief.—The Lolos are a strange people who hold a large portion of the province of Szechwan as independent territory. There is continual warfare between the Lolos and the Chinese, and the Lolos frequently descend upon the Chinese villages, massacring the men and boys, and carrying the women and children into slavery

REPRESENTATIVES OF THE THREE LARGEST ABORIGINAL TRIBES IN YUNNAN

MOSO
SHEPHERDS
AT THE BASE
OF THE SNOW
MOUNTAIN

The Mosos, who at one time ruled the larger part of northern Yunnan, are one of the semi-Tibetan tribes. They have large herds of sheep and cattle, and consequently in their region it is possible to obtain fresh milk and butter





A large series of gorals was collected by the American Museum's expedition in this cañon formed by a branch of the Swelie River, near the village of Hui-yao. Just under the bank at the left is the entrance to a cave which was inhabited by a large colony of bats



Bandits killed in the city of Yenping, Fukien Province.—The city was attacked by rebels and bandits, and for several days a reign of terror ensued during which many Chinese were killed. The missionaries (assisted by Mr. Andrews, who happened to be there at the time) carried on Red Cross work, bringing the wounded to the Mission Hospital. Through the efforts of the missionaries a terrible massacre was prevented. China is infested at present with bands of brigands, composed largely of soldiers who have deserted or have been expelled from the army

Permanent Agriculture and Democracy¹

AS SUGGESTED BY THE SITUATION IN CHINA

By L. H. BAILEY

Formerly Director and Dean of the New York State College of Agriculture,
at Cornell University

THE phrase "permanent agriculture" is a real contribution to the discussion of rural affairs in recent time, expressing the idea that we must be able to maintain ourselves on the planet at the same time that the earth retains its producing power for all coming generations. This phrase is important both because it demands the facts and also because it sets ideals for the future. It is the highest expression of being our brother's keeper—the brother who is yet to come. It suggests the most perfect altruism, and the truest socialism. Sometime this will be the greatest concern of government,—in the time when the concern of government coincides with the primary concern of mankind.

It has been said that permanent agriculture has been developed in the Far East. I have recently returned from the Far East, where, with King's sympathetic book, *Farmers of Forty Centuries*, in mind, and with opportunities to learn something of the rural situation in China in a few parts of the republic, I received certain impressions, and the reflections therefrom are the subjects of this address.

China is a people still in its agricultural phase, and as eighty-five per cent of the population is said to be engaged in farming, the public polity must be largely a reflection of the rural situation.

At the same time, China is a land in which great numbers of people live constantly on the verge between sustenance and want, in which poverty rather than middle-class comfort-earning deter-

mines much of the life and civilization, in which the scale of living is reduced to the lowest terms for the mass of the people, in parts of which human beings may be worth less economically than beasts of burden, in which government does not reach the social and economic needs of the population, and in which the people on the land are uneducated and the ideals undeveloped. The mere statement of the situation is a challenge of the agricultural status of the country in the twentieth century, when expressed in terms of human beings.

China is a land of unnumbered people, of vast resources, of stimulating history, stagnant in the occidental commercial sense, still under its own sovereignty, trying to adapt itself to the current ways of the world, a racial complex of marvelous vitality and endurance—probably the greatest human problem on the planet. Its agricultural or rural status is the fundamental fact in this problem.

I went to China filled with the expectation of its wonderful centuries. I was to find at last an exhibition of permanent agriculture. Here is solved the problem, apparently, of maintaining the fertility of the earth. Here also is said to have been solved the problem of the greatest possible yields, of the best disposition of human waste, of the closest utilization of the land, the best conservation, the elimination of the unnecessary accessories of life, and something like final rural individualism.

It is difficult for an occidental to judge any situation in the Orient. He must approach the subject largely

¹ Abstract of paper read November 12, 1917, before the Society for the Promotion of Agricultural Science at Washington, D. C.

from the objective point of view, yet remember that the oriental may live in a subjective civilization.

My first impression was of waste land, and this impression grew constantly in spite of all the dissuasion of friends. The smaller the divisions of land, the greater is the wastage of the partitions. In the best-tilled parts of the coastal plain, possibly ten per cent of the land sometimes is wasted by mere embankments and division lines. Much of the land also is taken by the grave mounds, and the unoccupied land near may be left in such small and irregular areas as to be utilized with difficulty. In the interior are vast shaven hills and mountains, swamps and flats due to uncontrolled streams and lakes, semi-deserts under no kind of effective control. One is impressed with the barrenness of the country, although the fields themselves when cropped may yield well or may not. One is impressed everywhere with the merciless skinning of the land to get every last fragment of fiber and root for fuel. He has never seen such sacrilege of the earth.

Much has been said about the use and conservation of resources in China, whereby the last fragment is saved; but this is in the nature of private scavenging and is not public conservation of natural resources. In fact, it is quite the opposite, for it looks only to the present need and does not consider the future. It is more likely to be a vast practice of waste, looked at in the national and social sense, however well it may meet the penury of the present. It has no large result in it, no state policy, no bountiful provision for the future. It is true that definite public plans of conservation are now under way, as in forestry, and in some places they are beginning to work out excellent results; but these are modern and recent adaptations or movements and not the result of the historical experience of China.

The first duty of agriculture is to

produce supplies, and to maintain the fertility of the earth while producing them; and yet the measure of agriculture is not the yield, nor is it the maintenance of the greatest number of people on a given area of the earth's surface. Nevertheless, it is just this assumption on the part of both agricultural publicists and economists—that the test of agricultural excellence is that it sustain the greatest possible number of people—which is the underlying fallacy in present discussions. The greatest yield of agriculture is the human result, not the maintenance of given numbers.

King writes that he was "amazed at the amount of efficient human labor cheerfully given for a daily wage of five cents and food, or fifteen cents United States currency, without food." You well know the slaving labor that is required, the long hours of mere grinding physical toil, the slender margin of profit, the skin-and-bone existence for the mass of the folk on the land, when people by millions give themselves for five cents a day and food. It does not matter what may have been the classification of the ranks of society by Confucius, placing the farmer only second in the scale of four, unless such classification works itself out in practice with those who actually handle the land. On a basis of five cents a day and food, there can be no satisfactory agriculture.

We are not to overlook or to deny, of course, the many highly developed manual agricultural practices of the Chinese and their neighbors. The Occident undoubtedly has much to learn from these patient toilers who for tens of centuries have produced supplies for such crowding millions and have still maintained the producing power of the earth. Their patience, persistence, and elimination of all frills and unessentials, the heavy yields in many places, the painstaking care to the smallest detail, all inspire one's admiration: it is

time that these people receive larger recognition before society; yet we are now projecting the larger results in human progress. Perhaps their painstaking is most apparent in the saving of human waste and the application of it to the land: but one cannot think that this method will be the final practice in any highly developed society. We are not to solve the excrement problem on the scavenger basis, applying the raw material to the land, particularly now that we know its relation to carriers of disease. Such practice will not appeal to western peoples. If such waste is to be used for the land, it will be on the principle employed in the manufacture of commercial fertilizers or other treated and modified products, and not on the principle of the stable. Probably nowhere has the problem of the disposition of human waste been settled. Our present sewerage systems possibly are only temporary or transitory, when considered against the progress of civilization. Yet the oriental method cannot be accepted as even an approximate solution of the problem. Nor is it yet proved that human waste is capable of producing the best yields.

For the most part, the areas under cultivation in China are too small to allow a man to express himself on them. They make him a slave to mere hand labor, and doom him to a condition that has in it little hope of personal advancement. The problem China is facing in this respect, is to produce the same or at least sufficient supplies with fewer men, with men of more power, more capital and turnover in the business, more science and invention at their command, more mastery of the business, more economic and social freedom.

The acreage to the person in China cannot yet be accurately stated. King says (in the second edition) that there are "scarcely more than two acres per capita, more than one half of which

is uncultivable mountain land." Yet one is impressed, in parts of the interior, with the great extent of land awaiting reclamation or at least better utilization, with the bare hills, and also with what seem to be inadequate yields. Famine is an expectation in some of the agricultural regions. For every famine in any country, indictment should be brought against government. A good part of the population in such countries as China eventually will be utilized in the industries: the countries will pass out of their rural phase. Whether the remaining rural population can secure sufficient additional production to the person, by means of machinery and more masterful handling of resources, to sustain the entire population can be little more than speculation at this epoch. It is probable that great fertile areas of the earth will remain relatively sparsely settled and will supply the congested parts. One day we shall farm the seas. Perhaps synthetic chemistry will contribute something to the solution of the problem. Yet whatever the final solution, we must assume that the surface of the earth and its yields must always have significance, and that a certain large part of the race must exercise the arts of keepership.

Probably we make a mistake when we assume that the present rate of increase in population is to continue on the earth. But if population is to increase to such an extent that all the people are to be reduced to existence rations, all one can say is that the farmer should not be so reduced sooner than others. Certainly the man on whom the maintenance of the race depends should not also bear the burdens and the penalties of the race.

How to secure to the farmer in China or elsewhere the proper acreage so that he can afford to educate himself for his business is a very complex problem. It cannot be accomplished in a country like China without pulling up

the very roots of society and the civic order. It must be a process of adjustment and growth that works itself out slowly. Whenever you touch agriculture, you touch the foundations of society.

Education in agriculture means larger and better holdings. There are persons enough who would vote public funds for the farmer if he be kept in his proper sphere and disturb not the established order of things; yet the introduction of even practical agriculture into the school means that the farmer is not to remain where he is, and that the present subdivisions of the earth are not likely to be adequate to men with more vision and more personal power.

It is not my object to suggest the ways of bringing about changes or what occidentals might call improvements in the agriculture of China; that would be presumption. I approach the subject with no desire to criticize the Chinese or to offer them remedies or panaceas, but rather to evaluate the situation in terms of the Occident. With the Chinese themselves I am in greatest sympathy, and my attitude is to learn what their situation, as a great school of experience, suggests for us.

The bearing of the situation on the maintenance of a democratic society

We come now to see that the agriculture of China has direct relation to the constitution of the civic order in China. Agriculture has such relation in any country, but the relationship is particularly marked in China, where the constitution of the body politic is yet evidently rural, or at least not industrial, and where, also, the element of time has worked out certain results: therefore I use my reflections in China to bring to your attention certain fundamental questions touching the constitution of society.

I read in a press despatch the other day that Germany had now become a

democracy, the change having taken place within a space of five days. I wonder whether the German people know it. If the leaders alone know it, then there is not a democracy, however perfect may be the piece of political machinery that may have been devised.

In the Far East I asked a German of the office-holding class how the war would end. He replied that it would end by governmental changes and revolutions in the different countries. I asked what would be the nature of the change in Germany, to which he replied that there would be no change in his country for the reason that it is at present so democratic that no change is needed. I then asked myself whether men mean the same thing when they talk about democracy. Apparently we are glibly confusing many ideas under one catchword.

When a monarch is overthrown, we hail the revolution as an instance of democracy; yet the people may be as far from democracy as nadir is from zenith. Contrariwise, when a king is set up we deplore the defeat of democracy; yet democracy may be only stabilized thereby. Democracy is not a form of government. It is a constitution of society that allows each member to develop his personality to the full and to participate in public affairs on his own motion. Freedom is not democracy; it is only release from restraint. No people needs discipline and restraint so much as a democratic people, but it should be self-discipline. Freedom is only a condition antecedent to democracy. Of all forms of society, democracy is farthest removed from anarchy. Neither is it popular politics. A people may be ever so free politically and yet not constitute a democracy. Democracy cannot be bestowed. You cannot give it to anybody. It must be won, by patient preparation. It is a result, not a gift.

Democracy is primarily a sentiment—a sentiment of personality. It is the

expression of the feeling that every person, whatever his birth or his occupation, shall develop the ability and have the opportunity to take part. Its motive is individualism on the one hand and voluntary public service on the other. The person is to be placed in the most advantageous environment. Overhead domination not delegated by the people is to be obviated or eliminated.

Democracy rests on living conditions and on civic opportunities. It is rooted in the daily life, in what a man is able to acquire in goods, in his intellectual progress, in what he is competent and at liberty to think, in his freedom of movement, in his expression of himself.

Democratic society expresses itself in many ways: in government and other national action, in education, in religion, in some particular social order. To say that democracy is a form of government is like saying that religion is a form of worship. Democracy is a state of society. A democratic society can exist only on the basis of active and enthusiastic public service. Essentially this service is voluntary, yet it may be required of the few who do not volunteer. This service is far broader and deeper than military service alone.

We live in days of vast organization, yet organization is not the basis of democracy, at least not as organization is now prevailing understood, which is the power to control and to make demands. Here lies what I must consider the failure of the present organized labor movement in a democracy: its motive, as displayed to the public, is to make demands or to control situations rather than to serve.

I have said that democracy rests on the conditions of daily living. Our situations are primarily those of the planet on which we subsist. The care of the planet conditions our existence. Many persons and classes of persons are directly delegated to the care of the

planet, but there is practically only one range of the people that lives day by day in actual contact of subsistence with the earth. This range is the farmer. I shall not gain popular hearing when I say that the farmer is the fundamental fact in democracy, yet before this Society of Agriculturists I must speak the truth. He is the fundamental fact not merely because he produces supplies, but because to him is delegated the keepership of the earth, and to him are we to look for the interpretation of the earth in our civic relations. This is a deeper and much more fundamental relationship than the contribution of any extent of organization, however perfect in its constitution, which is concerned primarily with class interests.

Just now we hear much about the farmer's attitude toward the great affairs confronting us. There is considerable criticism. All the criticisms I have heard are projected from the point of view either of class organization or industrial organization. . . . Let me give you a formula:

The farmer is part of his environment, matching himself into his background, perhaps unconsciously, much as a bird is matched, or a tree, or a quadruped. His plan of operation, his farm-management, is an expression of his situation in nature: he has worked it out because it fits. He cannot shift it radically to meet the advice of any other person. As he himself develops in ability, he will modify his plan of operation so far as he can, but the plan always must fit his place in the environment; no great change is possible unless his natural conditions change: he does not make his conditions. The farmer exemplifies, in the human range, what the naturalist knows as "adaptation." His situation does not admit of compromise, and therefore it may not be understood by teachers, publicists, officials, and others.

The consequences of this formula, if

it is true, are tremendous. All the advice given the farmer that does not recognize his necessary adaptation to his environment is useless; and useless advice is harmful. It is of no advantage to rail against the farmer any more than against the wind or the rain. It is idle to try to apply to him the pressures that are exerted on corporate business. It is of small consequence either to praise him or to condemn, to take sides for him or against him, except so far as it may affect his spirit as a man. When, under pressure of great crises, we radically change the conditions under which the farmer works, we must allow him time to readjust himself: he must take account of the latitude that he may reasonably expect in weather and soil and human forces. He needs not favors, but conditions that will allow him to operate. The natural conditions within which he works cannot be changed, but they can be modified in some ways and he can make new adjustments within certain limits: these possibilities he begins to understand, and they are parts of his problem as a farmer; when the economic or outside conditions are changed, the modifications must be such as will match the natural limitations, if he is expected to adopt them. In the present crisis, our public agencies must understand and recognize what reasonably can be required of the farmer.

From this caution I do not omit many of those connected with our agricultural institutions and agencies. I am afraid that their advice is not always sound. It is likely to be departmental. We always need the specialist, but in the present crisis we are also in urgent need of the generalist, who sees the agricultural situation as a whole. It is easy enough for the departmentalist to say that we can double our poultry product under an emergency, but we now need other things than poultry. One cannot feed grain to

poultry, grind it into flour, and send it to the Allies all at the same time; and the management of the farm scheme is to be considered. An increase of a certain dependable percentage in the staples, brought about by proper adjustment and stimulation, is the need of the hour. To talk about doubling the output in some special department, considering limitations and particular issues at stake, may be nonsense.

The cohesive force which we know as "labor" does not contribute, in its organizational method, to democracy: quite the contrary. The force we know as "capital" does not contribute, in its corporate capacity, to democracy: quite otherwise. These forces exercise or usurp powers that inhere properly in government: they practically govern classes, more or less independently of the general public weal. They are forced to take action in self-defense because government does not act. It is often said that we have too much government. In fact, we have too little government. Much of what we know as government is only compromise or the balancing of forces between different factions.

The great and abiding contributions to democracy are made by the vast middle classes and by the rural people who are not organized for the purpose of securing collective or mass advantage.

It is an old adage that appearances are deceitful. I wish to add that they may be misleading. Persons managing corporate, industrial, labor, and professional affairs have a certain air and habit of presentation. The farmer operating his farm may not have this air. He has nothing to present. He may be following a plow in the back lot, unshaven, trousers in his boots, working until the work is done even though the clock points to five. Perhaps he would not discuss politics or civics or religion, at least not until he knew you: but, good or bad, he has worked out the management of his

farm, and he thinks he knows why. He will listen to your advice; then he will go on with his plowing. He is hard against facts, real facts, not paper facts; he accepts them, and acts accordingly. You may not like him, but he himself is a fact.

Bearing in mind these fundamental considerations, established in the nature of things, some of the popular attitudes toward the farmer become ridiculous. I was out of the country when war was proclaimed, but I understand that everybody who had a public voice fell to advising the farmer. This is futile, since the farmer is the one part in the population that cannot apply advice. I am sure that much of this advice made no account of situations that neither the farmer nor any one else can change.

It is simple enough to change an outside or commercial condition in relation to the farming occupation: it is quite another matter to expect the farmer to accept it unless other essential conditions are changed to meet it. Fixing the price of any product, while it may be necessary in times of crises, does not add fertility to the land, or modify the weather, or affect the habits of a sheep or a horse, or the requirements of a herd of swine. To say that a billion dollars is to be added to the income of farmers by war prices means nothing unless we have at the same time a statement of outgo. To say that the increased gross value of farm products of 1917 over 1914 represents war profits is to state only one factor in a transaction and to state it loosely. To advise the use of less milk in order to save it does not take the cow into consideration; the cow is not a machine that can be stopped by turning off the steam and discharging the operator.

To establish any regulation touching production only on a basis of compromise or agreement between contending parties, does not take into consideration the fundamental problems on which

the regulation must rest for its operation. This is well expressed in Warren's recent statement following a long hearing on the cost of milk, that there is no known way of making a cow produce milk by argument.

The political method, which is the method of compromise or expediency, cannot change a single fundamental fact in agriculture.

You understand that I am not defending the farmer: his acts are as much open to review as those of any other citizen: I am merely stating his natural situation. As illustration, let me refer to the recent charge that he is profiteering. The farmer does not make profit in the commercial sense, but only a labor income. Now and then a farmer may buy and sell without producing, or even speculate, but this is not farming. The producing farmer does not become "rich" in the commercial sense. His occupation yields only the returns from his work. His overplus is likely to go back into the land, and the next generation has the benefit.

One of the most amusing statements I have heard is that reported of an influential financier to the effect that we must now take the farmer in hand and control him. The idea is that the farmer is becoming too powerful and makes too many demands. For the last ten years and more, public men have been advising the farmers to organize for protection, and the farming people have been shown the results that have been won by organized labor and industry; yet as soon as the farmer begins to use this dangerous weapon, a shout of alarm goes up from those who have advised it. If the farmer anywhere uses the weapon of organization he only follows the precedent of industry and commerce. This is to say that the weapons of industry and commerce are then turned against themselves. The present mood to discipline the farmer is but another expression of the old disposition—so old as to be

automatic—that the farmer must be kept where he belongs.

In fact, however, agriculture is yet very little organized commercially or politically. Former attempts have failed. We are watching the two movements now before us with new interest; it is yet too early to measure their accomplishments. It is now charged that farmers are withholding the sowing of wheat in order to hold up the prices. In the first place, there is no organization of farmers that can control the wheat situation; and if any number of individuals reduced their own production they would be playing into the hands of the heavier producers or of handlers. It is impossible for farmers to control their production as manufacturers control their output. Whether a man sows more or fewer acres of wheat, he does not know what his crop will be: the unpredictable conditions that make the wheat crop are too many.

Organization for commercial offense, or even for defense, is indeed a dangerous weapon. It is dangerous in itself; it is dangerous because it forces government into compromises, and also because it relieves government of its plain obligations; it is dangerous because it sets one part of society against another. In agriculture it is especially dangerous: it has here all the danger that it has in any other realm, and, besides, it cannot change a single natural condition. I have hoped that the correctives of such commercial inequalities as may exist in rural affairs would arise in the action of society as a whole, that legislatures and statesmen on their own motion would apply the remedies, without pressure and therefore without compromise. I have been willing to wait, remembering that we are here trying to develop a democracy and hoping that we may eliminate the antagonisms of differing interests. I have preferred even that the rural interests should undergo disadvantages rather than that we should throw agriculture into the

maelstrom. So far as I know, I have been alone in advising that we withhold the commercial and political organizing of agriculture. The movement of the time is against me and will be increasingly against me so long as society is founded on commercial enmities; yet I think that I must still hold. If such organization is necessary in order to perform the office that government neglects to perform, I hope that it will not become a permanent movement to control affairs in the separate interest of the farmer; yet one must express sympathy for the objects for which certain powerful organized movements are now contending.

Agriculture may not have had the support which it should have had, but it has not had organized opposition. As soon as it begins to make collective demands, so soon will all other interests begin to oppose it. The results on our democracy may be dangerous and far-reaching.

The incompetency of organization to accomplish in agriculture what it has been able to accomplish elsewhere may be illustrated in the field of labor. Farm labor cannot be organized on the basis of other labor, nor can the same ideas dominate it: on the farm there is a natural day; the plants and animals are governed by this day; at any time the weather may change the whole situation; moreover, most of the farm labor is also capitalistic, for the owner and his family are the operative organization. Hired labor is relatively a minor part of all the labor; it is, or should be, resident labor except such excess as may be needed in certain kinds of harvest. Much of the hired labor is in the process of acquiring ownership. The mass movements of organized labor cannot apply to the rural situation; or if they are forced into the rural districts, the farmer will simply hire less labor and set his business more completely into nature-farming.

The measure of agriculture any-

where is the sufficiency of it as a source of supplies, together with the satisfactions and opportunities for comfortable living and advancement that it offers those who engage in it. Considered from this angle, the agriculture of China is not satisfactory and therefore is not successful: most agriculture, considering the world as a whole, is neither satisfactory nor successful.

This brings us to a statement of the two theories, or at least the two practices, as to the place of agriculture in society. On the one basis, the farmer comprises a substratum of human beings whose necessity it is to provide subsistence for higher strata from which are to come the leaders, thinkers, artists, rulers. On the other basis, the farm class itself is a lateral and co-operating factor in affairs, capable of producing leaders, thinkers, artists, rulers, a class coördinate rather than subordinate, directly related to civic needs: this is the American idea. You will agree that we cannot have a democracy on the former basis, which is the theory of the subordinate or peasant class. You will now better understand that the farmer is the fundamental fact in a democracy.

On the one basis rest autoeracy, aristocracy, oligarchy, arrogancy, tyranny, stratified social systems, whatever the name of the government. On the other basis rests the possibility of free institutions. The farmer should have equal privileges with any other man to develop himself and to partake in all affairs, not to be merely a mudsill on which a superstructure may rest.

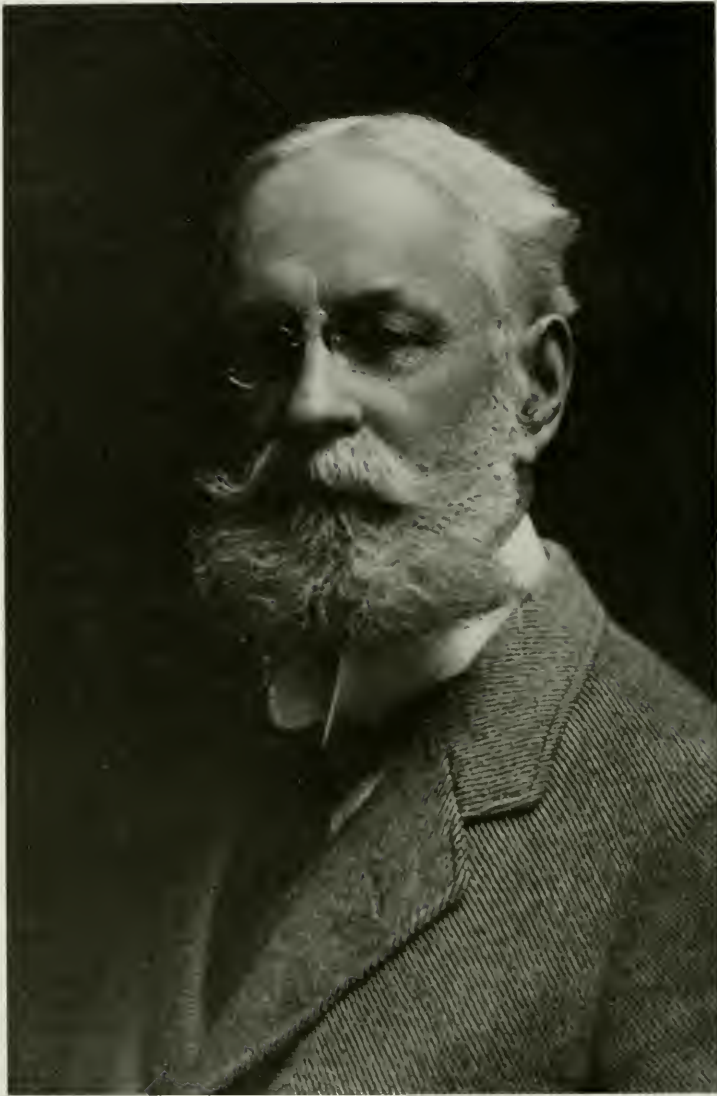
Democracy rests on the land, on such a division of it and such an ease of acquiring it and such freedom of establishing new ownerships and combinations, as will allow the farmer to buy and to sell it in his own name, and assure him the economic and civic freedom to make the most of himself as a man. This is equivalent to saying that the man is more important than the crop.

By this I do not mean that every man shall be a farmer, or that in the future state of society every man shall raise his own sustenance. This socialistic notion belongs to the idyls of poetry. But a man shall not be bound and chained to a hereditary piece of land. King says that in China one sixth of an acre of good land is ample for the maintenance of one person. No man should be sentenced to one sixth of an acre of land.

While democracy rests on the land, it does not rest on landlordism: quite the contrary. There is no aristocracy so hateful and so difficult to dislodge as the aristocracy of land. Landlordism is not agriculture: the agrarian questions in the different countries are not agricultural questions. However free a people may be politically, if a large part of the land is held by a relatively few families and beyond their reach, that people cannot be a democracy.

The world troubles of the present rest very largely, and in fact mostly, on the iniquities of land confiscations and territorial expansion. The world is trying at this moment to wrest from Germany—I hope for Germany's good—the usurpations of feudalism and to give back to the people some of the powers and initiatives to which we suppose all people are born.

These many statements have come out of my reflection on the situation in China. We are told that China has a permanent agriculture: I think that this is the most serious difficulty with China. If the agriculture of China is permanent, then there is no outlook for the Chinese people except that they shall remain just what they are. The same remark can be made for other peoples. If this type of permanent agriculture is to be the final practice of mankind, then there is no prospect of advancement and progress for the race as a whole. We must distinguish sharply between permanent agriculture and stationary agriculture.



MAJOR GENERAL A. W. GREELY

UNITED STATES ARMY, RETIRED

Commander of the International Polar Expedition, engaged in scientific work, 1881-84, at Lady Franklin Bay. His expedition attained the "farthest north" of that time and discovered the most northerly land—the latter achievement exceeded in thirty-five years by only one explorer, Peary.

Enlisting in the Civil War, where he was thrice wounded, he reached the rank of captain and of brevet major. Appointed in the regular army, he was the first enlisted man to reach the grade of brigadier general, becoming successively chief signal officer and major general. In addition to being the author of many scientific publications, he has constructed more than twenty thousand miles of telegraph lines, including war lines in Cuba, China, and the Philippines, as well as the system of four thousand miles of aerial, cable, and wireless lines in Alaska. In recent years his administration of San Francisco relief operations at the time of the earthquake and fire, and service as military ambassador at the coronation of King George, have been important items among the duties that have fallen to him. In connection with his interest in the flora and fauna of polar lands, see pp. 358 to 425, Vol. 11, of *Three Years of Arctic Service*, for his personal work on the plants and animals of Grinnell Land



South Georgia Island of the subantarctic region, showing Lucas Glacier

Terrestrial Life in Polar Environments

By A. W. GREELY

Major General in the United States Army, Retired

VITAL and engrossing is the titanic struggle now shaking the very foundations of civilization, wherein is involved the survival of a world-wide democracy, which is stunted in growth and threatened with extermination by an environment of irresponsible autoeracy. Yet nature presents often similar aspects to the scientist. Somewhat akin to this ruthless war of mankind is the never ending struggle of various forms of life either to extend their own domination or to secure the survival of their species.

In the scheme of life zones outlined by the distinguished American biologist, Dr. C. Hart Merriam, are clearly set forth not only the interrelations of moisture and temperature with the various floras and faunas, but also the absolute dependence of these for existence on suitable conditions thereof. The controlling influence of these factors in plant life is evident to the most casual of investigators. It therefore seems probable that a nontechnical article on this subject, although confined to the polar zones, might prove of interest to the readers of the *AMERICAN MUSEUM JOURNAL*.

While the views herein expressed

naturally are tinged with opinions resulting from personal experiences and observations during three years of Arctic service, they are dependent more largely upon the studies and researches of competent scientists along this or parallel lines of polar phenomena.

As is well known, certain extended sections of land within the temperate and tropical regions represent exceedingly adverse conditions for the perpetuation of animal, human, or plant forms of life, yet such areas are so local and limited as to be of almost negligible importance. Within the Arctic and Antarctic circles there are, however, vast contiguous areas—aggregating several millions of square miles in extent—where the polar environment is so adverse that most, and indeed at certain points all forms of life find development and perpetuation impossible. The tragic and heroic story of Scott and his companions discloses the inability of man, even with perfected plans, to survive on the ice-clad continent of Antarctica. Thereon, indeed, are to be found in the scantiest quantities the lowest and hardest species of life: these survive only within the sphere of the ameliorating influence of the ocean.

The extent and distribution of these desolate regions, as yet unvisited by man, have been made known through the investigations of a polar expert, Dr. William S. Bruce. An article, published in the *Scottish Geographical Magazine* in 1906, sets forth that at that time the unknown areas of the polar regions aggregated 7,550,000 square miles, practically equal to the area of the continent of North America. These unvisited areas have not decreased more than 50,000 square miles since that date. The unknown seas of the Arctic regions cover 1,330,000 square miles. The unknown regions within the Antarctic circle aggregate 6,320,000 square miles, of which area the continent of Antarctica includes 5,470,000 miles, the rest being ocean.

The continent of Antarctica, which approximates in size the combined continents of Europe and Australia, virtually covers all land areas of the south polar zone, and it presents the most adverse environment for life forms on the land surface of the earth. It is not alone that its ten thousand miles of sterile, practically inaccessible coast faces an always stormy, ice-encumbered sea, but that the continent itself has an average elevation estimated at more than double that of any other. It rises sharply from the frozen ocean to the central ice plateau, at an elevation of ten thousand feet or more surrounding the South Pole. The whole continent is buried by an almost unbroken sheet of glacial *névé*, hundreds, if not thousands, of feet in thickness. Here and there the extreme monotony and desolation are relieved by the projection above the ice of a barren peak in the interior, or by the ice-free face of high sheer precipices along the sea front.

The practically impossible temperatures for the sustenance of terrestrial life on the continent of Antarctica are indicated by the climatic conditions of Adélie Land, 1400 miles from the pole. The average annual temperature is

slightly above zero—about thirty degrees below the freezing of water—and this is the approximate temperature for the year along about two thousand miles of the Antarctic Circle. The annual temperature at the South Pole has been estimated roughly at forty degrees below zero. Scott, it may be recalled, when hundreds of miles from the pole, experienced for ten consecutive days in March (our September) an average temperature of sixty-eight degrees below freezing. Violent gales, with winds of fifty miles or more an hour, are frequent and prolonged, under which the snow drifts in enormous masses, burying the whole country. As to south polar climate in general, Nordenskiöld says: "The study of the climate and glaciation of Antarctica has made known to us a new type of climate, which is prevalent in a whole continent. The Antarctic climate is distinguished by its cold summer, *beyond comparison the coldest in the world.*" The impossibility of life existence or survival under such conditions is evident, save for the hardiest and most tenacious forms.

It may be mentioned that the Antarctic fossils of the Cambrian, Devonian, and Permian periods pertain, so far as has been made known, largely to oceanic forms, those of the land being few in species. It is interesting that a sea filled with wondrous forms of life, perhaps the richest of all oceans, should encircle a continent that has never known man as an inhabitant. Equally absent are forms of animal terrestrial life and of land birds. Flowering plants are likewise lacking.

That it was not always so is read in the rocks of Antarctica, and through the discovery of coal near the South Pole. The recurring changes of this continent in past ages have been beautifully referred to by Dr. Hedley, who said: "By the light of the magician's lamp we watch the summer of the cycles dawn. The glow of life returns,

the ice-mask melts, green spreads a mantle. At last a vision comes of rippling brooks, of singing birds, of blossoming flowers, and of forest glades in the heart of Antarctica."

But he adds elsewhere: "At present Antarctica lies dead and cold under its white winding sheet of snow." It is these adverse conditions that the world now confronts.

It is interesting to note, in passing, that to an American polar artist—F. W. Stokes—the world is indebted for the earliest collection of Antarctic fossils. They were only a dozen in number, but they proved to be of geological importance. Professors Stuart Weller and T. W. Stanton identified three of them as Cretaceous, and it is claimed that they establish the correlation of the Antarctic beds with the "Middle or with the Upper Cretaceous beds of Southern India." What vast geological changes since the time when climatic conditions associated the life forms of tropical India with those of ice-clad Antarctica!

In this connection is to be noted the opinion of Dr. H. T. Jensen, of the Shackleton Expedition, 1907–1909. He reports that experiments show the lack of vegetation due not to the poverty of the Antarctic soil but to the severity of the climate.

In the last Scott expedition there were rare instances of life of the lower orders: green moss, tiny insects—red and blue springtails—which hibernate in or near the moss beds. Taylor relates that they were normally "frozen stiff in a thin film of ice, adhering to the stones. When the stone was exposed to the summer sun, and the ice melted, the springtails moved about sluggishly until the sun left them."

In Adélie Land, Mawson found in fresh-water lakes algae, bacteria, diatoms, protozoa, and rotifera, mostly microscopic. There were mosses, as also on Gaussberg, and lichens, the last on red sandstone being "an example of

the most conspicuous vegetation of Adélie Land." Antarctic mosses usually grow in clumps with an occasional hepatic in the midst. Sometimes moss and lichens form a small tundra, which is used as a nesting place by skuas and gulls. The luxuriant growths of these mosses and lichens in penguin rookeries are significant of their origin and continuance. Tiny eye-visible insects have been found also.

Subantarctic islands offer a less hostile environment than does the Antarctic zone, yet the life of these islands is most scanty. The terrestrial life consists almost entirely of insects and vegetation. Indigenous human and animal life is missing, although there are visitors from the sea.

The most favorable environment for terrestrial life among these islands is found in the Kerguelen group, latitude forty-nine degrees south, more than twelve hundred miles north of the Antarctic circle, in a latitude corresponding with northern Maine. Annexed to France and occupied as a whaling station, the Kerguelens have been the field of tentative, but not successful colonization as a stock country. Horses, sheep, and hogs were imported, while unfortunately rabbits, rats, etc., have invaded the island through visiting ships.

Mr. Henry Bossiere, who passed fifteen months on the group, furnishes the following information as to the various forms of terrestrial life found there: "Nowhere is to be seen a single tree, but over very extensive areas there grows an Antarctic forage plant, called *acoena*, which resembles the pimpnel [the plant which is used by whalers for tea]. It has large roots, suitable for fuel, and its leafy branches rise at times to the height of fifteen to twenty inches. It is the main forage for the stock. Sheep and hogs eat it with great relish, and the horses have no other food for six months of the year. Another plant, the *Azorella celago*, grows

in great clusters, sometimes being three feet in height. This plant is dying out, as the rabbits make their burrows amongst these bunches and destroy the roots. Similarly the well-known Kerguelen cabbage is steadily disappearing, except on the islands and high land unoccupied by the rabbits. Moles and field mice abound. Among the numerous insects are wingless flies, spiders, ants, etc." It thus appears that this most fertile and favorable subantarctic land presents extremely limited life forms.

Let us turn to south polar lands about four hundred miles nearer to the continent of Antarctica.

The best known of these islands from the standpoint of life is perhaps South Georgia. This land is of especial interest to the American Museum, which obtained therefrom its important Antarctic collections through the American Museum Expedition of 1912. With this expedition a young but well-known American naturalist, Mr. R. C. Murphy, of the Brooklyn Museum, passed four months in researches on this island, and from him certain data of much interest have been obtained. Indigenous animals are wanting, but man has introduced horses, rats, and reindeer, all of which thrive in a wild state. The Crozets, Kerguelen Land, and other snow-covered austral islands have no land birds of any kind, but in South Georgia is to be found a land species peculiar to the island, a titlark (*Anthus antarcticus*).

The severe climatic conditions closely restrict vegetation. In striking contrast with Labrador, where, in a latitude corresponding with South Georgia, there are great forests, the austral island has not even a single shrub. Cryptogams abound to the number of perhaps two hundred species, but the vascular plants scarcely reach a score, and

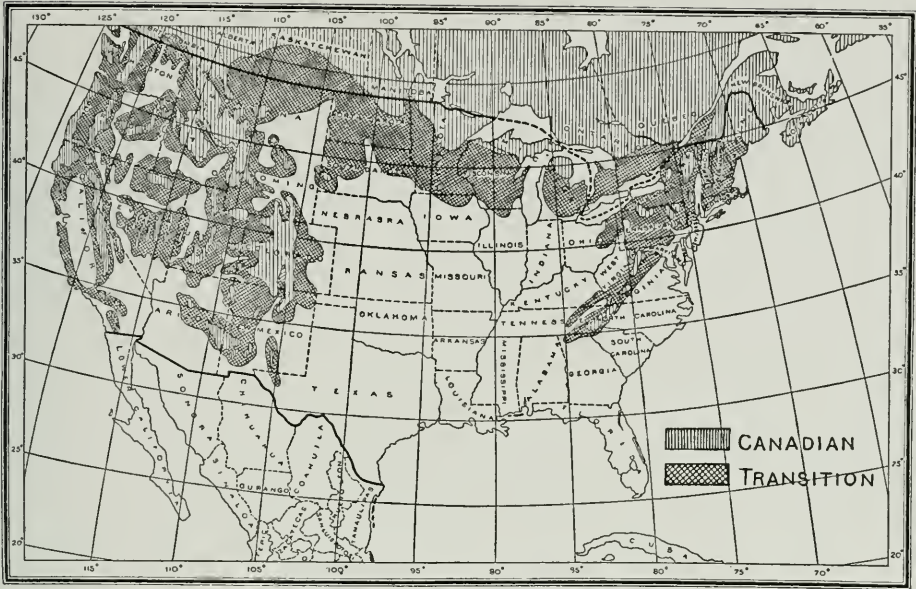
but fifteen flowering species are known. The most attractive plant to the eye is that which American whalers in olden days made familiar to the world by using it for beverage purposes, calling it "Kerguelen tea" from the island where it was first used. It is a rosaceous plant (*Acocena adscendens*), with round, red flowering heads, and its hardiness is evident from its frequently pushing itself up to the air and to the sunlight through beds of snow.

A vigorous tall tussock grass (*Poa labellata*) is extremely abundant, especially near the sea, much to the advantage of the wild horses of the island. An earthworm, a mite, and rock spiders are found. Among the insects are to be named fleas, beetles, flies, May flies, and swarms of springtails. The fresh-water lakes are devoid of fish. Considering the climate, it is remarkable that so much terrestrial life exists.

A suggestive paragraph in Mr. Murphy's narrative happily illustrates the environment. He says: "All summer long hundred-ton ice blocks fell thunderingly from a beautiful valley glacier near by."

South Georgia has a typical Antarctic climate. The average temperature for the year is but slightly above the freezing point. On January (our July) 1, 1913, half an inch of ice formed on all the fresh-water ponds. Gales are frequent and violent, the winds exceeding at times one hundred miles an hour and averaging nearly forty miles an hour for an entire month. Snow falls in every month of the year, and on five days out of six there is either snow, sleet, or cold rain. What an unfavorable contrast with Arctic conditions, anywhere and everywhere!

Possibly the north polar phenomena may be discussed in a later number of the JOURNAL.



Map of life zones in which fox farming is feasible in the United States, showing the Canadian Zone, where conditions are excellent, and the Transition Zone, in parts of which conditions are favorable (*Farmers' Bulletin 795, United States Department of Agriculture*)

Why Not Raise Your Own Furs?

A FEW FACTS ABOUT THE LITTLE-KNOWN INDUSTRY OF FUR FARMING

By NED DEARBORN

Assistant Biologist, Bureau of United States Biological Survey

IN considering the factors which led to the exploration and development of the North American continent we are prone to forget the important part played by the fur industry. Since man first felt the need of protection against the elements, skins of animals have been in demand for clothing, and when no longer an actual necessity, because displaced by woven materials, they still held their own in the esteem of mankind on account of their beauty. Marco Polo, the first great traveler, whose narration of his wanderings thrilled the world, told of furs, and the great trading companies then formed

for the East were but the forerunners of others which came West. As the population of the world increased, the desire for furs kept pace, and a new source of supply was welcomed eagerly. French and English explorers in the New World soon discovered that the Indians were ignorant of the value of furs, and hence an enormous profit was possible to the collector. They therefore pushed boldly into the wilderness, braving all difficulties and paving the way for the less adventurous agriculturist. Many of the first settlements in North America were founded by the fur traders, to whom the Canadian prov-

inces owe their start on the road to prosperity.

Today the business of fur trading is an important factor of our commerce. North American furs annually marketed in the United States and England have an approximate value of sixty million dollars. Although the European war has decreased the demand to

vance of the farmer, they are followed into almost inaccessible regions by the trapper, who is urged on by the stimulus of high prices. It is evident, therefore, that the demand for furs before many years will exceed the supply, unless this supply can be increased by artificial propagation.

To meet these conditions a new in-



The mink was one of the first fur bearers to be domesticated, and was propagated successfully in the state of New York fifty years ago. If taken young it is tamed easily, but owing to its capricious temper it becomes dangerous to handle as it grows old

some extent, exports from the United States alone during the fiscal year ended June 30, 1916, amounted to more than nine million dollars. A glance at the market reports dealing with furs and giving figures showing the actual number of skins handled will surprise the ordinary consumer, and at the same time cause wonder that there should be a fur-bearing animal still in existence. As a matter of fact the number of fur bearers is steadily decreasing. Driven farther into the wilderness by the ad-

dustry is springing up—that of fur farming, or the raising of fur-bearing animals¹ in captivity. Generally speaking, fur-bearing animals are easily domesticated. All our domestic animals were once in a wild state, and there is every reason to believe that

¹Fur-bearing animals in the stricter sense of the term belong to the families of carnivores—the Mustelidæ, Canidæ and Ursidæ, which embrace the weasels, martens, sables, badgers, skunks, wolverenes, otters, sea otters, foxes, wolves, and bears; and the families of rodents which include beavers, muskrats, squirrels, and marmots. In a broader sense the term applies to all animals which yield pelts used in the preparation of marketable furs.

animals now wild eventually may be tamed. Their dispositions as well as their diet are readily adapted to conditions of captivity. Persons who are fond of pets may find a fresh field for their activities in this new enterprise, and also an opportunity to raise their own furs. Experiments have been carried on for some years, until now success with at least a few animals is assured, while others are being tested with good results. About one half the fur bearers of North America seem suitable for domestication, and of these the mink, the skunk, and the silver fox have been bred successfully in many parts of the United States and Canada. Among those which have been only partly tested for this purpose are the marten, fisher, otter, blue fox, raccoon, and beaver. Experiments, however, have been sufficiently conclusive in most cases to predict ultimate success with these animals also.

The first of the wild fur bearers to be domesticated in this country was the mink, whose soft, dark brown fur is one of the most durable as well as most beautiful. It is nearly fifty years since a man in Oneida County, New York, began to breed and sell minks for propagation. In those days it was a profitable undertaking, the skins being high priced and the live animals bringing \$30 a pair. Later, owing to a period of financial depression, the business became unprofitable and was abandoned. After being almost forgotten as a money-making industry, it has been revived and, where conditions have been favorable, has proved more than satisfactory to those engaged in it.

A fur bearer peculiar to the Western Hemisphere, the finest specimens being found in the United States, is the skunk. Its glistening black fur of medium length is very attractive and has a ready sale notwithstanding the fact



Arctic or blue foxes have been tested to some extent for domestication. They have been raised successfully on several of the Alaskan islands and on Prince Edward's Island. From the latter place, in January, 1917, six blue fox skins, valued at \$250 each, were shipped to the United States. On the Pribilof Islands these foxes are protected by the government, and in 1916 six pairs were furnished by the Bureau of Fisheries for use on a fox farm in the state of New York.

that long use causes it to fade to a reddish brown color. This animal, so commonly found even in well-settled districts, was first tried for domestication about thirty years ago. Today the number of skunk breeders in this country is greater than that of all the other breeders of fur animals combined. This pretty animal is easily tamed and, aside from its one objectionable feature, the offensive scent glands, which can be removed easily, makes quite as pleasing a pet as a kitten. Its habit of remaining in its den during the severe winter months simplifies the work of caring for it. The trade in skunk furs alone amounts in the United States to three million dollars a year, slightly exceeding in value the mink industry.

Another American fur-bearing animal now permanently domesticated is the silver or silver-gray fox, which is found in nearly all parts of the United States and Canada. This fox is a melanistic color phase of the red fox (*Vulpes*), in which the red hairs of the upper parts are replaced entirely by black, while the white hairs remain as usual, producing the rarest and most valuable of fox pelts. Skins of the finer grades are valued at from one thousand to two thousand dollars each.

Breeding silver foxes has been successfully carried on for a number of years on Prince Edward Island and elsewhere in Canada, as well as in several of the more northern of the United States. At present there are fox ranches in most of the Canadian provinces and in about fourteen states and territories of the United States. The first ranch on Prince Edward Island, built in 1894 and stocked with two pairs of silver foxes, proved the forerunner of a great industry in that region which attained after 1900 a phenomenal growth. According to the

report of the Commissioner of Agriculture of the Island for 1913, there were in that year 277 ranches stocked with twenty-five hundred foxes, more than one half silver black. The value of these ranches was placed at fifteen million dollars, or twice that of all the ordinary farm live stock.

The pioneers in fur farming had a monopoly until 1910, in which year they were able to send to London a shipment of twenty-five pelts bringing an average price of more than thirteen hundred dollars each. As soon as this fact became public it was only natural that many others should be anxious to engage in this interesting and profitable business. Not only did the private individual invest all the money he had and mortgage his farm to obtain more, but speculation became rife and continued up to the outbreak of the European war in 1914, when the demand for furs diminished greatly, and speculation, for a time at least, stopped. During this period prices were greatly inflated, so that in the fall of 1913 good ranch-bred cubs six months old brought from eleven to fifteen thousand dollars a pair. As was inevitable under such conditions, much dearly bought experience was gained, resulting to the good of those who had sufficient capital or staying powers to remain in the business. Best methods of handling, feeding, and breeding were sought until a large percentage of the losses coming through ignorance and carelessness in these matters was eliminated. Henceforth, with the return to moderate prices for the stock, a steady and healthy development of fox farming may be expected.

Without doubt, when properly managed, fur farming may become a profitable undertaking. Like all business ventures wherein considerable profits

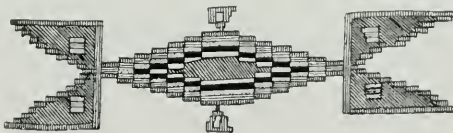
are looked for, sufficient capital is required to place it on a firm basis. Unless the work is carried on under favorable conditions for the animals, failure is bound to result. These conditions must include a locality suitable to the nature of the special fur bearer selected, proper housing, and the right kind of food, as well as a study of the individual traits of the animal.

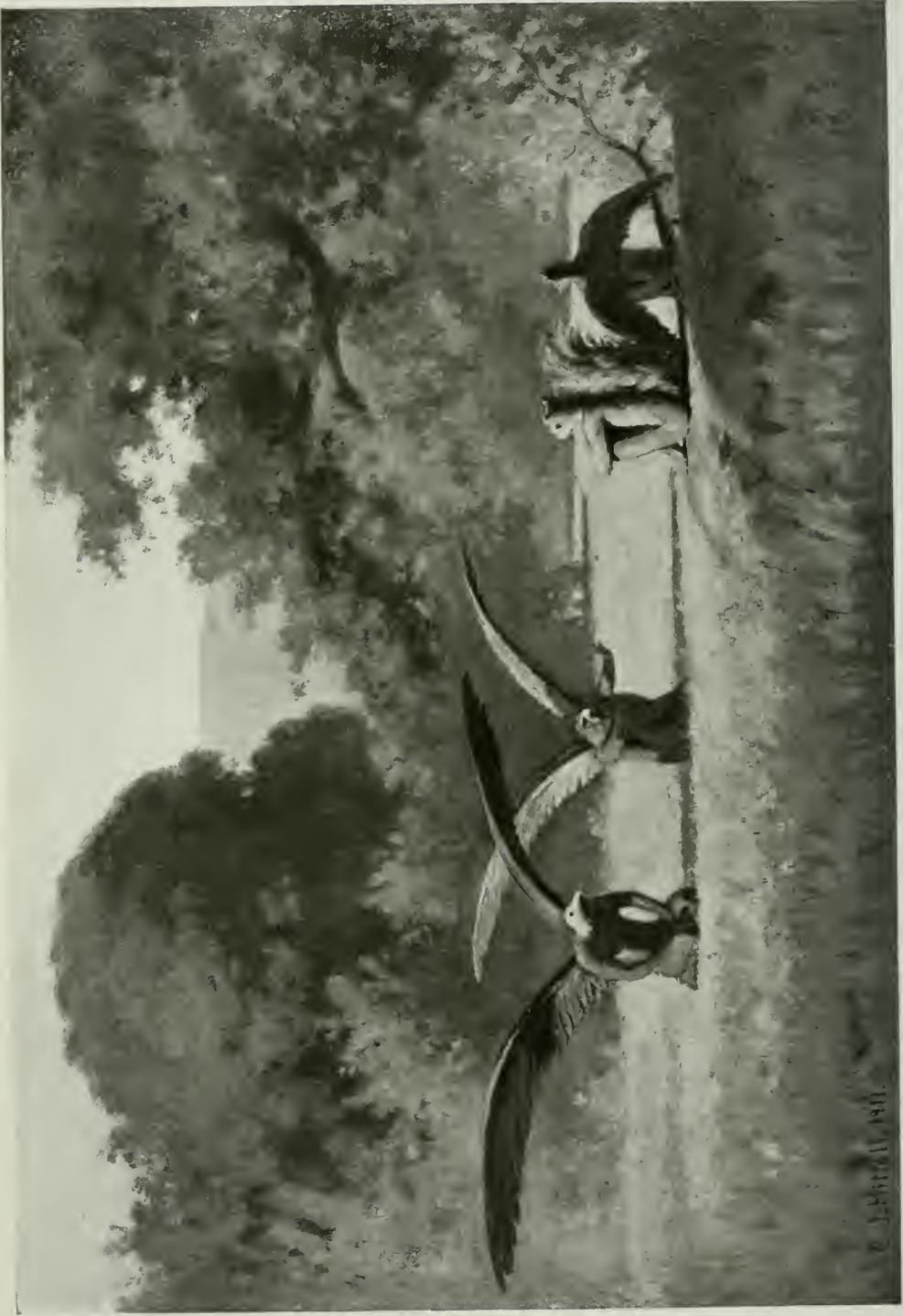
In choosing a site for the farm, the first consideration is climate, which has much to do with the character of the fur produced. A long cold season and at least a moderate rainfall are important. A short hot summer is not detrimental if followed by a season of frosty weather during which the animals renew their coats. Dry winds tend to make fur harsh, while excessive sunshine injures it both in color and character. It has been found that in densely wooded districts furs are darker in color than in more exposed regions and that the quality is softer and more silky than that of furs from bare tracts of country, where the greater effort required to secure food develops stronger limbs and a coarser body covering.

The last suggests at least one reason for the higher character of ranch-bred furs. It is evident that the fur of animals reared in captivity and given every care as to food and protection from the elements must of necessity be in better condition than the wild skins, many of which are worn and imperfect in coloring. Something of the fitness of a locality for fur farming may be judged by the quality of fur produced by the native animals. Some regions possessing the requisite degree of cold

are too dry and sunny for the production of a high grade of fur. Seclusion and quiet are other very desirable features of a site, since some animals, as the fox, are timid and nervous, and prefer to keep out of sight and in the shade during the middle of the day. The farm is therefore best located in the midst of a grove of young trees.

That careful and selective breeding will produce greatly improved stock in wild animals as it has in our present domesticated ones has been proved in the case of foxes. Within sixteen years of the time the two pioneer fox breeders of Prince Edward Island built their ranch they had eliminated the tendency of the silver foxes to produce red progeny and were sending to market the finest fox pelts in the world. As with poultry, horses, and other farm animals, so it is with fur bearers. Each breeder should strive to perfect his stock according to some standard. Food is recognized as a very important element in the development of good stock. The finest specimens of domestic cattle are those which have been fed most wisely. It should be a part of every breeder's plan to discover all he can about the relative values of food and methods of handling as influencing the process of selective breeding. The value of breeding stock is naturally dependent on the demand and in particular on the character of the fur of individual animals. Prolific animals belonging to choice strains, in which a superior color and quality of fur have been fixed, are of course worth much more for breeding purposes than ordinary stock.





A SILENCE CONTEST

Red-tailed Hawk and Turkey Buzzard are partners on one side, Bluejay and Gray Squirrel on the other

The imaginative Indian accounts for every phenomenon of nature in some picturesque manner. The origin of the Picnics, why the autumn woods are so beautiful, how the wind is generated by some one of the thousands

How Mah'-tah, the Turkey Buzzard, Lost his Speech

MYTH OBTAINED BY THE AUTHOR FROM
THE HAMFO INDIANS OF CLEAR
LAKE, CALIFORNIA

By C. HART MERRIAM

ONE day four of the First People met and chose partners for a game. These people were Ke'-ah, the Red-tailed Hawk, Mah'-tah, the Turkey Buzzard, Wes'-wes, the Crested Bluejay, and Sek'-a-lan, the Gray Tree Squirrel. The game they were to play was SILENCE, the stakes they put up were their languages. The first to speak or laugh was to lose his language forever—to remain silent the rest of his life; the other side was to win it.

Red-tailed Hawk and Turkey Buzzard were partners on one side; Bluejay and Gray Squirrel on the other. For a very long time they sat facing one another; for days and even weeks no one spoke. They looked at one another and made faces and tried to make each other laugh but without success. It was very tiresome and they all grew weary.

Finally, after a very long time, Ke'-ah, the Red-tail, said something, so his side lost. His partner Mah'-tah, the Turkey Buzzard, gave up his language to Sek'-a-lan, the Gray Squirrel, and has never spoken since. This is the reason the Turkey Buzzard is always silent.

Sometimes we hear Sek'-a-lan, the Squirrel, say "quach-quach-quach"—that is the language he won from Mah'-tah.

But Ke'-ah, the Red-tail, refused to let his go. He said, "I am not willing to lose my language; I shall never give up my talk." But Wes'-wes, the Crested Jay, said he would have it anyway, and he took it, but Ke'-ah kept it too and still speaks it. Bluejay usually speaks his own language, but sometimes we hear him say "ke'-ah"; this is the language he won from Ke'-ah, the Red-tail.

Bats of the Belgian Congo*

In current popular value, a welcome addition to the African negro's food supply; in ultimate scientific interest, the only mammals on our planet adapted for flight

By HERBERT LANG and JAMES P. CHAPIN

The main object of the Congo Expedition of the American Museum, which penetrated into the northeastern section of the Belgian Congo for a distance of from twelve hundred to two thousand miles, was the gathering of larger mammals and birds. We present here some notes on one of the minor results, an extremely interesting collection of Chiroptera. The many zoölogical expeditions that have entered a similar field in Africa, even the more successful ones, have brought home only ten or fifteen of the commoner bats from the regions they traversed—usually in great haste. Our collection numbers about 800 specimens.

In order to mark an advance in zoölogical explorations, the authorities of the American Museum of Natural History and the friends who helped support this expedition extended the privilege of continuing well-organized research work over five years in one of the least explored and most interesting regions of Central Africa. As this area usually is considered the most unhealthful on the globe, much depends on physical fitness,—should a kindly fate let one escape from the hundred and one chances of infection by tropical diseases. The abundance of tsetse flies makes even the use of beasts of burden impossible, so that thousands of miles have to be covered on foot under disagreeable and adverse circumstances. As a result of the daily rains and on account of the moist climate, collections are especially liable to destruction. Yet the specimens, exceeding a hundred thousand in number, arrived in perfect condition at the American Museum. Their packing in loads of about sixty pounds was especially annoying, but, in the interior, portage becomes the only mode of transportation. For more than five years we were out of reach of railroads, telegraphs, and telephones, and never heard a steam whistle or saw a motor car.—THE AUTHORS.

BATS from the Belgian Congo¹ have, up to the present, been known very little except by a few dry skins and skulls in museums. Travelers report having seen hundreds, or even thousands, roosting head downward in the trees, or migrating. But in the forest regions of the Congo an unsuspecting traveler may cover thousands of miles on the beaten track without ever hearing more than the noises of animals escaping at his approach. Or he may see a few troops of noisily

passing monkeys, a hundred and fifty feet above the ground in the somber canopies. From the tales of the natives or his porters, he may learn about the devastation caused, often long ago, by elephants or buffaloes. Unfortunately stories of man-eating leopards that carried off children and attacked women, too often are based on facts. We know of at least two white men during our stay killed within their very tents. Both had laughed boisterously at the tales of the terrified natives. To show their courage they left their tents open during the night. Rudely shaken out of their sleep, they had not enough time to call for help, so quickly did these leopards crush their skulls. In only one case was the leopard killed by the armed sentinel.

Our excellent relations with the natives in the Belgian Congo helped us in

¹The American Museum Congo Expedition Collection of Bats. By J. A. Allen, Herbert Lang, and James P. Chapin. *Bull. Amer. Mus. Nat. Hist.*, 1917, Vol. XXXVII, Art. XVIII, pp. 405-563. Pls. XLIV-LV, 26 text figures and map. Price \$1.50. Systematic list, pp. 405-478; Notes on the Distribution and Ecology of Central African Chiroptera, pp. 479-496; Field Notes, pp. 497-560. This recent publication deals with the description of sixty-eight different bats, of which twenty-nine are newly discovered forms. The unique feature is a record of their life histories with numerous excellent illustrations.

* Illustrations from field photographs by Mr. Lang and color drawings made in the field by Mr. Chapin.

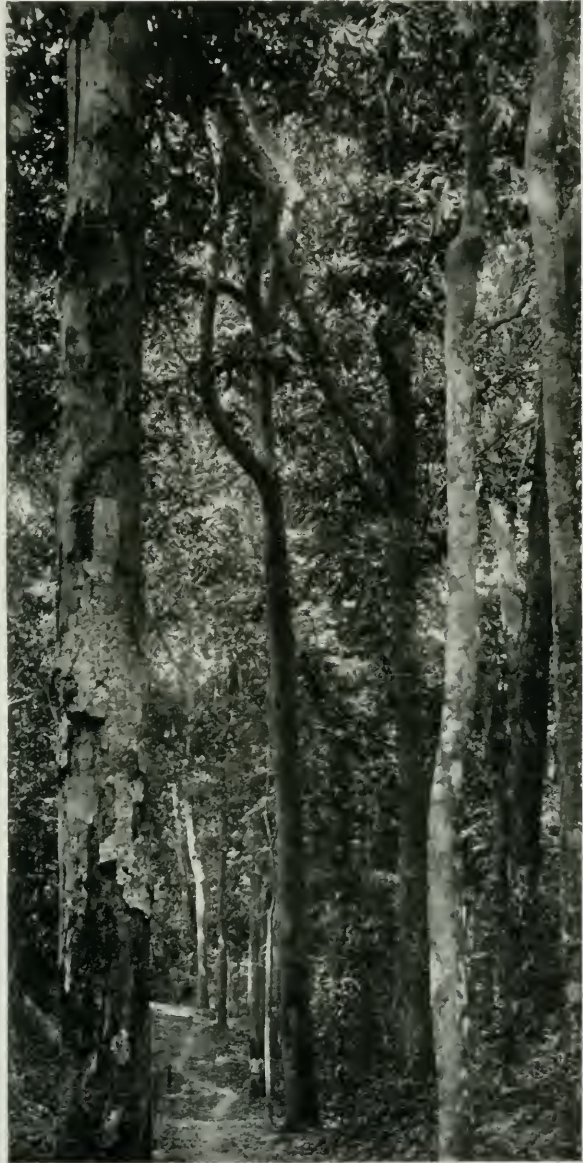


FRUIT-EATING BATS OF AFRICA

These portraits, showing four species of bats never printed in color before, were made by Mr. James P. Chapin in the field in Africa, with the strange, small creatures alive before him. They are $\frac{3}{4}$ natural size. "Epaulet bats" (the two species above) are so named from the white shoulder patch borne by the males. The "roussette" (left of the two lower species) is the most common among African fruit-eating bats, and the "hammer head" named from the enlargement of the muzzle, is the largest. The epaulet bat at the right produces a whistle-like sound, one of the most typical of the African jungle; the hammer head has a croaking voice much like that of an American wood-frog.

the search for rarer animals even more than the cordial and kind assistance we received from the officials whom we had the good fortune to meet occasionally. And as for bats, the lack of meat-producing herds of cattle—with dogs and chickens only as a meager substitute and with cannibalism virtually abolished—had developed in these Congolese negroes a keen interest in the haunts of this odd source of food supply. They are a more satisfactory food than grasshoppers or caterpillars. The smaller species, inhabiting hollow trees, rocky clefts, or caves, are, on account of their great numbers, as welcome as the larger fruit bats. The native says the former live together in "bat villages," and if he finds fruit bats hooked together in clusters he believes they assemble so as not to get wet from the daily rain, and he is quite amused that the younger ones, having to cling outside, complain and scold continually. Many others hang about singly or in pairs and sleep in the daytime, yet no matter how cautiously approached, the finely chiseled snout quickly emerges from its restful pose between the soft folds of the dark wings, and the twitching ears and twinkling eyes seek to gather information about the disturbance. The negroes often succeed, nevertheless, in shooting a few fruit bats just before they take wing, and conclude that all of them are blind during the day.

Although hardly any species is rejected as too small, the mastiff bats, forming large colonies, contribute much to the fame of bats as delicacies. The natives consider disagreeable odor an



Deep in the gloom of the tropical rain forests of the Congo tower giant dead trees. These often shelter great and mysterious bat "cities." From their dark labyrinths bats may be seen to fly out every evening—only to disappear instantly behind the veil of the damp equatorial atmosphere. The natives often set fire to these dead trees, and take home basketfuls of what they call delicious fat "birds" to be consumed as delicacies

advantage and fat flatters their palate. The bats make choice morsels spiked on a splinter of wood, singed and broiled over the fire, the bowels left in as a condiment but pressed out just before serving. Meat and bones are crunched with delight. The canines of insectivorous bats, which the natives

speak of as needles, are removed with great care; for, according to general belief, they would pierce the stomach, with sure death as a result. Among the Mangbeta the fat, wrinkle-lipped bats (*Molossidæ*) are often brought to the king as an especially dainty dish. Roasted and arrayed in rows of five and ten on a rod, they make a very welcome present; but should the donor forget to break out their needles he is guilty of the gravest offense. Suspected of an intention to murder the king, his days are numbered.

Tropical regions offer comparatively ideal conditions to bats. Such restraining influences as lack of food during the winter months and the enforced hibernation to which they have to submit in temperate climates are entirely absent. Bats, on the whole, are either crepuscular or nocturnal, but when disturbed, all can fly easily, even in the glare of the sun, to a new shelter. Most of them are unobtrusive and seek complete seclusion. Close observation, therefore, often culminates in the search for the varied hiding places to which they retreat during the day.

All the equatorial part of West Africa is covered by luxuriant rain forests, which extend as a broad band, sometimes exceeding four hundred miles in width, more than half across the Dark Continent. Seasonal changes scarcely are noticeable, although rain storms of indescribable



All bats hang head downward while resting or sleeping. This species of fruit bat (*Epomophorus anurus*), to effect this position, hooks its sharp claws securely over a twig. Sometimes flocks of from thirty to forty of these bats fly to the same tree to sleep, at once disappearing from view as though they were only so many additions to the indistinct blotches of shadow cast by the surrounding boughs

violence sweep across the country almost every day. A steady temperature of about one hundred degrees, together with the moisture-laden atmosphere, accounts for the ripening of fruits throughout the year. Upon these fruits the fruit bats depend entirely for their sustenance, but they have to move about continually in search of a new supply. Nowhere else in Africa can they find such ideal conditions, yet these two hundred and fifty thousand square miles of uninterrupted forest are inhabited by only twenty-five different kinds of fruit bats. Most of these are very rare. In every region one species at least is common, but on account of frequent migrations, a few other kinds may appear for a short time in great numbers. From the rest of Africa only a dozen more forms are known, but these occur everywhere as occasional stragglers. As here well-defined seasonal changes bring about alternating scarcity and abundance of food supply, they are forced to migrate. In the coastal districts, however, the cultivation of imported fruit trees has altered the conditions so as to make fruit available at all times. This allows a few fruit bats to become residents.

Fruit bats (*Pteropodidae*) are restricted to Africa and tropical Asia.

They are absent from South America, which has, however, the blood-sucking vampires (*Desmodontidae*). These are not found in Africa, and yet they, more than all others, have helped to increase the evil fame and superstitious beliefs about bats all over the world.

Fruit bats have nowhere well-established



The soft folds of a bat's wing membrane function as umbrellas during the numerous rain storms in the Congo forest; at other times they protect the bat's eyes from the glare of the sun. When a bat is sleeping we can see little of the khaki-colored bunch of fur, but when he is disturbed the finely chiseled fox-like head emerges quickly, on the lookout for danger.

roosts but are naturally more common in districts covered by rain forest than in the more arid regions, with well-marked rainy and dry seasons. Fruit is of course scarcest after the annual fires have eaten slowly across the country and left the shrubs and trees leafless and the fields in such a barren condition that a comparison with the effects of heavy frosts in temperate climates suggests itself. Within a very short time the grass sprouts again and flowers often cover the trees before the leaves have appeared. It is of great importance

to the fruit bats that only a few degrees north of the equator the seasons are the reverse of what they are at that time south of the equator. Furthermore, the essential features of the flora remain nearly the same over the entire eastern and southern Ethiopian subregions. Thus the fruit bats of these districts, by adjusting their migratory flights, might easily escape the unpleasant and otherwise inevitable conditions of an-

nual famine. In fact, the power of flight would bring them within range of the fragrance of ripening fruit throughout the year, if they but chose to travel across country between five degrees south and five degrees north of the equator. Although no positive observations with regard to regular migrations are on record, and only "large flights" and "great numbers," without date or locality, are found in the descriptions by various travelers, the occurrence of several species (*Eidolon helvum*, *Rousettus leachi*, *Rousettus aegyptiacus*, *Epomophorus wahlbergi*, *Epomophorus anurus*) across the eastern and southern portion of the Ethiopian subregion would be a good reason to suggest migration as the only possible solution of their presence throughout the entire territory, where they would have to starve should they remain in one region throughout the year.

The fruit-eating bats are usually built on a heavier plan than their insect-feeding relatives, and although they grow to a much greater size, some very small forms are on record. The head is nearly always more elongate and the ears are more simple,



The hunting grounds of the smooth-faced "tomb-bat" (*Taphozous mauritanus*) are over wide, steaming river beds. Its silver-gray back and creamy belly, erect ears, short-haired, pointed muzzle, and relatively large eyes are as characteristic as is the swiftness of its flight



A wing spread of more than two feet makes this "hawk-bat" (*Sacco-laimus peli*) the largest of the insect-feeding species in Africa. Often on moonlight nights, a dozen or so swoop across the village spaces, uttering short chirping or squeaking sounds as they come nearer in marvelously rapid turns

with borders joining below. The generally more rounded wings have, besides a long thumb, a claw on the second finger. This enables them to use the wing as a supplementary foot, when climbing about the trees in search of fruit, and

considerably increases its use as a hand to help hold the fruit while feeding. When these bats are at rest, the extensible membranes are often folded about the body as a protection against the rain or the glare of the sun. Contrary to the behavior of insectivorous bats, the larger fruit bats, when let loose in a room, fly against obstacles and windows with the same injurious effect as birds, because they lack highly developed sense organs in their wing membranes. The tail is either much reduced or entirely absent. They also are devoid of a continuous caudal membrane, relying chiefly upon their long legs for steering. At any rate, flight for them is only a means of travel from tree to tree to obtain fruit, and not an important factor in the rapid and eager pursuit of fast-flying prey, as in the case of insectivorous bats. These highly specialized forms at times display abilities that place them among the most successful predatory types. They open the mouth wider than other mammals and suggest comparison with the wide gape of swallows or goatsuckers. Such a large opening acts as a net. Every insect entering it is put to death instantly by the sharp dagger-like teeth. We greatly admired the speed of the fastest among them. Their success and cleverness in catching insects and the rapidity with which they masticated the tiny beetles in full flight were proved



Faces of two of the newly discovered species (*Hipposideros gigas niangara* and *Rhinolophus axillaris*). It is more or less easy to see ears, eyes, and mouth, but the strange structures between eyes and mouth are various nasal appendages. These serve during flight as wireless stations announcing in due time the proximity of objects, be they ever so minute. Thus in the Congo forests these bats dodge in and out among the branches with an ease that calls forth admiration. The nasal appendages are different in different species, and, to the scientist, reveal the identity of the bat and its general habits

through the microscopical evidence of the stomach contents from specimens shot on the wing. They literally cut and grind their prey to dust in a few bites.

The wings are either narrow and pointed, as in those that fly as swiftly as swallows, or broad and rounded, as in those that flutter about apparently in the aimless fashion of butterflies.



In these bats (*Lavia frons affinis*) the nasal appendages, together with the large ears and the supple wing membranes, are organs of such extraordinary sense of touch that, even if blinded, the bats would not be hampered in their predatory flights. By means of these sensory organs, they evidently are able to measure air waves, and thus are effectively warned from flying against obstacles. This bat is far more diurnal than any other we saw, and the curious orange and yellowish green tints of the huge nose leaves and ears add much to its strange beauty. (Locate the eyes and the picture will then take on the appearance of a face with great ears.)

The curiously modified nose leaves, ears, and especially the soft wing membranes seem to be able to measure air waves, and, even if blinded, bats will not strike against any solid object unless they are thoroughly exhausted. When chased in closed rooms, they escaped by narrow slits in windows and doors through which it seemed they could hardly crawl. These remarkable adaptations but add interest to the fact that bats are the only mammals on our planet which have developed the power of true flight. On account of this effective locomotion, zoögeographers excluded them from their conclusions, especially as certain species were believed to extend uniformly over Europe, Asia, and Africa. Chiefly on account of our long sojourn in these regions, we were able to prove that, just as with birds of the forest and birds of the plains, about twenty-five forms are endemic to the rain forest and about thirty to the open country. Five others may occur everywhere because they follow closely in the wake of man and live either in the native plantations or in and about human dwellings.

Some of the Central African bats are by far more interesting than their Asiatic relatives, among which, however, is the most gigantic of all bats, the Malay flying-fox, which measures one foot in length and five feet across its fully expanded wings. On the other hand, the largest of African Chiroptera, the hammer-headed bat (*Hypsignathus monstrosus*), measures only ten and a quarter inches in length and has a wing spread of three feet two inches. These are the strangest of all the bats and the males are absolutely unique, not only among mammals but among all vertebrates, in one feature at least. The larynx of adult males is almost completely ossified and so tremendously enlarged that it actually fills two thirds of the entire body cavity, crowding the heart and lungs

back toward the pelvic region. The vocal cords, of course, are also greatly broadened in proportion. Furthermore, they have one air sac on either side of the neck that can be inflated at will, as in certain frogs. Indeed, when the old males were in full assembly, their chorus made us think of a pondful of noisy American wood frogs, greatly magnified and transported into the tree-tops. The natives assured us that these poor males had to croak from sunset to sunrise for the enjoyment of the females, supposedly deaf. Whatever may be the cause of their rapidly reiterated "pwok" or "kwok," they are completely fearless or dull of hearing during the time they make this racket. They would not mind even the detonation of a gun, much less the flash of a

lamp, although at other times they are extremely shy.

In no other creature is everything so completely subordinated to the organs of voice. In the howler monkey (*Alouatta*), famous for its far-sounding cries, the hyoid only is transformed into a resonating apparatus, but in the males of this species of bat everything seems to be designed to produce continuity of noise rather than a loud reverberating sound.

In their manner of feeding, these bats are equally interesting. Their relatively large teeth merely lacerate the outside of fruits. The hardened ruffles on the nose probably are used in the manner of a pig's snout, to loosen the pulp inside the fruit. The tongue, instead of becoming slender



Two other newly discovered species (*Charephon russatus*, at the right, and *Mops congicus*, at the left). These cling to the rough decayed surface of the inside of hollow trees, with their dark wings tucked closely to their plump bodies. In the waning light they look more like glistening lumps of fungus than live creatures. They huddle together in great numbers, screaming and fighting for desirable positions

when stretched out, assumes the form of a spoon. A triangular, rasplike set of papillae, conveniently placed near the tip, helps to gather pulp and juices. The whole face in front of the orbits is loose, and in its upper parts the channels reach as far back as the ear. These and the lips function evidently as muscular pouches to squeeze out the pulp of the fruits. The œsophagus is so narrow that only juices can pass. This fact offers an explanation for the great patches of fresh pulp often found together with the remnants of spoiled fruits underneath the boughs that appear to be used as their habitual dining halls.

These hammer-headed bats occur singly or in small flocks, rarely exceeding thirty, and are most frequently seen shortly after sunset when leisurely flapping across the rivers or open expanses of water. We often observed them, too, stealing ripe fruit in the government posts. They are especially fond of guavas, mangoes, and sour sops. They take ripe bananas even from underneath the roofs of houses where natives have stored them.

One of the epaulet bats (*Epomops franqueti franqueti*) is also known for its vocal efforts. Its calls, however, sound more like musical whistles that ring intermittently through the stillness of the night. Together with the loud croak of the tree hyrax (*Dendrohyrax*), these are the most typical nocturnal sounds in these forested regions. Yet, to our great surprise, not a single European knew that he was listening to a bat. The high-pitched, tirelessly reiterated note seems to be emitted by a bird rather than by a mammal. Questioning natives is to little purpose, for they consider bats to be birds and will reply simply that it is a bird of the night that eats fruit. Here, too, only the males produce the noise, but their vocal organs are enlarged comparatively little. Their popular name "epaulet bat" refers to a

glandular pouch on each shoulder, lined with stiff white hair, a distinction marking only the adult males.

The most frequent and greatest wanderer among African fruit bats is the "roussette" (*Eidolon helvum*), which, unlike others, assembles in great numbers, sometimes completely covering trees. At Avakubi a flock of perhaps one hundred had taken shelter for the day beneath the limb of a large tree, where they were shaded by a mass of epiphytic ferns and orchids and formed one great squirming mass. Ever and again one seemed to lose its hold in the crowd, took wing, and hooked itself anew. All the while they kept up a chorus of snarling and scolding noises that could be heard a hundred yards away.

According to our experience it is their strongly developed sense of smell that guides them to the fragrance of ripened fruit which is generally hidden beneath the dense canopies; for, although the bat's eyes are large, sight alone could not lead to its discovery.

Fruit bats cause no damage to native plantations in these West African forests, as the negroes there do not plant any indigenous fruit trees, except the oil palm, the nuts of which do not entice these little marauders. Sweetish, acidulated, or juicy pulp is their chief aim, and thus their tastes coincide with those of the human race. Their devastations really are restricted to fruits of imported trees. But, of course, as the seeds are dropped to the ground, the bats unwittingly contribute to the distribution of valuable fruit trees beyond the confines of the plantations, for, under the favorable influence of the moist climate, these seeds readily sprout and grow into trees. Since the larger species (*Hypsignathus monstrosus*, *Eidolon helvum*, and *Epomops franqueti*) habitually move fruits as large as figs or guavas in fairly great quantities, we can easily imagine what an important rôle fruit bats

play in the propagation of certain fruit-bearing trees. It may even surpass any similar agencies of monkeys and birds, which usually receive all the credit in this line. *Éidolon helvum*, with its flocks of thousands dropping into a country in search of ripe fruit, should certainly be an effective factor for the dissemination of many forms, such as wild figs.

Besides omnivorous man, their only enemy is a rather rare bat hawk (*Macharhamphus*) that perches on high trees, but at dusk spends most of its time skimming over rivers and shooting about clearings or over the bush country in pursuit of its habitual prey, the bats.¹

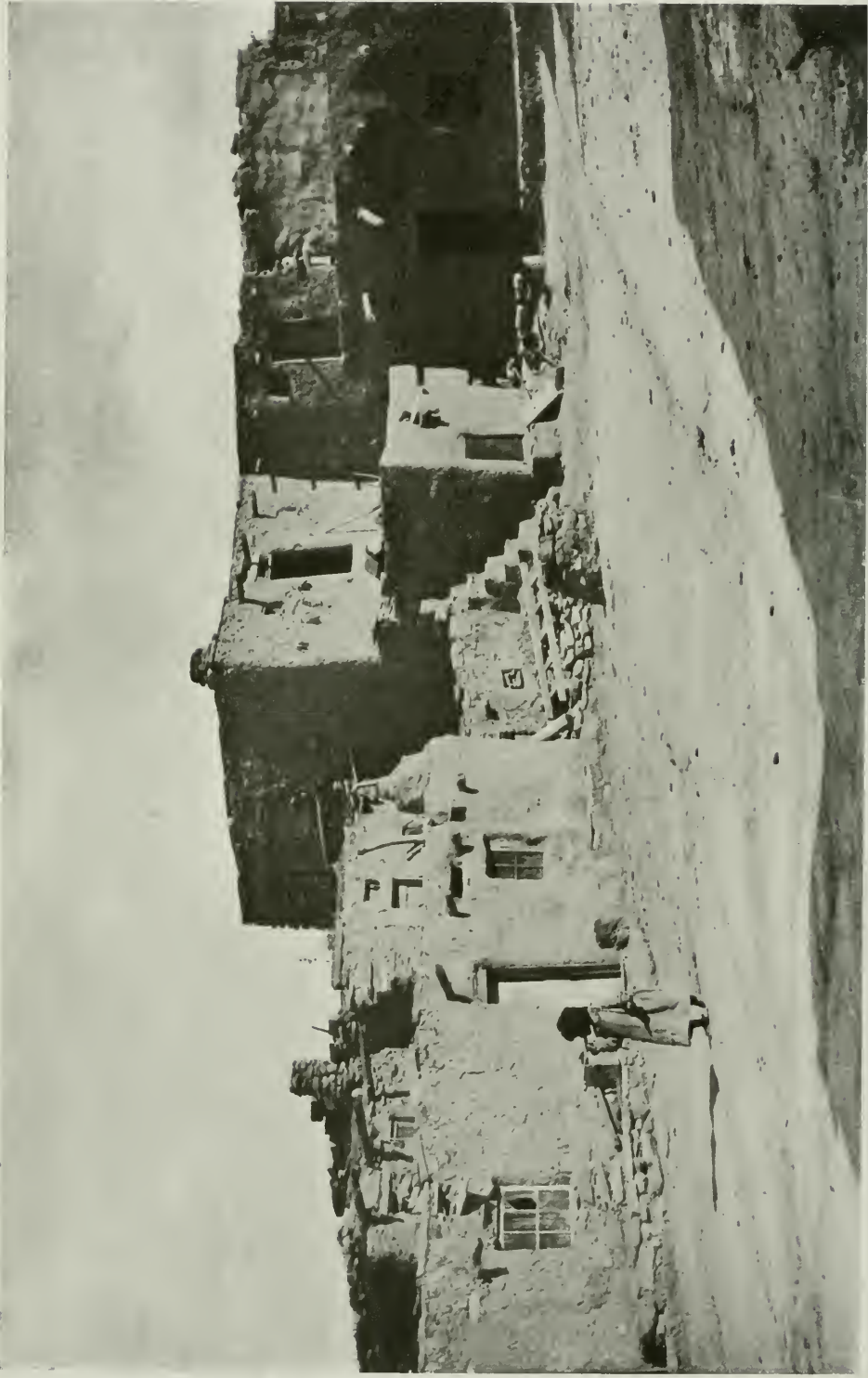
Among the new forms, the most surprising were a number of crested bats (*Lophomops*) that evidently have no close relation to any known species. The papyrus swamps also gave up a curious bat that hangs just beneath the bushy crown of this stately sedge. Others were taken in hollow trees and some even in houses, clinging to the thatch. We were especially successful in the northeastern part of the Congo-Nile divide, which is not to be pictured as an abrupt mountain chain. Quite the contrary, it is only a rolling bush country, about twenty-eight hundred feet above sea level, studded with great numbers of rugged granite hills, rising from three hundred to five hundred feet higher.

¹ It was the good luck of Mr. Chapin to kill one of these hawks whose crop contained four species of bats, three of which were new to science.

Just as these hills are inhabited by a number of birds not found in the more level country, so too they have certain peculiar mammals, notably hyraxes, and their fissures and grottoes harbor, as one might well guess, numbers of bats. About two hundred and thirty miles from the coast we found a cavern,—a real sanctuary for bats. Fairy tales have made it the lair of a weird leopard which leaves no traces of its victims. The ever recurrent rumors of plaintive voices heard within the cave keep most of the natives at a respectful distance.

We had with us two of our old trusted boys, Wawe and Choma-Choma, and proceeded but slowly inside so as to make sure of our way out. As we were without firearms, we wondered how we could get the bats; but as the manifold echoes of our voices broke the mystic silence, the cave suddenly became alive. To the great terror of our boys, the "devils" came down upon us. Although the volume of whirring noises was enormous, only a few of the bats encircled our lanterns, like timid scouts who alone dared to inquire into the cause of the unusual disturbance. After catching some with a few lucky strokes of a butterfly net, we were glad to come back again to daylight. Our guides, black messengers of bad omen, cheered up, and we ourselves laughed heartily as we explained to them that according to the white man's superstition we had had bad luck, for we had caught thirteen bats.





THE PLAZA OF SHIPAULOVI

Smallest of the Hopi villages, Shipaulovi is situated on the Middle mesa. Its houses of stone, plastered over with mud, are terraced back from a square court or plaza, upon which the doors of the lower terrace open. While the men sometimes build the house walls, the women are always expected to do the plastering. Inside, the walls are whitened with gypsum. The windows now have glass panes

Noted in Hopiland

By ROBERT H. LOWIE

NOTHING is more remarkable about the Hopi than the contrast between their mode of life and that of their closest linguistic relatives. There is probably no more telling example of the principle that language and culture need not go hand in hand. In the Hopi vocabulary the most superficial observer who has traveled among the tribes of Utah, Idaho, or Nevada, finds abundant evidence for the philologist's assertion that the Hopi belong to the same family as the Shoshone, Ute, Paviotso, and Paiute. But in point of arts and customs the resemblance is practically nil. The Plateau Shoshoneans represent the lowliest stage of native North American life,—that of the roving nomad subsisting on small game and roots, using the most primitive brush-covered lodges for shelter, ignorant of all but the crudest pottery, loosely organized from a social point of view, and virtually without the spectacular ritualistic performances that characterize many of the Indian tribes. On the other hand, the Hopi have attained the high-water mark of aboriginal advancement reached north of Mexico. They eke out a living as agriculturists in a desert region where the government farmer is likely to throw up his hands in despair; they inhabit settled villages of terraced sandstone houses; their pottery, ancient and modern, delights the heart of the artist by its wealth of decorative motives; they are organized into a considerable number of clans; and their ceremonialism centers in a calendric series of highly elaborate festivals.

The principal object of my two visits to the Hopi, in July, 1915, and from the beginning of August until the end of September, 1916, was to investigate the kinship terminology of the tribe. For this purpose I visited four of the Hopi villages,—Walpi, Sichomovi, Mishongnovi, and Shipanlovi, the first two being situated on the First or Eastern, the others on the Middle mesa. Ethnologists have paid great attention to the methods used by primitive tribes to designate their relatives, and some very far-reaching conclusions have been drawn therefrom as to the marriage customs of early man. But for some reason, except for the Tewa,

the Southwest had remained practically unknown from this point of view until in 1915 the American Museum despatched one expedition under Professor Kroeber to the Zuni, and another under the present writer to the Hopi. Investigations of this type had just received a powerful stimulus by the publication of Dr. W. H. R. Rivers' "Kinship and Social Organization," in which the distinguished British scholar connected one form of kinship terminology with a clan system of social organization, and another with a classless or "loose" organization. Since the Pueblo Indians have a highly developed clan scheme, it seemed important to use these Southwestern data to test the theory. The Hopi were particularly tempting in this respect because of their known affiliations with the classless Plateau Shoshoneans. Had they by any chance preserved traces of this connection in their nomenclature of relatives? Or had the difference in their social conditions blotted out any similarities of the sort?

A thorough examination proved that the latter alternative very closely approaches the truth. The Plateau Shoshoneans have some very remarkable features in their relationship terminology. Thus, they generally have quite distinct words for the maternal and the paternal grandfather. Again, they have a tendency to use a single word reciprocally for two distinct relatives of different generations. For example a boy will call his mother's mother by the same term by which she addresses him. Now these traits are not shared by the Hopi at all. On the other hand, these people have developed a nomenclature that largely reflects their clan organization. By this is meant that in many instances they group together individuals whom we distinguish because those relatives belong to the same clan. For example, all my father's brothers belong to the same clan as my father, that is, to their mother's (because the Hopi trace descent in the female line); and accordingly we find that one word is used to cover our "father" and "paternal uncle." Since a Hopi must not marry within his own clan, my mother's brother, like my mother, can never belong to

the same clan as my father's brother, and accordingly he is distinguished by a separate word. But the Hopi carry this principle to what might be considered ridiculous lengths. Not content with extending the meaning of terms within a certain generation, they sometimes class together relatives who differ very widely in point of age. Thus, the son of the father's sister is not a cousin as in English, but a "father,"—obviously for no other reason than that he is a fellow-clans-

ritualistic performances. But in some of the more important of the religious fraternities ceremonial offices were found to be definitely associated with certain clans, and to descend not from father to son but from maternal uncle to sister's son, or from elder to younger brother. In other words, they do not normally pass out of the clan.

During my first stay I witnessed only a single ceremony, the Niman Kateina (Kachina). The Hopi divide their ceremonial



Village of Shipaulovi rising from the Middle mesa

man of the father. But the climax is reached in the designation of the paternal aunt's female descendants, all of whom (through females) are called "paternal aunt" to the *n*th generation. This, however, is really not the happiest way of expressing the facts. We should rather say that a single term is used to denote any female member of the father's clan from his own generation downward. The clan theory is thus well borne out by the Hopi data.

As kinship proved to be inextricably bound up with the clans, so the clans proved to be intimately connected with ceremonialism. This does not indeed apply to all the

year into two parts—masked dancers or Kateinas participating during the one season and unmasked dancers in the other. The former impersonate ancestral spirits, and cottonwood effigies of them, which they distribute at the close of their performance, are treasured by the children as dolls. The Niman or "Home-going" ceremony terminates the mummers' season. In the summer of 1916 I was almost "surfeited with honey" in a ceremonial way. I attended two performances of the Snake Dance, saw the Flute Dance, the Mámajau'tó, and an entirely anomalous Kateina performance. All of these have been described before, with the

exception of the last-mentioned, which accordingly merits some consideration.

As explained above, the normal Katsina season closes with the Niman. But in 1916 a First mesa Hopi had vowed to perform a certain special Katsina dance provided he recovered from illness. For some reason it proved impracticable to intercalate this extra performance into the crowded Katsina calendar; accordingly it was necessary to insert it after the Niman. But here a difficulty arose. It was logically absurd to have a Katsina dance after the official farewell of the Katsinas. Worse than that, it outraged all traditional Hopi notions of the fitness of things. The dilemma was overcome by an argument that might have shed luster on some medieval casuist. The First mesa comprises three villages,—Walpi and Sichomovi, which are inhabited by Hopi; and Hano, where an offshoot of the unrelated Tewa of the Rio Grande region has long been settled. Now, the Niman of the First mesa is always celebrated at Walpi. Hence, the Hopi argued, it is true that no Katsina dance can be held after the Niman at Walpi; but it is perfectly legitimate for the same people who participated to go several hundred yards eastward to the plaza of Hano and hold the ceremony there. Accordingly, it was performed there several weeks after the traditionally final celebration of a Katsina dance.

The ceremony was conducted by its pledger, Hō'nau'ö, whose costume differed from that of the other participants in that he wore a shirt, trousers, a snoutless mask, and a feathered headdress. Two unmasked men were equipped with pouches of corn meal, with which they liberally sprinkled the line of dancers, passing from one to the other and casting a pinch on each at a time. One man, whose mask was distinguished by drooping moustachios, was seated on a chair vigorously beating a big drum, but the greater part of the music was furnished by the dancers themselves, who held gourd rattles in their right hands and had turtle-shell rattles tied to one leg in such a way as to produce characteristic sounds at each movement. The rank and file wore masks representing some horned animal, woven kilts decorated with native designs, and a foxskin hanging down at the back. Many wore armlets and had their arms and bodies daubed white with paint. Each had a collar of spruce needles.

The ceremony began in the morning and ended about sunset. There can be no question that so far as the populace at large was concerned it answered the purposes of a theatrical performance. The sides and roofs of the Tewa plaza were crowded with spectators. Back of this stage the Katsinas assumed their mummers' garb and made a solemn entrance in single file, forming a line on the north side. The drummer took his seat and began beating his instrument. Hō'nau'ö signaled directions, and the rank and file began to chant, shaking their rattles and stamping one foot. Without moving from their position, they would sometimes execute a violent turnabout face at the director's behest, and from time to time extended a feathered wand held in the left hand. While they were indulging in this relatively mild exercise, one participant danced outside their line, now jumping up and down with the utmost vigor, then again proceeding with exaggerated gravity, and altogether cutting the queerest capers of which he was capable. The two unmasked performers would pass along the line, sprinkling the performers with corn meal.

After completing their chant, all the dancers proceeded toward the west side of the plaza, forming the arc of a circle, where they went through exactly the same performance. After this a third dance was executed on the south side, and then the performers withdrew to rest and remove their disguise. Throughout the morning the same "act" was repeated with intermissions of from twenty to twenty-five minutes.

In the afternoon new features were added. For one thing, the dancers before forming their usual alignment would distribute gifts of food to the children in the audience. But the essential novelty was the entrance of three clowns, who thenceforth held the stage even when the dancers had retired. They were all Tewa men, though their speech was Hopi. Their costume consisted of a crude clout, a footgear of rags and a double-pronged headdress of sheepskin. From the top of the prongs down to the feet they were daubed with alternate zones of grayish and black paint. In the middle of the plaza a little tree had been planted to symbolize "the home of the clowns." From somewhere they produced a little doll, and this represented their housekeeper. One of their principal aims seemed to be to gather together



In this view of the Katsina dance, the man in the center wearing coat and trousers and a feather headdress is the pledger of the dance. The unmasked man at the right is the corn meal sprinkler



In the Katsina dance given at the Tewa village of the First mesa the clowns are Tewa, the other participants Hopi. The clowns may be seen at either side of the line, sprinkling corn meal on the dancers in imitation of the ceremonial sprinkling customary on such occasions

as much food as they were able to get by fair means or foul, which they would then brazen-facedly eat in the presence of the entire audience.

This, however, was only part of their licensed behavior. Throughout the afternoon they attempted to excite the mirth of the spectators, whether at the expense of the audience, the dancers, or themselves. They seemed continually on the lookout for tricks of buffoonery. If an old man had dozed off on one side, one of the clowns straightway ran up to steal his cane and bring it to their "home." When another saw me leveling a camera at him, he immediately dashed up to my vantage-ground and in broken English demanded an indemnity, the moderate sum of fifty cents sufficing for him and a nickel apiece for his associates. But the clowns were not always allowed to have things their own way. When they had embarrassed one of the women by dragging her to the line of dancers and asking her to interpret the chant, one of her relatives with well-feigned indignation seized the chief offender by the ear and dragged him through the arena till he was ransomed with a gift. Similar scenes were enacted repeatedly and added to the general gaiety. Nothing could be more ludicrous than the exaggerated gestures of

fear and pain on the part of the buffoons when taken to task by their victims.

The Ibox Katcina, as my interpreter called this dance, confirmed a view I had long ago developed with regard to primitive ceremonies. The tendency of most ethnologists has been to overemphasize the importance of the religious and the esoteric in ritualism. They fail to understand that even though the ostensible object of a performance may be to supplicate supernatural beings or to bend nature to the will of a priesthood, there may also be satisfied quite other than magico-religious cravings,—aspirations that we may group together under the head of the æsthetic. This applies even to the fraternity conducting the activities, but with tenfold force to the throng of beholders who are shut out from whatever secret meaning the drama may hold for the initiated, but who can be thrilled by the beauty and solemnity of the spectacle or moved to Homeric laughter by the clowns' extravaganza. In the dance described there was undoubtedly, over and above any other significance, a dominant element of farce and vaudeville; but it seems more than likely that a corresponding interpretation holds for the most serious Hopi rituals: they are not merely religious observances, they are aboriginal drama.



Spectators gathered in the plaza and on the housetops at Hano to witness the dance, which so far as the populace at large was concerned answered the purposes of a theatrical performance



The presence of many ornaments and implements of bronze in prehistoric Peruvian burials has raised much discussion as to whether the ancients knew the secret of combining copper and tin in proper proportions to make the harder metal or whether its production was accidental. Among the articles found are knives, needles, battle axes, chisels, and shawl pins

Prehistoric Bronze in South America

By CHARLES W. MEAD

THE discovery by primitive man that certain kinds of stone or mineral would yield a metal on application of heat, made possible an advance in civilization relatively as important as any that has followed. Metal implements superseded the more clumsy and inadequate tools of stone, and metallurgy became an established science.

Bronze, an alloy of copper and tin, is obtained by smelting these metals together in proportions which may be varied according to the nature of the product required. The addition of tin to copper makes a combination which not only is more fusible than copper alone, but also harder and less malleable. It is therefore more suitable for casting and more useful for making implements. Copper and tin are reduced quite easily, unlike iron, which requires a greater application of heat to separate it from its ore than it was possible to obtain by primitive methods. In the hands of the ancients these metals are responsible for what is generally known as the Bronze Age of culture.

It has seemed probable that the original discovery of bronze and its advantages over copper were a matter of chance. It is possible that the metals often found in copper of the early bronze age were not intentionally added but were the result of smelting impure copper ore. Later, when experience had shown that the combination of copper with other metals yielded a product superior in many ways to copper alone, the additions were made purposely.

Strictly speaking, the term "copper" should be applied to all implements which contain ninety-six per cent or more of this metal, the remaining four per cent being a mixture of two or more other metals in varying proportions, with occasionally some sulphur and less than two per cent of tin. Such alloys come under the accidental category, although in exceptional cases, such as the tin and copper ores of Cornwall, a much larger proportion of tin may be accidental.

It has been affirmed by some that bronze could not be produced by smelting a copper ore containing tin. Experiments with the

tin-copper Cornish ores¹ have led to the opinion that none of these ores could be smelted so as to produce a mixed metal consisting only of copper and tin in such proportions as to form bronze; and that although the ore might contain a sufficient proportion of tin, it would be impossible to get rid of all the other extraneous ingredients without eliminating the tin also. Professor Gowland² answered these statements by preparing a furnace in primitive form, consisting merely of a hole in the ground. In this he smelted a mixture of copper ore (green carbonate) and tin stone and obtained a copper-tin alloy, by which he claimed to have proved indisputably that when primitive man smelted a copper ore containing tin a bronze resulted—completely refuting the statement that such ores will yield nothing but copper. Furthermore, the metallic ores within the reach of prehistoric man were undoubtedly those lying near the surface of the ground, in a mineral vein or outcrop. Ores so found are as a rule oxides and carbonates, the most easily reduced of all, and from them metals can be obtained with very little difficulty by treating them in the primitive "hole in the ground" furnace above mentioned.

Now the implements and ornaments of bronze which have been found in such large numbers in prehistoric burial places within the boundaries of the ancient Peruvian empire have caused much difference of opinion and discussion as to whether the mixture of copper and tin contained in them was intentional or purely accidental. In other words, did the copper which these people mined contain, among other impurities, tin in such proportion as is found in these objects by analysis, or were the two metals separately procured and smelted together with the object of producing a harder metal?

With a view to the solution of this problem, 172 analyses of prehistoric copper and bronze objects from Peru and Bolivia have been made for the American Museum of Natural History³ and for the Peabody Museum.⁴ The percentage of tin in these ob-

jects was found to vary from nothing to as high as thirteen per cent, seeming to preclude the possibility of its presence being accidental in most cases. The metals differ remarkably in composition and indicate the possession of considerable metallurgical skill on the part of the inhabitants of the region from which they came. The absence of the slightest trace of silver seems to prove that the tin was derived from an oxide rather than from the native metal.

But it is the historical evidence, taken in conjunction with the chemical, which furnishes the most interesting data on the question. The early historians, Garcilasso de la Vega and Father Barba, state positively that the Indians were acquainted with the secret of making bronze. Garcilasso tells us that they "worked with certain Instruments they had made of Copper mixed with a sort of fine Brass."⁵ At the time the Inca historian wrote, tin was often called brass in Europe as well as in South America. Confusion in the names of metals is very old according to Sir John Lubbock, the great English naturalist, who states that "In the Pentateuch, excluding Deuteronomy, bronze, or as it is unfortunately translated, brass, is mentioned thirty-eight times."⁶

Early in the seventeenth century Father Alvaro Alonso Barba, whose parish was situated in the very heart of the mining district of Bolivia, and who combined with his duties of priest that of the office of director of the mines, published a book on *Arte de los Metales*. In this he stated that the Indians were acquainted with the use of the tin-copper mixture and employed it to give hardness to their instruments and arms. Father Barba's intimate relations with the Indians should give great weight to this statement. Another circumstance that should be taken into consideration in estimating the value of his account is the great probability that the parents of some of his Indians must have been living at the time of the Conquest and the facts in the case, therefore, well known in his day. In his chapter on tin he gives the following, which is of interest for comparison with the findings of the modern analysts:

"Not far from Carabuco, one of the towns bordering on the margin of the magnificent Chucuyto Lake, toward the borders . . . of Larecaxa, there are also mines of this metal

¹ See report of Alfred Jenkin, an experienced assayer, published by Sir John Lubbock in *Prehistoric Times*, p. 608.

² Copper and Its Alloys in *Prehistoric Times*, by W. Gowland, *Journ. Anthropol. Inst. of Great Britain and Ireland*, Vol. XXXVI, pp. 11-38.

³ By Mr. W. A. Wissler, Dr. Morris Loeb, and Dr. S. R. Morey.

⁴ By Professor S. P. Sharples.

⁵ *Royal Commentaries*, Book II, chap. XVI.

⁶ *Prehistoric Times*, p. 5.

which the Indians in the time of their Incas worked and afterwards were continued by the Spaniards. The veins are large and the metals rich of their kind; from among them some ores are also taken containing much silver, and all partake of some copper, and on account of this mixture this tin is more showy and hard. . . . In the hills of Pie de Gallo of Oruro there is much tin, although not known by many, and because no silver, which all seek, is found there, they pass them by."

The localities mentioned by Father Barba are in Bolivia on the shore of the great Lake Titicaca or at no great distance from it. From other evidence also, it is clear that Bolivia was rich in tin. This is particularly interesting in view of the fact that the proportion of objects of copper containing tin in South America increases from north to south, reaching its maximum in Bolivia and in the high plateau region of Peru. This observation is supported by the analyses made for the American Museum, which show that of fifty-one objects from Chepen, in the northern coast region of Peru, but five contain more than a trace of tin, and only one of these more than four per cent of that metal; and of eight objects from Trujillo, also in the northern coast region, none contains traces of tin.

On the other hand, of sixteen objects from Cuzco, in the high central plateau region, all except one contain tin, averaging five and one half per cent, and fifty-nine objects from Bolivia are of bronze, averaging nearly six and one half per cent of tin. Tin would appear, therefore, to have been made use of especially in those districts where it was easily obtained, and it at once becomes of interest to discover whether the copper ores of Bolivia contain tin as an impurity, or are found in close proximity to tin ores.

Although works on metals and mining are not prolific in analyses of Bolivian copper ores, the writer was able to collect enough information to convince him that the old bronze implements could not have been made by smelting impure copper ores. This opinion was confirmed by a report¹ of about five

hundred assays and analyses of Bolivian copper ores none of which showed tin.

Another fact which seems to preclude the accidental theory of Peruvian bronzes, is that analyses of seventeen specimens from Tiahuanaco, a village of Bolivia, showed twelve of them to be of bronze, with an average of six and a half per cent of tin, while the other five objects—which are clamps used to hold the stones of buildings together—contain no tin whatever. We must believe either that these were purposely so made or that they were the result of accident. Two more clamps from Tiahuanaco, analyzed in 1905,² also were found free from tin, while four other specimens analyzed at the same time contained six and a half per cent of tin. Only one theory can be advanced to explain the absence of tin in these clamps and that is that they are very much older than the other objects from Tiahuanaco which have been analyzed—that they were made before the discovery of bronze. This seems exceedingly improbable.

Bronzes from Argentina and Chile present another phase of this problem, since these countries have no tin deposits. It has been supposed by some archæologists that the bronze objects found in Argentina were imported from Bolivia, but the discovery later of furnaces, melting pots, molds for casting, and slag in the ancient ruins makes it certain that the bronzes were cast on the spot. Did the prehistoric peoples of Argentina and Chile work tin mines of which we are ignorant, or had they discovered copper ores containing a high percentage of tin of which nothing is now known, or did they obtain their tin of their northern neighbors? The latter theory seems most reasonable. It has been argued by Professor Gowland that when once the discovery was made that metal for many useful purposes could be obtained simply by heating stones of a certain color and weight, there was bound to be a large production in the localities where these stones or ores occurred; and that while these localities naturally must have been the centers whence the metal was supplied to others, it does not follow necessarily that the largest number of metal objects were made always in or near them, since the crude metal often

¹ By Mr. R. M. Atwater, Jr. Mr. Atwater has spent much time in Bolivia and is familiar with the copper ores and copper mining in that country. He assures me that it is perfectly safe to proceed upon the ground that there does not exist in the mines of Bolivia any natural alloy of copper and tin, or either veins or placers where the two metals occur in such proximity that their mixture could be accidental.

² Adrien de Mortillet. Bronze in South America Before the Arrival of Europeans. *Annual Rep. Smithsonian Instit.*, 1907, pp. 261-6, Washington.

would be merely an object of barter which would be worked into useful forms elsewhere.

A large piece of tin was found among the ruins of Machu Picchu¹ which was considered one of the most important discoveries made in that ancient ruined city. This piece of pure tin apparently had been rolled up by the Peruvians and kept for making bronze, slices being cut from it when needed by the artisan.

Those who have advocated the accidental theory to account for the bronzes found in South America have adduced as their chief reason for that belief the fact that such objects as knives or chisels often contain a smaller percentage of tin than pieces like spoons or pins which have no cutting edge; but this argument entirely loses force when we inquire into the conditions under which these things were made and the behavior of copper and tin when melted together. It has been pointed out² in writing of the bronze statues of Alexander made by the celebrated artist Lysippus, the three thousand bronze statues found at Athens by the Roman Consul Mutianus, and the many statues at Olympia and Delphi, that the ancients could not be supposed to possess the skill of moderns in dealing with this metal. Since they had no means of ascertaining the actual composition of the alloys, they could not provide against the oxidation of the tin and con-

sequent refining of the copper, one of the greatest difficulties to be overcome. Analysis has shown their bronzes to be variable in composition, some of them having the correct proportion of tin while others are nearly pure copper. But even modern works have not always overcome this difficulty, instances of failure being shown in the statue of Desaix in the Place Dauphiné and in the column in the Place Vendôme. Specimens taken from the pedestal, shaft, and capital of the latter were found on analysis to contain in the first case six per cent of tin, in the second much less, while the third was nearly pure copper. Such statements as these seem to explain satisfactorily the variation in the quantity of tin found in Peruvian bronzes.

Finally, taking into consideration the positive assertions of Garcilasso and Father Barba that the Indians knew the secret of combining tin with copper to harden their implements; the analyses, which show that bronze objects contain considerable amounts of tin, especially those found in Bolivia, where it is now pretty certain that the copper ores contain no tin; the discovery of a piece of tin in the ruins of Machu Picchu; the finding of smelting furnaces, slag containing tin, and molds for casting in Argentina—where all known coppers have no tin in their impurities; and such facts as can be gathered concerning the composition of all copper ores in the region under discussion, we can but come to the belief that the accidental theory of the production of ancient bronze must be abandoned.

¹ Hiram Bingham, *The Story of Machu Picchu*, *National Geographic Magazine*, Feb., 1915.

² A. Snowden Piggot, *The Chemistry and Metallurgy of Copper*, 1858.

Note on Texas Land Snails

By E. D. D. C R A B B

Written while in military service at Camp Bowie, Fort Worth, Texas

AS THE medical department of the First Oklahoma Infantry was marching from the train to its cantonment, we noticed a great many snail shells on the ground; and over the prairie where the infantry had not marched we saw the mollusks clinging to the grass and weeds, some attached to the tops as well as to the lower parts of the mesquite bushes. In places

these mollusks were so numerous that their white shells, shining in the morning sun, suggested, as one of the men said, that "even the prairie weeds blossom snails in Texas!"

The infantry marched in columns of fours from the trains to the cantonment, destroying almost every snail along the line of march. The mollusks were brushed off the weeds by the men in the front ranks, and the

merciless "hobs" of the other soldiers ground the fragile shells into the prairie sod and into the dust of their fossilized univalve and bivalve relatives.

We read about snails of various countries forming an important article of diet, and of the peculiar habits of some species, but unfortunately it is not practicable for all of us to see them in their native surroundings, or to enjoy snail salad. For centuries Europeans have considered certain forms (*Helix*) a delicacy when properly prepared, and a giant snail (*Strophocheilus ovatus*) from southeastern Brazil, which has a shell about six inches in length, commands a place in the markets of Rio de Janeiro. Some of the forests of Africa afford species of *Achatina* that have shells ten inches long and live in trees. These giant forms rarely descend to the ground except to deposit their eggs.

As I had never before seen "weeds blossoming snails," my curiosity and desire for first-hand knowledge led me to make such observations as conditions and opportunities would permit. Through specimens submitted to the American Museum of Natural History, these snails were identified as belonging to the species *Bulimulus dealbatus* Say, and to the varieties *moorcanus* and *patriarcha*. It is believed by many that this species is nocturnal in its habits, because it rarely is active between eight o'clock in the morning and sunset, unless cloudy weather prevails. My observations, however, lead me to believe that moisture, rather than darkness, lures the mollusk from its shell; for immediately after a hard shower I found that none were cemented to the weeds, rocks, or other objects, but all that I saw were crawling on the ground.

Prompted by these observations, I immersed three living specimens in a cup of water, and one of these emerged from the

shell in just six minutes. I then punctured the epiphragm of one of the other two and placed all three specimens in a dry cup in my locker. The next morning the one that had emerged while immersed had escaped, but neither of the other two had emerged. Before noon, however, these two "poked their horns out" to see what was going on in the outside world, but, evidently disgusted with the view, they soon retreated into their shells and sealed the entrances. In the afternoon, six other specimens which had been in my locker several days without removing their epiphragms, emerged and, without much crawling about, cemented themselves to the sides of the till, to my shaving box, and to other articles in the locker. I think that the activity of the snails may be accounted for by the humidity of the atmosphere, which really is great when the sun shines just after an autumnal shower, for the clothes in my locker were damp the day after the rain.

Two specimens, each having a large hole knocked in the dorsal side of the shell just behind the animal's body, came out through the broken place and crawled about, but died within a few hours without having attempted to form an epiphragm or to repair the break in the shell. This experiment was performed about half-past nine in the forenoon; by four o'clock both snails were dead and considerably dried.

For some time after our arrival at Camp Bowie I had no time for photographing the snails on the vegetation; when matters so shaped themselves that I might have found time, the snails within walking distance of camp had been so reduced in numbers by the drilling of the soldiers that it was a rare thing to find as many as three individuals on one weed. I regret that it thus was impossible for us to get a view showing the "weeds blossoming snails."¹

¹ The shells collected by Mr. Crabb belong to a group of land molluscs (*Bulimulidæ*) characteristic of tropical and temperate South America, and of outlying faunal limits that extend to Yucatan and Vera Cruz. They have many representatives in Central America, and are found also in the West Indies, although here perhaps restricted more narrowly to the Caribbean group of islands; extralimital species are found under favorable circumstances as far north as Arkansas and Texas, and the genus on the west coast prevails in parts of California. The *Bulimulidæ* embrace a family of shells conveniently separated into three sections (Pilsbry) according to the smooth, wrinkled, or ribbed surface of the apical whorls. The species whose numbers elicited the picturesque comment that "the prairie weeds blossom snails in Texas," claims quite extended areas of habitation from southwestern North Carolina to Kentucky, to central Missouri, to Kansas, and southwest to Alabama and Texas. It is the *B. dealbatus* Say, and is found very commonly in central and southern Texas, living in dense hordes in the mesquite chaparral, wintering in the earth and summering upon the bushes. Like most of its congeners, it luxuriates in moist conditions, and when under the stimulus of humidity it swarms, like an apparitional blanket of life, covering the herbage of the warm plains.—L. P. GRATACAP.

Museum Notes

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

Honorary Fellow, The Honorable Theodore Roosevelt.

Life Member, Mr. George Notman.

Annual Members, Mrs. Augusta G. Carr, Mrs. Charles B. Hewitt, Mrs. Walt Kuhn, Mrs. J. Edwin Mastin, Dr. E. Santley Butler, Dr. George E. Davis, Messrs. William Brewster, F. N. Doubleday, S. A. Goodman, Barton L. Keen, Isador Koplik, Stanley V. La Dow, A. Edward Lester, D. Thomas Moore, Wm. Wesley New, Stanley G. Ranger, George Semler, and Cecil P. Stewart.

Associate Members, Dr. Robert Milligan, Dr. J. Scott Willock, and Mr. John G. Masson.

DR. JOEL ASAPH ALLEN, after twenty-eight years of active service as editor of the scientific publications of the American Museum, resigns in order to devote himself to the study of the ever increasing collections of the department of mammalogy and ornithology, of which he is curator. The following is an extract from the resolution passed by the publication committee of the Museum at its meeting of October 25, in appreciation of Dr. Allen's valuable services:

"... As the scientific editor, he has been little less than ideal, since with a natural fitness for the calling there was combined also the highest quality of scholarship in the subjects dealt with by his contributors. He was thus more than editor; rather a leader in the researches represented in the *Bulletin* and *Memoir* series."

Dr. F. E. Lutz, of the department of invertebrate zoölogy of the American Museum, was appointed to succeed Dr. Allen, beginning his administration of the work November 1.

IN recognition of his contributions to science, Colonel Theodore Roosevelt has been appointed Honorary Fellow of the American Museum of Natural History, of which his father, Theodore Roosevelt, Sr., was one of the founders and most energetic supporters. Colonel Roosevelt has always taken a keen interest in the life histories of animals. When a boy he was an enthusiastic student of ornithology,—a collection of birds made in his youth now forms a part of the exhibit

in the bird hall of the American Museum. On his many hunting and exploring trips he has made extensive collections; the expedition of 1913 to South Africa resulted in the accession by the American Museum of 2000 mammal and 500 bird specimens. His writings based on these travels are not merely narratives of adventure possessing literary charm, they are also studies of the habits and the life histories of animals and of social and ethnological conditions of peoples encountered, and as such are of great scientific value. Among some of his well-known works are: *Ranch Life and the Hunting Trail*; *American Big Game Hunting*; *African Game Trails*; and *Through the Brazilian Wilderness*. The election to Honorary Fellowship is the highest honor that the Museum can bestow. There have been only ten men so honored in the history of the institution. In the order of their election these are as follows: Dr. Bashford Dean, Baron Ludovic Moncheur, Lieutenant George T. Emmons, U. S. N., George Bird Grinnell, Roald Amundsen, Rear Admiral Robert E. Peary, U. S. N., Dr. Leonard C. Sanford, Vilhjálmur Stefánsson, Sir Ernest Shackleton, and the Honorable Theodore Roosevelt.

THE following were the lectures to members given by the American Museum in November. Mr. Donald B. MacMillan, the Arctic explorer, gave an account on November 1 of the difficulties and dangers experienced during four years' exploring in the North, with important details regarding the character of the country and the customs of the Eskimos, with whom the expedition established cordial relations. The following week, Captain A. Radelyffe Dugmore gave "The Romance of the Beaver and the Caribou," and illustrated his talk with some splendid stereopticon views of the wild life of Newfoundland. "The Southern Andes" was the subject of an address by Dr. Frank M. Chapman on November 15, in which were described the features of the Peruvian coast and climate and the rugged scenery in the lofty Titiacaean region. Native types and ceremonies, pack trains of llamas, and the making of reed boats were pictured. The final lecture of the series, on November 22, was by Mr. Roy Chapman Andrews. Mr. Andrews told much that was new concerning

many tribes of non-Chinese people in the province of Yunnan, where few white men have ever been, and showed numerous fine views and motion pictures of the region explored, the various types of inhabitants, and the animal life.

FIVE of the members of the scientific staff of the department of mammology and ornithology of the American Museum, who have been in training camp at Plattsburg, have received commissions as follows: Mr. Leo E. Miller, 1st Lieutenant of Infantry; Mr. Ludlow Griscom, 2d Lieutenant of Infantry; Mr. H. E. Anthony, 1st Lieutenant of Field Artillery; Mr. James P. Chapin, 1st Lieutenant of Infantry; Mr. Carlos D. Empie, 2d Lieutenant of Infantry. Mr. Griscom has been assigned for duty at Leon Springs, Texas, December 15; Messrs. Anthony, Chapin, and Empie at Camp Dix, New Jersey, on the same date. Mr. Miller has not yet received his assignment. Mr. Joseph Connolly, of the department of invertebrate zoölogy, has become a member of the 308th Field Artillery, stationed at Camp Dix.

A NEW book, *The American Indian, An Introduction to the Anthropology of the New World*, by Clark Wissler, curator of anthropology in the American Museum of Natural History, has just been issued from the press of Douglas C. McMurtrie, New York. It will be reviewed in a later issue of the JOURNAL.

WORD has been received from Dr. Herbert J. Spinden, who has been for some months exploring in Nicaragua, that he is shipping a collection of ethnological and archaeological specimens from that region to the American Museum. At the time of writing Dr. Spinden was on his way up the San Juan River to Managua. He reports an exceedingly wet season, which has made exploration very difficult and excavation almost impossible.

DR. C.-E. A. WINSLOW, curator of the department of public health of the American Museum, professor of public health at Yale University, and editor of the *Journal of Bacteriology*, together with most of the other scientific members of the American Red Cross Mission to Russia, returned to this country about the first of November and resumed his duties at the Museum and at Yale. The business staff of the Mission re-

mained in Petrograd to continue the administration of the plans for military and civilian relief which were worked out during the summer.

DR. BASHFORD DEAN, of the Metropolitan Museum of Art and the American Museum of Natural History, has been assigned the rank of major in the United States Army and on November 14 he departed for Europe. He will pass the next two months in France and England.

ON the evening of November 15, Prof. Henry Fairfield Osborn delivered an address on "The Origin and Nature of Life" at the anniversary celebration of the New York Academy of Medicine.

IN early November the thirty-ninth anniversary of the New York Microscopical Society was celebrated with a public exhibit held in the American Museum of Natural History. Several of the municipal departments had important exhibits of microscopical methods and results, showing the progress and development of microscopy and its wider use in the arts, manufactures, and sciences.

MR. G. K. NOBLE, who in June, 1917, was appointed research assistant in herpetology at the American Museum, has been granted an eight months' leave of absence to complete research previously begun on the Peruvian collections of Harvard University.

MR. T. GILBERT PEARSON, secretary of the National Association of Audubon Societies, is in charge of a newly established department of birds in *Country Life in America*. Dr. A. A. Allen, assistant professor of ornithology at Cornell University, is conducting a similar department in *American Forestry*.

THE model of a temporary military hospital, on a plan of construction in which the hospital units are convertible into dwelling houses, has been set up in the workshops of the American Museum of Natural History. It was designed by Mr. H. F. Beers, superintendent of construction of the American Museum.

AMONG the interesting acquisitions in the department of geology is a seventy-pound mass of telluric iron from the island of Disco, Greenland, which was purchased near the locality by Dr. E. O. Hovey when on his way home from Etah last summer.

AN occasion of recent interest was the dedication of the new museum of Santa Fe, New Mexico. The building is patterned after the old Mission Church on the Rock of Acoma, in a style of architecture said to be one hundred and fifty years older than the California missions. A notable feature of the dedication was an exhibition of paintings by well-known members of the Santa Fe and Taos artist groups, including Robert Henri, E. J. Couse, J. H. Sharp, Walter Ufer, and others, on subjects inspired by Indian, Spanish, and frontier lore. The ceremonies extended from November 24 to 28, and consisted of addresses, concerts, Indian dances, and excursions to Indian pueblos and ancient cliff dwellings. The American Museum was represented by Dr. Clark Wissler, curator of the department of anthropology, who gave an address on "The Opportunities of the New Museum," and by Mr. N. C. Nelson, who spoke on "Recent Archæological Discoveries in the Southwest."

THE American Association for the Advancement of Science meets in Pittsburgh December 28 to January 2, where the Carnegie Institute, the Carnegie Institute of Technology, and the University of Pittsburgh will provide entertainment. Dr. W. J. Holland, director of the Carnegie Museum, is chairman, and S. B. Linhart, secretary of the University of Pittsburgh, is secretary of the committee on arrangements.

IT is expected that the new Field Museum, Chicago, for which ground was broken in the summer of 1915, will be ready for the transfer of the contents of the old museum in Jackson Park by August 1, 1919. The new building is situated south of Twelfth Street and east of the Illinois Central Station. It is of Georgia marble, and, exclusive of the porticoes, will measure 756 feet long and 350 feet wide. It will cost \$5,000,000. Papers and documents containing an account of the founding and maintenance of the Field Museum, together with a photograph of Marshall Field, and a copy of his will, were placed in the corner stone.

A GREAT public aquarium for San Francisco has been provided for in the will of Ignatz Steinhart, who died at his home in that city on May 15. The sum of \$250,000 is bequeathed to the California Academy of

Sciences to be used for the erection of the aquarium building. By the express terms of the will the aquarium is to be in Golden Gate Park, adjacent to or adjoining the Museum of the California Academy of Sciences. It is to be called the "Steinhart Aquarium" and is to be under the management, superintendence, and operation of the California Academy of Sciences. The expense of maintenance will be met by the city of San Francisco, provision for which was made in a charter amendment voted by the electorate recently.

As the entire quarter of a million dollars will be put into the building, it is evident that San Francisco will have one of the greatest aquariums in the world. Mr. Steinhart was very desirous that, if he established an aquarium, it should be under nonpolitical control. Until recently he had not been able to discover any entirely satisfactory method by which this end could be accomplished, and he had practically abandoned the project, when he heard through Dr. Barton Warren Evermann, director of the Museum of the California Academy, of the transfer of the management of the New York Aquarium from the New York Board of Park Commissioners to the New York Zoölogical Society, and the splendid success of that aquarium under the efficient directorship of Dr. Charles H. Townsend. Mr. Steinhart's interest at once revived. It was suggested that the California Academy of Sciences would probably be willing to accept the management of the aquarium he desired to establish, should he wish it to do so, and the suggestion met Mr. Steinhart's approval. Mr. Steinhart was one of the most philanthropic citizens of San Francisco, and his name will ever be held in grateful remembrance by the visitors to the great aquarium which his breadth of vision and liberality will have made possible.

A BULLETIN issued by the department of public health of the American Museum emphasizes the fact that the sugar shortage is really a blessing in disguise and that most necessary changes in diet are not only economics but positive gains from the standpoint of hygiene. Although sugar furnishes more calories per unit of cost than any other food, it gives us almost nothing except energy. The same is true of butter and other fats, and too large an amount of these sub-

stances may mean a correspondingly great deficiency in necessary body-building materials. The results of a study of 102 typical city dietaries, published by Professor H. C. Sherman and Miss Lucy A. Gillett, bring this fact out clearly. The food purchased by each family for the period of a week was weighed and analyzed. The families were then divided into four groups according to the proportion of their total food energy derived from fats and sugars. In the first group 26.7 per cent of all food energy came from these two sources, in the fourth group only 16.7. It was found that the amount of iron furnished by the diet varied inversely with the proportions of sugars and fats, and that in the first group, which used most fat and sugar in proportion, the amount of iron obtained was less than the minimum needed for health. If, therefore, we use less sugar, and more vegetables and fruits, in the present crisis we shall help to win the war and form health habits for the future.

THE library of the American Museum is indebted to the generosity of Mr. Ogden Mills for a rare and valuable first edition in Latin of the De Bry *Peregrinationes*. This work includes, in two handsomely bound volumes, nine parts, covering travels in the Orient and extending into Africa. Many illustrations add to the beauty and usefulness of this unique edition, which was compiled by Theodorus De Bry, a German engraver and publisher of Frankfort-on-Main, with the assistance of the geographer, Richard Hakluyt. These travels were published in London, Part I bearing the date 1598. The extreme value of a work of this character cannot be emphasized too strongly. Researches in geography, anthropology, zoölogy, and kindred sciences are all dependent upon such sources of information, while the rarity of the book makes it a prize which only a few institutions possess.

MR. MARSHALL C. LEFFERTS has presented to the American Museum four complete suits of Japanese armor mounted on effigies and accompanied by helmets and weapons. The suits are of fine handwork, inlaid with gold and silver, and decorated with the crests of well-known feudal lords and families of the sixteenth and seventeenth centuries. One piece of armor, bearing the

Tokugawa crest, is of the style "Murasaki Odoshi," or imperial purple cord, and is signed by a famous maker of armor, "Miochin Shikibu Ki Menesuke, tenth year of Genroku, twelfth month" (1697). Other pieces are signed "Sotome Iyetada" (sixteenth century), "Unkai Toshinao" (early seventeenth century), and "Kashiu ju Munehide Saku" (sixteenth century). The gift is valuable as a well-preserved reminder of the feudal times and customs so rapidly relegated to the background when Japan came into contact with modern European armament.

THE trip made by Mr. N. C. Nelson to the Indian River country of Florida in the early summer of 1917 brought out some interesting facts regarding the ancient culture of that region. The trip was undertaken in response to a letter from Dr. E. H. Sellards, state geologist of Florida, regarding some shellmounds which were being cut into for road building material, thus affording excellent opportunity for inspection of the refuse contents. Mr. Nelson called first on Dr. Sellards, and the two in company visited a group of interesting sand mounds of Indian origin on the shores of Lake Jackson, not far from the capital city. Later Mr. Nelson spent a brief time working in the fossil and artifact-bearing deposits at the much discussed archæological station near Vero, on the east coast. A number of shellmounds along the Indian River were also examined and at one of these, near Oak Hill, three days were employed in making observations on the composition and structure of the mound, and in picking from the exposed section broken pottery and other artifacts. The following is the point of chief interest brought out by the examination:—that the earliest inhabitants of this site apparently did not make pottery at all, while those of the long middle period of its growth made only undecorated pottery, and those who lived on the mound during the last days of its occupation made ornamented pottery. The ornamentation consisted solely of a stamped checker pattern impressed on the ware. The possible implication is that we have here a center of origin for a particular type of pottery decoration which occurs sporadically as far away as Alabama, Tennessee, and North Carolina.

WITH the object of promoting the active protection and increase of wild life and forests in the United States, a new society entitled the "National Educators Conservation Society" has been organized. Among its honorary vice presidents are Elmer E. Brown, president of New York University, John Grier Hibben, president of Princeton University, and George E. Vincent, president of the University of Minnesota.

As a part of the educational work of the American Museum, an exhibition of designs inspired by Museum specimens, suitable for the decoration of textiles, wall paper, and ceramics, will be held in the American Museum the latter half of December. During the last year more than three thousand students have made use of the specimens in their work, and the Museum authorities believe that the exhibition will be the means of bringing this rich field to the attention of an even larger number.

THE skin of the pygmy elephant, Congo (representative of the type of *Elephas pumilio*), which lived several years at the New York Zoölogical Park, is being prepared by Mr. James L. Clark for exhibition in the American Museum. In contrast with the bull elephant of enormous proportions which will occupy the central position in Mr. Carl E. Akeley's elephant group, Congo stands only six feet high at the shoulder.

At a meeting of the National Association of Audubon Societies held in the auditorium of the American Museum on the evening of October 29, some splendid views of oceanic bird life, made by Mr. Rollo H. Beck in the course of the Brewster-Sanford Expedition to South America, were thrown on the screen, and Mr. Beck gave fascinating descriptions of the circumstances under which the pictures were taken. Following these was exhibited a series of motion pictures of western animal life taken in the Yellowstone National Park by Mr. Norman McClintock and not previously shown. Bands of elk, deer, and mountain sheep appeared in their natural surroundings, and were shown almost to have lost all fear under the protection which they receive from the government.

THE American Museum Liberty Loan Committee reports a total subscription of \$13,250 for the first bonds and \$9100 for the

second issue. The American Museum has purchased also \$20,000 worth of the second bonds for its endowment fund. The institution has been enabled to receive bond subscriptions in installments from its employees through the generosity of Mr. Adrian Iselin and Mr. Felix M. Warburg, members of the board of trustees.

THE American Museum War Relief Association has increased the scope of its activities by the organization of a class in the preparation of surgical dressings. This class meets Tuesday evenings and is largely attended. Through the assistance of friends of the association, a musicale was held on the evening of November 12, to which Professor Bertrand de Bernyz and his Artist League gave their services. The entertainment was given in the ballroom of the Hotel Majestic, which the hotel management generously donated. The affair was a success not only artistically, but also in a financial way, netting to the association \$309. This fund is to be used for the maintenance of the war relief work carried on by the various committees. The posters used in advertising the musicale were made by artists in the Museum and are now exhibited near the entrance of the west assembly hall.

THE large collection of birds and mammals obtained as a result of the American Museum's Asiatic Zoölogical Expedition to China, conducted by Mr. Roy C. Andrews, has been placed on display just as it was received instead of first putting it through the processes of preparation. This collection comprises hundreds of skins of beautiful tropical birds, including newly discovered pheasants and peacocks. Small bright-hued jungle fowls are interesting as the ancestors of the present barnyard fowl which is playing such an important part in the food problem at the present time. For thousands of years this original type has existed in the heart of China. Unusual rodent forms are represented in the black flying squirrels, four feet long, together with huge rats, including the rare bamboo rat, scores of mice of strange appearance, and odd variations of the mole. The chipmunks include several varieties hitherto undescribed by zoölogists. Skins of serows and gorals, strange animals intermediate between the goat and the sheep, are also included in the exhibit.

WE quote at length the following extract from a paper by Dr. Frank M. Chapman (Vol. XXXVII of the American Museum *Bulletin*, 1917):

"Dr. Abbott's discovery that a race of the White-winged Crossbill inhabits the pine forests of the higher mountains of Santo Domingo, is one of the ornithological sensations of recent years.

If the bird were a Red Crossbill, its presence, even in a West Indian island, would not be so surprising. This latter species nests as far south as the Alleghanies of northern Georgia, and its accidental occurrence in the Bermudas proves its ability to reach an island well removed from the nearest mainland.

The White-winged Crossbill is not known to nest south of northern New York, and, even in winter, it has not been recorded from south of Virginia. Its fortuitous occurrence in the West Indies is, therefore, not now to be expected. Nor does it seem probable that under existing climatic conditions, a bird of the Canadian Zone would thrive in the tropics, even at an altitude of 4000 feet, if introduced there.

If this be true, it follows that *Loxia* has adapted itself to life in the Subtropical Zone through, not a sudden, but a gradual climatic change. Such a change we know to have accompanied the wane of the last Glacial Period. Perhaps, therefore, we are warranted in assuming that the climatic conditions which brought the Musk Ox to Kentucky, the Walrus to the vicinity of Charleston, South Carolina, and the Great Auk as far south as Ormond, Florida, are also responsible for the original occurrence of the White-winged Crossbill in Santo Domingo.

The pines which had preceded it, and which may also be considered as boreal invaders forced southward by the Ice Age, offered the food supply the bird's habits require, and in its insular home it has been stranded, after the causes to which its presence is due have disappeared.

It is not implied that the existence of *Loxia* in the greater Antilles indicates a land connection between these islands and the southeastern United States. We have seen that the Red Crossbill is of recent occurrence in Bermuda, and it is therefore well within the bounds of probability to believe that during the time when the Glacial Period forced the White-winged Crossbill far below its present range in North America, it might have occurred fortuitously in Santo Domingo.

The case is, in a measure, paralleled by that of the Andean Horned Lark (*Otocoris alpestris peregrina*). Here we have a species of unquestionable boreal origin confined to the Savanna of Bogotá, in the Temperate Zone of the Colombian Andes. Its nearest relative is found in Mexico. It is not conceivable that the pioneer ancestors of the Colombian race can have crossed the wide area lying between that country and Colom-

bia, and, as with the Santo Domingan Crossbill, we are forced to conclude that the original introduction took place when different climatic conditions prevailed in the areas concerned.

The fact that *Loxia megalaga* is more nearly related to the European than to the American White-winged Crossbill, does not, of course, imply that it has descended directly from that species. Its characters of comparatively large bill and short wings are shown by many island-inhabiting races, and they doubtless indicate parallelism in development rather than direct descent from the physically nearest form."

THE following is quoted from a letter written by a member of the Canadian Expeditionary Force, who was on the firing line in Belgium:

"It is very strange how the birds stay around right up in the front line. After a terrific bombardment the other morning, which was the worst we had experienced for six months, a skylark soared up from 'no-man's-land' and gave us a lovely song, almost as soon as the firing ceased. A partridge flew over our parapet one evening and settled in 'no-man's-land,' quite unconcerned by the rifle fire. The blackbirds give a lovely concert every morning and evening you can just catch a snatch of in temporary lull of the firing."

This comes in a letter from the western front:

"On the river Anere about 600 yards from the trenches, there are numbers of coots and moorhens, who are apparently entirely oblivious to the tremendous battle all around them. Before the 'push' they were about 400 yards from our front line trenches opposite Thiepval, and in front of our field guns."

And this from the neighborhood of Lens:

"All through the night the battle of the guns went on and the sky was filled with the rush of the shells and the moon veiled her face from this horror which made a hell on earth. But in a little wood a nightingale sang all through the night, in a little wood in the curve of a crescent of guns, which every shell flash lit up with white light so that the delicate tracery of the boughs and branches was ruffled and the tiny green leaves were tremulous. In the heart of that thicket a nightingale sang with trills and flutters of song, trying to reach higher notes, to rise higher in its ecstatic outpouring, then warbling little snatches of melody."

Similarly, birds on the Macedonian front are said to return calmly to their usual haunts as soon as the firing ceases, little disturbed by the tremendous artillery discharges that deluge their homes with shot and shell. (From *Current Items of Interest*, Henry Oldys, Editor.)

The American Museum of Natural History

Its Work, Membership, and Publications

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

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

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

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

The educational work of the Museum is carried on also by numerous lectures to children, special series of lectures to the blind, provided for by the Thorne Memorial Fund, and the issue to public schools of collections and lantern slides illustrating various branches of nature study. There are in addition special series of evening lectures for Members in the fall and spring of each year, and on Saturday mornings lectures for the children of Members. Among those who have appeared in these lecture courses are Admiral Peary, Dean Worcester, Sir John Murray, Vilhjálmur Stefánsson, the Prince of Monaco, and Theodore Roosevelt. The following are the statistics for the year 1916:

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

Membership

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

THE AMERICAN MUSEUM JOURNAL

The various Classes of Resident Membership are as follows:

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

They have the following privileges:

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

Associate Membership

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

- Current issues of the AMERICAN MUSEUM JOURNAL—a popular illustrated magazine of science, travel, exploration, and discovery, published monthly from October to May (eight numbers annually), the volume beginning in January
- A complimentary copy of the President's Annual Report, giving a complete list of all Members
- An Annual Pass admitting to the Members' Room. This large tower room on the third floor of the building, open every day in the year, is given over exclusively to Members, and is equipped with every comfort for rest, reading, and correspondence
- Two complimentary tickets admitting to the Members' Room for distribution by Members to their friends
- The services of an Instructor for guidance when visiting the Museum

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

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

Publications of the Museum

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

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

POPULAR SCIENTIFIC PUBLICATIONS

HANDBOOKS

NORTH AMERICAN INDIANS OF THE PLAINS	
BY CLARK WISSLER, PH.D.	Paper, 25 cents; cloth, 50 cents
INDIANS OF THE SOUTHWEST	
BY PLINY EARLE GODDARD, PH.D.	Paper, 25 cents; cloth, 50 cents
ANIMALS OF THE PAST	
BY FREDERIC A. LUCAS, SC.D.	Paper, 35 cents
DINOSAURS	
BY W. D. MATTHEW, PH.D.	Price, 25 cents
TEACHERS' HANDBOOK, PART I, THE NORTH AMERICAN INDIAN COLLECTION	
BY ANN E. THOMAS, PH.B.	Price, 10 cents
TREES AND FORESTRY	
BY MARY CYNTHIA DICKERSON	A new edition in course of preparation.
HEALTH IN WAR AND PEACE	
BY C-E. A. WINSLOW, M.S., M.A.	Price, 25 cents
ANCIENT CIVILIZATIONS OF MEXICO AND CENTRAL AMERICA	
BY HERBERT J. SPINDEN, PH.D.	Cloth. Price, 75 cents

ILLUSTRATED GUIDE LEAFLETS

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BY LOUIS P. GRATACAP, A.M.	Price, 5 cents
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THE AMERICAN MUSEUM JOURNAL

SYLLABUS GUIDE TO PUBLIC HEALTH EXHIBITS IN THE AMERICAN MUSEUM OF NATURAL HISTORY BY LAWRENCE V. COLEMAN	Price, 10 cents
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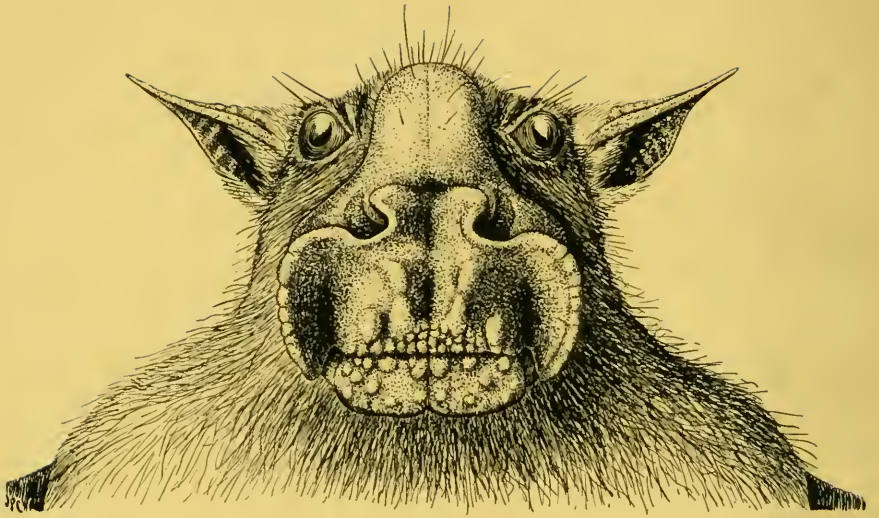
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