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NATURAL HISTORY

The Magazine of the American Museum of Natural History

FREDERICK TRUBEE DAVISON, President

ROY CHAPMAN ANDREWS, Sc.D., Director

VOLUME XLIII—No. 1

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JANUARY, 1939

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UNTAMED SOUL

Photograph of a Hawk, By H. B. KANE



The Disappearance of the Greenland Colony

Established as a Christian republic almost five centuries before Columbus, this pastoral settlement in Arctic America swelled to 9000 souls and helped support the Crusades. Then it mysteriously vanished. Was it the Black Death, starvation, barbaric invasion, or intermarriage with the Eskimos that obliterated it? Here is the evidence, gleaned from their homes and bones, and from crumbling documents

By VILHJALMUR STEFANSSON*

THE great romance of the Middle Ages was the first crossing of the Atlantic by Europeans, the unveiling of the New World. The great tragedy of this westward movement was the disappearance of 9000 Europeans from their first American colony. The great mystery is how and why they disappeared.

Shortly before 900 A.D. a Norwegian colonist, Gunnbjorn, on his way to a homestead in western Iceland, saw and reported Greenland. In 982 a chieftain of the northwest coast of Iceland, Erik the Red, was outlawed for a period of three years. He decided to devote those years to the exploration of Greenland. He spent three winters there and examined the west coast several hundred miles northward, perhaps to Disko.

Erik liked the new country so well that he decided he would urge its colonization when his exile was over. According to the saga, he called it "Green Land" because he thought people would colonize it more readily if it had an attractive name. But there may have been the other reason, too, that he found the districts green and beautiful, as travelers

do now. For it is only in such literature as the kindergarten songs of our childhood that "in Greenland there is nothing green to grow."

The colonization propaganda took hold so readily in Iceland during the winter after Erik's return that he was able to start out the next spring with 25 ships carrying perhaps an average of 30 persons and a varying cargo of the Icelandic farm animals—horses, cattle, sheep, goats, pigs and fowl. The ships met rough weather. Some of them were lost, and some turned back. Fourteen arrived in Greenland with about 400 people. This was in 986.

The colony developed at first chiefly along pastoral lines. However, as in northern European countries of the time, there was considerable reliance on fishing and hunting.

Immigration continued, chiefly from Iceland, and a government was formed similar to the Icelandic. By 990 the Greenlanders had their congress in session. This was America's first democracy, if we look upon Iceland as European.

In the year 1000 a citizen of the Greenland republic, Leif, the son of Erik the Red, saw the mainland of North America first in Labrador. During the next few years the Greenlanders tried to plant

*VILHJALMUR STEFANSSON'S analysis here of the mystery of the medieval Greenland colony carries particular weight owing to his world-wide reputation as an authority on living conditions in the Arctic, his extensive explorations in the far north, and his penetrating historical researches. In 1914-15, while a skeptical world believed him dead, Stefansson was living comfortably and in comparative plenty in regions previously unexplored. By his application of new

theories on living in the Arctic, he survived some of the most daring adventures in Arctic history and won innumerable distinctions from governments and scientific societies, including no less than 7 gold medals. He has explored and mapped large areas of previously unknown lands and seas, and his other discoveries relating to human and animal life in the North have abolished the heroics of Arctic exploration and ushered in a new era in the marginal development of our globe.

Older readers of NATURAL HISTORY will welcome in these pages the reappearance of a personality whose work has meant much in the development of the American Museum of Natural History. The present article is an abridgement of the first chapter of a book called "Unsolved Mysteries of the Arctic," of which in December the Macmillan Company published a limited edition of 200 copies for The Explorers Club. The regular edition will appear in January or February, 1939—Ed.

colonies on the mainland, and explored it southward. The discovery and exploration are not, as a share of the public still believes, a matter of dispute with historians. What they dispute is merely how far south the Greenlanders went. It is agreed they reached the St. Lawrence and Nova Scotia; many believe they reached Massachusetts or New York; a few think they attained Florida; and the suggestion has been advanced that the later Norse view of a connection between America and Africa was probably based on some voyage which discovered that the north coast of South America trends easterly and runs well toward Africa.

In the year 1000 parliament voted that Greenland should be Christian. Thenceforward we have two main European sources of the history of the New World, the literature of Iceland and the records of the Church of Rome.

Greenland was constituted a separate bishopric in 1124, governed through the German archbishopric of Hamburg at first but later through the Norwegian archbishopric of Nidaros. The chain of bishops remained unbroken till 1537, when, after the Reformation, the last of them, Vincentius, died as a prisoner in the hands of the Lutherans.

Life in Greenland at the height of prosperity, which was perhaps in the twelfth century, was similar to life in Iceland. The government was a democracy, with well developed legislative and judiciary sides but with a weak executive; so that decisions of the court, rendered according to law, were at times not carried out against chieftains who were able to gather around them considerable groups of fighting men.

Greenland farms were at the heads of fjords, some of which run so far inland that you are 30 to 50 miles from the chilling effect of the ocean proper. The main dependence was on animal husbandry. Stables have been excavated which show as many as 104 stalls for cattle in a single barn, and there were corresponding numbers of sheep, with a few of the other domestic animals, horses, goats, pigs and fowl.

Nearly 200 farms

At the height of prosperity during the twelfth and thirteenth centuries there were in the Eastern Settlement twelve churches, an Augustinian monastery, a Benedictine nunnery and about 190 farms; the Western had four churches and some 90 farms.

The houses were small, for fuel was hard to come by and large timbers for building were scarce. But the Greenlanders used driftwood and doubtless made voyages north along the West Greenland coast to pick it up where it was more abundant.

We know that voyages were made across to Labrador, where ships took on cargoes of timber that either were brought back to Greenland and used directly or were taken to Iceland where they were exchanged for European wares.

During the republic, Greenlanders had their own ships; but other vessels came to Greenland from abroad, chiefly at first from Iceland but later from Norway and from other European countries. By the fifteenth century a part, and likely enough the greater part, of the shipping was from the British Isles—from Bristol and Lynn. Garments have been found preserved by the frozen ground of cemeteries that are cut in fashions which prevailed in Germany around 1450, whose arrival probably depended on shipping from England.

Commerce before Columbus

The dress of Greenland in this late period, as well as in the earlier, was partly of imports and partly of cloth woven locally from the wool of Greenland sheep. The exports with which Greenland paid for her imports were, in addition to the already mentioned timber from America, chiefly walrus and seal oil, the hides of these animals, wool, and perhaps dairy products. There were two luxury exports from Greenland, polar bears and falcons. The bears always, or nearly always, were bribes or presents for princes, secular or churchly. The falcons were sometimes gifts, but they were used in the payment of tithes or taxes and were regular exports.

During the late Middle Ages the sport of falconry had a hold on Europe such as not even baseball has on the American public now. Emperors and kings were passionate falconers, and so were nobility and gentry. There was a corresponding social gradation among falcons. Some species were so low, socially, that even peasants might use them. One of the eagles was reserved for emperors. Second rank was held by the Greenland falcon, the hunting bird of kings and other royalty. That Greenland was the home of this bird of kings makes works on falconry sources of Greenland history.

In 1396 a son of the Duke of Burgundy was taken prisoner by the Saracens, who demanded twelve Greenland falcons for his return. That might seem a difficult ransom, for these birds were never domesticated—they had to be captured in their native country. The young nobleman, however, was ransomed. This means, among other things, that the Saracens knew enough about Greenland and its falcons to ask for the birds, and that either there were a dozen Greenland falcons in Europe where the Duke of Burgundy could get them, or else a

special consignment of falcons was obtained from Greenland.

In the early farming period, as we have implied, the European population of Greenland was concentrated at the heads of the fjords. From the start there must have been some dependence on hunting, and a greater dependence on fishing. We find archaeological confirmation of this, for in the farm refuse heaps the bones of game animals appear early. As time advanced there were more and more of these bones, showing an increasing dependence upon game.

But game is scarce in the farming districts, more abundant on the headlands. Then as now it was scarcer in the south of West Greenland than farther north, as a result of natural law. For the chief game animals are the seal, walrus and polar bear. Seals may be found where there is no ice, but they are usually more numerous among ice and much easier to secure, by Eskimo technique. The walruses, easier to kill than seals and bigger, are creatures of the ice. They are more numerous where there is more ice, and more readily secured on the ice than in the water. The polar bear, superficially a land animal, is really a sea beast. He, like the walrus, depends on the ice.

Northward journeys

Accordingly, people from both the southern and the northern colony went for hunts north along the coast, well beyond the northern colony. These were at first summer journeys, made with tents; but there developed gradually a custom of spending the winter.

The most northerly undisputed evidence of European colonization in western Greenland is a runic stone which was found about 450 miles north of the Arctic Circle. The inscription is signed by three men and is dated in April, which shows that these three at least must have spent the winter in the vicinity.

Folklore gathered by Knud Rasmussen indicates that the medieval Europeans went much farther north. They used to come sailing at least as far north as Etah, where Peary, centuries later, had winter base stations for his polar work. Here numerous European objects from the medieval Greenland period have been dug up within the last few years by archaeologists, some of them well north of Etah and about 850 miles north of the Circle. These articles may, of course, have been brought here by people of Eskimo blood who traded to the south, but if not, the Norsemen themselves were there.

Further, there is evidence indicating that Norsemen, of the centuries between the eleventh and sixteenth, also crossed Melville Sound and spread west

into the Canadian islands. But we need not look beyond Greenland in the present story.

The first premonitions of Greenland tragedy came in 1261, for in that year Greenland voluntarily ceased to be a republic and affiliated itself politically with Europe as a province of Norway, with a resulting decline in prosperity. It had been a republic since 990, or 271 years—more than 100 years longer than the United States has yet been a republic. During that period the country had been free to do the best it could for itself. Now, instead of receiving the expected favors from Norway, it became a stepchild, the victim of petty and major tyrannies, particularly of monopolistic trade.

The foremost historian of medieval Greenland was Professor Finnur Jonsson of the University of Copenhagen. In 1899 he estimated the population of the colony as never having exceeded 3000; 30 years later he raised the estimate to 9000. For meantime great numbers of ruins from the days of the republic had been excavated and a better basis for estimating had been gained.

When the world forgot them

Students who depended solely upon the direct literary sources of the history of the Greenland church and state, as found chiefly in Rome, Norway, and Iceland, have considered that the "last recorded voyage" to Greenland was either in 1410 or in 1448. They believed that even before this time all farms in the so-called Western Settlement (we would call it the Northern Settlement) were tenantless. On the other hand, they considered that many if not most of the farms of the "Eastern" district (to us the Southern district and also on the west coast) were still occupied when this "last" contact with Europe took place.

Scandinavians reoccupied Greenland in 1721 with the support of a king who lived in Denmark, but under the leadership of Hans Egede, a missionary from Norway who had dedicated his life to the proposition that there still were Christian Scandinavians in Greenland whose faith needed rejuvenation. He was not the first to think and talk this way, for there had been through the centuries to 1492 a sequence of spokesmen ranging from Italian popes, who wanted the Roman Church strengthened in Greenland, to Norwegian bishops (from the sixteenth century on), who wanted to save the Greenlanders from the heresies of Rome and guide them toward the orthodoxy of Lutheranism.

Egede found ruin of churches and homes and the graveyards of Christians in southwestern Greenland, which he took to be the remains of the Western

Settlement. It appeared to him that, but for these monuments, his departed countrymen had left no sign. He did not hear Norse words when he listened to the speech of the Eskimos. The customs of Europe and the religion of Christianity had left no traces that he could find.

Some years later, and particularly when Egede's children had secured a command of the Eskimo tongue, the missionaries began to pick up stories of how and why the Greenlanders had disappeared. Essentially these were that they had grown weak through the breakdown of commerce with Europe. They had not been able to secure iron for weapons, they had sickened because they had been deprived of those foods which are required for the health of Europeans. The weakened whites were then attacked by the Eskimos, not in any systematic way, but every now and then through specific quarrels. Finally the last small settlement was wiped out, the last white man destroyed.

Thus Egede and his successors in Greenland and the scholars of Europe built up a consistent explanation of how and why the medieval Europeans had disappeared.

According to the theory developed, there had been ominous signs of the final tragedy from the start. For the Icelandic colonists who first settled Greenland, though they had seen no people, had found here and there on the coast remains, such as peculiar skin boats, which they afterwards recognized as proving that the same people had been ahead of them in this part of Greenland as those whom the Greenlandic explorers following the year 1000 had met in Labrador—Eskimos. But seemingly the Eskimos themselves were never seen in Greenland during the first generation or two of occupancy by the Europeans. Then the contact with the Eskimos began, and increased steadily. By the thirteenth century there were recurrent attacks by the natives; around 1345 the northern colony of the Europeans, (i.e., the "Western Settlement") had been destroyed.

Farm animals but no men

The account of the destruction of the northern colony we have from Ivar Bardarson, who was, from about 1341 to around 1360, manager of the farm attached to the Bishop's seat at Gardar, now called Egaliko, in the Julianehaab District. No news had been received from the Northern Settlement for several years and Bardarson organized a relief expedition. They sailed north along the coast, past an uninhabited stretch that separated the two colonies, and came to farmhouses. They were afraid to land.

Spying from the boats they saw domestic animals grazing around the farms, but there were no people. Bardarson assumed they had all been killed by the Eskimos.

The main forces of destruction, scholars agreed, were malnutrition due to the lack of a mixed diet suited to Europeans, and decimation by attacks of savages healthy and aggressive on a meat diet.

The historians speculated as to subsidiary causes. The Black Death had swept over Norway, in 1348-49. Although there had apparently been no sailings during the period 1346-55, from Bergen, which then by royal decree had a monopoly of the Greenland trade, this school believes that some ship finally carried the disease. Assuming, then, a mortality as in Norway, the Greenland colony would have been so weakened that the remnants became an easy prey to the Eskimos.

Forthright statements that the Greenland settlements were declining are found chiefly in certain papal documents. We give samples.

In 1276 Pope John XXI received a letter from the Archbishop of Nidaros, which he summarized in a reply. In this the Pope notes what the Archbishop says about Greenland being a remote country and about the difficulty of collecting tithes from it. The diocese of Greenland is so far distant and its farms are so far apart, making it necessary to camp out between settlements, that the Pope now understands, from the letter of the Archbishop, that it may require five years from the time that the Archbishop receives the instructions of his superiors, to gather the tax and bring it back to Norway. Nevertheless the Pope commands the Archbishop to procure suitable men for this task and to give the collection of the tithes his own diligent solicitude.

In 1279 the Vatican had again received a letter from the Archbishop of Nidaros concerning the delay in collecting the Greenland taxes. Pope Nicholas III wrote on January 31, 1279, that the Vatican perhaps had been a little hasty in excommunicating the Greenlanders for being so slow in paying their tithes, and notified the Archbishop that the decree was lifted.

Tithes for the Crusades

In 1282 Martin IV wrote that he understood from the Archbishop's letter that the recent consignment of the tithes consisted mainly of leather and of leather rope—commodities which Norway itself produced in abundance so that it was extremely difficult to sell them in the local market. The Archbishop wanted to know whether he should sell them for a nominal sum, hold them for a rise in the market, or ship the leather and ropes to Italy. The

Pope agreed that the situation was difficult but thought that, everything considered, the Archbishop had better sell the leather for whatever he could get. And would he please hurry the proceeds along, for the Vatican was in desperate need of funds (to meet the bills of a projected crusade).

Nicholas V, in 1448, wrote to the Bishops of Iceland that he was saddened by the doleful story of the inhabitants of Greenland who for hundreds of years had been faithful to Holy Church. He had only now learned that these people had been attacked 30 years before by barbarians, who had devastated their homes, destroyed all but nine parochial churches, killed a large number of inhabitants, and carried many others away in captivity. The nine churches that were spared were those which "extend into the farthest districts, where they [the barbarians] could not approach conveniently because of the defiles of the mountains." At the same time that this news reached the Pope there had come the further word that many of the captives had returned to their homes, making such repairs as they could and attempting to carry on divine worship. But their poverty was so great that for the entire 30 years they had been unable to support priests and a bishop, and had during this period been deprived of priestly guidance, except for a few who, after arduous travel, "had succeeded in reaching those churches which the barbarian hand had passed unhurt." The Greenlanders now were petitioning the Vatican to send a representative to minister to their spiritual wants. The Pope, therefore, commanded the Bishops of Iceland to send to Greenland priests to govern the restored churches and administer the Sacrament. Also, if it seemed expedient, the Icelandic Bishops were instructed to ordain some practical and able person as Bishop of Greenland.

Eighty years out of touch

In 1492 Alexander VI, who had just ascended the throne of Peter, gave out a sort of letter of credit to Matthias, bishop-elect, who was about to devote himself to reviving the Church in Greenland. The Pope recites that when he was in minor orders (around 1456) he was already interested in the Greenland Church, and that when he was a bishop he participated in the election of their beloved brother Matthias to the Bishopric of Greenland. Now that he is Pope he continues his interest and is concerned over the deplorable condition of the Greenland Church, which has had no resident priest for about 80 years—a period during which no ship has visited the country. The Greenlanders, who "are accustomed to live on dried fish and milk for lack

of bread, wine and oil," have, as a result, in many cases renounced their sacred baptismal vows.

The general idea that the European colony was destroyed through the breakdown of commerce with Europe, through the attack of "pirates" (as one letter calls them) who were Eskimos, with possible help from the Black Death, has been coaxed along right down to our own time, until in 1935 Poul Nörlund gives it the benefit and implications of what are to him the up-to-the-minute verdicts not merely of archaeology and geology but also of physiology and dietetics.

Nörlund and other somewhat less recent commentators have, then, added new trimmings to the Bardarson-Egede-Rink picture. One of them is that the climate of southwestern Greenland has deteriorated since the colonization, and that poverty and scarcity of food resulted in part from the growth of ice fields on land and the filling of the sea with drift ice, thus restricting the acreage of the grazing fields and meadows, decreasing their output through a shortening and chilling of the summer—rendering commerce less profitable to European ships because there were now fewer things for which to trade, and making navigation difficult because of the ice blockades.

This theory proceeds along the line that commerce declined through these natural causes and through the Norwegian monopoly of trade. There came, as a result, a physical deterioration which has been shown by archaeologists, particularly through skeletal proof of rickets and other deficiency diseases. It is no mere theory, says Nörlund, but is actually proven through the skeletons, that the people were weakened by malnutrition—the assumption being that, although Eskimos are healthy on a meat diet, Europeans cannot be; and that the cereal and other vegetal elements in the food of the Greenlanders became insufficient for health through the above-mentioned decrease of commerce.

Their death uncertain

But whereas most of the school to which Nörlund belongs previously wanted to put the final extinction of the Norse colony fairly early in the fifteenth century, Nörlund concedes that evidence of many kinds makes it highly probable, if not certain, that European civilization was still being maintained by a people of Christian religion and blond complexion in southern West Greenland at least 30 years after Columbus.

We have now devoted all the space we can to what had long been the orthodox view. We turn to contrary views, which are frequently spoken of

as new but which have been maintained sporadically at least since 1776.

The main attack on the theory originated by the Norwegian Egede and brought to full stature by the Dane Nörlund, came from the Norwegian Fridtjof Nansen.* However, in working out the chronology for the predecessors of Frobisher for the 1938 Argonaut edition of *The Three Voyages of Martin Frobisher*, we happened upon several persuasive forerunners of Nansen. We shall mention here only three. Two of these were apparently unknown to Nansen.

In 1774 the Icelandic missionary Egill Thorhallason was in Greenland and visited what we now know were both the Eastern and the Western Settlements, although he thought he had seen only the Western Settlement. He was familiar with the views of Egede and his successors, and ridiculed them in an appendix to his *Rudera*, published in Copenhagen in 1776.

Extinction doubled

Thorhallason feels that perhaps most absurd of all the absurdities in the "orthodox" theory is the contention that the Black Death, introduced from Norway, so weakened the Europeans in Greenland that they fell a ready prey to the Eskimos. We know, says Thorhallason, that there was a great deal of contact between the Europeans and the Eskimos during the fourteenth century. What reason have we to think, he asks, that a plague coming from Europe would pick out only Europeans for destruction and leave the Eskimos in full number to strike down the surviving whites? Thorhallason contends that the reverse would have been more likely; for European plagues, so far as he knows, are more deadly to American natives than to Europeans.

Thorhallason bears down on this argument and suggests that the Black Death, if it had reached Greenland, would have killed a higher percentage of Eskimos than of Europeans, reversing the strength ratio, if it was previously in favor of the Eskimos. He does not say so, but evidently means that if there had been a Black Death the next act would more reasonably have been an extermination of the few surviving Eskimos by the Europeans.

Next in absurdity, says Thorhallason, is the idea that the "barbarians" or "pirates" whom the Pope mentioned were Eskimos. What can be more ridiculous than to say that Eskimos were able, in their "ships," to attack only those Europeans who lived on promontories, but could not reach those who lived

in the depth of the fjords? On the contrary, he says, the Eskimos would surely be able to ferret out any corner that was available to the whites. The barbarians to whom the Pope referred as taking prisoners on the forelands, and as being unable to reach the depth of the fjords, must have been Europeans in big ships. They had, perhaps, no local pilotage and so were timid about the narrow fjords.

Thorhallason takes up the Pope's statement that the barbarians took prisoners, whom they repatriated after several years. He thinks it absurd to believe that Eskimos would carry off captives. But this is just what you might expect from European pirates of the fourteenth century. Doubly illogical would it be for the Eskimos to repatriate captives: it would be logical for Europeans to do so.

Thorhallason feels that, if not absurd, it is scarcely reasonable to suppose that the Europeans and the Eskimos were hostile to each other in Greenland, and that the Eskimos were the aggressors. His whole knowledge of this people, he says, inclines him to believe that they would have been friendly, helpful, sympathetic.

Adoption of the Thorhallason view leads to a decision that Bardarson was wrong in thinking that the Eskimos had destroyed the northern settlement, and that everybody must have been wrong in thinking that the colony disappeared at all, in the sense of being exterminated. What happened was that, when European commerce declined, the European colonists gradually adopted an Eskimo culture, intermarried with the people, and disappeared only in the sense that their culture disappeared.

Seemingly unaware of Thorhallason, the Norwegian sociologist and historian Eilert Sundt, in a note to his edition of Hans Egede's diary (Kristiania, Norway, 1860) gives only about half of Thorhallason's reasoning but arrives at the same conclusion.

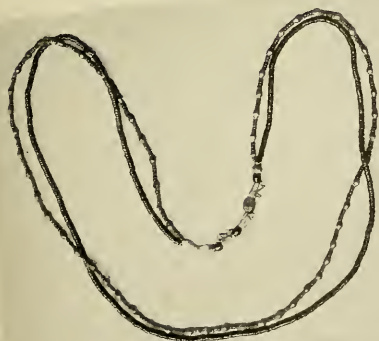
Intermarriage

Sundt found that, among white families dwelling in Lapp districts of Norway, within a generation the tall and blond Norwegians begin to feel that the Lapps are a more successful and in that sense a better people, so that not only do the Norwegian men marry Lapp women but Norwegian girls come to prefer Lapp husbands, since they are more at home in the country and are better providers. And, queries Sundt, what reason have we to think that the modern Norwegian is different from the Norseman of the Middle Ages in Greenland? European culture would be less well adapted to Greenland conditions, and men would be the more successful, the better providers, the more nearly they adapted themselves

Continued on page 34

*Chiefly through his Norwegian original of *In Northern Mists*.

THE STORY OF GLASS



*Courtesy Metropolitan
Museum of Art*

(Above) THESE BEADS, old as any glass known, were worn by Princess Maït of Thebes about 2000 B. C.

(Below) A modern use for glass: the giant "eye" of California's Mt. Palomar Observatory telescope, a 200-inch mirror, will project man's vision deeper into the heavens

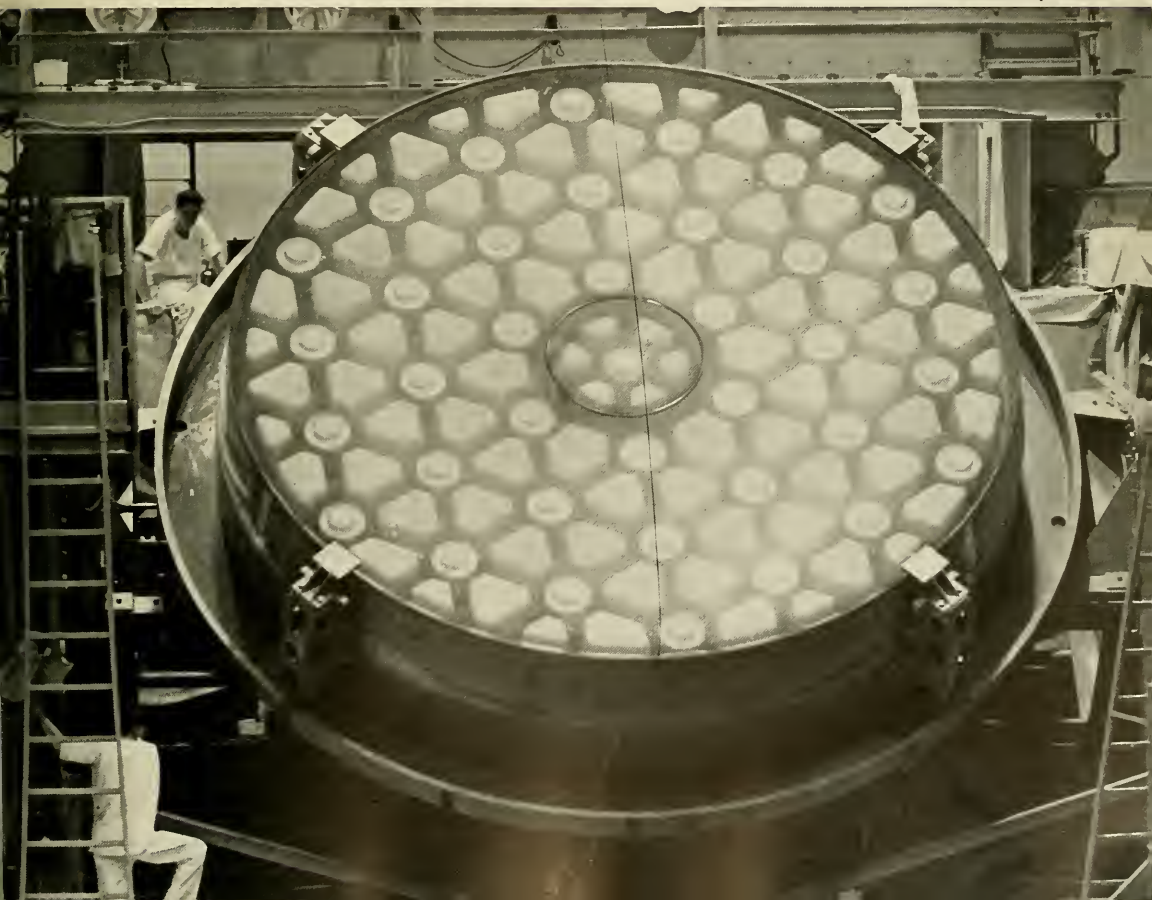
From precious stone to telescope lens, from alchemist's crucible to modern test tube, glass reflects the progress of man's ingenuity; but its chemical structure remains to this day as baffling as its ancient origin

By **WILLY LEY**

WHEN in 1900 the Universal Exposition in Paris opened its gates, one of the numerous addresses made was by Eugène Houtart, a famous master glass-maker. After reviewing his subject, Monsieur Houtart dared to prophesy: "Steel and glass are without doubt the two substances that will characterize the twentieth century and will give their name to it."

Even Monsieur Houtart himself probably did not realize then how quickly and to what amazing extent his prophecy would come true. When he delivered his address the art of glass making was about five thousand years old; but during the 38 years since the Universal Exposition this ancient art has progressed several hundred times as far as during the preceding five millennia.

Pictures Inc. photo



It is an interesting fact that the masters of glass will again use a universal exposition, the New York World's Fair 1939, to show what they can do and what they have learned in the meantime. As the President of the Owens-Illinois Glass Company, Mr. William E. Levis, said when he placed his estimate of attendance to the Fair under the transparent blocks of structural glass at the "Glass Center": "The great development of the industry has all come within the twentieth century. In this period the automatic machine production of glass containers, windows, light bulbs, tubing, structural glass, glass yarns, laboratory and scientific equipment has evolved."

America's first industry

Prominent as glass is in America, few know that the glass industry is actually America's first industry. There was a glass factory erected in Jamestown, Virginia, in 1608.

When, where, by whom and how the world's first glass was made is shrouded in mystery. The famous sources of ancient history tell us nothing. Even Pliny's "Natural History," that beautiful and comprehensive "Encyclopædia Britannica" of ancient Rome, offers only a legend, doubted not only by later critics but by Pliny himself. One feels that he related it only because there was nothing more tangible to tell. Glass existed when Rome was at the climax of her power and splendor. It was used more extensively even than, say, half a century ago in our own civilization, because the Romans did not know how to make porcelain. No wonder that they tried to learn the origin of this useful art. But all they could learn was that it had come from the eastern parts of the Mediterranean Sea, and finally they invented the legend of its accidental discovery in Syria, near the mouth of the River Belus, a river "unwholesome to drink." As Pliny relates the legend, a ship laden with niter was moored where the river washed the sand of the shore: "... the merchants, while preparing their repast upon the sea shore, finding no stones at hand for supporting their cauldrons, employed for the purpose some lumps of niter which they had taken from the vessel. Upon its being subjected to the action of the fire, in combination with the sand of the sea shore, they beheld transparent streams flowing forth of a liquid hitherto unknown: this, it is said, was the origin of glass."

Since glass must have been an accidental discovery, it would seem plausible that something like this might actually have happened, except for one thing. Modern experiments made as a repetition of the legend have shown that a wood fire is not hot enough to produce glass. If on the other hand the

materials are ground up, thoroughly mixed, and the fire blown with bellows, a glass flow does result. Thus it seems more likely that the first and accidental discovery of glass occurred in a blacksmith's shop.

First glass

Be that as it may, we are fairly certain that the discovery was made in ancient Egypt. The oldest glass known is of Egyptian origin, dating from about 3200 B. C.

At first the ancient Egyptians used glass only to cover or glaze things made of clay; then around 2000 B. C. they discovered that beads could be made of glass alone without a core of foreign material. A thousand years later they had progressed to making simple glass containers, or drinking vessels. The oldest known and preserved is a goblet, dating from 1490 B. C. and bearing the inscription of the name of the Pharaoh Thutmosis (or Thothmes) II. It is ornamented with two bands of gold, one around the foot, the other around the upper rim.

There has been some controversy as to how these goblets were made. Some believed that they were formed by winding a heated and, therefore, plastic glass rod closely around a core made of clay. A more recent opinion is that the core of clay was fastened to a stick and simply dipped into the pot containing the molten glass. Either opinion may be right, in all probability both are.

It was about 250 B. C. that a very important invention was made, the art of blowing glass. How it came about is not recorded, probably somebody tried to blow liquid glass away and saw to his amazement how it expanded into a hollow globe. At any event, this discovery proved extremely fruitful. Hollow vessels could be made much more easily and quickly than by either of the existing methods. Whether the glass makers knew at that time how to cast things of glass is not definitely known. They probably cast simple forms, but the story that Sesostris* ordered a life-sized statue of a man to be cast of emerald green glass should be received with caution.

Around the time of Christ, glass was already common for drinking vessels. While it is related that Emperor Nero paid a large fortune for things made of glass, one could buy a glass cup on the streets of imperial Rome for a copper coin. Rome became the center of glass making in the ancient world. The Greeks of that period valued glass, but it seems that they did not produce any themselves. The art of glass blowing, practiced in much the same way then as 1800 years later, radiated from Rome to the

*A mythical king of Egypt, whose exploits are founded on the deeds of Rameses II (about 1324-1238 B. C.) and others.

Roman colonies. Glass factories were established in Spain and in Gallia (France). However, they did not survive the fall of Rome, when the art of glass making found its new center not in one of the northern colonies but in Byzantium (Constantinople). And with the decline of the Byzantine period in turn, the center shifted back to Italian soil to find a well protected home (at least for a few centuries) in Venice.

Trade secrets

The Grand Council of Venice knew well how valuable the artisans were to the mighty city. Many of them had their trade secrets. They knew how to make white opaque glass (looking almost like porcelain); they knew how to make yellow, green and black glass; they produced glass that was as transparent as water. This was the most valuable and had been so even in Roman times. We now know that the greenish tinge of cheap glass is caused by minute traces of iron oxide in the glass mixture. The masters of Venice probably did not know this, but some of them had found a way to avoid it. Venice produced the most complicated statuettes of glass, also cheap glass beads for rosaries, which competed with amber beads for the same purpose. The Grand Council of Venice granted liberties and rights to glass makers that approached the rights of nobility. On the other hand it "exiled" the valuable men to the beautiful island of Murano, the better to guard their trade secrets.

While Venice remained an important center of glass making until well into the seventeenth century, it did not succeed in establishing a monopoly. German glass began to compete in the fourteenth century, and Bohemian glass began to become important in the fifteenth century. China had learned the secret in the fifth century and though never in competition with the European countries, its own art reached a remarkable peak in the eighteenth century.

It is not surprising that there could be no monopoly; the art of glass making is essentially simple and the raw materials are abundant anywhere on earth.

Glass is a mixture of silica and an alkali, either sodium or potassium. To make glass one needed only pure white sand (which is almost pure silicon-dioxide), limestone and sodium or potassium carbonate, and heat. Much heat, in fact. If the heat is great enough these materials fuse together to form glass. Broken glass, "cullet," of the same kind is mixed with the materials, in some instances as much as a fourth of the "batch." The difficulties lie in obtaining pure raw materials. Even minute impurities may ruin the quality. It is here that the trade secrets

come in. Almost anybody can make glass, but *good* glass or even glass with special properties—that is another story.

From the scientific point of view, glass is a baffling substance. It has no crystalline structure as do all metals and many other substances. It is what is termed a "solid solution." One might almost say that glass is always a liquid. It has no well defined melting point. Other substances, if they melt at all without decomposing, retain their properties as solid bodies until a certain temperature is reached, at which point they change from solid to liquid. Glass at very high temperatures is a liquid, to be sure, but if cooled it does not strictly cease to be one. Gradually it becomes more and more viscous, looking and acting like thick molasses and having the same unpleasant tendency to retain bubbles longer than you can wait for them to disappear. To let it "cook" until the bubbles are gone helps much but usually does not remove very tiny ones. The making of glass really free of bubbles is a remarkable achievement that took centuries to learn. How to cool the glass is another important question. Glass that is cooled too quickly sets up internal strains that let it break easily. If glass is cooled much too slowly, it may even decompose again.

St. Rupert's drops

How powerful the internal stresses can be is shown by the well known St. Rupert's drops. They are obtained simply by letting melted drops of glass fall into cold water. The glass then forms an extremely hard surface, but the internal strains are so great that the whole drop shatters the moment the surface is scratched.

That glass is not crystalline in structure is not its only mystery. The make-up of the molecules is still unknown. We know that silica, silicates, borates, phosphates and aluminates in glass are either solvents or substances dissolved. We know that metals or their oxides, instead of mixing with the glass, are kept either in solution or in suspension. But all this does not give a clue as to the exact molecular make-up. Glass is not a chemical compound as the term is normally understood; therefore, there is no chemical formula for glass. It is practically in a class all its own.

Centuries of experience and research have taught the glass makers their craft and circumvented the mysteries of its molecular structure. Alone the fact that the specific gravity of glasses ranges from 2.4 (light calcium glass) to 5.6 (thallium glass) is a proof of the mastery that has been gained over this mysterious substance.

If glass is colored it owes this to the admixture of

metals or their oxides. Greenish glass is usually colored by ferrous oxide. But ferrous oxide may also impart a pale blue tinge if the glass mixture itself is different. Cobalt produces purple or blue, manganese violet, chromium yellow or green, lead a pale yellow, vegetable charcoal the same. Copper may also produce a greenish hue; but the color becomes crimson ruby if the glass is cooled slowly and contains a reducing agent. Nickel produces a violet color in potash-lead glass, a brown color in soda-lime glass.

A lost art

For about two centuries the secret of producing the highly prized ruby glass was lost and not rediscovered until only a few years prior to the year 1900. Its original inventor was an alchemist, Johann Kunckel von Löwenstern, a man who curiously combined alchemistic superstitions with scientific zeal and a quite modern frame of mind. He was convinced that some alchemists had succeeded in making gold. The secret, therefore, did exist; it was not a chimera that could never be caught. To find this secret others prayed or indulged in rites they proudly believed to be black magic. Kunckel did not say it might not be found that way, but he thought that incessant research was a better and surer way. He was well aware that any amount of labor might be fruitless and wrote that alchemists usually leave no trace when they depart from this world, at any event "nothing but pots and pieces, books, manuscripts and children, but neither money nor cattle." He succeeded in obtaining the ear and the grace of his master, the Great Elector, who gave him a laboratory on Peacock Island, near Potsdam, and the Island with it.

Kunckel was well satisfied and wrote that in his work he lacked nothing except what all chemists lacked—the result. He could not make gold. But around 1680 he began to make ruby glass which satisfied the very parsimonious treasurer of the Great Elector, at least to a small extent. But when Kunckel finally died he left, as he had prophesied, books and children, but no money and no cattle and not even a manuscript telling how to make the beautiful ruby glass. It took almost exactly two centuries for someone else to discover that if gold is dissolved in liquid glass, ruby glass as beautiful as Kunckel's of Peacock Island is the result.

Kunckel's story is not the only one of a "lost art" connected with glass. One of the others comes down to us from Roman times. In the words of Pliny, who had a healthy streak of skepticism:

"In the reign of Tiberius, it is said, a combination was devised that produced a flexible glass; but the

manufactory of the artist was totally destroyed by order of the Emperor we are told in order to prevent the value of copper, silver and gold from becoming depreciated. This story, however, was for a long time more widely spread than well authenticated."

We have every reason now to think that Pliny was right in discrediting the legend. The legend presupposes a glass behaving like soft copper, so that a bowl fashioned of it would not shatter when dropped to the marble floor of the emperor's throne room but be merely dented. This behavior of metal is due to its structure; and the structure of glass is basically different. It is, therefore, scarcely likely that a glass could be produced that would behave exactly like metal, though it might have properties superior to metal in some respects.

Natural glass

Among the "lost arts" of the glass industry there is also an entertaining story closely connected with Bohemian glass. This begins with the name of Johann Wolfgang von Goethe, who was not only a great poet but an able scientist as well. Goethe's scientific writings contain a short note: "*The Bouteillenstein* is found in the vicinity of Kornhaus near Schlan." Now, *bouteille* is French for bottle, *stein* is German for stone: the name, therefore, suggests a glassy material. In fact the material he referred to looks like green bottle glass, and as far as its chemistry goes it *is* glass.*

Nobody ever succeeded in finding a large piece of *Bouteillenstein*. The fragments range in size from a large pea to a walnut, and rarely to the size of a hen's egg. While jewelers were quick in discovering that the material could be faceted, polished, and sold as jewelry (under the trade name of Bohemian chrysolites), geologists were much puzzled by them. These moldavites were evidently glass, presumably volcanic glass, since they looked very much like obsidian, the classic example of volcanic glass. Used for weapon points and tool blades, obsidian has long been important in the history of some primitive people. But while obsidian is obviously of volcanic origin and was regularly "mined" by natives, for example on Easter Island, no large "parent mass" of moldavite could be found. The small pieces were just scattered over a strip of land 100 miles long and approximately a score of miles wide. They did not lie exactly on the surface, but the farmers' ploughs brought them to light with reliable regularity.

Bohemia boasts a number of extinct volcanoes; in-

*Kornhaus in the Sudeten area is not the place where it is found most frequently. It is abundant near the upper Moldau River around the city of Budweis in Bohemia. From this locality these pieces received the name of "moldavites." Another big field is located nearly a hundred miles away from Budweis, east of Trebitsch in Moravia.

NATURAL HISTORY

Presents

The Strolling Players in the Mountains of Bali

By *Margaret Mead* *

*Assistant Curator of Ethnology,
American Museum of Natural History*



For 35 exciting days the semi-religious theater season brings carnival thrills to sleepy villages, featuring the weird Barong who may be god or clown

ONCE every two hundred and ten days comes the Balinese feast of Galoengan, when offerings are made to the souls of the dead, pigs are killed, elaborate cakes are made, people go visiting, and prodigals and wanderers return home. For 35 days after Galoengan, anywhere on the roads of Bali, but especially on the roads that lead to the mountains, one is likely to meet a Barong.

The Barong is a magnificent beast mask, worn by two men who give it a most engaging, life-like quality, prancing with soft, tripping, carefully synchronized steps, to maintain the four-footed illusion. The Barong may be white or black, his hair coat made of various kinds of vegetable fiber, or rarely of crow

feathers specially sent by the gods. His great mask is of wood, with a movable lower jaw held in the hands of the man inside—"he who dances in the head of the Barong"—and manipulated to produce a great clacking and champing of teeth. His protruding round eyes are painted so as "to live" as the people say. The underpinning of basketwork which supports the series of golden leather decorations adorning his spine is so flexible that it is possible for him to turn his head around and contemplate his tail, a magnificent erect structure decorated with many little looking-glasses which catch the light of the sun by day and of torches at night. His legs—actually the legs of the men inside the mask, but with the

*One of the most famous women in the ethnological field, Margaret Mead is among the leading authorities on human culture in the Islands of the Pacific. Doctor Mead first won widespread renown by the publication in 1928 of her best-seller, *Coming of Age in Samoa*. She is at present Assistant Curator of Ethnology at the American Museum, in

which capacity she has spent over one-half her professional life in the field. She has still found time, however, to write three other books: *Growing Up in New Guinea*, *Changing Culture of an Indian Tribe*, and *Sex and Temperament in Three Primitive Societies*, as well as numerous magazine articles on her expeditions. The article above was

mailed to NATURAL HISTORY from Bali where Doctor Mead has been studying native life since January, 1936.—Ed.





THERE'S GOING TO BE A GREAT DAY in this village of Bali's mountain district. Man and child alike gape at the awesome actor-god Barong (*above*) whose arrival heralding the theater season's gala opening bores only the babe. Cut off from the comparative cosmopolitanism of the plains, these mountaineers live like one big family in pastoral monotony six months of the year. When boredom weighs heavily the significant phrase "Come Galoengan" is heard. For the national feast of Galoengan comes every 210 days bringing in its wake 35 days during which strolling players arrive headed by fantastic Barongs



THE BARONG HIMSELF (*above*): like our "stage horse" he is maneuvered by a man stationed at each end. But the Barong is no crude buffoon. Featured by a theatrical "club" 50 to 100 strong, he is often regarded as a god and housed in the temple. *At right*: a "pig Barong." Shoddy makeshifts supposed to represent various animals are used in poor villages



WHAT THE CIRCUS is to provincial American lads, the *Man-o-War* (ship) to South Sea Islanders, the Barong is to the children of Bali. They follow him in droves as he goes about from gate to gate (above) performing his preliminary "side show" for less than five cents worth of Chinese coins. Many edge close, working up courage to ask to dance inside. Mimics, like children everywhere,

they will borrow their mothers' shawls when the Barong has gone and thus cloaked, imitate the soft-tipping, carefully synchronized steps with which professionals create a four-footed illusion. Having been dandled from babyhood to the catchy theater songs, the children early develop into good critics and can run to their fathers in the fields shouting whether the theatrical "club" is good, fair or poor

EVERY IMPORTANT BARONG HAS ITS PRIEST who wears a characteristic white turban. Below, he is plucking out tufts of Barong hair to sell as souvenirs. The hair is of vegetable fiber, the great, movable-jawed mask of wood, and the golden leather decorations adorning his spine so flexible that he can turn to contemplate a tail glittering with tiny mirrors

TYING ON bracelets of Barong hair. The mountain people say they do this because it is the custom, while plains people think the hair wards off bad dreams among children who have just seen the Barong. But early fears soon vanish and mothers have to soothe fretful children during the dull season by promising to take them to see a Barong





SACRIFICIAL OFFERINGS at sunset: the priest wafting the essence of a dish into the Barong's nostrils. Sometimes the priest ritually puts food in the mask's mouth, but the offerings are actually eaten by the troupe. Often food is vowed to the Barong before his arrival by friends of sick people, delivery being contingent on the ailing one's having recovered before the actors enter the town. A few rare, extra-sacred Barongs rely on their healing powers alone, but most are accompanied by theatrical entertainers. All Barongs are respected, however, and the fact that attendants (*above, right*) hold pennanted princely lances near him during his antics signifies his high position

(*Right*) A SERVANT of the Barong: these servants are comic characters who gambol about their master wearing grotesque masks and delighting the crowd by their clowning



SNEAKING UP BEHIND his servant as though catching him red-handed in some fancied misdeed, the leering Barong prepares to maul the culprit. The traditional striped trouser legs are always worn by Barong operators

BOISTEROUS PANTOMIME COMEDY follows as a brother servant attempts to rescue his friend from the tyrant's clutches. The Barong is amazingly agile and frightens children deliciously by suddenly rushing at them



TYPICAL of his capacity for delightful comic posturing is the Barong's ludicrous sprawl (*above*). He has been temporarily worsted in the fight. At right, rice, fruit and flowers are borne in orthodox Balinese fashion on the head of a woman who will offer them to the Barong



A MOUNTAIN AUDIENCE, watching the *Legong*, a comic ballet, from the women's and children's side of the temple. This attraction which often follows the buffoonery of the Barong and his servants may be enacted inside or in front of the temple. But since a number of taboos such as a recent death in the family or a babe not yet three months old, preclude some villagers from entering the temple, their plea is always to hold the show outdoors. Wherever it is held the theater curtain (*right*) has little functional value. Although the dancers make formal entrances and exits, the audience can see them clearly both on-stage and off

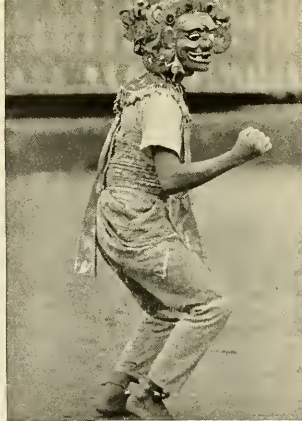




BOOTH AND BARRYMORES of Bali: a series of leading roles in the national theater



(Left) NOT AN ESCAPED CONVICT, but a grotesquely masked comic character in the play *Topeng*



TWO SERVANTS (above and at left) strike significant attitudes in the course of their pantomime



THE PRINCE enters with graceful pirouette. The part is played by young girl



1 THE UGLY ONE is fobbed off on the suitor instead of the fair damsel he loves but when he discovers Rangda's skullduggery, he turns on her (*below*) in fury. That Bali should countenance such treatment of mothers-in-law may possibly help explain its charm for tourists



5 THE SUITOR'S SUPERNATURAL FORM (*below*) turns out to be our old friend the Barong. Now the audience's excitement sky-rocket. To them Barong vs. Rangda is the battle of the century even though it may come twice a day



The Players



KAMA, a character in the *Wajang* play, weeps for the loss of his wife



FEAR is portrayed in the tense stance and popping eyes of this sinister character



A JAOEK. He has a white mask, gold crown, and very long transparent fingernails

2 THE DRAMA is complicated by the fact that Rangda and the suitor both play double parts—each having a supernatural form. Below, the suitor crouches in front of the curtain ready to battle the witch who is backstage changing to her supernatural garb



3 IT LOOKS as though it's all over, but the suitor's apparently decisive victory (*below*) is but another example of the primitive dramatic elements in this pantomime. Every seasoned spectator knows the now supernatural witch is sure to rise, but they love every minute of it



6 THE SUPERNATURAL ANTAGONISTS confront each other (*below*). The fight usually ends in a draw, which, though pointless to us, reflects an interesting set of values, and delights the Balinese. Note operator's hand feverishly clacking the jaws



7 IN A TRANCE: showing how seriously the players take their work. Although rigidly stylized, their theater, offering at least the scope of our sonnets or grand opera, is recurrently vitalized by fresh variations on an old theme



illusion perfectly maintained by the delicate pawing, the mincing prance of the dancers—are decked out in long striped trousers.

This is the Barong *Ketket*, whose magnificence does not correspond to any real animal. There are other Barongs, representing pigs, tigers, lions, and sometimes cows and even caterpillars, but these are usually smaller and less splendid; instead of the shaggy coat they wear cloth, their masks are poorly attached at the neck, and their rôle tends to be a comic one.*

"On the road"

When the Barong walks the roads his mask is usually covered with a white cloth, and the men who "wear" him, do not wear the trousers which to the Balinese turn their shanks into animal legs. In the little dust-stained procession accompanying the Barong, are tall shallow umbrellas such as are carried whenever gods or princes go abroad; there are lances with floating pennants, and sometimes, banners; an orchestra of small metalophones and cymbals and drums and gongs plays as the procession straggles along. Some of the followers carry on their heads square boxes containing masks; others carry bundles which the children by the roadside know to contain costumes for theatricals; others carry double shoulder loads of dozens of little bundles, each no bigger than a pound of butter, the personal effects and the "presents for the journey" of the members of the club. They are going to *ngelawang*, "to go from gate to gate" showing off their Barong and their dancing, courting the appreciation of strange villages.

At this season in the mountain village of Bajoeng Gede, all through the 35 days after Galoengan, there is continual tension in the air. At any moment may appear a Barong—a black one or white one, a

Barong that is too sacred to dance and will be set up in the temple† like a god, or a Barong who will wander all over the village selling his hair for a bit of Chinese coin, or who dances with astonishing contortions and tricks, grasps at an umbrella, takes a drum away from the orchestra, or teases and tantalizes the children in the front rows of the audience. And it is usually not only a Barong, but theatricals also, for in most cases the club does not rely merely on the charms of its Barong alone, on the catchiness of the Barong music to which every child has been dandled from birth, on the cleverness with which the men have learned to dance in the mask, or upon the splendor of the gold and mirrors and semi-precious stones with which the mask is adorned. If the Barong is a very sacred one, whose presence can exorcise the powers and disease and death, then it is true he needs to bring no secondary attractions.

The troupe

He will be followed by 50 or 100 men, all dressed in white. The whole company will be entertained in the temple of the host village, the human followers will be feasted, and the Sacred Barong will be given many offerings from which his human followers will also eat. Women whose babies or pigs or chickens are ill, and who hear of his anticipated arrival, will promise special thank offerings—one roasted chicken, two rice croquettes, five pieces of cake, and a quantity of fruit—to be made to the Barong on his arrival, if only the baby or the pig or the chicken recovers before he enters the village. The rare and most sacred Barong can command offerings and entertainment from one village after another, on the strength of their power to heal and to consecrate holy water which brings cleanliness and blessing. Most Barongs, although treated with reverence, are said by the people to be made for enjoyment.

The Barong whose rôle is to provide enjoyment, is associated primarily with dancing. He himself dances, he brings with him dancers who wear grotesque masks and play a mischievous and teasing comedy with their lord, who mauls them about, to the delight of the onlookers. The Barong may also bring a Legong, a stylized ballet in which three little girls enact a set and familiar tale; an Ardja, the popular light opera with its new songs and new turns; a Wajang Wong, in which human actors, masked and costumed like the puppets of the shadow

*I have omitted here any discussion of masks worn by one person. These are also called *barong*, but usually with a qualifying word following as, Barong Landoeng, Barong Beroetok, Barong Belas-belas, Barong Dingklik, etc. To the children and to the average Balinese, the word *barong* used alone always means one of the four-footed beast masks worn by two dancers. A Barong such as this is connected with one of the village temples, and there is usually a special group of people who form a "club," and who look after the Barong, play in the orchestra—which is the property of the club—refurbish trappings of the Barong when necessary, make him offerings, and accompany him when he goes abroad. This club may themselves give theatricals, or they may confine themselves to dancing in the Barong, and when they go to other villages, take other theatrical groups with them. In the Barong group there is someone who acts as the priest of the Barong, and he, by virtue of his office, is also regarded as sufficient chaperon for the young boys and girls who travel about with the Barong and who sometimes do not return to their homes for ten days or two weeks.

†A Balinese temple consists of a series of one or more walled courts within which stand scattered buildings, shrines, meeting pavilions, etc. While almost all strolling Barongs and their followers sleep in the temple, only the more important Barongs are actually entertained by the host village.

play, stalk through old heroic tales, and perhaps, best of all, they may bring a Tjalonarang, a ritual drama in which the Rangda, the great witch mask so often carried in the Barong procession, is brought out to engage in combat with the Barong.

Delights of anticipation

With such possibilities, there is continued anticipation in the village. As the women go to and from the distant spring with their water jars on their heads, as the small boys tend their cattle on the highlands above the village, or the men sit in a solemn town meeting discussing whether the man who arrived late to help chop the pig shall pay a two-cent or a three-cent fine—they listen. Above the steady beat of the women's wooden rice pounders, above the crowing of fighting cocks lined up along the road in cages, above the incessant barking of the dogs, and, if it is ploughing time, shrill above the mellow thunder of the wooden ox bells, comes the children's triumphant shout: "Barong! Barong!" which an American child would take for a cry of "Fire" and a South Sea child for the equally excited shout of "Manowar," which announces a ship. For what a fire is to an American child, or a ship to a South Sea Islander, a Barong is in the monotonous lives of the Balinese mountaineers. For six months they have gone soberly about their business; they have gone daily to tend the cattle, or to their little farms to plant or weed. When there have been feasts for the village gods, they have dutifully made offerings, knelt in the baking sun or played vigorously in the village orchestra. But it has all been terribly familiar, like going to a party where everyone is a member of the same family.

There is no Barong in Bajoeng Gede, but when children are troublesome and fretful, mothers promise them that they will be taken to see one, and they hum over the tunes to which the Barong dances. Small boys borrow their mother's cloth shawls and play at being a Barong, or with a smaller piece of cloth covering their faces, with blood-curdling yells, they enact the witch Rangda. Their fathers make them bamboo clappers which rattle like the Barong's champing jaws. Still, life is dull and uneventful, and people say "come Geloengan" with a light of expectation in their eyes.

With the cry of "Barong," crowds of children begin to scamper toward the gate from which it came, they tug at their mother's skirts and fret to be taken to see the Barong, the man whose duty it is to attend such matters this month goes to fetch mats for the Barong company to sit upon and betel to refresh them. While it is still at a distance, rumors

begin to circulate, "It's a white Barong"; "It's the Lord King from the village of Tiga"; "They have an opera company with them for there are six little girls with them"; "They are bringing two Rangda masks"; "They have a Wajang Wong, and they say they have fifteen monkey masks, but only five tails." Those whose cattle must be fed before nightfall hurry off to their farms. The Barong company marches up to the terrace outside the temple, there to await a formal welcome from one of the village head priests. They are a bedraggled little company, dusty, dressed in shapeless faded garments; except for the shining gold of the Barong, the paint and gilt on their musical instruments, the glitter of the lances in the sun, they look as workaday and dull as the people of the village who gather around with gaping mouths to stare vacantly at them. No one would guess that the little group huddled around the Barong will blossom out into accomplished dancers most variously costumed in gold and silk, nor that the sullen peasant spectators will turn, at the drawing of the curtain, into exacting critics of every turn of the King's wrist and every swish of the Princess' train in the theatricals.

Enter the Barong

Finally, the head priest comes. The Barong and his followers troop into the village temple, where the Barong club places offerings in the altar made from a living tree, and the Barong dances a short measure, "as an offering to the gods of the village." Meanwhile, the dancers dress outside, on the edge of the terrace, while the village children cluster about, commenting in low twittering voices on the quality of the materials and the shape of the elaborate gold headdresses. The dance troupe comes into the temple and in the wide courtyard they give a tiny selection from their dance—just a preview. This little sketch is said to be "offered to the gods of the village." There are only a few spectators, women with babies, a following of children, half a dozen men who happen to be about the village. Nevertheless, this little dance is important, for it gives the village people an idea of what the Barong club has to offer, whether the costumes are new and shining, whether the dancers are accomplished, the clowns amusing, the kings and queens properly regal. The word goes out, by a child sent to take a packet of rice to its father, or a boy gone to fetch home the cows: "The Barong of such and such a village is here, with a fine Ardja," or "a fair Ardja," or "a poor Ardja" as the case may be. And on the farms people hurry with their work to come into the village, or grunt and settle more firmly on their haunches to show they are not tempted by the second-rate.

Meanwhile, whatever the response to the "preview," the village must order the dance, if only for a hundred pieces of Chinese cash (about six American cents). The gods of Bajoeng Gede and the souls of the dead speak through the mouth of the village trance priestess, an old woman who has been the medium for 30 years. She is a gay and lively old woman, who, no matter how bitter the night air, never fails to watch to the very end a visiting theatrical company. And the gods, speaking through her, have often announced that they so love dancing that no single dance troupe is ever to be turned away, unordered.

On with the dance

Obediently the village head men follow the dictates of their gods. There is a long conference between representatives of the village and the head of the dance club, or sometimes with the priest of the Barong. They speak of the road the Barong has taken, of the road it will take, and finally, the village heads say they will offer a *tapakan*, an offering which means, "a footstool for a God," which will contain, for example, 1100 pieces of Chinese money. In return for this, the dance club will give so many "characters," if the theatrical form is a long one; so much time, if it is a ballet. If five characters of an Ardja are ordered, the spectators will see the Princess' servant, the Princess, the first servant of the Prince or King, the second servant of the Prince, and the Prince himself, and only so much of the long fairy tale plot will be presented as can be alluded to in the songs and comments of these dancers.

Once the matter of ordering the dance has been settled and a fair supply of betel offered to the Barong club, the head men of the village go home, and the town crier for the month may be sent out to notify the women to make offerings which after the Barong has taken the essence, will become the food of the club. The great slit gong, hanging in a high little house in front of the temple, is beaten resonantly so that, everywhere, to the farthest limits of the village fields, people know that there will be a performance that night. Meanwhile, if the Barong is a relatively ordinary and unsacred one, he is set up on two special sticks with umbrellas over him in the courtyard of the temple, or sometimes outside the temple on the terrace, if the dance is to be given outside. (There are always many people who for various reasons, such as a recent death in the family, or a baby not yet three months old, cannot enter the temple, and these make an urgent plea, whenever the news from the preview is very favorable, to have the dance given in front of the temple so that all may watch.) If the Barong is a sacred one, he will

be set up in the special little house in the temple reserved for visiting gods, and later, the people will come and make offerings and receive holy water from his priest. Specially sacred or not, he will be given offerings by his own club, and the Barong priest will ritually lift up food into his very mouth.

If the day is yet young when the arrangements for the dance are completed, the Barong may go out into the village, and, with flags flying and orchestra playing, go from gate to gate, stopping to dance a few measures at the door of anyone who will pay it a little money. The village children troop after it, mothers come to the gate to buy pieces of its hair to make bracelets for their children (in the mountains the Balinese say they do this because it is the custom, but, on the plains, they say that this is done so that the children may not have bad dreams after seeing the Barong, who can be rough as well as playful, threatening as well as lovable). Village boys who aspire to be Barong dancers some day, follow about wistfully, trying to get up courage to ask to be allowed to dance inside the Barong.

Open-air theater

In the evening, when the people have gathered from the fields, and the night air is so sharp that the children huddle together and wrap their cloth shawls tightly around their throats, the crowd gathers. If the play is an Ardja, a curtain is set up and the dancers, no longer the grimy, travel-stained little urchins of the morning, but resplendent creatures from a fairy tale world, file out and sit behind the curtain, to emerge one by one, with lengthy stylized opening and shutting of the isolated curtains, around both edges of which the audience is free to peek at will. The Barong has no part in many of the theatricals; he stands above and beyond, immense in the dim light, presiding over the festivities which are given under his patronage. But, if the play is one of the many Balinese dramatic performances which culminate in a ritual flight between the Barong and the Witch Rangda, then the Barong is set up ready for action, and the Witch's mask box is gotten out and set up on a pedestal, while in front of it a little house is constructed or curtains are hung from which the witch can emerge.

The long story which proceeds the conflict, has many forms which center around the terrors of marrying the witch's witch daughter, or the witch who tries to fob off an ugly daughter upon the suitor who loves a beautiful one. Finally, the deception is discovered, and the human witch heroine becomes the Rangda, that is, assumes the great witch mask and the supernatural form of the Rangda, the

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THE ANT THAT CARRIES A PARASOL—*Inside its maze-like underground nest thrives not only one of the world's more astonishing social organizations but a carefully tended farm, yielding food for the whole tribe and guarded by terrible-jawed soldiers*

By V. WOLFGANG VON HAGEN

IT was my misfortune to become intimately acquainted with the Parasol Ant during my expedition to the Mosquito Shore in Honduras. I planted a small garden in the jungle, a laborious affair that meant the felling of trees, the tearing up of lianas and other jungle creepers, but I was rewarded by uncovering a wide expanse of rich black loam which, with the alacrity of growth in the tropics, augured well for a rapidly growing garden.

My Indian servants, dusky, kinky-haired Miskito men, lamented all this work. It was useless, quoth a toothless elder, to plant anything but bananas or manioc, as the *Wiwis* were sure to cut off all the leaves. Without the slightest encouragement the Miskito Indians would launch forth on the tales of the ravages of the *Wiwis* *Laca*, but unswayed by the illustrations, like Pangloss I could only remark that all this was very well but let us cultivate our garden.

In two weeks the carrots, the cabbages, the turnips were doing well. The carrots had unfurled their fernlike tops, the cabbages grew as if by magic. From our small palm-thatched house my wife and I cast admiring eyes over our jungle garden. Our mind called forth dishes of steaming vegetables to replace dehydrated greens and the inevitable beans and yucca. Even the toothless Miskito elder came by and admitted that white man's energy had overcome the lethargy of the Indian. Then the catastrophe fell upon us.

We arose one morning and found our garden defoliated: every cabbage leaf was stripped, the naked stem was the only thing above the ground. Of the carrots nothing was seen. In the center of the garden, rising a foot in height, was a conical peak of earth, and about it were dry bits of earth, freshly excavated. Into a hole in the mound, ants, moving in quickened step, were carrying bits of our cabbage, tops of the carrots, the beans—in fact our entire garden was going down that hole. I could see the grinning face of the toothless Miskito Indian. *The Wiwis had come.* As it was too near the rainy season to begin another garden, I made no attempt to rid myself of the ants, and we turned perforce to

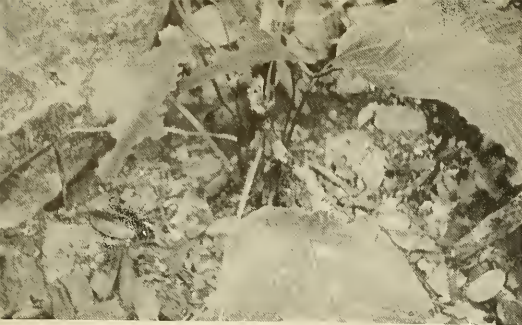
our dehydrated vegetables, beans and yucca, for the duration of our collecting trip on the Mosquito Coast.

Since we had the Parasol Ant with us*, and as I had promised Dr. Julian Huxley to obtain a colony for the Insect Vivarium of the London Zoo, I began the observations preparatory to securing a group. To prepare a colony of these ants for a long journey is not so simple as placing them in a box with their larva, food and a moistened sponge; for the Parasol Ant is a vegetarian, a horticulturist, in short, a grower of mushrooms, and more intimate details about its habits had to be known before a nest could be transported.

The Parasol Ants, however, are the least difficult of organisms to observe. Night or day they can be seen moving from their nests along one main "highway"; a hardened path three inches wide, trampled bare by the ceaseless movement of millions of ants. Moving over this path which they have doubtless cleaned of grass, come the rushing, hurrying legions of the Leaf Cutters. The broad-headed workers are maroon-colored, a half-inch in length, and are accompanied by other polymorphic workers somewhat smaller. It is an industrious group; the incoming ants with their waving leaf banners collide with the legions of the outgoing ants. The ants sometimes run into each other, when there is a brief pause while the ant with the leaf and the ant in search of one tap each other with their antennae.

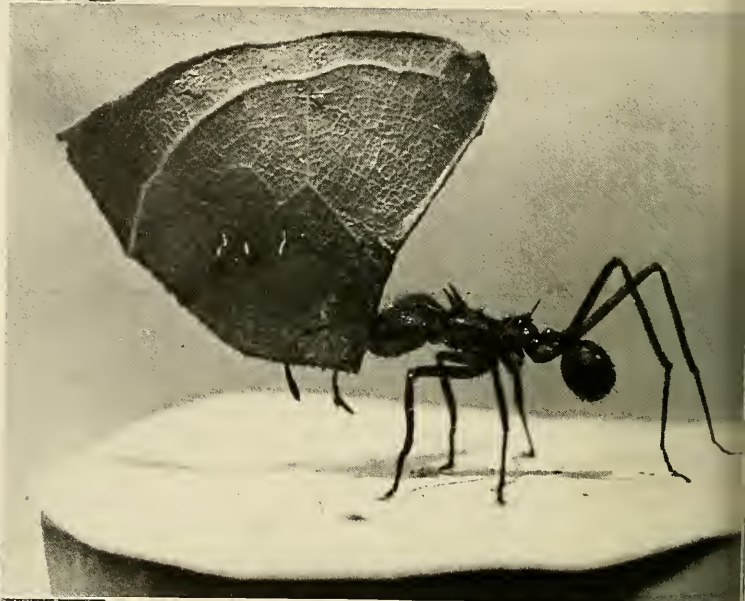
The "highway" runs some distance from the nest and loses itself in the jungle verdure, for from that point on the ants take themselves to the vegetation for their cuttings. I followed a contingent of the ants to a low-lying, broad-leaved *Heliconia* (a not distant relative of the plantain), and watched them mount the stems and join their fellows wandering on the wide surface of the leaf. That this plant pleased the Leaf Cutters was evident for some of the stems of the *Heliconia* were standing bare and bald, devoid of leaf. One leaf, recently unfurled and moist from its compact growth, was filled with ants rushing excitedly about it, colliding with one an-

*It is sometimes called the Umbrella Ant, though it does not work in the rain.



(Left) THE UTOPIAN SOCIALIST community of M. Fourier had 2,000 individuals occupying a single dwelling, each pursuing whatever employment he was best fitted for by nature, and each receiving an ample minimum of the common wealth. This dream, so far impractical among men, happens to summarize the social system of Parasol Ants. Though confirmed horticulturists themselves, these ants are dreaded foes of tropical farmers. At left are Heliconia leaves despoiled by the shear-like jaws of the ants' worker caste. What happened to foliage thus cut away was long a biological mystery

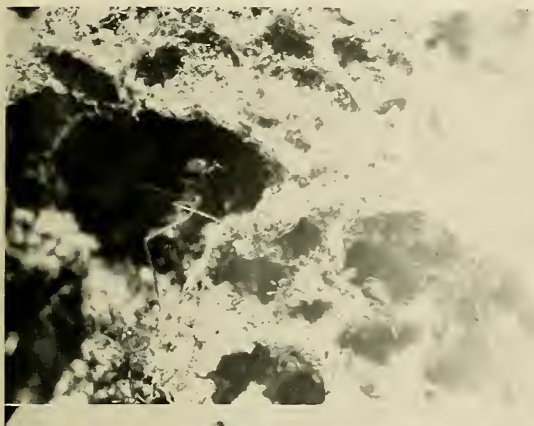
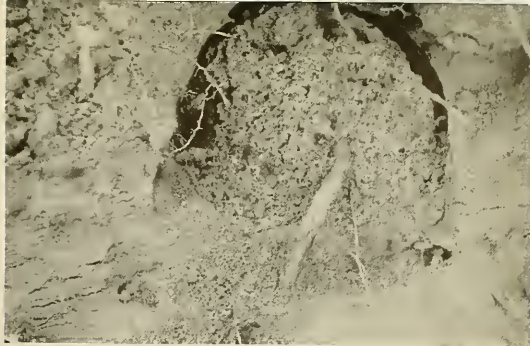
(Right) OBVIOUS to all aspirant mystery-solvers was the fact that workers could carry large pieces of leaf resembling parasols along a definite highway to the nest. At the entrance a much smaller worker hops on his back, thence to the leaf, then both disappear inside. Since the ants did not appear to eat the leaf segments, early theorists believed they stacked them up to shingle the nest during the tropical rainy season. The naturalist Belt discovered the secret, proving the ants to be farmers



ANXIOUS to witness the course of the leaf segment through the ant world, author van Hagen (left) excavated a giant nest the invaders had built on the remains of his Honduras garden. The excavated mounds of such nests may tower five feet above the earth, while the underground regions extend nine feet below. The digging went smoothly until the author and native helpers were faced suddenly by the most fearsome of the ant castes—the soldiers. Pouring out by the hundreds these belligerent defenders, each a full inch long, threatened to overwhelm the diggers until von Hagen turned to modern artillery—a spray gun filled with insecticide

(Left) WHAT THE SOLDIERS were so vigorously guarding: at center of the nest the spades lay bare a fungus farm. As large as cauliflower heads and similar in color, these fungus masses lack the vegetable's consistency, collapsing like soap bubbles under slight pressure. Nevertheless they form the economic basis of a communal social order that is one of Nature's marvels of efficiency. Apparently, the smaller workers that hop on the bigger ones' backs munch the leaf segments into tiny pellets which supply essential fertilizer to the growing fungus

(Right) CLOSE-UP of one of the perfectly rounded fungus farms that feed the ant community. Skillful farmers as well as rampant destroyers, the ants nurture the fungus by fertilization and other means. Though they will attack almost any foliage, they are especially fond of citrus fruit leaves, on which the mycelium of the fungus develops underground. But their association with the plant extends somewhat beyond the relationship of cater and eaten, in so far as they also use the chambers of the porous fungus to hatch out their eggs

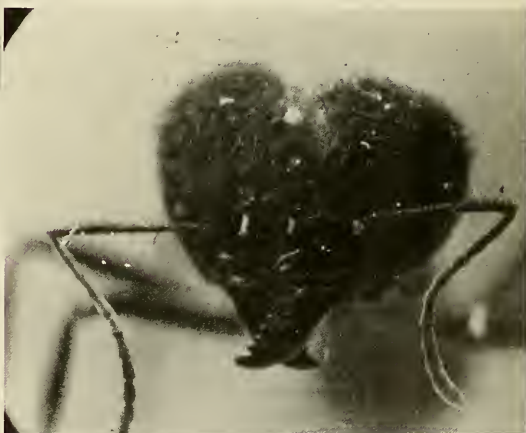


(Left) INTO THE HOLES of the porous fungus flee the ants to escape the light of the photo-flash-bulb. Though unmistakably reacting in this case, they tend to concentrate all their attention on the changeless specialty for which Nature designed them. While the author's spades hacked at the vital farms, bustling workers scuttled to and fro with new leaf segments oblivious to the intruders. Their society is thus almost pure organism. It is also, like that of most insects, dominated by the females. Males die immediately after mating, while their "wives" shed the wings they use only at the mating season and become prodigious producers of eggs which are carried to the fungus cells by workers



(Lower left) THE SOLDIER PARASOL ANT. Twice the size of the workers, this undeveloped female warrior is absolutely fearless, and perhaps the world's most perfect soldier, since all she does from birth to death is fight

(Right) THE FEARFUL, heart-shaped head of this soldier-ant is speckled with white tufts of the fungus she has been so ardently defending. Note the cruel "saw-toothed bayonets" which she uses scissor-fashion on all foes of the sacred nest. At lower right, five snipped-off soldier heads are shown with their jaws fixed in a death-grip on a fold of cloth. Even when beheaded, you cannot loosen their bulldog hold. South American natives know this and use the heads to close wounds. Were it aseptic this primitive method of "clamp-stitching" could easily replace catgut in an emergency. The natives have other uses for the ants. During the mating season when all ants emerge in droves, the men, like the birds, catch and eat them. But both predators avoid the worker and soldier castes because of their sharply spined thoraxes. When toasted, the ants taste something like crisped bacon. Were it not for men, birds, reptiles, and a semi-parasitic beetle harbored within their nests, Parasol Ants might reach such numbers as to destroy utterly even the lush vegetation of the tropics



other, making a rapid play over the body with the antennae, then hurrying away again to tap the edge of the leaf. Some of the ants were already cutting, and I bent closer with a magnifying glass to watch the performance, being careful to shield my breath from them. Holding by four of its legs to the leaf, a worker would lean forward to the edge and start to cut by opening and closing its mandibles. The jaws are heavily dentated and move across one another, functioning like shears. The cutting is always done in a quarter circle, arc-like. When the ant has cut a piece of leaf somewhat larger than itself, it grasps one edge as it makes the last cut through the fibers. Bracing itself, it pulls backward and, gripping the leaf anew, raises it over its head and moves toward the ground. Likely as not at this stage will appear another ant, which eagerly (and one might almost be tempted to say enthusiastically) taps the ant and its leaf with its antennae and then lays hold of the leaf with its own mandibles. This is, of course, not at all sporting, and for some while there is a tug-of-war between the two, with the owner usually winning by its spirited tenacity.

Endless activity

Again on the ant highway the worker with its *Heliconia* "flag" moves along with its fellows to the nest. In the cool of the morning, with the sunlight piercing through the heavy vegetation, one can make out an unending stream of Leaf Cutters. From a distance, with the ant barely seen under its burden, it appears as if a breeze were ruffling the bits of jungle undergrowth. On the ground the workers returning with their burdens are met by other minuscule inhabitants of the ant nest, tiny workers one-fourth the size of the larger workers. These do not cut or carry leaves, but can always be seen hurrying along the path. One will mount the back of the worker and, climbing on top of the leaf, hold to this leafy perch on its way to the nest.

The path leads to the central entrance, and without letting go of the leaf the worker descends. What happens to the leaves? My Miskito Indian insisted that the *Wivis* take the leaf below and feed it to a larger ant, which, when it grows large enough, comes from the nest and makes off into the forest where it becomes a wild pig. Bates, the English naturalist, when on the Amazon, gave his studied opinion. The leaves he said were brought below to carpet the nests, and others were placed about the entrances to stop the water from running into the hole during the torrential rains. Later, Belt in Nicaragua, came to the conclusion that the best way of finding out what they did with the leaves was to

open the nest and see for oneself. What he found was startling enough.

The leaves were used as fertilizer for large fungus gardens which the Parasol Ants grow in their subterranean chambers deep in the earth. He insisted the ants live exclusively on the fungus which they grow, and such a suggested symbiosis between plant and insect was of such interest that Alfred Moeller in Brazil gave himself over to the matter and communicated some of his observations to Darwin. The fungus, Moeller found, is actually an artificial culture of a *Rhizites gongylophora*, a whitish mold-like fungus mycelium, which does not develop into large mushrooms because of some action performed on the heads of the mycelium by the ants. He further proved Belt's theory that the ants live exclusively on the fungus, the ants providing the fungus with the substratum for its growth and the mycelium in turn repaying its part of the symbiotic bargain by growing luxuriantly in the chambers made for it.

This then, became our problem: if the ants live only on the fungus and must have leaves to fertilize it, how could I construct such a nest and transport the ants in a three-months' journey to London. To see more of this organism, I also opened the nest. Now this is not a simple task. The Attini, the Parasol Ant, builds immense nests, some of which have been estimated to spread over 100 cubic meters of earth. The excavated mounds tower to as much as five feet above the earth, and the subterranean regions are as deep as nine feet.

Excavating the nest

We began our excavation fifteen feet from the central cone—on the outside edge, in fact, of the nest. We began a broad trench into the mound, and by keeping up a relay of Indians I had the trench fairly well into the center of the mound in the first hour. By this time we had run into trouble, for our digging had disturbed yet another type of Parasol Ant, the soldier; and the more we dug into the center, the more spirited became the defense. We had reached the center when suddenly one of the Indians gave a blood-curdling shriek and made for the jungle. We stood aghast watching him, and then the other Indians screamed and began beating about them. The soldiers had called the reserves and they had come in hordes and were now crawling over us, biting and drawing blood. These soldiers are twice the size of the worker, about an inch in length, with large heart-shaped heads and immense mandibles. Once they bit they held on so tightly that the only way to remove them was to crush the whole ant.

Indians, taking full advantage of this tenacity, use the soldier ant to suture wounds. When one has cut his arm, he holds the cut together, takes a live ant by the back and places it near the wound. The soldier ant bites deep, clamping the two edges of the skin together as in a vise. The Indian takes another ant and performs the same operation near the first and so on down the length of the wound. The next step is merely to wring their necks and snap off the body from the head. The ant will not relax its hold even though decapitated, and if it were aseptic this method could replace catgut sutures in emergency.

A modern touch

The excavating was now difficult, due to the interruption occasioned by beating off the soldier ants, so I had recourse to a modern turn: I sent one of the Indians after my Flit-gun. Filled with insecticide, this proved just the right thing. Every few minutes we would spray each other and kill or stun the soldier ants on our clothes, until eventually we were so permeated with the fluid that the soldier ants kept from us.

In the center of the nest we uncovered the large spongy masses of fungus. They were as large as cauliflower heads, of a grayish color, and so flocculent that, like soap bubbles, they collapsed with pressure. The fungus grew from the bottom of the rounded mud cell; and housed within the interior of it were eggs, nymphs, soldiers, small and large golden-winged alates. As soon as we broke into the fungus garden, the alates made quickly for the dark recesses of the fungus, while the broad-headed soldiers moved toward us, making in all their myriads a curious rustling sound. On one side of the cell was an entrance, and unmindful of the catastrophe that descended on their fungus garden, the workers with their leaf banners continued to pour through it into the nest. *Atta* is ultra-methodical; repeated catastrophes have to occur before it takes cognizance of them; so, despite the hurried antennae-tapping of the ants in flight, the workers continued to come with their burdens. They dropped these on the floor of the garden, reflectingly tapped the fungus with their antennae, and left through the same entrance without so much as being disturbed by the fact that their gardens were in danger. When matters quieted down in the opened nest, other workers, the Lilliputians of the Parasol Ant world, confined wholly to the fungus crypts, swarmed over the freshly gathered leaves. Under the magnifying glass I could see their small mandibles crushing the leaf into minute pellets, which they carried into the mass of fungus and buried in the

crannies. This then was the ultimate end of the leaf—fertilizer for these gardens.

Each fungus garden is a complete world in itself. It receives its quota of eggs from the central reproductive chamber, which is larger than the rest and usually found below the other cells. In this nest we counted 40 distinct cells of irregular sizes, round and spheroid, covering an immense stretch of ground. The many thousands of workers composing this colony had been produced from eggs laid by a few gravid females. Most good-sized ant colonies contain more than a single queen, but the number of these fecundated egg-laying individuals is never large. As quickly as the eggs are laid, the workers carry them off to the cells and place them in the warm confines of the mycelium gardens. The egg hatches, and through its larval growth it is tended by the workers. Each cell within this formic republic is complete within itself yet held together by that obese matriarch below, which produces the new life for the colony.

Had M. Fourier, the French mathematician who conceived the ideal cooperative social unit known as the phalanstery, wished an example, he could have found no clearer one in nature than the community of the Parasol Ant. For his Utopia, M. Fourier suggested that mankind be segregated into units of 2000 occupying a single dwelling and each providing itself with its own amusements and necessities. Each individual of the phalanstery would be permitted to pursue whatever employment he was best fitted for by natural aptitude. There were to be no salaries; but each was to receive an ample minimum and a share of the surplus.

Communal living

Fourier's system did not work, but the caste system of the Parasol Ant permits it to exercise its specialized aptitudes in this communal way of life. Each member is limited from performing a task other than that which its own physiology will permit.

To regulate its community, the Parasol Ant has a common dumping ground where the used, dried leaf-fertilizer is disposed of along with the dead ants. Emerging from all of the fungus chambers, tunnels lead to this dump, where ceaselessly the workers bring the refuse and drop it, as a miner might dispose of the waste of a mine. Raking among the debris I uncovered numerous large Staphylinid beetles feeding on the dead exo-skeletons of the ants. Curiously shaped beetles, generally apterous, or "wingless," they live on friendly terms with the ants and can with impunity wander among the

galleries and fungus gardens. As the beetles have the same nest odor as the Parasol Ant and as they exude from the base of their anal extremities a delectable liquor which the ants lap up avidly, the Staphylinid beetles have become part of the formic republic. The beetles are lacking in decorum, however, for instead of confining themselves strictly to a coprophagous diet they plunder the live young larvae of the nest, and if unchecked one might believe that they could seriously undermine the ant colony.

With the beginning of the rainy season, the winged species take to the air to mate and then to create new colonies. For some days before the nuptial flight there is an animated tenseness within the formicary. Then one day when the rain pours down in torrents, the winged species feel the time has come and emerge into the open. The alates are twice as large as the soldier, with great golden membraned wings. One can readily distinguish between the male and female, for the male is smaller but has larger eyes than the female. As the whole system is based on the principle of matriarchy, the female has a larger body, with a greatly developed thorax to propel the enormous wings. These winged species, making their exit from the subterranean chambers, poise for an instant and then soar into the air to become victims of this great genital frenzy. The males follow the females, and fecundation takes place, usually in the air. The female is pursued by many males, one of whom she selects as a mate before they fall to earth, locked in a golden cloud to be dispersed by the death of the males. Poor males of the insect cosmos, they are only casual intruders in a purely feminine world.

The fertilized female then seeks and digs out a place in the earth, where she breaks off her wings. For this time at least, she loses the blue-blooded prerogatives of a queen and performs all the menial tasks of the workers. It is at this stage that the colony is an amazing illustration of the directive instinct of the insects. Dr. Carlos Bruch found that just before the females leave the nest for the nuptial flight they feed heavily on the fungus. The thread-like hyphae of the fungus as well as other particles of the substratum become packed in the "infrabuccal pocket" and form a large pellet. This the female retains until she has made her little cell underneath the ground, whereupon she regurgitates the hyphae pellet onto the floor of the chamber. Caring for her garden and using her feces for the manure to insure its rapid growth, the Queen meanwhile is busily laying her first eggs. As soon as the workers mature, they take over the duties imposed upon them, and

the Queen becomes less active as she grows older. Finally she abandons forever any tasks connected with the operation of the colony and becomes virtually an egg-laying machine.

The Parasol Ants are a potential force antagonistic to civilization, if it be true that civilization is based on agriculture. Were it not for the fact that the swarming sexual reproductive forms are set on by reptile, bird, and man, their numbers would overwhelm the vegetation. At the time of the swarm, Indians of the Amazon construct miniature dirigible-shaped baskets, which they hold over the exits of the nests so that the flying insects fall into them. Birds perch in nearby trees to fly down and eat them as they emerge, among them the resplendent trogon, which takes them on the wing; and immense frogs merely sit near the nest and with their flat, mucuous-covered tongues swallow them as fast as the winged ants appear. So the supernumeraries of the Parasol Ants serve man again, for almost all the Indians of the Amazon and as well as those on the Mosquito Coast have developed a taste for them. The workers and soldiers have sharp spines coming from the thorax and the top of their heads. Generally these castes are avoided by birds, but the winged "castes" have no such spikes; and seeing my Miskito Indian devouring them, I decided that I, too, would try this formic-delicacy. All Indians have names for this ant and all eat it, from the head-hunting Jivaros, who call it *uku* and eat it raw, to the Jicaques of Central America who like their *ara* cooked. My Miskito Indians would pull off the heads, legs, and wings, and toast them in a sort of flat *cumal*; and I must own that the flavor was not bad, somewhat resembling crisped bacon. For the day at least, we all became insatiable. Molochs eating the ants as fast as the little children brought them to us; but, eventually wearying of the pungent oily taste, I gave the signal that I, for one, had had enough of this repast.

On the way back to our camp, laden with the nest for the London Zoo, filled as it was with the crumply fungus and all the ant-forms, we found that the Parasol Ants, now that the nuptial flight had ended, had taken up their interrupted tasks and were again cutting and carrying their leaves along the ant-highways through the jungle to their nests, beginning yet another yearly cycle.

Owing to the fact that our traveling formicary was held up in transit and lay three weeks on a dock, it did not reach London successfully. Such are the disappointments when one tries to move a "universe." But a new attempt will be made in the near future.

INFORMATION TEST

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

Score 5 points for each correct answer. Correct answers on page 64

1. The story of the discovery of North America by Norsemen almost five centuries before Columbus is
....(a) a legend proved to be without foundation,
....(b) an established fact, or
....(c) a political fabrication designed to prove Nordic supremacy?
2. The oldest glass without a core of foreign material was made in Egypt about
....(a) 1000 A.D.,
....(b) 2000 B.C., or
....(c) 1000 B.C.?
3. The mysterious "moldavites" discovered by Goethe have been identified as
....(a) a tribe of northern Tibet,
....(b) termite companions of the Parasol Ants, or
....(c) glass meteorites?
4. America's first industry was
....(a) glass-making,
....(b) beer-brewing, or
....(c) ship-building?
5. The large jaws of soldier Parasol Ants are used by the natives
....(a) as a great delicacy similar to the Frenchman's frogs' legs,
....(b) to make "saw-toothed" arrowheads, or
....(c) as "clamp stitches" to close their wounds?
6. The first white colony in Greenland was based on
....(a) farming,
....(b) whale-hunting, or
....(c) the mining of "fool's gold"?
7. The eared pheasant was threatened with extinction because
....(a) its feathers were avidly sought by Paris milliners,
....(b) the Tibetan tribesmen suddenly discovered how delicious its meat was, or
....(c) the lama priests removed an age-old taboo against killing it?
8. A medieval scientist named Kunckel discovered how to make ruby glass while
....(a) trying to make gold,
....(b) experimenting with the chemical content of blood, or
....(c) boiling beets in a glass jar?
9. St. Rupert's drops are
....(a) according to Mexican legend, tears shed by that saint over the country's sad plight,
....(b) berries eaten by the natives of Bali, or
....(c) drops of glass that shatter when the surface is scratched?
10. Venice kept the secrets of its glass craftsmen by
....(a) killing them,
....(b) having them work in hypnotic spells, or
....(c) "exiling" them to the Isle of Murano?
11. Parasol Ants get their name from
....(a) their habit of carrying large pieces of leaf above their heads,
....(b) their greatly modified umbrella-like antennae, or
....(c) their skill in tightrope-walking along jungle vines?
12. The legendary discovery of glass when a fire was built near lumps of niter on a sandy shore is discredited because
....(a) a wood fire is not hot enough to produce glass,
....(b) all necessary elements were not present, or
....(c) the molten stream would have sunk into the ground before it could have been observed?
13. "Cullet" is
....(a) the call of the eared pheasant of Tibet,
....(b) broken glass mixed with the fresh materials, or
....(c) a sweetmeat familiar to all tourists in Bali?
14. Parasol Ants carry leaves to their underground nests
....(a) to thatch the nest against tropical rain,
....(b) to store the leaves for winter food, or
....(c) to fertilize their farms?
15. In 1261 Greenland
....(a) was sighted for the first time by Europeans,
....(b) is known to have been practically free of ice, or
....(c) had been a republic 100 years longer than the United States has today?
16. The beetles living inside the Parasol Ants' nests are tolerated because
....(a) they exude a delectable liquor which the ants love,
....(b) their chirp has a musical charm for the ants, or
....(c) they supplant the ranks of the soldiers in great danger?
17. Greenland is inhabited
....(a) by no permanent residents,
....(b) by pure Eskimos, or
....(c) by people almost all of whom have European blood?
18. The telescope was invented
....(a) about 1400,
....(b) about 1600, or
....(c) about 1700?
19. Ruby glass
....(a) became a lost art for almost two centuries after its discoverer died,
....(b) loses its characteristic color in a few years, or
....(c) is not safe to eat out of?
20. An achromatic camera lens removes
....(a) "rainbow fringe,"
....(b) polarized light, or
....(c) cosmic rays?

THE DISAPPEARANCE OF THE GREENLAND COLONY

Continued from page 12

to Eskimo ways. Thus, as among the Lapps whom Sundt knew personally, there would have been not only a marriage of Eskimo women to Norse men but also, by the choice of the women themselves, a deal of marriage between Norse women and Eskimo men.

Sundt closes by saying it is pathetic that Hans Egede, who longed for nothing so much as to discover in Greenland traces of the former Icelandic colonists, must have seen (without understanding what he saw) many who bore in their faces the clear proof that they were in part of European descent. Egede unknowingly revealed that he had seen European traits occasionally among the Greenland Eskimos of 1721 when he said: "Both the men and women . . . have broad faces and thick lips; they are flat-nosed and of a brown complexion. Still, some of them are attractive and of a fair complexion."

Game more plentiful

As said, the attack upon the extermination theory which the world has most noted was Nansen's *In Northern Mists*. He uses the same arguments that Thorhallason and Sundt used, buttressing them with scholarship and adding a few details of his own. He makes it clear that there is no sound reason to believe that the medieval colony suffered from a change of climate. Besides, a chilling of the climate might have had effects that were on the whole good. An increase of ice in the sea, for instance, might have interfered somewhat with husbandry and with commerce, but it would have brought a compensating increase of game. For it is the veriest commonplace of northern countries that the more sea ice there is the more game there is, and the easier to secure. This, indeed, was one reason why the colonists, even during the early and largely pastoral stage of the settlement, used nevertheless to have their hunting outposts in the far north.

With greater scholarship, Nansen was better equipped than Thorhallason in at least one other way for tearing up the orthodox picture of how the Greenlanders disappeared. As a practical hunter, and as one who knew Eskimo hunters, Nansen asks us to consider the facts on which Bardarson grounded his conclusion that the Europeans of the Northern Settlement were killed off by Eskimos.

Bardarson was not a Greenlander but a Norwegian temporarily resident there as superintendent of the bishop's farm in the southern district. His understanding of Greenland matters would be incom-

plete. The southern colony was little in touch with the Eskimos, as compared with the northern colony.

For several years none of the northern colonists had come south. They had no reason to come except for European wares, and we know that trade with Europe had sunk low before this period. On the other hand, they had a pressing reason for going north: they were more and more dependent upon hunting, less and less upon husbandry, and the hunting was better up north.

The southerners were curious to know how the northerners were getting on. Perhaps the new farm superintendent combined the traditional good Norwegian seamanship with the equally traditional Norwegian venturesomeness and a desire to see new countries. He made an occasion for going north, at once eager to see strange things and a bit fearful of the Eskimos who were supposed to be powerful in witchcraft.

When the Bardarson party came opposite a farm of the northern settlement they pulled close inshore and had a good view of the house and of farm animals grazing about. But they saw no people. Doubtless they shouted, and probably they hovered about just offshore for a good while, finally convincing themselves that there were no Europeans anywhere near. They then returned to the southern colony and reported that the people of the northern settlement had been exterminated by the savages.

We have no information as to whether the southern colony accepted Bardarson's view that the northerners had been exterminated. The document we have is not even written by Bardarson himself. It was written in Norway after he had returned to his own country, his assignment to the Greenland job finished. Then apparently Bardarson gave verbal information to someone who knew how to write. There resulted the document we have, a memorandum by an unknown Norwegian of what Bardarson told him.

Live animals meant live Europeans

Nansen considers that Bardarson's interpretation of what he saw (perhaps rather the interpretation given in Norway to Bardarson's statement) is preposterous: that it shows a complete misunderstanding of the situation in Greenland, of hunting peoples in general and of the Eskimos in particular. He says it is easily possible that Eskimos, meeting domestic animals, might kill them as if they were a new kind of wild animal; or that, understanding them to be domestic and the property of a given person, they might nevertheless kill them. Their purpose in killing, in either case, would be for eating. Eskimos might have killed farm animals with-

out killing the people; but they certainly would not have killed the people without killing the farm animals.

The truth was the northern colonists were now mainly devoted to hunting, but they had not yet wholly discontinued the breeding of sheep and cattle. It was mid-summer and the entire family were in one of the mountain valleys gathering eggs, catching salmon at a waterfall or pursuing the caribou which, then as now, would have been hunted at this season. Had Bardarson understood the conditions he would have inferred that all was well, from seeing the farm animals grazing about. The people, he would have known, were away because it was the hunting season.

From husbandry to hunting

It is more than possible that communication between the north and south colonies was resumed after Bardarson's time and was known in Iceland, even in Norway and at the Vatican, without documents surviving; and it is also probable that cataloging and arranging of the Vatican archives will reveal further documents and make them fully available for study. However, if not at Bardarson's time, then perhaps not much later, the northern colonists gave up husbandry pursuits and went over completely to hunting. Thereupon they would naturally migrate northward, gradually or in a concerted movement of a large group. For it had now been known to them for centuries that the better hunting was in that direction.

Like Thorhallason, Nansen points out first that the Black Death may never have reached Greenland, and second that, if it did arrive, it must have killed natives as well as whites. He agrees that it was European pirates and not Eskimos that would have devastated the forelands without being able to reach the heads of the fjords. Like Thorhallason he says that for Eskimos to capture people for slavery is absurd, although for Europeans of the time it was logical. Doubly absurd would it be for the Eskimos (though logical for Europeans) to repatriate captured slaves, which the Pope says was done.

Thorhallason rested his argument about the pirates on common sense and a general knowledge of history. Nansen was able to document his conclusion; for he knew that in 1432 King Henry VI of England made an agreement with his royal uncle Eric of Pomerania, king of the Scandinavian countries, that English privateers should repatriate in dependencies of King Eric's realm prisoners who had been captured there. Among the dependencies were both Iceland and Greenland. So here you have an English promise that the very thing would be

done by the pirates (or privateers) which Pope Nicholas V says was done by the "barbarians."

It is mainly through documentation that Nansen carries beyond Thorhallason the attack upon the contention, from Egede to Nörlund, that the blood of the European Greenlanders disappeared from Greenland, nearly or quite. In this sphere the one thing which Nansen does not thoroughly demolish is Nörlund's contention that signs of rickets in the skeletons found at Herjolfsnes are proof that the medieval Norsemen disappeared from the whole of Greenland partly through malnutrition. So we follow that question beyond Nansen, aiming to show that while Nörlund is correct for Herjolfsnes, and for such trading centers as may have resembled Herjolfsnes, he is wrong in extending conclusions derived from a trading village to those hunting or farming communities which contained the larger part of the Greenland population during the centuries 1400 and 1500.

Nörlund's basic assumption is that Europeans will suffer malnutrition on an all-flesh diet, though Eskimos do not.

A healthful diet

It was demonstrated by the Stefansson expeditions, through the experience of more than 20 non-Eskimos between the years 1906 and 1918, that everyone who tried it was as healthy on a diet consisting wholly of animal tissue and water as he had ever been on any diet. These men included not only more than half a dozen European nationalities but also South Sea Islanders. It is known from other sources that Negroes do as well on an all-meat diet as Eskimos or whites.

A survey of the history of human diet through the resources of anthropology will show that in many different countries and climates, in the remote and recent past as well as in the present, large numbers of people have lived without malnutrition on diets where elements from the vegetable kingdom were either wholly absent or present in negligible quantity. No doctrine of that rapidly changing science, dietetics, is so surely on its way out as the notion that the only diet on which you can have normal health is one of elaborate and careful food mixture. The fact is, of course, as most anthropologists have long believed and as dietitians are now beginning to realize, that you can be healthy on a vegetarian diet, that you can be healthy on a flesh diet, and that you can be healthy on a blending of the two.

In any case, there is no evidence that people who live exclusively on flesh have a poorer chance of normal health than those who use, in addition to

meat, such things as were imported from Europe to Greenland during the Middle Ages. This is the general statement on health. The particular one concerning rickets is that an investigator of Nörlund's own nationality, Alfr. Bertelsen, has shown the disease is today fairly common in Greenland within the families of Danes who live mainly on food imported from Europe; and that rickets is practically unknown among those Eskimos in Greenland who still live on their native diet.

Dr. William A. Thomas of Chicago reported on deficiency diseases through the *Journal* of the American Medical Association from his observations in Greenland and northern Labrador. In Greenland he concluded that "among these primitive, carnivorous people there is neither scurvy nor rickets," thus confirming Bertelsen. In Labrador the natives have for so long been in contact with civilization that they have abandoned their primitive diet in favor of European foods. Among these Doctor Thomas found rickets to be "almost universal."

More recent Norwegian testimony confirms the Danish and American sources with regard to rickets. Dr. Arne Høygaard published at Oslo in 1937 "Some Investigations Into the Physiology and Nosology of Eskimos from Angmagssalik in Greenland: A Preliminary Statement." He says: "There was possibly slight rickets in the case of three small children in the colony, but none in the outlying district." The context shows the "slight rickets" to have been among families who lived partly on native and partly on European food; the absence of rickets was where European food was also absent.

Physical breakdown unlikely

While the most striking Nörlund argument is that the Europeans of Greenland during the Middle Ages suffered from rickets *because they had insufficient European food*, he also gives a picture of general physical breakdown. Such a breakdown would necessarily include tuberculosis. It is, therefore, pertinent that Doctor Høygaard writes (personal communication dated June 29, 1938) that he has been investigating the relation of tuberculosis to diet in East Greenland, and that he has found a better prognosis when the patients live in the primitive way than when they use, in addition to the meat, considerable amounts of a food rich in carbohydrates. Now grains (the only noteworthy source of carbohydrates available by European commerce to the medieval Greenlanders) rank high, if not at the top, among those food elements for the want of which Nörlund thinks the Europeans died out from Greenland during the Middle Ages. Thus he recommends for better health the very factors which

Høygaard finds detrimental in the same climate.

True, Nörlund argues that carbohydrates are necessary for Europeans but not for Eskimos. However, as we have said, the existence of such a racial difference is a pure assumption. What little evidence we have tends in the opposite direction—the presence or absence of things like vitamins or carbohydrates apparently will have about the same physiological effect upon different races.

The place where Nörlund found the skeletons that showed rickets was the main trading station of south Greenland, Herjolfsnes, where people would have more European food than anywhere else in Greenland—partly because the ships arrived there and partly because the townspeople and the surrounding community made their living by dealing with these ships. In other words, what Nörlund has really shown is only that dietetics and physiology were the same in Greenland during the Middle Ages as they now are in Greenland and in Labrador—that those who live on European foods, or on native foods handled in the European way, will develop rickets and other deficiency troubles.

So we can forecast with confidence that, whenever archaeological studies of Greenland are carried far enough, it will be established that skeletons show rickets where there are evidences, or at least probabilities, of a good deal of European contact; and that skeletons will not show rickets, nor marked signs of any of the deficiency diseases, where the evidence or the probabilities lead us to believe that the people were living chiefly on Greenland food prepared in the native Greenland way.

The medieval Europeans in Greenland needed for survival only the good sense to realize that they ought to change the European for the Eskimo way of life. Nansen puts it well where he says that he cannot think so badly of his own countrymen of the twelfth to fifteenth century as to believe they were too stupid to learn that the road to salvation lay through shedding the customs they had brought with them and adopting those of their new country.

Shadows of their presence

Nörlund has shown in our cited volume that the Europeans were still surviving as Europeans in Greenland to at least 1520. The summer of 1578 Frobisher went ashore in Greenland and saw an encampment whose people had fled. He found there an iron trivet.* Nothing is clearer among students of the Eskimos than that a trivet has little or no place in their way of life, and that any piece of iron is sure to be cut up immediately into implements for which they have a real need.

*A three-legged stand for holding cooking vessels, etc.

Therefore, the people who left a trivet at their encampment, when they fled on the approach of Frobisher, either were not wholly Eskimo in their way of life or else were Eskimos who had such an abundant supply of iron through European contact that they could afford to leave some of it unused, in the shape of a trivet.

Eighty years later we have a confirmatory statement from the Frobisher-Davis region, that of Nicolas Tunes of Flushing.

Tunes saw in 1656 two kinds of people living in perfect amity in the district where, Nörlund concedes, European Greenlanders were living at least to 1520. One sort Tunes describes as if they might have been nearly or quite pure Eskimo; the other "had a very tall stature, well-formed bodies, of a fairly white complexion . . ." which means that they could have been half or three-quarters European.

Both schools of thought with regard to the lost colony agree that, among the present 16,000 "Eskimos" in Greenland, few if any are without European blood, while some are so European in appearance that, conventionally dressed, they would pass unnoticed in any American or European gathering.

For this high percentage of European traits, including light eyes and hair, the two schools advance different explanations. Those who believe that there was extensive intermarriage between the two races during the Middle Ages, and that the civilization disappeared but not the blood, claim that these

mixed people get half of their European traits through descent from the lost colony. Those who believe in the extinction of the medieval Europeans claim that all the European qualities, or practically all, are to be explained by mixture with Europeans since the time of Frobisher and Davis, chiefly through intermarriages since the Danes took over, following Egede in 1721.

Because the exterminationists have the advantage in point of numbers, we let the survivalists have the last say, through two quotations:

We repeat the statement of Hans Egede for what he saw in west Greenland during the years following 1721: "Both the men and women . . . have broad faces and thick lips; they are flat-nosed and of a brown complexion. Still, some of them are attractive and of a fair complexion."

To supplement Egede's statement we use a translation from Eilert Sundt. In his 1860 edition of Egede's diary, Sundt comments on the above passage: "Egede had probably expected to find recognizable countrymen; but the indefatigable way in which he took care of the 'savages' that he found there will please us still more when there is a reason to think that the remains of the Norwegian population really had assimilated with the Eskimos, so that he—though without understanding what he saw—had on his journey south [along the west coast of Greenland] a glimpse of his countrymen's fair hair and blue eyes."

DO NOT MISS

One engaging phase of that highly variable phenomenon—the human diet—is revealed in Dr. C. H. Curran's thoroughly objective essay **ON EATING INSECTS**. Doctor Curran pleads guilty to the social anathema of devouring these creatures as well as the generally tolerated profession of studying them. But he insists that you, too, eat them, if unknowingly, almost every meal. If the idea repels you, consider that they have nourished mankind for countless centuries without ill effect and are still openly relished in many parts of the world.

Continuing in the same lyric vein of his previous essays on the great boon of natural history as vocation and avocation, **DONALD CULROSS PEATTIE** offers a helpful discussion of **YOUR NATURE HOBBY**. Here is a source of true friendships among the sort of people you would want to know. As you broaden the horizon of your vision of Nature you will find therein an insurance policy against sickness, over-wrought nerves, or unemployment, a shield against the slings and arrows of outrageous fortune.

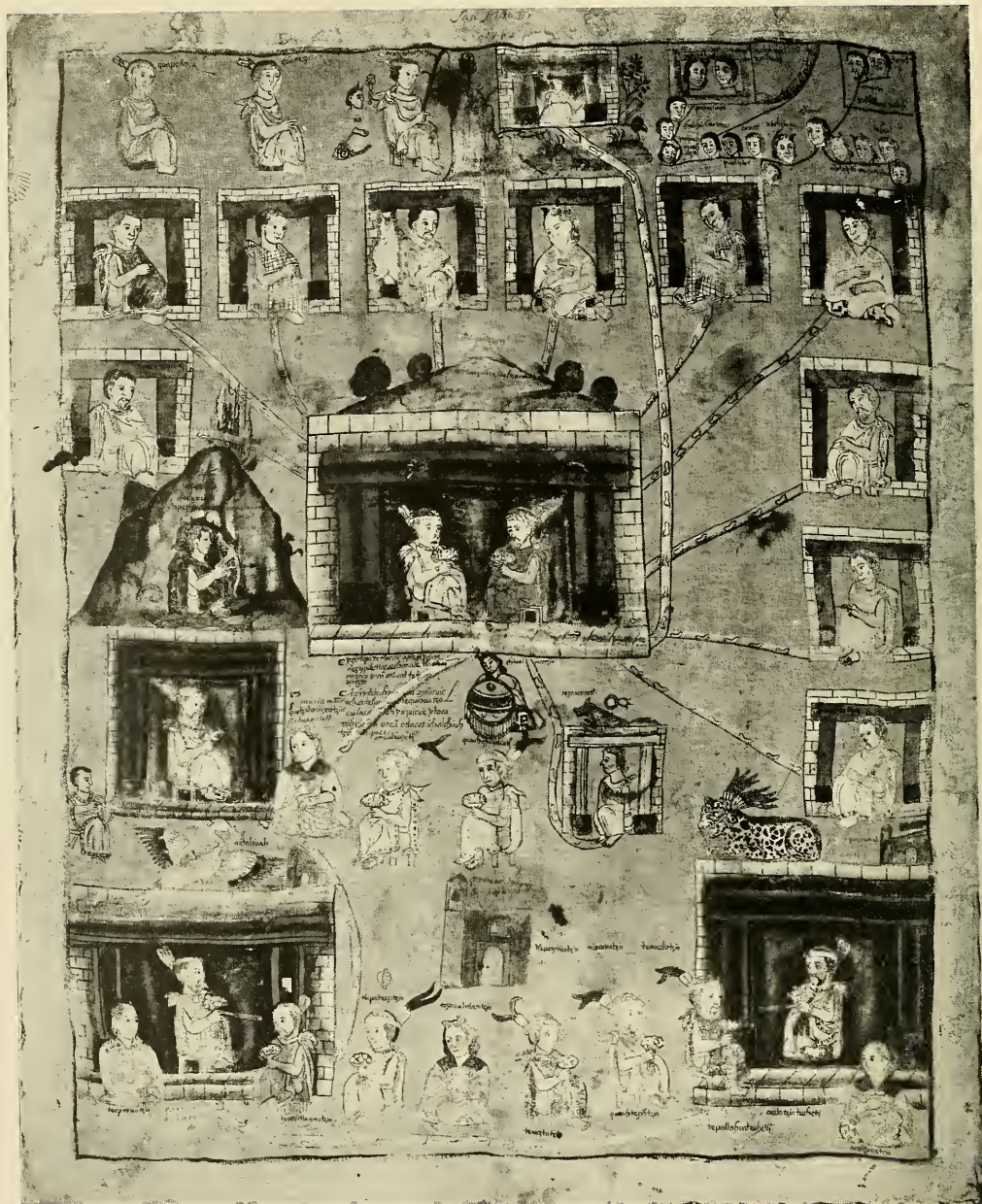
NATURAL HISTORY Readers already familiar with the telling power of Virginia S. Eifert's graphically written histories of the Art of Beautification, Spices, and Orchids,

will welcome her distinctive treatment of **THE STORY OF FIRE**. She reveals the strange rôle of Fire in the March of Man from caves to skyscrapers. Fire—a terrible power for destruction yet one which beckoned our ancestors upward through the ages with a mysterious and often religious fascination.

Why have the number of hayfever cases doubled within the last twenty years? Is it accident, the increasing susceptibility of the race, or does the finger of suspicion point to our prodigal treatment of natural resources? Read the answer in **WEEDS, WASTE and HAYFEVER**, by Roger P. Wodehouse.

The "social" background, genealogy and origin of that animal known to many as man's best friend will be brought out graphically in Dr. E. H. Colbert's **WILD DOGS AND TAME—PAST and PRESENT**. No one with a love and understanding of dogs can afford to miss this panoramic history of canine life.

Mysterious laws govern the inner life of a **SEA-BIRD COMMUNITY**. Doctor Tinbergen will tell the highlights of four years' experience in studying the family life of the herring gull.



MUCH OF THE IMPACT of 16th century Spanish imperialism on the Aztec Nation is echoed today in the genealogical tapestries that have survived the amalgamation of Indian and Spaniard into modern Mexican. The picture writing on the cloth above is actually the legal claim to his possessions of one Chalchihuitzin, sometime chief of San Salvador Zumpango in the state of Tlaxcala. He is the right-hand figure in the central "house" seated next to his white-robed ancestor. Though guaranteed his holdings by a liberal-intentioned but distant crown government, Chal-

chihuitzin (meaning "jade") prepared the cloth in fear that greedy local colonists would override his rights. There is pathos in this earnest documentation of his lineage to support hereditary claims, for until the Spaniard took over, Indian chiefs held property only so long as they held office. At their death or removal it reverted to the whole community before being invested in a chosen successor. Hereditary ownership was an unheard of institution in their communal system, but they learned it painfully only to see it violated on all sides by high-handed colonials

THE TWILIGHT OF THE AZTEC CIVILIZATION—*An ancient tapestry sheds new light on the age-old struggle for property. The story of Spain's 16th century colonial enterprise, which failed in spite of its modernity*

By GEORGE C. VAILLANT

*Associate Curator, Anthropology,
American Museum*

THE Museum recently received a sixteenth century Mexican painting on cloth, which was formerly in the possession of the late Mrs. John Hay. It depicts the genealogy, land-holdings, allies, and dependents of one Chalchihuitzin Vasquez, who, some fifty years after the Conquest of Mexico, was the chief of the hamlet of San Salvador Zumpango, in the state of Tlaxcala. The routine analysis and identification of this document necessitated an examination of the social systems of Mexico both in Indian and Spanish times, and revealed a fascinating series of economic and cultural contrasts.

The nature of the document itself discloses a completely Indian culture existing fifty years after the Conquest. The manuscript is painted on a cloth of native manufacture measuring a little over five feet long by four feet broad. The subject matter is set forth partially in Aztec Indian pictographs and partially in a text expressed in Spanish script but in Nahuatl, the Aztec language.*

Although the flavor of the painting is completely Indian, we find evidence of the spread of Christianity. Conventional representation of churches and the use of saints' names in connection with Indian locations shows that the evangelization of Mexico was progressing rapidly and the chapel instead of the truncated pyramid dominated each native village. Some of the individuals shown in the manuscript have Spanish names, following the early colonial custom which substituted at baptism a sound, Christian appellation for the unpronounceable heathen names. Yet these few instances show how thinly the Christian veneer was spread over Central Mexico.

The purpose of the document evokes another fascinating social situation. Chalchihuitzin evidently had this cloth painted to prove his right to his chieftainship and to the land which he held, and thereby have legal recourse in the event his property was

taken. There are a number of similar legal documents of the same period, which likewise show Indian writing used for Spanish legal purposes, indicating that the Indian could plead his case in the courts.

This condition of affairs reveals a conflict, almost inevitable in colonial administration, between three principal interests, the original population of the territory, the colonists, and the home government. The native residents by no means like to relinquish the privileges of their own culture nor to shift to another set of social values. The colonists in making the daring step of populating and conquering a new land, wish to obtain rapid and abundant material rewards. A home government must consider its colony as a source of profit unless strategic considerations are paramount and, as such, it must conserve native sources of production as well as recognize its duties toward its colonials.

The government of Charles V and Philip II tried to meet this situation in a manner astoundingly advanced and tolerant for the sixteenth century. The numerous Indian population which was both docile and hard-working, provided a superb adjunct to the wealth of Spain. Yet the incredible daring of the original Spanish Conquerors brought this land to the Crown, which must express its gratitude to them. Unfortunately, it was far less of a feat to promulgate laws regulating social conflict than it was to enforce them.

The Indians were given the right to their villages and enough land comfortably to support those communities. They had their own local government, responsible to the colonial officials for order and for taxes. Their moral welfare was entrusted to the Church, which had the tasks of adapting Indian mores to Christian ethics and of transforming the natives into worthy Spanish subjects. The basic theory was to make Spaniards of the Indians, not to enslave them. How slow this process was, is revealed in our picture map.

The remainder of the land the crown either retained or granted to the colonial officials, the Con-

*B. L. Whorf of Yale University has translated the principal Nahuatl inscription in European letters shown on opposite page in center of picture as follows: "Here is where

Apitzin (the ancestor) took up his abode with Establestacuechimale (his wife) at Tloahut-machco where was born Teteuitzin. And Teteuitzin brought along to his home a young

warrior Huatzocuilacatl. And he took (as wife?) one named Tzihucuetzin and was born there Chalchihuitzin Vasquez."

querors, and the various ecclesiastical establishments. It also permitted favored individuals and religious orders to avail themselves of Indian labor. One way was to allow a Spaniard to use the man-power of a whole community. Yet in some places, as in the state of Tlaxcala where the native population had been potent allies in the Conquest, no such orders were enforced nor were many land grants made within the area.

As is inevitably the case, the colonists saw no reason for recognizing the rights of the Indians and many of these Spanish land-owners were vigorous people with powerful connections both in Mexico and Spain. Even at this time the civil and ecclesiastical authorities could barely restrain their vigorous rapacity with an active interest on the part of the home government. The final collapse of the conservational policy toward the Indians was soon to come, with the defeat of the Armada and the loss of Spanish sea-power. The Crown could no longer keep a firm hand on the colonial administration, when its lines of communication became tenuous and its political interests centered on an agitated Europe.

Yet, as a last flare that so often precedes the dying down of a fire, there was at this time a prolific intellectual activity on the part of Indians and their ecclesiastical mentors. Old manuscripts were copied, ancient lore was collected, and many histories and traditions were preserved. In part, this recording of the past may have been induced by the sense of disaster, that the Indian culture was to disappear as its makers were drawn into direct servitude to the Spaniards. Yet, as is suggested by this manuscript of Chalchihuitzin Vasquez, the Indians, frightened by the constant encroachment on their prerogatives, hastened to establish their titles to land without the possibility of question. To do this, they had to envisage the assumption of a colonist's legal status and to abandon their dubious position as Indians under Crown protection. The descendants of the great chiefs had some of them been ennobled by the Crown and many of them were people to be considered, in that they were potential pensioners of the government on account of past ancestral service. Thus this move was not one of blind desperation on the part of the chiefs, when we consider their rank in terms of Indian and Spanish society.

The position of a Mexican Indian chief is difficult precisely to define in view of the relationship between personality and office. A strong man may elevate a low office and a weakling lower an important one. Yet, in general, the tenure of office and its aperturances was better guaranteed under Spanish rule than under Indian. An examination of the broad outlines of Aztec government will illustrate the dif-

ferentiation of Chalchihuitzin's position under Spain as compared to that of his ancestors prior to the Conquest.

Each Aztec community was independent and self-governing, and the tribe and the community were one and the same. The economy of the tribe was based on agriculture and the farm land was the communal property of the tribe. The tenure of the land lay in its equal division between the twenty clans which composed each tribe. The clan leaders apportioned the fields among the heads of families, who could retain possession so long as they cultivated their allotments. A head of family could bequeath his property to his children, but, if there was no issue or if the land was left unworked it reverted to the clan. Special fields were worked communally for the tribal officers, the temple officials, and for the tribute payments which weaker communities had to pay to stronger.

The leading men of each clan elected a representative to a tribal council, which dealt with general tribal affairs and elected a war chief and a religious chief. As the communities grew in size and as the growth of crafts and industries complicated the general interest of the tribesmen, administration became more complicated, so that four chiefs were elected who, as in Tlaxcala, governed directly, or, as in the Valley of Mexico, operated under the direction of the old religious and war chiefs. Each of these supervised the land and living quarters of five clans. Simultaneously the duties of the clan leaders became more onerous. This growth of administrative duties made it necessary for more individuals to be supported by the fruit of communal endeavor. A simple system of communal land tenure with elective officers was gradually adding to itself an administrative class.

Changes induced by the manner of life altered the selection of this administrative group. The existence of many independent communities would lead to endless friction and war. In the Valley of Mexico and the eastern plateau simple agricultural sacrifices to ensure the growth of the crops became associated with war for survival, and there developed a bloody cult of human sacrifice, in which war became a means of getting victims to honor the gods. Whereas in some parts of the world, peoples justify their wars through such varying concepts as defense of liberty, spreading civilization, national interest, or plain, simple greed, the Aztec communities transformed their struggle to survive into a method of religious propitiation. With constant fighting, the war chief assumed an increasingly important function and the warrior group became the nucleus for selecting administrative officers.

Clans became famous for their military prowess

A Social Survey of 1577

This "long-distance" questionnaire, sent by King Philip II of Spain to all governmental officials in his New World possessions, shows the penetrating insight into colonial problems of the period and indicates the methods by which the King sought "to facilitate the good government and ennoblement of the Indies."

1. In towns with Spanish inhabitants, the name of the district or province is to be stated, also the meaning of the name and the reason it is so named. . . .
3. State in general the climate . . . of the province . . . whether it is hot or cold, dry or damp, with much water or little . . . the prevailing winds. . . .
5. State whether the district is inhabited by many or few Indians, whether in former times it had greater or lesser population, the causes for the increase or diminution . . . state the character and condition of their intelligence, inclinations and modes of life; also whether different languages are spoken or whether they have one spoken by all.
- 6-12. Requests for data on latitude, roads, distances between towns, plan of towns, types of roads. . . .
14. State to whom the Indians belonged in heathen times and what dominion was exercised over them by their lords; what tribute they paid, and the form of worship, rites, and customs they had, good or bad.
15. State how they were governed; with whom they carried on warfare, how they fought, the clothes and costumes they wore and now wear, and whether it used to be more or less healthy than now and the reason that is known for this.
16. . . . The district is to be re-

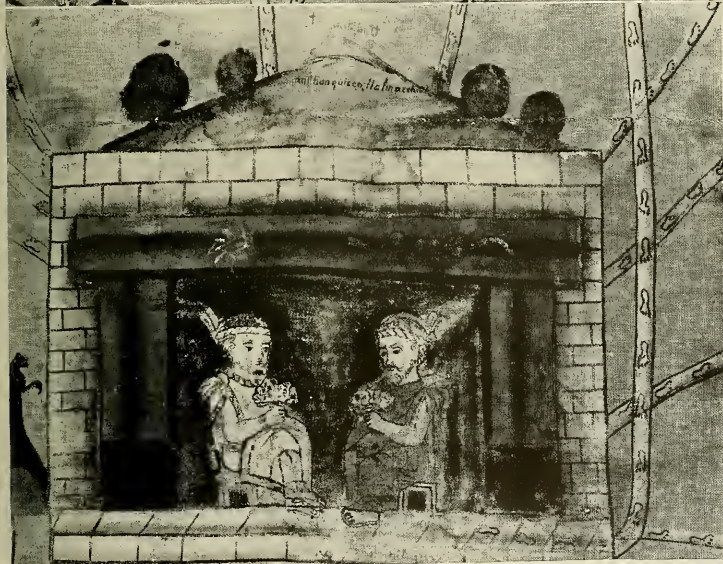
- corded with meaning of everything in the native tongue.
17. State whether the town is situated in a healthful or unhealthful place and, if unhealthful, the cause for this, also the kind of illnesses that are prevalent and the remedies employed for curing them. . . .
22. Describe the native trees . . . and the profit gained from their fruits and woods.
23. Mention whether the cultivated trees and fruit trees brought from Spain or elsewhere do well or not.
24. Mention the grains, seeds, and other plants and vegetables which have served or serve as food for the natives.
- 25-27. Requests for data on the imported plants, the native herbs and native fauna. . . .
30. State whether there are salt works near the town . . . and where they get their salt and all other things they need for sustenance and clothing.
31. Describe the form and construction of their houses and the materials for building them. . . .
33. Describe the trade and traffic and dealings with which the Spanish and native inhabitants of the town support themselves; state with what produce and how they pay their tributes.
- 34-37. Requests for data on the various types of ecclesiastical establishments and cathedrals, churches, monasteries, convents, hospitals, etc.

DETAILS FROM CHALCHUITZIN'S PICTURE CLOTH are shown directly below and on the opposite page. The top three figures in the panel below represent Vasquez's source of blue blood, the highly revered leaders of the original bands of Chichimec warriors who wrested the territory of Tlaxcala from the Toltecs. They occupy a position analogous to the Mayflower emigrants considered so important in American lineages



(Above) THREE CHIEFS (grouped at left) and two wives conferring. Note the characteristic cigar and bouquet in the hand of the central chief. The woman at extreme right has her arms adorned with stamped designs similar to those along the decorative borders of these pages. These designs from clay seals were familiar to science for years but not until this picture was discovered was their precise use known. The use of rebus writing is seen in the pieces of gold paper above the head of the middle figure whose subscribed name, Gold, literally "holy dung," expresses the Indian's almost oriental exaltation of his gods

(Below) THE FULL LIST of Chalchihuitzin's ancestors are shown in the top row. The second row, like that in the similar set of panels on opposite page, portrays his dependents. The main interest in these figures is that they show women were property owners as well as men. Their dress is much less ornate than that of the notables depicted below



(Above) DETAIL OF THE CENTRAL "HOUSE" in which Apitzin, the white-robed founder, is shown with Chalchihuitzin, his heir and present chiefly incumbent. They wear their insignia of office comprising two feathers attached to a leather headband, an ornamental detail conspicuously absent from the commoners shown above. The flowers carried in the hands of the chiefs reflect a characteristic custom of Indian Mexico. The ribbon-like bands stretching outward from the palace represent paths with footprints leading to the commoners' houses which are depicted at extreme right and second row of the full picture map



(Below) PLAN of rooms in the Palace excavated by the Museum at Chiconauhtla. Note the grouping of rooms around patios. The living-rooms are always equipped with a hearth, while the portico offered a pleasant working place. Room ST-10 in the South House, too small for either room or portico, must be an alcove or throne room, like those shown opposite



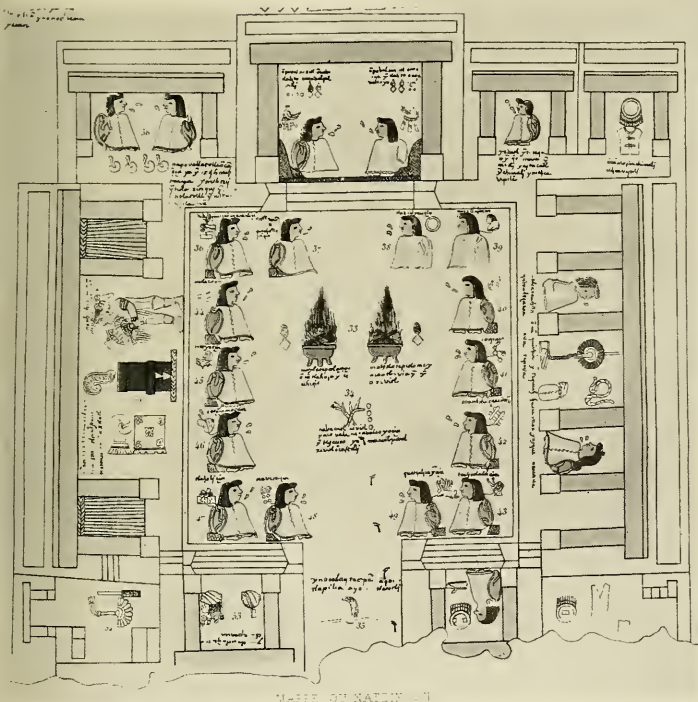
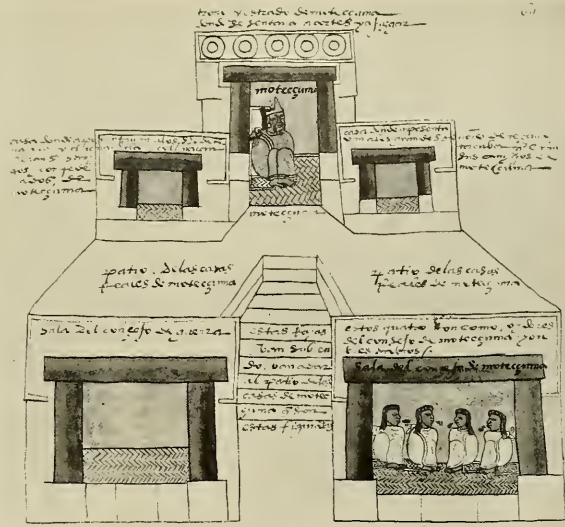
and an idea of lineage developed from the special eligibility of a group or family to act as leaders. Marriage of chiefs with the daughters of other tribal leaders also tended to establish this system, so that the chiefly successions which have been preserved in the literature, read like the descent of royal houses in Europe. Yet outside the community there was no political solidarity beyond loose and temporary systems of alliance and the obligations of vassalage. Basically, however, competence and energy, not birth, were the qualifications for office.

The Spaniards, however, envisaged only the lineage aspect and upon taking over the country conceived of the war chiefs as endowed with all the rights and powers of kings. They made the incumbents of those communities which they did not eradicate responsible for order in the tribes, and they recognized succession in terms of birth. The lands and property, which according to Aztec thinking belonged to the office, the Spaniards conceived to be the possession of the incumbent. In other words they froze the chiefs and their descendants into a subsidiary privileged class, so that in later times, to be able to show legitimate descent from a chiefly lineage, as did Chalchihuitzin Vasquez, was likewise to declare the validity of one's land title. Chalchihuitzin in this document ran his descent back to the Chichimec chiefs who wrested Tlaxcala from the Toltecs.

The Tlaxcallans, to judge from this document, were still able, in 1570, to maintain a very definite distinction between their chiefs and the ordinary tribesmen. The petty householders wear simple mantles and breech clouts, while women owning property restrict their ornament to simple embroideries on their huipiles and skirts. The chiefly personages, often shown in groups of four, signifying the leaders of the four tribal divisions, are sumptuously clad. Their mantles are richly embroidered and sometimes dyed with cochineal and indigo. They wear sandals in contrast to the bare feet of the commoners or maceguales. In their hands are bouquets of flowers and round their heads leather fillets binding plumes, which are standard insignia of high rank among Aztec tribes. Two of the notables are shown with potent-looking cigars, a method of smoking introduced from the West Indies in colonial times, since the corn-husk cigarette was the Indian smoking custom in Central Mexico before the Conquest.

The wives of the chiefs are even more elegantly dressed. The art of superb embroidery had not disappeared. Huipil and skirt are sometimes of contrasting colors and the element of richness was stressed in contrast to the simpler costume of the plebeian women. These noble consorts as a crowning elegance have designs stamped on their arms. It is of

(Right) PERSPECTIVE OF AN AZTEC PALACE from the Codex Mendoza. This drawing was made by Indian scribes shortly after the Conquest by Cortez. The general plan, not unlike that of the Chiconauhtla palace on opposite page, reveals a room on the right of the chief's apartment reserved for special guests among whom was the ruler of Chiconauhtla. The seemingly herring-bone markings denote straw mats. In the lower right-hand hall four judges are seen settling a dispute, an acrimonious one if we may believe the symbols of their speech. This building is not so elaborate as the one below, in combining plan and elevation without the use of perspective



THE CHIEF'S PALACE AT TEXCOCO as pictured in the Mapa Quinatzin (1540). Many aspects of tribal administration are shown, each labeled in Nahuatl language but European script. Two great successive chiefs, Nezualcoyatl and Nezualpilli, face each other (top center) as did Chalchihuitzin and his ancestor in the tapestry. Below them in the central court, tributary chiefs pay their respects, including our ubiquitous friend, the head of Chiconauhtla. The pillared vaults at right are store houses for tribute; at left is a hall devoted to what they called science and music, but which really signifies religious ritual. The alcoves at either side of the throne room (top) house the judges (left) and the arsenal (right). At bottom are the halls for the war council and visiting ambassadors

considerable interest to see for the first time the exact method of using the clay seals, which are frequently found in Central Mexican sites. There is no trace in this document that the women adapted costume elements from Spanish sources. They evidently preferred secure native standards of elegance to the incongruities inherent in borrowing elements from other styles of dress.

An additional emphasis is added to the class distinctions implicit in the dress. This is in the depiction of the houses. Those of the commoners are shown as small buildings of sun-dried brick with an open portico of unpainted joists and beams. The dwellings of the nobility are much larger, the porticos are painted, and open platforms project from the houses where visitors may sit. There is no hint of the interior arrangements, but just as archaeological research could throw light on the arm designs of the women, so it contributes to our knowledge of the interior of a chief's house.

In 1935, the Museum carried out extensive excavations at Chiconauhtla, which was in Aztec times a fief of the great Valley of Mexico city state, Texcoco. The work centered on the palace of the chief, which was composed of a series of patios surrounded by rooms. The standard unit was a portico with the columned side opening on the patio. Behind the portico a door led to a closed room, equipped with a hearth. Occasionally there was a supplementary room as if for storage. One of these patios had an alcove at one end, very evidently to serve as a throne or dais, and another had a platform which probably supported a similar structure.

It was possible to trace the growth and changes in the palace for at least two centuries. Calculating a hearth as representing a family unit of five, a couple and three children, there were some 40 people quartered in the palace during the fourteenth century, as opposed to more nearly 80 in the fifteenth. This doubling of the palace population has a close correlation with the growth of administrative personnel as suggested in the histories of the period.

The ancient manuscripts give pictures of palaces which although crabbly depicted in the Indian manner closely confirm the testimony of our excavations. An elaborate drawing of the great palace at Texcoco shows rooms devoted to government, such as the throne rooms and open alcoves of the

chief, judges, and administrators, other apartments for the storage of military supplies and tribute, a large room for music and science, according to the inscription, a secular interpretation of a place to carry out the constant ceremonial obligations of Aztec life.

A simpler drawing shows quarters for the chief and at each side, rooms for visiting dignitaries. These quarters are on a platform from which steps lead downward to other chambers where the judges render their decisions on the various conflicts and complaints of the tribesmen. The multiplicity of function in the governing of a tribe required many quarters for the council of war, and guest rooms for visiting allied chieftains. There was in addition rooms to house officials and store equipment. The old communal ideas would combine the tribal headquarters with the residence of the chief. Naturally, the extent of such palaces would vary according to the size of the community. One can estimate the palace shown in the manuscript of Chalchihuitzin as more nearly the size of that of Chiconauhtla, than of the elaborate one at Texcoco. To maintain such elaborate households must have required considerable land and it is easy to see why the Spaniards tried to marry into the families of chiefs. How long it took tribal leaders to make the step from looking on this property as personal rather than official cannot be estimated, but by the first generation after the Conquest, they must have seen that they had to maintain their land as if it were personal property, since such was their position in Spanish law.

To describe the alienation of this property, the abasement of the Indian, and the destruction of his culture is to recount only one of the innumerable tragedies in the story of colonization and the growth of peoples. Yet inexorably humanity continues to create and destroy. There is tragic drama in this twilight of Mexico, when the old Indian culture was being forgotten, the deeds of the Conquerors neglected, the Spanish power crumbling, and the order of united social action broken. This old and faded cloth brings to life again those tragic years of darkness and despair. If research into the past does nothing else, it enables one to fortify himself in the tragedies of the past against the calamities of the future.

THE EARED PHEASANT

By ROBERT B. EKVALL



The high adventure of pioneer bird stalking in the remote hills of Tibet. One pheasant does not make a new fashion in millinery, but the hunt threatened to revive an April Fool's market for the plumes that once carried this bird to the brink of extinction

IT was during the month of March that we were staying in the Tibetan community of the Stone Box—a great crag-enclosed amphitheater in the more inaccessible southern slope of the Minshan on the Sino-Tibetan border. In the mountain meadows, hung on the steep slopes of that rocky rampart or caught among the highest peaks, blue sheep were to be found and the clucking of ram chukar or snow fowl was to be heard. But the foothills were mostly wooded: dark patches of spruce mixed with the lighter color scheme of birch covering the shady slopes, and on the sunny slopes thickets of juniper and buck thorn alternating with patches of meadow, which generally are a tangle of fireweed and a dozen different kinds of grasses.

In the deep valleys of the foothills, my Tibetan friends told me, eared pheasants were to be found in considerable numbers; and one morning I went gunning for them, taking with me a Tibetan as guide and one of my Chinese caravan boys to hold the horses. H. B. Conover's collection of "Game Birds of the World" in the Field Museum, to which I occasionally shipped specimens, needed a pair of eared pheasants in their spring plumage; and if they were plentiful in the environs of the Stone Box, here was the opportunity to get them.

The great eared pheasants are as handsome as any members of the pheasant family, the three principal species known to science being chiefly distinguished one from another by the color of their body

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try and some zoological collecting. He is the author of "Gateway to Tibet" and of two other books in the course of publication. While doing graduate work in anthropology in the University of Chicago, he prepared one of these, a monograph entitled "Culture Con-

tacts on the Kansu-Tibetan Border," which is being published under the direction of the University's Department of Anthropology. He expects to return to the field this winter by way of Yunnan.

—THE EDITOR.

plumage. The brown eared pheasant is found in Manchuria and northeastern China; the somewhat larger and incomparably gorgeous white eared pheasant is found along the Szechuan-Tibetan border in that region where are found the giant panda and the gold snub-nosed monkey; and the blue variety is found in western Kansu, the Koko Nor region, and adjacent areas of northern Tibet. This latter species (*Crossoptilum auritum*), though not as large as the white or quite as stunning in appearance, may yet lay claim to equal elegance in dress, with slate-blue coat set off with trimmings that make him look like a guardsman in full regalia.

A Mephistophelian look

They are considerably larger than the common pheasants, and in size the cocks and hens alike average from six to eight pounds in weight. The head is well covered with wattles and tiny feathers of an uncompromising crimson, against which two white tufts curve upward on either side of the head like exaggerated mustaches, giving a peculiar and strikingly Mephistophelian appearance. The legs are a similar shade of crimson. For fineness and grace the tail coverts, which curve almost to the ground, are only matched by bird of paradise feathers and egret plumes. The white patches at the base of the tail feathers, set off by the slate blue body in front and the black tail feathers, create the peculiar visual illusion that the bird is a four-footed animal showing a flash of white belly as it slips through the underbrush.

In the days of the Empire in China, the tail feathers of the eared pheasant—the *ma-chi* or "horse-chicken"—were greatly in demand, a tuft of the plumes on his hat being as indispensable a part of a mandarin's outfit as a bearskin is to a guardsman. So for years the eared pheasants lived a much hunted existence. Still later Paris decreed feathers for ladies' hats, and *ma-chi* plumes were even more sought after.

The thrifty border peoples hit on the plan of keeping the birds alive and reaping a yearly harvest of plumes. But the great birds, seeming to accept their lot with haughty melancholy, refused to breed in captivity. So in the spring the Chinese and Tibetans ranged the forested foothills of the Minshan, seeking and finding nests from which eggs were taken, later to be hatched by domesticated hens. Thus year by year the numbers of the eared pheasants decreased, until it was only in the wilder and more inaccessible valleys and mountainside coverts that any of the handsome birds ran through the underbrush or planed noiselessly across the deep valleys from hiding places to feeding grounds and back.

Then fickle fashion, heedful of pressure from the humane societies (women of a more streamlined age were temporarily tired of feathers anyway), said no more feathers; and bundles of plumes no longer found their way from the Tibetan border in the heart of Asia to the shops and boulevards of Paris. The bottom dropped out of the market and various enterprising local traders, after stubbornly refusing for a long time to believe the cessation was anything more than a device for forcing down the price, found themselves holding stocks of plumes for which they had no earthly use, and feeding birds more worthless than the drabest barnyard chicken. In disgust they fattened the birds they had and learned what a delicious treat eared pheasant meat is. The peasants and woodsmen gave up looking for nests in the springtime, and gradually once more the big blue birds began to run through the underbrush. Valleys that had long been still again began to echo the gong-like cry that, like sardonic laughter, so well matched their Mephistophelian aspect.

On the trail

These were the birds we sought as we passed in and out of alternating sunlight and shadow, following the narrow, twisting streambed between the steep slopes. The great ice flows along the river were crumbling and rotten, but we rode in winter weather and the horses' hoofs rang on frozen ground when we entered the shade where the sun hadn't reached. The next minute we were in the sunshine where it was already spring though the trees and bushes did not fully trust the sudden warmth that left a film of freshly thawed, slippery mud on the trail. The Tibetan guide, in spite of my reiterated statement that I only wanted to shoot eared pheasants and indeed hadn't brought a gun that could shoot anything large, couldn't quite take a pheasant hunt seriously, so hopefully watched the coverts of brush and bits of meadow for sign of musk deer. Yet I was solely interested in getting a pair of the big birds, perfect specimens exemplifying spring and courtship-time plumage.

I also wanted to make a conclusive check on their breeding habits. When one looks through a book on pheasants such as William Beebe's "A Monograph of the Pheasants," the repeated representation in the plates of a cock and a hen creates the impression that all the pheasants are strictly monogamous. Closer research indeed reveals that this is true of such members of the Phasianidae as the steppe partridge and the chukars, among whom the cocks and hens dress alike—generally in quieter colors than the garish splendor of the true pheasant cocks but

nevertheless in some very handsome and elegant feather patterns. These go in pairs when breeding; but after the breeding season is over they are exceedingly gregarious and congregate in large flocks during the fall and winter.

But the evidence seems less definite with the true pheasants—the ring neck, Reeves, and other even somewhat distinctive species such as the blood pheasant. And of the eared pheasant which I was hunting there was apparently no definite information on the matter of breeding habits.

We followed the valley turn by turn ever higher into the mountains, and at each turn we hoped to find the eared pheasants—only to be disappointed. The final head of the valley could not be more than a turn or two away I thought—in fact we had entered one of the two branches into which it forked at the very end—and then suddenly the bit of meadow at the foot of the valley walls was alive with the big blue birds we were looking for. Without a split-second of hesitation or uncertainty, without a single squawk of alarm, but as though released by a single impulse, they raced for the brush and coverts of the hillside. I had been momentarily expecting to see pheasants; and yet when they started running, the queer illusion they created—that of four-footed, fox-like animals scurrying through the brush—was so strong that, as though they could only run and not fly, I raced my horse after them across the meadow.

First capture

My dash cut the distance almost in half and I was sure of an easy shot, for they would be slowed up in getting out of range as they climbed the hillside and though moving fast would be getting very little farther away in a straight line. But then my horse came out of the shadow and into a patch of sunlight where he came to a sudden stop, scrambling wildly on the treacherous film of freshly thawed mud. There was hardly time to roll clear of him and seek a target among the fast vanishing birds. Indeed, only one straggler was conceivably within range, and I let it have both barrels. I couldn't quite tell whether it had dropped or gone on, but when I finally climbed to where I had last seen it, a slate blue bird with black plumes, its red head with ironic tufts more Mephistophelian than ever, lay behind a clump of the long grass.

Finally convinced that I really wanted eared pheasants in the bag, the Tibetan tightened his girdle for climbing and we started up the mountain-side through thickets of buck thorn, scrub willow, and juniper. After ten minutes of following my guide, I decided that I neither could nor would

stand the pace, and that he would be in the way if I attempted to shoot anything. So I ordered him to heel and we climbed on, mostly worming our way on hands and knees through twisting aisles where thorny snares tripped and ripped us mercilessly. Always A-te stepped closely on my heels and gestured again and again as a vague rustling and querulous twittering came from all around us.

A difficult chase

The birds were no doubt quite close. Finally, both to rest and to get him off my heels, I set myself where several tunnels in the brush crossed and recrossed ahead of me giving a fair field of vision for that jungle; then I sent him in a wide arc, hoping he would drive some of the birds across my field of fire. I could follow his progress as he crashed his way, and realized what a terrific noise the two of us had made in our upward climb. No wonder the pheasants were twittering! But even as I pondered, the birds were on the move, crossing the tiny open spaces so fast that it didn't seem I could get a shot. I finally held the gun on one of the tunnel-like cross-roads until one of the birds crossed like a shadow—a shadow which the roar of the gun nailed at the opening. With thorns raking my hands and head, and with bits of bark and twigs down my neck, I reached and held the second specimen for my bag.

From there A-te and I quartered along the hillside, coming to an open space just in time to see the entire flock cross the practically cover-free hillside on the opposite slope of the valley head. Rock, dead leaves, and patches of snow were still in the shadow, for the sun had not yet found the spot, and on that dark background the tree boles of the red birches barred the hill with lines of vivid red that seemed like veins of fire. Behind those bars the pheasants unhurriedly crowded toward the shoulder of the hill, beyond which rose a steeper slope covered with fireweed and brush. They were too far away, so we rested and watched until the trailing plumes went over the hill; then we raced after them, intent on getting within range before they were lost in the heavier brush.

We did not find them and climbed higher and higher through tangled fireweed and scrub forest. Somewhere, if it were only at the base of the cliffs, they would come into view, and I would surely get one more for the bag. I climbed desperately on. The slope had become so steep that I was using first one hand and then the other to find hold among the dwarf junipers; and indeed I was hooked precariously on one of them when the quickening whir of wings told me the birds were flying.

Along quite a wide front, like a squadron of planes beginning to power-dive, they came over the tops of the junipers so fast that my shotgun swinging in a wide arc could barely spot one of the last to come over. They were all moving so fast downward and across that, whether hit or not, that bird seemed to travel like the rest; but though the others landed running at full speed with a rustling of the bushes and grass, he remained where he lit. I had my three birds and could go home to repair the damage to clothes and skin as best I might.

The dissecting knife showed that all three were cocks and that the mating season had not yet begun. I must still get a hen; but before I could again ride up that valley a heavy storm of snow kept everyone indoors, and it was days before the snow had melted and the ground dried enough for hunting.

Market soars

In the meantime rumors of my hunt had created an extraordinary situation in the moribund plume trade. The very day I was working on the skins, Chinese and Tibetan traders tried to sell me bundles of plumes at prices they had obtained at the peak of the feather market years before. When I refused to buy, they came down slightly in their asked price—but not much—thinking I was only trying to beat down the price. Confident that feathers were again stirring (no fantastic tale of interest in the spring phase of plumage and specimens for the Game Birds of the World Collection could command the slightest credence), some of them started for the Chinese border seeking an April Fools market, for it was the first of April.

On the sixth of April I again rode up the valley, the scene of our former hunt, intent on getting a pair or at least a hen to complete the pair needed. Everywhere spring had come with sudden force. Even in the shadow of the hill the ground was no longer frozen hard but wet with half-thawed muck, and the places upon which the sun had been at work were dry with the new grass. The red birches were as starkly red as ever, but a faint green tinge like verdant mist hung between the trunks and branches, and everywhere the faint, sweet odor of freshly sprouted plants and newly budding leaves was strong.

In contrast to the silence of the place when last I had been there, the valley rang with sound. Above the songs of thrushes and the chattering of azure magpies sounded the gong-like clamor of the eared pheasants; and remembering the painted, mask-like faces, it seemed very like the musical ha-ha of operatic laughter. In every bend and side canyon of the

valley a pair of the big birds had set up housekeeping. There were never more than two together, and with the tendency to sing and call there seemed to have come an added wildness, for I could not get anywhere near them.

From the head of the valley we worked downward along the halfway level of the hillside on foot and eventually flushed and followed a pair into a little grove of spruces in a hollow. Beyond the trees, thick brush covered most of the hillside to the next rise, and below us a little glade of birches was like a faint cloud of green veined with red where the tree trunks gleamed. The two birds must be in the brush I thought, so studied the thicket for movement. Then a shriek of wild, clanging laughter sounded so close that I knew they must be among the spruces; but try as I might, I couldn't spot them.

Rare for western eyes

To move into the spruces would be to forfeit all chance of seeing them; so I waited. Then from behind the trunk of a large tree a red head, trimmed with white ear tufts, winked into a patch of sunlight that sifted through the branches. It was so close that to have shot would have meant to destroy its use as a specimen. I cautiously shifted away, moving so that I could get sight of the bird for a body shot, aiming to catch it with the fringe of the shot pattern and so not do so much damage. But the pheasant shifted with me, keeping close behind the tree trunk, watching me with interest as it climbed upward and pausing to chuckle as its head appeared at unexpected points. It might get up to where the trunk and branches were less thick and I might get a shot. But it was too tired of playing peck-a-boo, and with a sudden whirl of wings, not one but two birds sailed from the spruce tree toward the brush patch. The spruces masked their flight, but one landed on the very edge of the bushes and ran on among the birches. What a picture it made—a magnificent blue-gray bird carrying his plumes and crimson and white trimmings with the hauteur of a grandee. Then the shot caught and held him there, and I knew he was mine, yet not mine only but a thing of beauty to belong to thousands who would otherwise never have known him.

After that the all-important thing was to get the second bird that climbed somewhat noisily upward through the thicket; then I would be sure to have a hen—better still a complete pair taken on the same date. With sweat running into my eyes and my breath coming in burning, bitter gasps, I climbed upward, slashed by thorns and finding the footing all too insecure. Somewhere ahead the pheasant

dodged and loitered. Again and again I had a half chance that was gone before I could get my feet set for a shot. At last it tired of going upward and launched itself toward the far side of the valley. It planed at terrific speed and as it passed—a side shot of unusual difficulty—I led it by more than I had ever led any bird except teal in full flight. My feet began to slip. I was falling, and yet at the report the bird came out of its dive and, banking at a sharp angle, began to climb, which I knew meant it had been struck.

It was mine. I had a pair of eared pheasants for the collection of Game Birds of the World. But there was no real exultation in my heart, only the consolation that a judicious amount of hunting is necessary if people who never leave civilization are ever to see and enjoy the beauty of these creatures of the wilderness.

The dissecting scapel showed a pair at mating time. Sometime during the stormy days around the first of April, when winter had brought the last snows to signalize his going, and spring had come back with sudden power to clear the way for the

sprouting grasses and to draw a mantle of green over the stark red framework of the birches—sometime in those days courtship broke up the gregarious winter flock of eared pheasants, and in pairs, with gong-like exultant laughter, the birds scattered to every bend and side canyon of the valley to set up housekeeping. It is interesting to note that by all obtainable evidence this species of eared pheasant is monogamous in habit.

Freed from the danger of extinction that threatened but a few years ago, because now neither Chinese mandarin nor fine lady of Paris demands the fine hair-like plumes they trail through the brushwood and grasses, they can go on multiplying pair by pair in every valley throughout the region of the Stone Box. And since a good pair has been secured to bring a glimpse of the wild life of the Tibetan borderland to lovers of wild life and beauty in far-off America, even the white man will no longer disturb their peace or bring the roar of gunfire to drown their wild, sardonic laughter, as with rampant ear tufts they race through the thickets and plane from hiding places to feeding grounds and back.



RECORD MOOSE ANTLERS

PRESIDENT F. TRUBEE DAVIDSON of the American Museum of Natural History and MR. WILTON LLOYD-SMITH with the largest and the most magnificent set of Alaskan moose antlers in any collection in the world. The antlers were presented to the Museum by Mr. Lloyd-Smith with other specimens for the Hall of North American Mammals now under construction.

BREAKING all previous world records for sheer size, the 60-pound antlers shown above, recently brought back to the American Museum by the Wilton Lloyd-Smith Alaskan Expedition, have a truly magnificent spread of 6 feet 5½ inches across the broad sweep of their spreading palms. They are declared by experts not only the largest but the finest on record.

As Dr. James L. Clark, head of the Museum's Department of Arts and Preparations, has pointed out, they are taken from a perfectly normal Alaskan moose and exhibit all the characteristics expected in a fine moose horn, plus record size. The antlers are in no way a freak. They have especially wide and heavy palms which carry the weight through to all the points. The total weight is 60 pounds. The right palm measures 20 inches across, and

the left 15. The points are long and graceful around the entire edge, and are particularly well defined at the extreme upper ends where most moose antlers have merely a ripple of knobs. In general appearance the horns have a curving basket effect which gives the head a flowing grace.

Back of the discovery of these antlers lies a fresh instance of one of the oldest and most dramatic stories of the natural law of the wilderness—mortal combat for the leadership of the herd. The antlers were found on the scarred and battered carcass of a moose by Alaskan guides in the Kaslof River in October. There had been a battle between this old bull and a stronger and younger rival in which the veteran had met the inexorable defeat which Nature ever imposes as the penalty of age. According to the guides the

head, neck and shoulders showed deep wounds, obviously inflicted by the antler prongs of the triumphant rival. Evidently the defeated warrior, mortally wounded, had tried to make his way across the river when he sank into the water and died. The body had been in the water about a week or ten days before it was found.

The personnel of the expedition consisted of Mr. Wilton Lloyd-Smith, his thirteen-year-old daughter, Miss Virginia Lloyd-Smith, who between them collected six moose, three bears and thirteen caribou for North American mammals groups; and Mr. Robert H. Rockwell and G. Fredrick Mason, both from the Museum, who preserved the skins, made anatomical studies, drew background sketches and collected accessories such as moss, tree and shrubs for the groups.

deed, Goethe himself had made extensive studies on one of them, the Kammerberg near Eger. But the Bohemian volcanoes had apparently never produced obsidian, and the idea that the moldavites might have had such an origin did not make sense to those living in the region. Mineralogists classified them as obsidian, but occasional skeptics remained to doubt this explanation. With good arguments to refute it, one Professor Makowsky of Brünn (Brno) finally broke openly with tradition and disputed that the moldavites were works of nature at all. Not only, he pointed out, was it extremely unlikely that the Bohemian volcanoes produced obsidian, but it was quite unexplainable why they should have produced only small pieces and scattered them over so large a territory, with concentrations far away from extinct volcanoes. Therefore, he concluded, moldavites are the product of man. Bohemia had for long been famous for its glass; the moldavites were but waste matter of an old and forgotten industry.

There were plenty of weak spots in Makowsky's theory, but the volcanic theory had even more. Thus his was accepted as the true explanation of the moldavites, and mineralogical samples in collections and books were quickly dropped. They did not belong to natural history but to history. But also, the historians did not know what to do with them. No other traces of this forgotten industry could be found: no documents, no tradition, not even a legend, no remains of buildings or of finished products—only this "waste" that was good enough in quality and sufficient in quantity to be the foundation of a whole branch of the jeweler's trade.

Hollow spheres

When the mineralogists threw away samples, one thing that influenced them was an actual difference between obsidian and moldavites. The latter completely lacked the many microscopic "needles" invariably encountered in obsidian. Chemical composition was much alike, but not exactly the same. The whole thing was puzzling enough, but Charles Darwin made it more so. When he returned from his world trip on the *Beagle* he brought with him a curiously shaped piece of what he believed to be volcanic obsidian. It had been found in Australia, several hundred miles from the nearest signs of volcanism. As long as it remained a single piece one might overlook it. But then came the 12th of February, 1851 and the discovery of gold on the Australian continent. There followed much digging and washing, which produced more gold and more "obsidian," shaped often like mushrooms or buttons, or even hollow spheres only a fraction of an inch in thickness

but as large as an apple. There could not be a forgotten glass industry on Australia, yet it was the same type of glass. And soon after, Dutch traders brought "*Glaskogels*" from the island of Billiton, between Borneo and Sumatra.

It is rather mysterious how the glass spheres, after having been formed during the fall, could manage to arrive unshattered, as they did. The most sensible explanation seems to be that the glass, heated by atmospheric friction, was simply too soft to shatter. It must also be remembered that those that did not break are exceptions rather than the rule and the percentage of survivors is certainly small.

The puzzle was finally solved and Bohemia deprived of her mythical glass makers by Professor Franz E. Suess, who in 1898 published a treatise* proving that all these pieces were natural glass but not fused in the bowels of some terrestrial volcano. They were glass meteorites, resembling obsidian in composition but with a higher percentage of iron and magnesium. All of them, no matter where found on earth, are much alike. They now bear the name of Tektites†.

The story of man-made glass shows several quite distinctive periods. At first glass was used much as precious stones are. Then it acquired a position comparable to that of porcelain. Its transparency, while valued for aesthetic reasons, was largely incidental. Slowly the transparency gained importance as glass began to replace the older materials that had served to admit daylight to human habitations without admitting the cold of winter. Windows were previously covered with mica or with oiled membranes of animal origin. With this new use for glass, a special art developed. A piece of colored glass through which the sun shone was more impressive by far than the same color painted upon an opaque surface. Artists soon realized the possibilities, and stained glass windows quickly became the only appropriate kind for churches and monasteries.

But the transparency of glass, of which so little advantage had been taken for so long a time, suddenly acquired a tremendous importance when the science of optics came into being.

Spectacle lenses were invented in Italy, probably in Florence, during the last quarter of the thirteenth century. By the end of the fourteenth century lens grinding and spectacle making had become a large industry, centered in various places in Italy and in the Netherlands. It is true that the science of optics existed before that time. But, although Nero is said to have possessed a monocle (of unknown optical powers, if any), and although Pliny knew that a

*Franz E. Suess: "Ueber den kosmischen Ursprung der Moldavite," Vienna 1898.

†From "*Tektos*" (Greek)—melted.

hollow glass globe filled with water can concentrate the sun's rays so as to ignite pieces of cloth, optical knowledge dealt chiefly with mirrors. Glass lenses opened up a new and fruitful field.

A boon to science

Practically all of the early spectacle lenses were made to correct farsightedness, from which most elderly persons suffer. Lenses to correct nearsightedness came centuries later, say a few decades prior to 1600. It was then that several opticians in Middelburg, the Netherlands, working about the same time, invented the telescope. In fact, it is doubtful to this day whether Jan Lippershey, Jaakob Adriansz Metius, or Zacharias Janszen was the first. Probably it was Lippershey, who applied for his patent in 1608; but the claims of Janszen, whose father (Hans Janszen) invented the microscope, are well founded too. These two instruments, telescope and microscope, were followed about two centuries later by two other inventions, also based on glass lenses. They were photography, invented mainly by Niépce and by Daguerre (and later improved by use of glass plates), and spectroscopy, discovered by Newton and developed by Fraunhofer, Kirchhoff and Bunsen.

These four instruments, and a host of others that are adaptations and modifications of them, not only shaped our scientific conceptions, they made our civilization largely what it is. It has been said that the difference between America 1939 A. D. and Greece 1939 B. C. rests on the better knowledge of metals and their alloys. But without the knowledge of glass and of optics there would be little knowledge of metals and alloys.

The optical applications of glass, crude as they were in the beginning, demanded a high-grade product. Glass used for lenses not only had to be comparatively free of bubbles and color tinges, it also had to be homogenous so as not to distort the image. Unfortunately even the best glass and the most carefully shaped lenses produced some distortion, and the image was always surrounded by a colorful but annoying display of miniature rainbows. At first, when magnification caused by a tube with a few lenses was an unheard of marvel, nobody cared much; but later, when the use of lenses was taken for granted, opticians felt compelled to eliminate this chromatic aberration. The curvature of their lenses was not perfect, a fact they more sensed than knew, but it was not the curvature that caused the rainbow fringe. It was the fact that an ordinary lens bends the blue end of the spectrum more than the red end, making the focal points for the various colors different.

The glass used at that time was crown glass, a fairly soft glass with neither much refractive power nor a very high degree of color dispersion. The second important type of glass, flint glass, was made for the first time in England around the year 1675. Chemically it differs from crown glass mainly in containing a large quantity of lead (sometimes up to 70 per cent of its weight). Optically it differs in having a much higher refractive index and also a higher index of color dispersion. Both these factors make it look very brilliant so that it is used extensively for cut-glass ware. The lead makes it much heavier than crown glass, and it is also more brittle. But the main point was that its different optical qualities enabled the lens makers to eliminate the rainbow fringe. Using a lens of this glass—one thinner at the middle than at the edges—in combination with one of crown glass thicker at the middle than at the edges, the undesirable effects were cancelled out. This invention of *achromatic* ("without color") lenses was essential for the development of precise photography. Eyes could get used to color fringes and overlook them to a certain extent, photographic plates could not.

While the part of the history of glass that fell between the years 1600 and 1900 was significant mainly for its optical discoveries, a new trend began to appear shortly before the beginning of the twentieth century. The substance that had originally been regarded as a jewel, that had afterwards made itself useful in place of porcelain, and that finally brought about a new science (or several sciences for that matter, if you choose to include X-ray tubes, radio tubes, thermometers and electric light bulbs), began to be turned into a building material.

In 1891 Siemens in Dresden began to manufacture spun glass on a commercial scale. Any glass blower since ancient times knew that glass could be drawn into very thin fibres that could be bent without breaking and within certain limitation could be handled like any other fiber. A French glass expert, J. de Brunfaut, began to pay attention to this feature of glass in 1850 and tried to work out a method of commercial manufacture and use. He was not successful, however, and another attempt made by Newton in England in 1855 failed also to bear fruit. But when spun glass finally came, it came to stay. It is an excellent material for purposes of heat insulation, used either as filling for insulation jackets or in the more convenient form of glass-wool blankets.

As soon as commercial methods of spinning glass were devised, other uses suggested themselves. Commercial glass fibers range in diameter from 0.00015 to 0.0003 inches. At that small diameter they have a tensile strength surpassing that of steel wires of the

same thickness. The fine fibers are threaded like any other fibers. There is glass filter cloth on the market, glass cotton, glass yarn, and glass fabric. For exhibition purposes a complete bride's dress—gown, veil, headdress and bridal bouquet—was made a few years ago. Needless to say, the slippers were also made of glass; so Cinderella's glass slipper is a commercial article nowadays.* Recently awnings were made of woven glass, but the endurance tests in open air are not yet completed.

Glass "rock"

In 1897 L. A. Garchey was granted a patent for manufacturing building bricks from glass waste. The waste was heated not quite to the point where glass becomes a syrupy liquid and the bricks were formed under pressure. They looked like marble, granite and porphyry. Transparent glass bricks were then considered unsalable but have since come to use.

When people think they can recognize glass on sight, they are mistaken. The Pittsburgh Plate Glass Company, for example, manufactures two types of glass commonly believed to be "artificial stone." They are black glass, used for table tops in many restaurants, and white Carrara glass, which forms the top of most of the lunch and soda fountain counters. It is also used extensively for switchboards, and for covering walls in staircases, laboratories, and operating rooms—in short, any place where marble is applicable. But while marble or any kind of natural stone is porous and, therefore, tends to soil and to retain odors, glass is the ultimate in spotless cleanliness. Being without pores, no dirt can ever penetrate the surface.

There are many more fascinating stories from the history of glass. Safety glass, so important for windows in all kinds of vehicles, is said to have been discovered accidentally in 1904 when a French chemist dislodged a bottle from its shelf in his laboratory. The bottle crashed to the floor and shattered but still retained its shape. There had been collodion solution in this bottle. The solvent had evaporated in the meantime, and a skin of cellulose nitrate had formed in the bottle, so that the splinters were held together. Laminated safety glass exactly follows this principle: a layer of transparent, unbreakable material is sandwiched between two sheets of glass. This safety glass took the place which the old type with imbedded wire screening had never really filled.

Glass that does not cascade down in splinters when smashed would have surprised people 40 years ago, just as would glass that does not break when

rinsed with cold water just after having been used to boil fat. The latter was developed by the Jena Glass Works years before the World War, after appropriating large amounts of money for pure research in glass. When the war interrupted importation of chemical glassware from Germany, American chemists set out to find a substitute of Jena Glass. That they were successful is testified by the popularity of their product, which goes under the trade name of Pyrex. It is a so-called boro-silicate glass, rich in boron, and has an expansion factor of only one-third of that of ordinary glass.

There exists another material that surpasses even Pyrex. It can literally be thrown into ice water when heated red-hot without cracking. It is fused quartz. To produce it is in itself not very difficult but requires incredible heat. Fused quartz, which also has remarkable optical qualities (bent rods of it can literally transmit light around corners), is also used extensively in chemical laboratories but, due to its high price, only for work where Pyrex will not suit.

One of the latest tricks is Polaroid Glass, which can be used in automobile windshields or spectacles to eliminate glare, and for many other purposes. However, it is not the glass itself that works the miracle of polarization. Polarization means that only certain radiations are permitted to pass through. Perhaps the easiest way to understand this is to imagine that unpolarized light is like a round rod, which, by passing through a polarizing material is sliced into thin sheets. One might say then that only vertical vibrations pass through, the horizontal vibrations being absorbed. The chemical compound that is used for this is iodo-quinine, of which crystals are sandwiched between two layers of transparent material, either celluloid or glass. Of course, there is no reason not to put another layer on that sandwich to make it also shatter-proof.

After a survey of the achievements of the glass industry and a little guessing on future possibilities, one is tempted to accuse the glass chemist of aiming at "dictatorship." He and his products try to dominate every branch of human activity and every phase of human life. Houses built of glass bricks, windows, mirrors, instruments, drinking vessels, cooking utensils, floor mats, awnings, shoes and dresses, even furniture and wall coverings—everything is made of glass except those things that require metals for purely metallic properties. Eugène Houtart was right to a greater extent than he may have imagined. Only he should not have said "Steel and Glass"—he did not know about the possibilities of aluminum and magnesium alloys. But "Metal and Glass" truly dominate and characterize the twentieth century.

*It might be remarked that the original Cinderella did not wear glass slippers. The French term *pantoufle de verre*, correctly translated as "glass slipper," is corrupted from *pantoufle de cuir* which sounds the same but has the meaning "ermine slippers."



"The man who came back"



His first contact with the Museum didn't "take" but after sketching the seamier side of war and crime, W. H. Southwick dedicated his talent to Science *plus* the mere 24 hobbies needed to keep him amused

At the age of three W. Hamersley Southwick had a red dress, a cigar box, and a yearning for beetles. The red dress was his mother's idea but the cigar box was his own notion of the proper treasure chest for the rising young beetle collector. Few young men destined to engage in scientific work at the American Museum could have made so auspicious a beginning. And it was a remarkable start in more ways than one. For this early collecting expedition found its specimens on the present site of the Gramercy Park Hotel.

Collectomania

It would have made no difference whether the hotel was there or not. W. Hamersley, we are assured, would have been collecting something no matter where he was. Both heredity and environment appear to have had a hand in building this trait, since the Southwicks were a collecting family of great scope and vigor. Southwick senior used to drive a buggy around the outskirts of New York looking for farmhouses. Not just any farmhouses. They had to be more than a hundred years old. These he could spot with an expert's eye from incredible distances. Whenever he saw one, he would ride up and commence haggling with the owner over old locks, door knobs, keys, mantel pieces, and almost any of the household paraphernalia which the occupant seemed at all willing to relinquish. Meanwhile, one of W. Hamersley's uncles was amassing a prodigious collection of firearms which has long since been taken over by historical museums. Another

uncle's activity was, however, the one closest to the boy's heart. He was the celebrated Dr. E. B. Southwick, an outstanding New York entomologist whose collection later formed the foundation of the American Museum's Department of Insects over which Doctor Southwick was promptly made the first curator.

It was in his office that young Southwick spent nearly every afternoon during his early teens. He had by this time developed an artistic talent which was attracting some notice and which, together with his instinct for collecting and his entomological uncle's connections, seemed to augur for an early apprenticeship to museum work. But like many vaccinations, his first contact with the Museum did not take. There was a life to be led. And although he was happily unaware of it at the time, this life was to take him among those estranged from society and across a dark and bloody ground before he once more came in touch with museum work.

No academician he

Young Southwick attended the college of St. Francis Xavier where he did *not* study art. Even today Southwick does not regret this omission. He holds no brief for formal art school training, believing that anyone with a true gift will develop best by himself. "Of course," he says, "it takes all the time you can spare and plenty of painstaking effort, but in the end you'll have a much better opportunity of coming out with something distinctive and original. After all, to stand the best chance of success an artist should always

try to do what nobody else is doing."

That Mr. Southwick by practicing this preachment eventually became one of New York City's most sought-after free-lance artists may or may not prove his case. At any rate returning to the artist as a young man, we find that Southwick's insect investigations had drawn him momentarily away from art and into the orbit of science. Much of his future was spent in the attempt to strike a nicely adjusted balance between these two fields, but at the moment science seemed uppermost. Young Southwick yearned to become a Doctor of Medicine.

Newshawk

But he had not counted on the influence of his relatives, of which there seems to be a surprising amount in his youthful career. The medical notion was dashed one evening at the dinner table by a cousin who was then connected with the famous old Pulitzer newspaper *The New York World*. The cousin painted a glowing picture of the gay independence of the journalist's life, and before Southwick quite knew what had happened he was working for Mr. Pulitzer at the munificent wage of \$8.00 per week.

The winds had shifted suddenly. Here was a new and unprecedented phase of the Southwick career. As a cub reporter the young man knocked about the police courts in search of stories of crime. At first he brought back the dreary notices of smaller violations, but eventually, as his insight and reportorial skill developed, he began covering murder trials of headline stature. Whether the assign-

ment took him among the pitiable small fry or to the so-called "master criminals" his sketching pencil was always with him. One day at the trial of some comparatively unimportant malfactor, Southwick sketched the man and handed in the drawing with his copy. His editors not only ran the sketch, but gave prominence to the accompanying story and asked for more.

Thus the New York City Criminal Courts, a sinister world of sudden lights and shadows, of warped minds and faces, like the ones that so fascinated Daumier in the Paris of his time, now found expression on Southwick's ubiquitous drawing pad. He covered every range and stratum in the broad province of prosecution—lawyers, judges, big and little crooks, Southwick knew them all. While he was picturing this tortuous world, he was a witness at eleven electrocutions. These and other emotional shocks inseparable from his chosen way of life might have soured a less irrepressibly extroverted young man than Mr. Southwick. But he found relaxation in producing a daily comic strip for *The World* which dealt with the Svengaliesque machinations of Gumbo the Hypnotist.

Nevertheless, the depressive strain of daily rubbing elbows with the socially maladjusted for ten years, began to tell on him. Perhaps he never allowed himself to think about it. Again, the realization of it may never have crossed the conscious part of his mind. Whatever the hidden motivation, Southwick closed his desk at *The World* one night in 1917, boarded his usual El train and seated himself with a copy of a paper that had just come off the presses. But Southwick did not go home for supper. He stepped off the train at one of the stations and transferred to the Downtown side.

When the next day dawned, W. Hamersley Southwick had signed himself away body and soul to the Presbyterian Hospital's Medical Unit of the American Expeditionary Force. He chose this division of war-time service partly because his early medical interest had been kept alive during his newspaper work by anatomical collections made in off-hours and partly because this was the first division of men leaving these shores for France. Three days later, he was out at sea without a uniform. But the uniform arrived in due course and for the second time in Mr. Southwick's

career the winds of his destiny had suddenly shifted.

The Presbyterian Unit consisted of professional men, mostly doctors and writers; but if Mr. Southwick had hoped that this apparently non-military organization would offer surcease from life's seamier side, he was in for a rather harrowing disappointment.



Everything started off calmly when the outfit was sent to a town called Etretat to relieve the British Medical Base. This encampment was not bounded by the mud walls of a trench or the canvas of a field tent. It was housed, piquantly enough, in the swank hotels and beach houses of a commandeered riviera watering place that, prior to the fell days of 1914, had rivalled Monte Carlo for the continent's aristocratic gambling trade. But here was no tinsel back-drop for an Oppenheim intrigue of archdukes, languid lady spies and missing pearls. True, it was not within gunshot of no-man's-land. Yet even though he was breathing tangy ocean breezes instead of burnt powder, Southwick saw the stomach-tossing results of those distant explosions as he gazed on the concentrated procession of—that magnificent understatement—casualties. Here the wounded came in streams and the former court room artist came into hourly contact with every conceivable type of torn flesh and shattered bone.

The Etretat hospital, however, figured conspicuously in other phases of

the allied medical program. Within the unit was a training post for field surgeons, staffed by many eminent doctors. It seemed that through lack of proper examination, many medical men had been placed in dressing stations at the front who were not qualified to be there. Part of the training post's task was to go into the field

and round up the least competent army doctors who, harassed by poor equipment and over-flowing ambulances, were, in the opinion of their superiors, often resorting to drastic measures which could have been avoided. Mr. Southwick believes that their haste rather than German shrapnel is responsible for many a legless veteran of that particular foreign war.

To safeguard against such practices, the surgeon's training post conducted an expansive program to teach incoming medical volunteers the proper field technique of diagnosis and treatment. To do this, all branches of pictorial art had to be called into action. Now all this time, many of his companions had been diverted by Mr. Southwick's casual sketches of hospital life—pretty nurses walking the spray-drenched parapet by the sea, wounded on their stretchers and convalescents in the garden. He was, of course, drafted as medical illustrator and for the first time in his life, Mr. Southwick's artistic gifts were being utilized in the field of scientific education. Myriad case his-

tories were recorded either by Mr. Southwick's pencil or his camera. With the latter he took over 25,000 clinical exposures, recording all stages in various reparative operations. Everything from routine autopsies to the most fantastic "miracle wounds"—wounds from which no doctor would have given the soldier any chance of recovery—became Mr. Southwick's order of the day.

After the Armistice, the doctors decided that these grisly records should be preserved. As assembled minutiae of the collective physical trauma of war, they might have given off a by-product of invincible pacifist propaganda. But it was not this aim that concerned the doctors. They wished to salvage whatever objective data might be useful to medical science in the event it should ever again face problems arising from dosing wholesale numbers of the human species with trinitrotoluene and other specifics of streamlined warfare. So for the last eighteen years Mr. Southwick has devoted whatever time he can afford to the compilation of this tremendous document of the Etretat Association's case records.*

Mr. Southwick's peculiarly resilient sensibilities, toughened as they had been in the Criminal Court, were not deterred by these horrors from pro-

bit-like grimaces to amuse the soldier audiences at his amateur theatricals. Eventually his reportorial staff grew to six men who had their private quarters in one of the beach houses. Printing was done by legless French veterans in the neighboring town of Fecamp, site of a famous Benedictine industry. Bi-lingual difficulties cropped up, of course, producing unimaginable tortures for the unhappy proofreader whose chore it was to iron out the peculiar Gallic twists given the American vernacular by these earnest French type-setters.

The first American army newspaper of any kind, *Doin's* was a weekly with a guaranteed circulation of over 50,000. Copies were sent to President Wilson and his cabinet members and the *New York Evening Sun* carried the entire paper in reprint every week of the war. Such useful diversions brought "Bunny" Southwick a merited fame as well as easing the nerve-wrack of the grisly details of hospital work. Among the latter, the one he is least likely to forget was the S. I. Division. These cryptic initials should give pause to anyone accustomed to weigh lightly the consequences of life in the trenches. They stood for a division of medical justice appointed to pass upon men accused of self-inflicted wounds. In his

mind that Mr. Southwick sailed for home following the Armistice. He had had his fill of horror and he sought a sanctuary wherein he could turn his talents to scientific uses of a happier nature. He was not quite sure where such a sanctuary could be found until one day he chanced to stroll past the American Museum. The sight of this institution at once recalled pleasant memories of his "insectivorous" childhood.

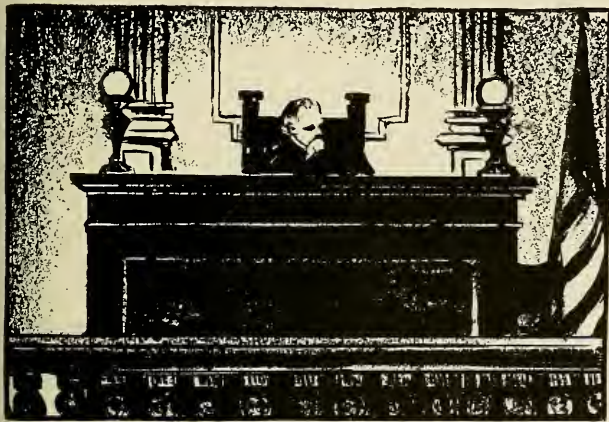
Ever in the thick of things wherever his multifarious activities had taken him, Mr. Southwick had developed a wide circle of acquaintances, both at home and abroad. Surely there must be someone he knew in the Museum. Even if there weren't, he felt certain they would remember his uncle. But on entering, he found, as he suspected he would, an old friend to whom he explained that he was weary of a life spent so largely amid the stark results of violence, both in the war hospitals and the criminal courts, and that his greatest desire was an opportunity to ply his art in a place removed from the gorier aspects of twentieth century civilization.

"Why don't you come here to work?" his friend asked him.

Mr. Southwick shrugged. "What do I know about natural history?" he returned, "all I ever did was collect beetles in Gramercy Park."

"Well," said the friend, "with your medical background you should have little difficulty getting the hang of biological work, and as a matter of fact, Doctor Miner is looking for a man like you. Why don't you go up and see him?"

Within the week, Dr. Roy Waldo Miner, Curator then as now of the expanding Department of Living Invertebrates, had established the former journalist, soldier and medical assistant in one of the key positions in his flourishing art department—a department comprising an astonishing array of specialized gifts whose personnel Doctor Miner has spent years in selecting. The celebrated Rotifer Group containing the miraculous blown-glass creations of Hermann Mueller offered so knotty a problem in zoological interpretation that it occupied nearly all of Mr. Southwick's first five years at the Museum. His duties required him to affix the most delicate nuances of coloring, always with rigid accuracy, to Mueller's enlarged models of these microscopic creatures. Such a task continued



moting plays, making movies and finally launching an Army newspaper called *Doin's*. Needless to say this paper was edited and largely written and illustrated by "Bunny" Southwick, the sobriquet "Bunny" having been acquired through the use of rab-

connection with this department, Southwick was continually brought face to face with men so desperate to be relieved from duty that they had shot holes through their own hands, feet, or any other member where the bullet would not prove utterly fatal.

But it was with intent to dismiss these associations forever from his

*Publication of this extraordinary volume has been understandably delayed pending the acquisition of the \$25,000 minimum fund required to print it.

the scientific discipline imposed upon Mr. Southwick's talent by the demands of his medical work. And as he proceeded from one of Doctor Miner's assignments to another, the absolute insistence upon fidelity to the original brought to its maximum acuity an already finely pointed skill. So great became Doctor Miner's confidence in this skill that he entrusted Mr. Southwick with much of the more important coloring work in his exhibits of ocean life. Great clumps of coral were transformed into seemingly living organisms under Mr. Southwick's slender brush, and schools of wondrous tropical fish were created to swim forever in the glass-walled "sea" of the famous Coral Reef Group in the Hall of Ocean Life.

Haven

This world which Mr. Southwick was reproducing in his new-found cloistered atmosphere was one of soft coloring and undulating form, whose fragile delicacy stood sharply at variance with both Flanders' smoldering fields and the monolithic tribunals of criminal justice. Here was work for the betterment of growing minds. The exalted process of educative science was being put forward in no small measure by his efforts. But not satisfied with this alone, Mr. Southwick was devoting an occasional evening to his medical interests, making himself useful to the science of healing by certain confidential photographic and coloring experiments which he is still conducting under the direction of a number of leading physicians.

However, as the reader must have learned by this time, there could be no serious side to Mr. Southwick's career without its counterbalance in the recreative field. He felt that a nine to five job left too many good hours going to waste. So he directed his ever abundant energy and spritely imagination to turning the delicate creatures of the natural world into possibly even more delicate *objets d'art*. In his avocation, too, we find the maturing of a fine talent. Shedding its heartier overtones, it had sharpened its focus to gain a truly remarkable feeling for the gossamer. On a wood pulp base he invented his own plastic material, reducing it from seven to three ingredients in the

course of patient experiment. With this special mixture, he began to mold lovely designs on large plaques, which soon became the delight of many of the city's busiest interior decorators. Against a dark background, the white raised traceries of his feathery underwater scenes produce magically beautiful effects. And such designs as tiny sea horses entangled in fairy-like filaments of seaweed have found their way into the ornate bathrooms of a number of New York's more illustrious families. Then there are the simpler, brightly colored groups intended as molding borders for privileged nurseries. These have had an amazing popularity. Parents take delight in reading to their children at bedtime and then directing their gaze to the border of the room where little Red Riding Hood endlessly picks her way to Grandmother's with the lean Wolf close behind.

Another of Mr. Southwick's extracurricular feats consists of gorgeously colored stippling work on tiles. And it is a feat not only for the artistic effect but for volume of production as well. A one-man factory, Mr. Southwick has turned out close to 18,000 intricately wrought individual tiles during spare time that concomitantly staggers under no less than 23 additional hobbies. It is no surprise, then, that Mr. Southwick wouldn't think of going to bed before 2 a. m.

The paint used on these tiles is made up to his exclusive order in Paris, tinted on the glazed surface by himself, and then baked in an electrical oven. These creations find uses varying from table supports for hot tea pots to panning material for an entire room. Like the plaques, the predominant theme of their emblazonry is undersea pictures. Attractive coffee tables can be constructed from six to eight of these marvelously executed tiles, and his agents declare that he has an insatiable customer list of over 3,000.

Hobby-workhorse

On top of all this, Mr. Southwick collects firearms, minerals, shells, autographs, stamps, and is now working on a special phosphorescent and fluorescent treatment for lampshade parchment. From this he hopes to develop a new medium, the idea being

that although the colored decorations would seem merely ordinary by day, the lampshades would glow with the loveliest of iridescent colors when the light was switched on in the evening.

Apart from this wholly individual work, Mr. Southwick has won international repute for his illustrations of books. He broke into this field by making the color plates for Thornton Burgess' Seashore Book. This led to collaboration on other books of natural history, perhaps the most voluminous of which he is illustrating at the time of this writing. But without doubt, the biggest job of all from every standpoint was the monumental seven-year work on the all-inclusive drawings accompanying the text of the New Webster's Dictionary. There being over 6,000 of these (plus two full-color pages of insects and fishes), dealing with every category of human thought, they are a tribute not only to the flexibility of his sketching pencil, but to the tremendous spread of his knowledge and experience. It is the work of a Leonardo in miniature.

Building for the future

Yet not all of Mr. Southwick's spare time is devoted to the expression of artistic and scientific inclinations. He is at the moment very enthusiastic over a project to guide victims of Infantile Paralysis and similar shut-ins into the collecting field. The program encourages each of the afflicted youngsters to build his own little museum, for which the collections would be made at his direction by friends and relatives. Mr. Southwick believes that this will not only increase the number of nature lovers but that embryo scientists will acquire from this hobby the training needed to nurture them to maturity. Who knows, he asks smiling, but that the eager bedridden child engaged in identifying the creatures brought in by his sister will not grow up some day to be a world famous authority?

Thus the little boy who once gathered beetles in Gramercy Park is passing on his unquenchable love of collecting to another generation, in hopes that from the many will come those few who will take up the burden of broadening the future horizons of Natural History.

D. R. BARTON.

LETTERS

SIRS:

May I express to you my enthusiastic appreciation of the September and October issues of *NATURAL HISTORY*. The caliber of the articles seems to be exceptionally high and the illustrations are superb. It is delightful to find information of real scientific value and accuracy in such a magazine which has, occasionally, a tendency to be a little popular. It can be read with enjoyment and advantage by the near scientist like myself and the intelligent laymen.

DOROTHY M. BLONDELL,
Chairman of Biology.

Curtis High School,
St. George, Staten Island, N. Y.

SIRS:

The rock pictures enclosed are from the western mountains of Wyoming, where for untold centuries the Indians and their predecessors have hunted and fished in the headwaters of Wind River. These pictures are among the more unusual and more interesting evidences of prehistoric human life in this region. The figures are somewhat obscured by thick growth of lichens and by deterioration and chipping of the rocks, indicating that they are by no means recent.

They represent for the most part human figures fantastically dressed and varying in height from eight or ten inches to two and a half feet. Those illustrated are from Torrey Creek; others, less distinct but more numerous, are found on Dinwiddie Creek.

The present-day Shoshones know nothing of the origin of these crude but imaginative pictures. But they have a legend, which has been handed down from father to son for many generations. The story



goes that it sometimes happened that one of their braves was lost or delayed while alone in the mountains. In the evening he would lie down in the shelter of a large rock and during the night he would half dream, half know, of the presence of a watching spirit. At sunrise he would find the rock inscribed with one of the figures. Glad in the protection of this guardian spirit, the brave would go his way.

Whence in reality these figures came is unfortunately another matter. Are they the relics of some prehistoric religious concept or ceremony? That is a good possibility. But the true story of the strange pictures of the Wind River country still remains to be unfolded.

JOHN UNDERWOOD.

Dubois, Wyoming.

SIRS:

In line with your recent article "How Snakes Are Born" by Carl F. Kauffeld you may be interested in the enclosed photograph of a brood of home-hatched snakes. The nest of eggs was discovered by Hyrle A. Ivy, swimming instructor in the North Side High School, Fort Wayne, Indiana, deep in the sawdust of an ice house while he was spending his vacation at Big Turkey Lake, a few miles north of Fort Wayne. With the discovery of the eggs and the determination to try and hatch them, Mr. Ivy found himself engrossed in an odd hobby.

The eggs were found in the latter part of August, and Mr. Ivy brought them home in a bucket, sawdust and all. About September 1st they started hatching.

There were 23 eggs in all and everyone of them hatched. One of the snakes was dissected by Ivy and one by Howard Michaud, biology teacher in the High School, so the picture shows only 21.

As seen in the picture they are eight to ten inches in length and are black with white stripes.* It is said that these snakes hatched in the home are the strangest bunch of incubator babies ever heard of in this community.

D. DELBERT BRUDI.

331 Edgewood Avenue,
Fort Wayne, Indiana.

*The locality and pattern point to the identity of the species as the Black Chicken Snake, *Elaphe obsoleta obsoleta*.



YOUR NEW BOOKS

FORESTRY: SAGA AND REGIONAL • WILDFOWLING WITH A
CAMERA • HAITI, A PANORAMA • THIS IS LIVING • THE
EARTH'S ARCHITECTURE • FISHING MEMORIES • REPTILES

SAGAS OF THE EVERGREENS

----- by Frank H. Lamb

W. W. Norton & Company, \$3.50

THIS handsome book is a treasure house of information and beauty. The story of the evergreens has been lovingly narrated by a man who journeyed among the Redwoods with John Muir, who traveled to far corners of the earth in search of tree lore, and of whom it has been said that wherever he goes, "there is always a tree at the end of the trail."

Humor, scientific knowledge, and the ability to tell a story, and tell it well, have all gone into the writing of this poetic narrative.

The story certainly is a "Saga" in every sense of the word. Commencing with primitive plant forms, we travel to the Ginkgo, "a living tree fossil from past ages," and onward to ancient types of cone-bearing trees from the Southern Hemisphere. The "Sequoia Giants" rear their lofty heads above both "Plebian and Aristocratic Pines." Wherever we go, throughout the forests of the Earth, we continuously stumble upon puny man, erecting his saw mills, producing his "board feet," and increasing his enormous piles of sawdust.

The author, being a trained forester, expert lumberman, and botanist, all in one, has carried his information along in a systematic fashion. The book has a crisp unity that will recommend it alike to the general reader and to the student of forestry. *Sagas of the Evergreens* is intimate and valuable, enriched by many fine illustrations, maps and charts. It should be placed in every public library in the land and entered as, "required reading" for all who hold the conservation and sane, economic use of our forests, a vital factor in the future of America.

WILLIAM H. CARR.

WILDFOWLING WITH A CAMERA

----- by Lorene Squire

J. P. Lippincott Company, \$7.50

MISS SQUIRE does not take herself and her camera too seriously. There is no dissertation on her work and its importance, no description of her photographic equipment and method, no essay on plates, developing, etc. Nor does she claim to be an ornithologist and present us with an array of "dates of occurrence" and allied data.

Fundamentally she is inspired by an overwhelming love of out-of-doors to which wild-fowl, in their goings and comings, their habits and personalities, contribute the essence of life and its manifold appeals and mysteries. The camera is her gun and a good negative of her quarry is of infinitely greater value to her than its dead body. She apparently uses no decoys; nor does she favor blinds. Usually she goes after what she wants and no stalk is too arduous if it offers a shadow of success.

"Always," she writes, "there is the question of luck. The composition and setting of bird flight pictures must mainly depend upon chance. There must be many bad pictures to get one that is good. . . . With all the conditions right about the best shooting average is one picture out of forty. In fact, I consider this a very good score in wing shooting with the camera. If, out of forty negatives, there is one that can be made into a print that expresses something of the beauty and motion and fascinating pattern of wild duck flight I am entirely satisfied."

And, accepting literally Miss Squire's figures, she certainly has reason to be "entirely satisfied" with the selection from presumably four thousand negatives which she contributes to this volume. Many are out of focus or too greatly enlarged and may not appeal to the photographer who counts sharpness of detail as a measure of success. But seen at arm's length most of them convey an impression such as one would receive from the wild bird and many certainly show the "fascinating pattern of the wild duck in flight." There are also several scenes to which the figure of a single duck gives just the touch that makes the difference between death and life.

F. M. C.

A PURITAN IN VOODOO-LAND

----- by Edna Taft

Penn Publishing Co., Philadelphia, \$3.00

EDNA TAFT is to be congratulated on her splendid presentation of Haitian life, in her book *A Puritan in Voodoo-land*. So many books have been published on Haiti, which developed into nothing more, or less, than highly imaginative adventure.

In glancing through the first pages of Edna Taft's book your reviewer was inclined to be rather skeptical and felt—here, perhaps, was another writer who had spent a month or two in Haiti, trying

to assure the reading public that she was the first white person to have witnessed a voodoo ceremony, etc. Most writers, unfortunately, visit Haiti, meeting only the ruling class, which represent about 2% of a population of two and a half million people, and through this very limited acquaintance, they try to portray the feelings and customs of all Haitians, which is neither fair, nor accurate.

Having spent over thirteen years in Haiti, actually a living part of this strange land of remarkable contrasts, your reviewer was particularly impressed with Edna Taft's word pictures of the native dances, the music which she clearly defines—"that of Latin America, sensuous, languorous, pulsating . . . somehow peculiarly fitting to this tropical setting . . ." The splendor of tropical nights, almost too overpowering for Northern eyes, the Haitian moon with its weird magnetism. The author's style of presentation deserves the highest praise.

For informative reading to a student of Haiti, a prospective visitor, or merely a fireside adventurer, I highly recommend Edna Taft's *A Puritan in Voodoo-land*. It is outstanding in its accurate description of native life in Haiti, losing none of the adventure interest sought by readers of this type of literature.

FAUSTIN E. WIRKUS.

KEY TO THE OUT-OF-DOORS

----- by Richard J. Hurley

H. W. Wilson Company, \$2.50

TWO hundred and fifty-six pages of popular natural history bibliographies are presented by Richard J. Hurley in his *Key to the Out-of-Doors*. Various books, pamphlets, magazines, motion picture films and lantern slides are suggested for the use of teachers, museum instructors, nature students, boy and girl scouts and the general science reader. Practically all phases of natural science are included. The subject matter ranges through Astronomy, Meteorology, Geology, Botany, Zoology and General "Devices and Supplies."

This is a useful book. The publishers would do well to provide supplements from time to time and to issue a new edition at least every second year. In the main, the author should be congratulated for his inclusions rather than condemned for any sins of omissions.

WILLIAM H. CARR.

HEDGES, SCREENS AND WINDBREAKS

----- by Donald Wyman

Whittlesey House, \$2.75

BOOKS on numerous phases of gardening appear at frequent intervals these days but this one is among the pioneer aids that deal with the amateur's problems involving such questions as, what plants to plant, where to plant, and how to care for those rugged individuals which are now used in this country to outline walks, create vistas, take weird form under man's pruning, tuck about houses to take away that stern inhospitable look, or perchance are to be employed to shut out the curious gaze of the passerby.

Probably no one is more fitted to give advice on this subject than Doctor Wyman, Horticulturist of the Arnold Arboretum, who is in charge of one of the largest collections of hedge plants in America and has devoted many years to plant experimentation. He has divided the text of this book into three sections which deal with general culture under such headings as, planting, transplanting, spacing, trimming, hardiness and the size of the mature plant, suitability for various types of situations, and descriptions of the plants listed.

This very thoroughly itemized book should be of practical value to land owners and gardeners who want help in that art—hedge manipulations.

FARIDA A. WILEY.

THE REPTILES OF OHIO

----- by Roger Conant

The University Press, Notre Dame, Ind.

IT has long been surprisingly hard to get any information on the reptiles of Ohio, but now this difficulty has been remedied by Mr. Conant. All previous accounts of the reptiles of the state have been carefully searched for worthwhile information which has been smoothly combined with new discoveries to make a readable whole. The clear precise style cannot be classed as either technical or "popular," being neither annoying to the herpetologist nor distasteful to the amateur. Here one can get an up-to-date summary of the life histories of most common lizards, snakes and turtles of the Northeastern states.

CLIFFORD H. POPE.

ARCHITECTURE OF THE EARTH

----- by Reginald A. Daly

D. Appleton-Century Company, \$3.00
The Century Earth Science Series

PROF. REGINALD A. DALY of Harvard University is internationally known as a leading geologist and is one of America's greatest speculative geological thinkers. There have been many popular and semi-popular books on the nature of the earth, but rarely does the non-technically minded reader have an opportunity to read with pleasure an authoritative work genuinely giving the latest thought on a subject. When Professor Daly advances a theory, and bolsters it by both

factual and theoretical evidence as he does here, it is worth reading.

This book discusses just what its title implies. It develops a model earth, with concentric zones of different composition and a different nature, based upon what is known and what can be deduced of the interior within which we can never hope to see. Having set up this model, the author then tests it, and endeavors to explain observed geological phenomena on the basis of his own theory. Consequently we find a description of diastrophic activity, all of the internal earth forces and their effects. The author is very fair in his discussion, however, and gives the other theories as possible alternative explanations for the observed phenomena.

The book is intended for the somewhat more advanced reader who has already had a freshman course in geology or read a popular book on the subject, who is now ready to be disillusioned about how much we know and at the same time to be inspired by how much can be deduced from the comparatively few facts available and the incomplete laboratory parallels of earth conditions that can be created by the research geologist.

F. H. POUGH.

FISHING MEMORIES

----- by Dorothy Noyes Arms,
illustrated by William J. Schaldach

Macmillan, \$3.00

THE title, *Fishing Memories*, hardly does justice to a book so full of beautifully written observations on the life of northern woods and river banks. The author's memories include her first camping adventure with her husband ("J.T.") in the Maine woods. To this adventure she went costumed in a walking skirt, high buttoned boots and rubbers, and was quite unprepared for the uncertain canoe, the sandy camp food, the bed of boughs and the nocturnal cries and scamperings of wood animals. Bravely lying about her enjoyment of these features, she soon came to find that the forest is a friendly place and to feel that if she had turned back from that first trip (chiefly because of the behavior of the rubbers) she would have "missed all the widened knowledge of nature stripped to its fundamentals, which I, in common with all others who live too close to too many people in the stifling comforts of civilization, so sorely needed."

Later trips to the northern salmon and trout streams show that the author became not only an expert salmon and trout fisherman but a keen observer of the habits of river and forest life.

F. LA M.

SOUTHERN FORESTRY

----- by Charles N. Elliott and
M. D. Mobley

Turner E. Smith & Co., Atlanta, Ga., \$2.00

FORESTRY practice in our Southeastern States has advanced greatly in the past decade. Both State and Federal agencies have succeeded in establishing nu-

merous forest preserves and have accomplished much to inform southern rural populations wherein conservation methods may be observed.

The book constitutes a splendid review of forest types in the Southeast. It is a well balanced textbook, excellent for ready reference, and complete wherein the general practice of forestry methods are concerned.

Southern Forestry, may well be the means of starting more than one young man on a career of out-of-door endeavor, for it is inspiring as well as informational.

WILLIAM H. CARR.

THIS IS LIVING

----- by Donald Culross Peattie
and Gordon Aymar

Dodd, Mead Co., \$4.00

THIS is one of the newest picture books to tell its story through the currently modish medium of photograph plus caption. As an anthology of deservedly renowned camera-poems, some familiar, others less frequently reproduced, the book ranks very high. But that is not the primary aim of its compilers. The pictures were selected by Gordon Aymar noted photographer, and the textual accompaniment is by Donald Culross Peattie, probably the most widely read and certainly the most iambic of our biologists. Their idea is to catch life in the living throughout the animal and plant kingdoms and in the sky and to give the reader (looker) as close to a tactual impression as possible of that multifarious living together with a modicum of generalized information. They have been distinctly successful.

There is also a brief, cautious chapter on death. Then the book ends on a swelling of its inspirational theme, with a message. It is a guarded message, and like all such, foredoomed to be not altogether satisfying.

THE POTTERY OF SANTO DOMINGO PUEBLO

----- by Kenneth M. Chapman

Memoirs of the Laboratory of
Anthropology, Vol. I
Santa Fe, New Mexico, \$4.00

THOSE who find pleasure in design and skilled crafts will like this new publication on the pottery of Santo Domingo Pueblo, one of the several quaint Indian villages in the Santa Fe country of New Mexico. Conquered by the Spanish almost 300 years ago, Santo Domingo drew into itself, determined to resist change and during all the time since the conquest, there have been no important changes in the potter's art. These enduring designs and technique are shown here in 79 full-page color plates.

Kenneth M. Chapman, both artist and scholar and widely known for his studies of Indian art, spent 20 years pouring over the Santo Domingo pottery before venturing to prepare this excellent book.

CLARK WISLER.

PATTERNS OF WINTER

H. B. KANE, *Photo.*



Snow Pictures

By CHARLES H. COLES

Chief Photographer,
American Museum

WHEN a brilliant winter morning dawns and a gleaming blanket of snow softens the sharp edges of cornices and evergreen trees, the urge to take the camera out of hiding and record white beauty becomes strong indeed. Not until we actually take some of these pictures for the first time and examine the result of our enthusiasm do we begin to realize that there is more to snow photography than it would seem at first.

Experts in photography have worked on the problem for years and have formulated some very excellent solutions to the usual difficulties encountered in depicting the out-of-doors in its winter finery. A large number of associated problems crop up in attempting snow pictures, so each type of picture will be treated separately.

Pictorial subjects

In this type of snow picture, it is generally agreed that the texture of the snow is of primary importance in the rendering. Working with the sun almost directly in front of the camera so that the tiny snow crystals reflect the sun's rays into the lens will cause the surface of the snow to sparkle and glisten in the picture. It is necessary, of course, to prevent the sun from shining into the camera lens otherwise severe flaring will fog the picture. While a lens hood is a great help in most snow photographs, it usually is not deep enough to prevent the sun from entering the camera when the sun is low. In this case it is necessary to shield the lens with a hand or hat, taking care that the shield does not protrude into the picture area.

Because of the smoothness of freshly fallen snow, the slight undulations of the surface are very faint and difficult to record in a picture. They are necessary, however, to give interest and variety to an otherwise flat and monotonous area and are vital in photographs of animal tracks, which afford pleasure to many. Sunlight just glancing over the surface will show these undulations to the best advantage. The faint shadows that will be cast will produce soft areas of slightly lower key than the high-lighted areas.

Shadows of plants on the snow are often used to break up expanses of snow and introduce fascinating patterns. To illustrate the major difficulty in reproducing these faint shadows it is very instructive to take a color picture of a snow scene. Immediately you will observe that all the shadows that are cast upon snow have an intense blue color in the photograph. Inasmuch as most black and white films are more sensitive to blue than to any other color it is obvious that the blue shadow will affect the film about as strongly as the white snow, and so the picture will have very little difference between them. By using a light yellow filter on the camera, the shadows will be reproduced in a pleasing gray tone.

Sport pictures

In taking pictures of winter sports, speed is the essence of success. The recent advances in high speed emulsions will open new fields to conquer for the sport photographer. The sun sets so early in mid-winter that many sport events take place long after the weak winter sunlight has disappeared. This is particularly true where the northern slopes of mountains are the only ones that have snow on them.

When the sun is shining upon the subject of the picture, such as a group of skiers standing on the top of a snow-clad hill, a very delicate balance of exposure must be observed. Usually ski costumes are dark in color, producing an extreme contrast to the snow and sky. It is usually best in such cases to work with the sun at your back so that the faces of the skiers are illuminated by the sun and the costumes reflect a maximum of light. The blue of the sky will usually photograph dark enough without a filter if a panchromatic film is used. A light yellow filter will improve the rendering given by an orthochromatic film.

After the sun has set or left the subjects of your picture taking, all filters are taken off the cameras and lenses are used wide open. The pictures cannot possibly compare in beauty and brilliance to those taken

Continued on page 64

AN ENTIRELY NEW TYPE OF CAMERA



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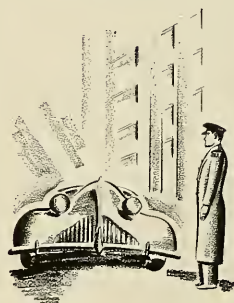
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in sunshine but can only be records of an indifferent sort. The interest of the picture rests wholly upon the subject matter.

Exposure

The extreme range of brilliancy encountered in snow subjects makes the determination of exposure a difficult task. In the case of normal subjects at a distance of 25 feet or more, it is sufficient to read the exposure required for the snow and then give the scene double that exposure. For instance, if your meter when pointed at the snow indicates an exposure of f8 at 1/100th of a second exposure, the scene should be taken at 1/50th of a second at f8. For close-ups, read the exposure required for the principal subject or the old reliable gray card.

Precautions

There are certain things to watch out for when you take your camera out into the snow with you. The first is flare and glare. The snow reflects so much light in all directions that a sun shade for the lens is almost an absolute necessity. It not only keeps unwanted light out of the lens but also unwanted snow and moisture.

The shutter speeds may also be affected considerably, especially if you have a camera equipped with a focal plane shutter. Movie cameras slow down to such an extent that sometimes normal speed cannot be maintained and slow motion is impossible. A benzine-burning pocket hand warmer kept in the camera case will keep the camera warm enough to operate properly for short periods of time.

Professional cameramen when working in very cold climates wear silk gloves inside their mittens. These gloves prevent the fingers from sticking to the cold metal parts of the camera although they do not offer much warmth. Be sure that the vapors of your breath do not condense and freeze to the finder or other lenses. The ice cannot be removed without the application of heat. Close the camera in its case tightly before bringing it into a warm room, otherwise moisture will collect on the lens and perhaps enter the mount. It is better if possible to leave the camera in a cool room for an hour or so after having had it outdoors, to allow it to warm up slowly.

THE STROLLING PLAYERS OF BALI

Continued from page 26

human hero disappears and is replaced by the Barong, and a battle ensues, a battle most frequently ending in a draw. During this climax, either the Witch or the Barong impersonators may go into trance, rush wildly at the deliciously frightened audience, or fall down, rigid or limp, only to be revived by incense and holy water. At midnight, sometimes at two in the morning, a perfect bedlam of barking all over the village announces to the sick and bedridden that the play is over.

Three-a-day

Sometimes, not one Barong but three will come in one day, crowding on each other's heels, until the children are hoarse from shouting and the heads of the village


weariness of ceremonial politeness. In this case, some of the dances may be given in broad daylight so that at least one of the clubs may push on to sleep that night in another temple. During the month after Galoengan these remote mountain villages have a taste of all the various elaborate dance forms of the more developed culture of the plains; they hear the new music, the latest witicism, the new songs. For months afterward, the village children will try to stand on their heads as the witches did in a particularly clever dance, and babies born at Galoengan will learn in the next six months to dance to the tunes which were brought into the village when they were born. The sluggish imagination of the mountain villages slowly responds to all this stimulation; here a village which has never had a Barong before decides to make one, there a group of young men form a new club to dance Ardja. A dance club, weary of its old repertoire, will begin practicing a new set of songs learned from some visiting company. For the mountain villages which are ambitious enough to plan a Barong and the accompanying dances, next Galoengan sets a date toward which they work. The new headdress, the new orchestra instruments must be finished by then; the new dance steps learned, and so the cycle starts all over again.

The living art of Bali

Much has been written about the fact that Bali has a living art, that the music,

the dance, the theater, despite their high degree of stylization, are nevertheless extremely alive, constantly being recreated in hundreds of performances all over the island. The high standard of the Balinese theater has been attributed to the influence of the old courts, with their Javanese connections. Each of these courts acted as a center which defrayed the expenses of musical instruments and costumes; the kings and their petty princelings who acted as deputy governors, vied with each other in the splendor of the artistic performances they supported. But if the courts were responsible for the standard of elegance and taste, for the selection which curbed, in some degree, the riotous exuberance of the Balinese theatrical imagination, it is to the village dance clubs, and to the Barongs under whose protective aegis they wander the country every Galoengan, that we must look for one of the explanations of why the Balinese theater is alive. The Barong has an honored place; he is treated as a god, and on entering a strange village he and his followers go, as of a right, to the temple. Thus the strolling players who carry from one part of Bali to the other new forms and old forms, newly refurbished, are given dignity and security. The performance, whether ordered by the village or by an individual, is never private; all the beggar in his rags, the tiniest, grubbiest child, enter the temple or the rich man's court to watch, to learn with their eyes, and later, perhaps, to become actors and dancers.

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Correct Answers to Questions on page 33

1. (b) An established fact. See page 7
2. (b) 2000 B.C. See page 14
3. (c) Glass meteorites. See page 52
4. (a) Glass-making. See page 14
5. (c) As "clasp stitches" to close their wounds. See page 31
6. (a) Farming. See page 8
7. (a) Its feathers were avidly sought by Paris milliners. See page 48
8. (a) Trying to make gold. See page 16
9. (c) Drops of glass that shatter when the surface is scratched. See page 15
10. (c) "Exiling" them to the Isle of Murano. See page 15
11. (a) A habit of carrying large pieces of leaf above their heads. See page 28
12. (a) A wood fire is not hot enough to produce glass. See page 14
13. (b) Broken glass mixed with the fresh materials. See page 15
14. (c) To fertilize their farms. See page 30
15. (c) Had been a republic 100 years longer than the United States has today. See page 9
16. (a) They exude a delectable liquor which the ants love. See page 32
17. (c) By people almost all of whom have European blood. See page 34
18. (b) About 1600. See page 53
19. (a) Became a lost art almost two centuries after its discoverer died. See page 16
20. (a) "Rainbow fringe." See page 53

NATURAL HISTORY

The Magazine of the American Museum of Natural History

FREDERICK TRUBEE DAVISON, President

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“There is no sadness in the silence,
only an immense and thoughtful gravity”—*Peattie*

Photo by H. B. KANE



YOUR NATURE HOBBY—*A source of friendships among the sort of people you want to know, an insurance policy against sickness or "nerves," a shield against the slings and arrows of outrageous fortune*

By DONALD CULROSS PEATTIE

A FEW years ago I lived through some of the darkest hours of my life. I was in a foreign land; my wife was desperately ill in a hospital; I had no money and streets full of creditors. Every one of my old delights and relaxations was impossible. Nature had been my hobby, as it was to become my profession, but now I had no time to go bird-hunting, no chance to collect wildflowers between hospital vigil and labor at my desk. But from five to six every evening I made myself take some exercise. It was autumn, and already dark, and the stars were out.

As I walked I wondered about the names of those stars and their slow, majestic turning. I thought how comforting it would be if only I knew the constellations and each star in them, if I could tell time by the stars and could read the heavens as they change each month and are fresh-strewn with new galaxies, as the fields are with flowers in their seasons.

So I got a book on the stars out of the library, and by the flame of my cigarette lighter I would read the charts as I tramped along by the sea. Then I would star-gaze, standing in the middle of the sidewalk, till my neck ached.

People stared, and I let them. A policeman, suspicious, came over to talk to me. He, too, had wondered about the stars, on his beat. He was delighted when I showed him Orion the hunter, and the Dog trotting at his heels. Others used to gather; I made a lot of fly-by-night friends, and it seemed to do them good, as it did me, to think of the incredible candle-power of Sirius, or the distance of Fornalhaut.

I believe that star-gazing saved my reason. In my dark hours, light came from heaven. Today, the happiest of people, I never step out at night without looking first at the sign-board of the sky, to see what stars are performing. I have friends in every quarter of the universe. And wherever I go, I can take this hobby with me. I have bought a revolving star and planet finder, and some day I hope to get a little second-hand telescope. Of course, such naked-eye astronomy as I have practiced adds nothing to science,

but to be at home in the heavens has added immeasurably to my pleasure on earth.

For Nature hobbies are the poor man's luxury, though the wealthy delight to spend thousands on them. There is no place that you cannot practice some of them, even in a great city, or in the best groomed of suburbs. You can start in at the age of six, as I am teaching my children to do. But I know a man who took up his first Nature hobby at 65, and was soon more than a dabbler; he had become an expert. A coal merchant who liked to collect mushrooms, he grew to be an authority on fungi, consulted by big museums.

A good Nature hobby is a form of saving for your old age. It is an insurance against the collapse of morale that may come with sickness, grief, unemployment, or the jangled nerves consequent on over-employment. It is a possession no one can take from you, and one to which you can add indefinitely, for to understanding there are no limits.

While a profession in the natural sciences is a serious business, requiring a gift and long training, demanding sacrifices and submission to a real discipline, Nature hobbies are open to everyone. They can be entirely self-taught; they need cost nothing or next to it, or you can develop them as far as you choose. You can give them a practical turn, if that is the way to make them worth while in your eyes, or a theoretical bent toward research. Thus, if you like birds and want to apply this interest practically, you can go in for bird protection, bird feeding, or building bird houses. Yet if you would like to make a record of the autumn migration, or take pictures of baby birds fed in the nest, or set up a photographic collection of every type of nest, from the hummingbird's no bigger than a penny, through the oriole's basket, the swallow's pottery work, to a crow's great lookout, these hobbies, too, have the useful value of amateur research.

Just a word on Nature collections, intended to cover every following reference to them: Collecting arrowheads, beetles, crystals, fossils, geological specimens, ferns, mosses, lichens, butterflies, flowers and all other Nature objects, is different, in spirit and

meaning, from collecting first editions, autographs, postage stamps, and old glass. These other-than-Nature collections can be great fun, though the best ones cost most, and it follows that only the rich can reach the top. A Nature collection, however, has deeper meanings. Each specimen is a witness to evolution and the fascination of distribution; it is also a voucher for your statements.

No Nature hobbyist worthy the name will, except under very special circumstances, consent to buy or exchange or sell a specimen. If he didn't procure it himself, it has no charm for him. Every one he has is a trophy, and a reminder of golden hours. Ask a good hobbyist about some rare glittering beetle in his collection, and he'll tell you the whole adventure of its capture. When I turn over a sheet in my herbarium, of some trillium taken years ago, I remember just how a wren sang, how the loam smelled, how the waterfall roared, that moment when I spied it.

Of all Nature hobbies, birds are the most widely popular, and have been through the centuries. I would rather go "birding" in this world than be sure of a harp and wings in the next. I might add that I have never had one hour's instruction in formal ornithology, and have just once been afield with a professional bird man. What I know is little enough, but I found it out for myself, and to me it was all new and exciting.

The beginner will want some glasses. You can buy second-hand binoculars, but be sure the lenses aren't scratched or chipped, and that you can bend the cylinders together or apart as your eyes require. The best magnification is 8-x. Less is usually not enough. More cuts down the field so that it takes you too long to find the bird, and too much light is cut out. A telescope is splendid for watching ducks, herons, and birds that are so shy they suffer no open approach within half a mile. I know a woman who lived on the twentieth story of a Chicago apartment, remote from the birds she loved. But with a small telescope mounted at her front window, she minutely observed the winter ducks that raft out on Lake Michigan in thousands, two miles beyond the treacherous ice.

The bird hobbyist learns to name his friends not only as adult males but also the immature, the females, and in autumn plumage. Or he may make a specialty of identifying bird song and every sort of call and alarm note. The time to dig in is March, when the first birds are coming back, and the easiest birds are those frequenting suburb, field and orchard. Shore birds, marsh birds, and ocean birds offer a world in themselves.

Many stay-at-homes, city dwellers, and people

with a turn for making things with their hands, create a special hobby in bird houses, and all sorts of shelters and feeders for attracting birds. Specifications for different types of bird houses are given out by the Department of Agriculture. Most of the bird-house fanciers sooner or later try the conquest of the most difficult type—a home for purple martins. These birds are one hundred percent useful to man, friendly, tuneful, social, and pretty. And they have now decided not to nest at all unless men put up houses for them. In return, they make war all day on mosquitoes and bothersome insects generally. The fascination of their sociable flocks and their beautiful formation flights is endless.

Or you can join the Audubon Society's Christmas bird census. Simultaneously all over the country in Christmas week, amateurs and professionals take a census of the number of kinds of birds seen, and an actual count of individuals of each kind. The accumulated data, nation-wide, are immensely valuable.

Then there is the nesting census taken in May and June. This is even more fun and more important, and science, as well as practical human economics, is deeply interested in getting actual counts of the numbers of nests per acre in all parts of the country. How to make your work really useful and standard you can learn from the Audubon Society, 1006 Fifth Avenue, N. Y. C.

There are, I suppose, more amateur butterfly collections in the world than any other sort of Nature collection. No doubt of their beauty and fascination. But of all creatures butterflies take probably most trouble and time to catch and preserve. Butterfly collections are difficult and expensive to house properly, and go to pieces heartbreakingly. Instead of collecting dead butterflies, two women with very small space and means decided to raise living moths, through all the different stages, experimenting in what they ate, watching their exquisite emergence. Great beautiful cecropias, silky samias, *Polyphemus* moths with their gleaming "eyes" on their wings, sphinx moths like insect hummingbirds—they studied them all, and discovered facts that were then new to science, because, though the world was full of mounted moths, even specialists knew too little but their names. The book these women wrote is still a classic.

You can raise ants in observation cases, too, and study their curious ways, for every ant is different in its "civilization." I explained how to build your own ant nest in an article in *Reader's Digest* last year, and will not repeat it here. For myself, I am such an ardent ant fan that I stop on city pavements to watch my Lilliput friends. They are to be found wherever one may live or travel. I have also made

an ant collection, and it was the easiest I ever amassed. You simply pop your catch in a tiny bottle of alcohol. Before long, ants of different kinds will look as distinct to you as Chinamen, Negroes, and Red Indians.

If what you long for is a collection of outstanding beauty, endless variety, and durability, why not try shells? There are fifty thousand species, to keep you busy, and we have thousands of miles of sea coast and lake coast where shells are to be had for the picking up. The rivers of the Middle West have exquisite shells in them; land snails and tree snails are among the most beautiful of all. I have even seen a conchologist go out and dig up unsuspected mollusc life in an Illinois timothy field, by delving down to their summer retreats.

The finest shells are usually found on the backs of their living inhabitants. The shell collector will treasure such specimens, cleaned and polished. But before long he is likely to become even more interested in the living mollusc, for there are some that fight, others that dive, swim, climb, and even "fly!" So he will presently want to start an aquarium and bring 'em back alive, to peer in upon their private lives. Such an aquarium, when you make your own and don't buy fancy and delicate tropical inhabitants, is costless and never-ending in delight. At college a friend and I had one for our chief sport; we bought the glass case at a rubbish sale, for 50 cents, and went out with a net and old bottles every Saturday and dredged up our own wonders out of the river. Beside molluscs we captured minnows, crayfish, water puppies, pollywogs, diving beetles, dragon-fly nymphs, and native water weeds. The fierce activities of this underworld became endlessly absorbing.

It is notable how a Nature hobby is the solace both of those who get too little of human society and those who are swamped by the life and work of high-pressure cities. The keeper of the lonely light-house on Heligoland, many years ago, made a hobby of migrating birds and ocean wanderers, for he had unrivaled opportunities. A famous astronomer who went blind made his ears so sensitive and accurate that he could identify birds by their every least sound, and comforted his dark years with a superb record of bird migration. Yet even in cities Nature hobbies are consolation and delight. I have heard of a man who made a study of street pigeons, their adaptations and instincts and intelligence; he ransacked the city for their nesting places and homes, and their nightly roosts.

One of the best of city Nature hobbies is an amateur weather station. My small boy grew interested in setting one up last year. At the hardware store I bought him a rain gauge, thermometer, weather vane

and simple barometer. He made an instrument for measuring wind velocity in "shop" at school, and has been keeping weather records ever since. In a glance at the sky, he can tell you what the clouds mean. To farmers and orchardists, the elements of local frost prediction, for instance, are highly valuable, and a weather station is a real boon to the neighborhood. The elements of the science can be got out of books; there is little that the amateur might want to know that he cannot teach himself.

Of all my own hobbies, plant collecting has come first and promises to last longest. The modern conception about plants is quite different from the old-fashioned album of pressed ferns that used to be kept on the parlor table to show to the minister when he came to call. Plant collections or herbaria are not for show at all, but for study and record; they are the basis of a very real science. Into the professional side of the science, or the deeper study, I won't go here, but, sticking purely to the hobby side, there is an undeniable pleasure in preparing beautiful specimens that will keep much of their natural shape and color. They are spread flat, taking care to crumple no leaf, in folded newspaper, which is laid between blotters; a pile of these are pressed between tightly belted lattices, to squeeze out the juices. When dry, each specimen is mounted with gummed paper on a stiff white sheet, and neatly labeled in one corner with name of plant, name of collector, time, place, and habitat.

One of my friends had a collection that, shelved in cases, rambléd all over the house. His wife had mounted more than fifty thousand specimens for him (catch my wife doing that!). He had differently colored folders for collections from different continents. Of course such travels, such a housing, means a great outlay of money and time. But remember Thoreau, who "traveled widely around Walden." You can have a world of pleasure with a plant collection on a modest scale. I have spent about fifteen dollars, in my twenty years of plant collecting, on equipment, which consists only in a vasculum or collecting box, a trowel from the hardware store, and some standard size driers or blotters. For drying sheets I used old newspapers. I built my own plant press, a lattice out of laths, and tighten it with an old trunk strap. I don't try to keep a collection forever. When I have had my fun out of discovering, pressing, identifying, mounting and labeling the flora of some limited region, and perhaps have published a little paper on it, I give the collection to a museum where others can use it, so it goes to add its mite to the grand total.

Many try a hand at flowers and trees. Why not do something more unusual? Earnestly needed by mu-

seums are good collections of fruits and seeds. One of the most fascinating collections I ever saw was a named seed collection; the seeds were just kept in ordinary bottles, and labeled. This collection was much sought out by ornithologists who in their study of the food habits of birds opened thousands of bird crops but did not always know what were the seeds they found.

The last thing I am going to pawn is my microscope. Yes, it's an old-fashioned one; yes, I got it second-hand, but it was a good one to begin with. If I lost it, I'd lose something like an eye. For it sees things I never could. I can go out to a little pond just beyond my garden, and bring home, in literally a thimbleful of pond water, more strange life than I ever knew was in heaven and earth. The most exciting movie I ever went to was a scene through my lens, thrown not on the silver screen but acted out on a glass slide. The original outlay for the instrument, glass slides and a little Canada balsam to make permanent mounts of my most interesting discoveries, are all I have ever spent on this hobby. With it I have seen plants that swim, animals that ceaselessly do dervish dances, the antics of the lowly amoeba, the eyes of ants, and the exquisite pollen grains of common flowers. My microscope answers question after question that is in no books. In my writings I turn to my microscope constantly for living witness.

In stressing the small outlays in all these hobbies, or the way you can get along with rudimentary materials, I do not mean that it is not worth while to get the finest instrument and collect the most complete library, if you have the means and *when* you have learned how to use complicated tackle. What I really wish to imply is that costly and delicate equip-

ment is no substitute for close observation, for skill, for curiosity—that divine wind that blows us to new shores of discovery! It isn't an elaborate microscope that makes the man peering through it an adventurer in science. It's the inquisitive eye behind the lens.

I haven't touched upon photography—a wonderful Nature hobby itself. Night photography, and color photography, are coming fields; but the biggest of all is going to be motion pictures of wild life. If I'd only had a movie camera when I saw my first king rails lead their chicks to the water, or when I visited my first rookery where egrets and vultures, like spirits of good and of evil, circled round and round through the mysterious cypress swamp! But the subject of photography is too big to cover here. Instead, let me conclude with a final suggestion: keep notes, keep a record, keep Nature diaries. Memories fade, or play you false; you can doubt what you saw or when you saw it, and others can doubt you too. A record, to go with your field experiences, with your collections, is solid evidence; it is the fact quarry out of which you can dig materials in later years. And in itself the record is half the fun of the hobby. When the house burns down I'm going to carry my old note books out under one arm and the baby under the other.

The man with a Nature hobby, or the woman, is a human being with a shield against the slings and arrows of outrageous fortune. His hobby brings him friendships among the sort of people he wants to know, and it shuts out his worries. You can't let him down, and you can't cut him off from reality. His assets are gilt-edged because so largely intangible; he can never own less of his unique treasure; he can always gather more.

SUGGESTED BOOKS FOR THE NATURE HOBBYIST

GENERAL INTEREST-ROUSERS: S. H. Williams "The Living World." P. G. Howes "Backyard Exploration."

ASTRONOMY. G. P. Serviss "Astronomy with the Naked Eye." J. Jeans "The Stars in Their Courses." W. T. Olcott "Fieldbook of the Stars."

BIRDS. R. T. Peterson "A Field Guide to the Birds" (eastern). G. H. Trafton "Bird Friends" (bird houses). R. Hoffmann "Birds of the Pacific States." A. A. Saunders "A Guide to Bird Songs." T. S. Roberts "Bird Portraits in Color." N. Blanchan "Bird Neighbors" (for nests).

FLOWERS. F. S. Mathews "Fieldbook of American Wildflowers" (but n.e. states only). A. Lounsbury "Southern Wildflowers and Trees." M. Arm-

strong "Fieldbook of Western Wildflowers" (but California and desert states only). Clements "Flowers of Mountain and Plain" (Rockies and great plains). Britton and Brown "Illustrated Flora of Northeastern U. S. and Canada."

INSECTS. F. Lutz "Fieldbook of Insects" (eastern). O. Essig "Insects of W. North America." E. W. Teale "Grassroot Jungles." J. C. Kenly "Little Lives." W. J. Holland "The Moth Book." "The Butterfly Book." I. M. Eliot & C. G. Soule "Caterpillars and Their Moths."

LOWER PLANTS. L. C. Krieger "The Mushroom Handbook." A. J. Grout "Mosses with a Hand Lens." W. Maxon "Ferns as a Hobby" Ntl. Geog.

May, 1925. R. T. Rolfe "Romance of the Fungus World." H. Durand "Fieldbook of Common Ferns."

MICROSCOPIC LIFE. G. N. Calkins "The Smallest Living Things." R. Disraeli "Seeing the Unseen." A. E. Shipley "Hunting Under the Microscope." G. Blavis "Book of the Microscope."

PHOTOGRAPHY. A. C. Pillsbury "Picturing Miracles of Plant and Animal Life."

SHELLS. J. Keep "Western Shells." Aldrich & Snyder "Florida Sea Shells." Julia Rogers "The Shell Book." W. Webb "Handbook of Shells of the World," "Shells of the United States."

WATER LIFE. Needham & Lloyd "Life of Inland Waters." A. Morgan "Field Book of Ponds and Streams."

THE LONG-HEADED MANGBETUS—*Intimate glimpses of an African tribe notorious in the last century as remorseless cannibals, revealing a hospitable and intelligent people, skilled in architecture and given to extreme polygamy*

By MARTIN BIRNBAUM*

WE had at last reached the ferry or "bac" of the Bima River, in the province of Stanleyville (Belgian Congo), and were rowed across by deep-chested, broad-shouldered, black pagayeurs, who sang with a savage, monotonous rhythm, while they toiled in their long canoes, carved from single tree trunks. The high-pitched voice of the leader, rang out as a solo, and was answered by his lusty chorus, "O Great River, give us strength—give us strength!" To keep them in time, one of their number beat a drum made of a hollow cylindrical block, closed at both ends and slit on one side.

As we approached the crowd on the opposite bank of the stream, I caught sight of a boy with a comparatively light, lustrous skin and a curious elongated skull, and I suddenly realized that we were in the land of the Mangbetus. In that moment, I recaptured the old boyish excitement which seized me when I first read Schweinfurth's account of his discovery of the remorseless, long-headed cannibals who indulged in unholy mysteries and whose avaricious king, Munza, feasted daily on the flesh of a succulent child. Schweinfurth's attractive portrait of the cannibal ruler, looks superficially like a drawing on an ancient papyrus, and there are ethnologists who maintain that Egyptian influences can be traced among these people who deform their heads.

There are said to be about 50,000 of them in the Belgian Congo, their territory lying at about 3° N. latitude and 26° to 29° longitude, in the region

drained by the Uele, Bomokandi and Ituri rivers. Although Schweinfurth's *Travels in Africa* appeared as recently as 1873, it soon became evident to us that the perils incident to his expedition were now virtually non-existent, and we felt that all the discomforts we had suffered, and the dangers, if any, which we might encounter in our efforts to escape the prosaic comforts of our firesides, would prove negligible, if we could add, however modestly, to our knowledge of these genial people, who received us smilingly and with genuine hospitality.

After an early breakfast at Isoro, to which we had been awakened by the chatter of hundreds of weaver birds nesting in the oil palms which were stripped and almost killed by them, we started from our rest house for our first real encounter with the Mangbetu tribes. It took the form of a visit, arranged by the Belgian Administrator, to the village of Matari. Tongolo, its chief, did not inherit his title, but it was conferred upon him by the Government as a reward for army services rendered, and he now settles quarrels and dissensions among the approximately 7000 natives of his district. Had his position been a hereditary one, the town would have been named after him.

He made a brave showing, when he came forward to greet us in his barbaric costume. Five leopard tails dangled loosely from his belt of raw okapi hide, each ending in a pompon of reddish orange feathers plucked from the grey parrot which abounds in the region. A similar tuft ornamented his leopard skin cap, which also boasted a bunch of long heron feathers and was held in place by the bone of a leopard.

* MARTIN BIRNBAUM, a man of many parts, is celebrated chiefly in the world of art. Born in Hungary, he came to the United States at the age of five. He early developed a lively interest in natural history and "practically lived in the American Museum of Natural History," where he belonged to a number of allied scientific societies. He is also a talented musician. After receiving a Bachelor of Science degree from the College of the City of New York he took an M.S. from Columbia Uni-

versity and graduated from its Law School, as well as from its School of Political Science, to become a practicing lawyer. But after 1910, his interest in art became predominant and carried him to world-wide recognition as an authority. He was decorated by the King of Italy for his work as Commissioner of Fine Arts at the Biennale Expositions in Venice (1934 and 1936). His discriminating eye has proved its uncanny infallibility on many an old master, and has also spotted the talents

of many new and unknown artists whose work he introduced through country-wide exhibitions. Working independently since 1916 he has traveled almost continuously, studying an amazing assortment of native arts, as well as natural history subjects. At one time he built up a private aquarium of between 3000 and 4000 tropical fish. Mr. Birnbaum is now on his way to some obscure islands of the South Pacific.

—THE EDITOR.



(Left) IN THE CENTER OF EQUATORIAL AFRICA, a reception committee greets the explorers in the name of Tongolo, Chief of Matari, a Belgian Congo village in the land of the Mangbetus. Supreme ruler over 7000 natives, Tongolo was the soul of hospitality and delighted in showing off his people to Mr. Birnbaum's party. The council house in the background is evidence of the architectural skill of the Mangbetus, considered the best native builders in Central Africa

(Below) SIXTY-FOUR WIVES AND 27 CHILDREN sometimes force Tongolo (resplendent in leopard skin turban) into the background, as when one of his wives poses with baby. Tongolo's title, conferred by the Belgian Congo Government for army services, is symbolized by his headgear, leopard tails on his okapi-hide belt, and his nondescript medals



(Left) CHIBBUKCHAK, Tongolo's man Friday. His duties include lighting his constantly smoking master's cigarette, holding his wholly superfluous ash-tray, and arranging the voluminous folds of his bark-cloth bloomers. The Mangbetus love tobacco but will smoke anything in a pinch

(Below) "QUEEN" MOTHER: dignity characterized Tongolo's aged mother. Women generally occupy an excellent position; to them is left the cultivation of banana plantations and other food crops. The men are expert hunters and fishermen. Note Mother's handful of cigarettes, her reward for posing



(Left) DANCE OF THE PYGMIES, with which the Matari Mangbetus entertained their guests. Terpsichore would seem to be one of their gods. for the Mangbetus are devoted to dancing and indulge in it on slight provocation, their bodies writhing in erotic gestures and their voices raised in monotonous chants. Accompaniment is provided by wooden drums and rattles woven from wood-fibre into gourd-like shapes, containing seeds or stones. These and their ivory horns and metal gongs, shaped like two lilies on a single curved stem, give evidence of delicate native artistry and craftsmanship



(Above) AN OLDER MEMBER of the nomad pygmy band which always comes to Matari to trade for food and other necessities. This 4½-foot man seems scarcely taller than Tongolo's grandson shown in the next picture.



The sturdy black babe, a favorite of his grandfather, was an exceptionally bright child and made friends with every white visitor. One of his cousins clings to his mother (right) who wears an elaborate *egbe*. Vaguely resembling a Gay



Nineties bustle, the *egbe* is a thick, flat mat of broad leaf strips, stained alternately orange, black and white. All Mangbetus wear them, each district sporting its own design

(Below and Right) NATIVE BEAUTY PARLOR: Before a ceremony, Tongolo's wives paint their bodies with black and white stripes and spots in attractive designs. Dye is said to come from the juice of a gardenia tree. Their bodies are also covered with intricate tattooing and scarifications, sometimes forming names—perhaps those of admirers. These women's elongated heads were bound in infancy with fibre wound spool-fashion around the skull. Their stools are *objets d'art*, carved from one block of wood, although Tongolo is far prouder of the imported Morris chair, in his new, unfinished brick home. Note the curiously uncomfortable wooden knob of the *egbe* which presses against the woman's spinal base

ALL PHOTOS BY
MARTIN BIRNBAUM



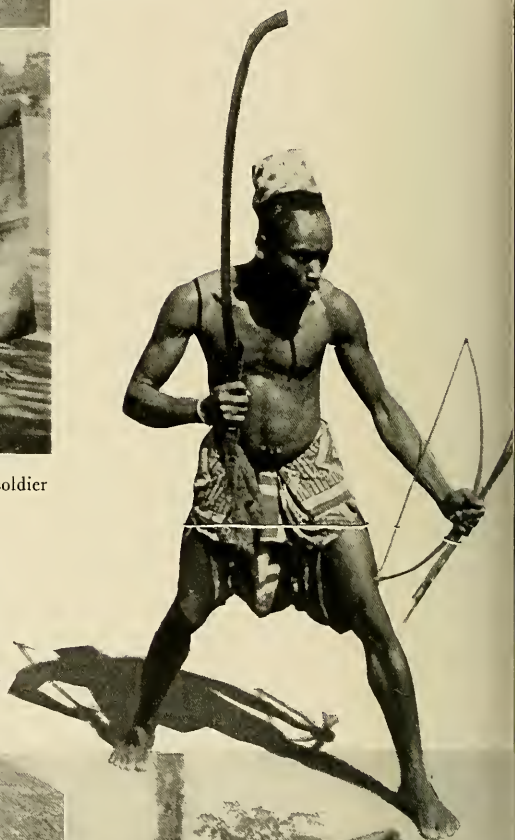


(Left) SIX FEET OF PIPE is joy unalloyed to any of the tobacco-loving Mangbetus. Even the onlookers seem happy. Among them appear an incongruous felt fedora and (center) a complete European sports outfit. This gentleman was a plain, everyday Mangbetu until he got hold of the white togs. Then he became cock of the walk and was with difficulty excluded from other pictures taken by the explorers



(Right) THE SAVAGE GRACE of this lithe-muscled Mangbetu soldier typifies the splendid physique of his people

(Below) YOUTH OF MATARI bid the explorers farewell. The impression given by this Mangbetu tribe was that of an intelligent, hospitable and happy people, easily won by necklaces, cloth, and the all-important tobacco. The next stop was the village of Naipou, named after Naipou, its chief, well known for his sagacity. Here the white men were received in style; an orchestra was sent to meet them on the road and escort them to Chief Naipou's council house (below right)



BORN ARISTOCRAT and hereditary chief of a century-old dynasty, Niapou met his visitors in befitting manner. Musicians were more numerous, their instruments more elaborate, than those at Matari, and although his costume approximated Tongolo's, Niapou's greater importance is further evidenced by his harem of 400 wives. A few are shown below on the receiving line. Some of the natives wear amulets to appease evil spirits. Their religion combines modern missionary influence with fragments of the old ancestor worship, with its human sacrifices, for which the Mangbetus were once widely feared



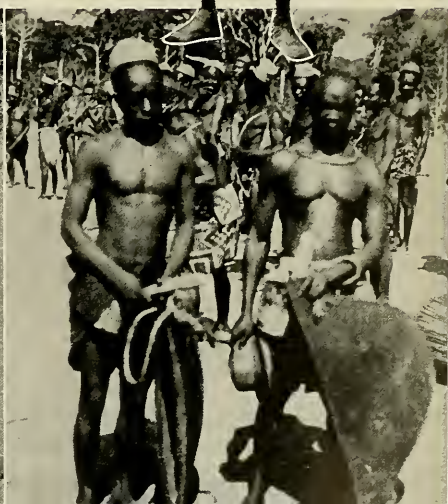
(Above) MORE WIVES obligingly pose to show off their headdress. The hair has been plaited like a college mortar-board but round, resting on top of the skull to form a sort of halo. Long pins of monkey bone or silver ornament the hair. Heavily tattooed torsos were in evidence here, as in Matari. The people were a bit shy and often clapped their hands over their mouths as a sign of astonished embarrassment provoked by the automobile and cameras of the expedition



(Right) ROYAL TRUMPETER with his five-foot horn, partly ivory, covered with leopard skin and adorned with pompons of reddish-orange feathers, plucked from the grey parrot's tail—a favorite Mangbetu decoration. No Louis Armstrong, this trumpeter could produce only a loud animal-like roar which reverberated through the jungle



(Below right) DRUMMER BOYS. One has removed his "ceremonial" fedora before posing with the triangular drums. Ornamented with metal knobs, these and other musical instruments, a few modeled clay pipes and jars were the only evidences of native craftsmanship. Masks, common elsewhere in Africa, are totally lacking among the Mangbetus

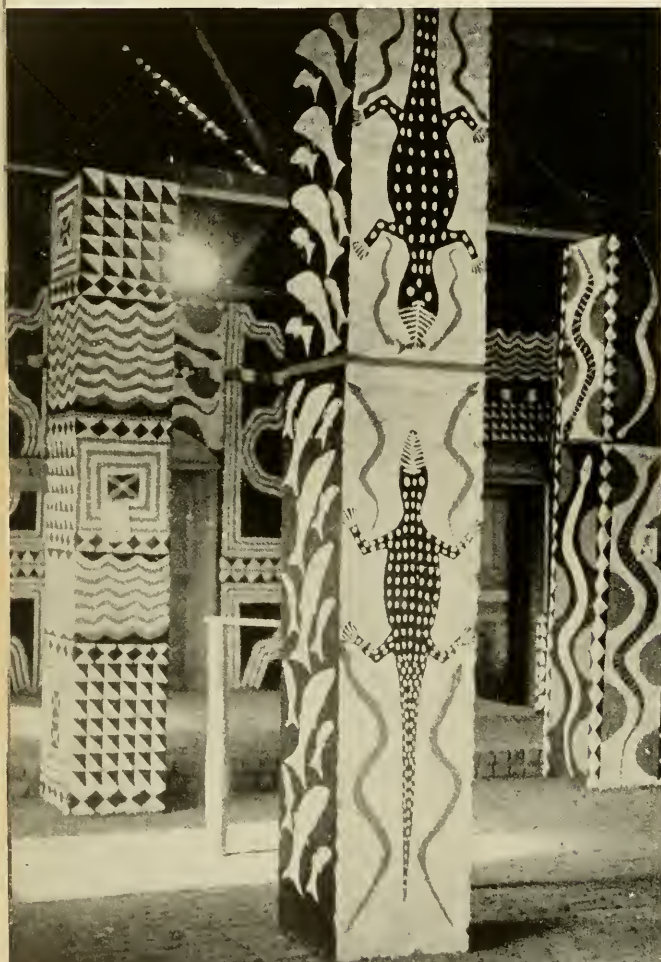


ONE OF THE 400 wives of Niapou, wearing a special type of *egbe* made of banana leaves. The more attractive women were prevented from posing by the jealous elder wives. As a whole, the Mangbetus are docile and childlike. Without aspirations to self-government, they feel that their highest achievement can be only service to the white man

(Right) TOURIST CONSCIOUS Ekibondo proved a decided contrast to the other Mangbetu villages. This was best expressed in its chief—Ekibondo—who, though descended from ancient rulers, was attired in unsavage white duck and wore a wrist watch. The cleanliness, the painstakingly decorated black, white and red walls of the conically thatched huts, the picturesquely placed forest trees which had been left standing here and there in the streets—all gave the effect of a stage setting, closer to the sightseer's idea of Africa than the usual jungle villages



(Left) NO FILM DIRECTOR could ask for a more decorative interior than the private Council Hall of Chief Ekibondo. The many square columns are carved and painted in bright colors that amply attest the persistence of the natives' artistic abilities despite relentless penetration of European goods



(Below) ENCOURAGED by their chief, the village women are always ready to pose for travelers. They publicly dress each other's hair, pound manioc, and sell their *negbes* and neatly woven, crownless hats. Ekibondo has a shrewd eye for business and is enthusiastic about tourists, though probably unaware of the dangers of over-exploitation with the inroads of white civilization



ard, whereas ordinary citizens use only monkey bones for such purposes, and their headgear, if any, was a broad band woven of vegetable fibre. Large nondescript medals hung from his neck, and his bloomers were made of a kind of tapa cloth, hampered from the bark of a tree. His "chibbukchak" or good man Friday, was a powerfully built Mangbetu, always at the chief's elbow, lighting his master's cigarettes, holding his ash-tray, or arranging the folds of his wide bloomers.

Pygmy dance

The reception took place in front of the large conference house, which was open to the wind on all sides. The Mangbetus are considered the best native builders in central Africa and such structures are often as much as 150 feet long, 60 feet wide and 50 feet high. To entertain us, a small band of Tongolo's pygmies, about four and a half feet tall, indulged in a round dance—endless repetitions of the same erotic body movements—to the accompaniment of wooden drums and rattles, beautifully woven out of strong woody fibres in the shape of gourds, with seeds or little stones inside. Some of these practically nude little people had tattoo marks and painted designs on their faces, in imitation of their superiors. Patrick Putnam, whom we visited later in his jungle home,* told us that these were Basua pygmies, but their Mangbetu masters called them *naka* (singular: *aka*).

When Tongolo thought we had seen enough of their gyrations, he marched us off to the village proper to present us to his aged and withered mother, and to his first but apparently not favorite wife—for there were 64 others, younger and more attractive. Fourteen sons and thirteen daughters were the offspring of these wholesale unions, and to maintain his position and support his vast family Tongolo had only to prove himself a good tax collector for the Belgian Government. The chiefs receive a percentage of all monies collected, and although the very aged are exempt and certain allowances are made to men with large families, Tongolo's income permits him to buy sophisticated luxuries like Morris chairs, the wooden arms of which ended in Mangbetu heads carved by pupils of the missionaries. With great pride he showed us these in his still unfinished European brick abode, never realizing that we were more interested in the native stools carved from a single block, or in the other household implements, musical instruments and weapons. The Mangbetus have always been famous for their metal work and still make beautiful scimitars. They still smoke pipes five feet long like the one described by Schweinfurth,

and are expert hunters and fishermen. To the women is left the cultivation of the banana plantations and the patches of beans, corn, pea-nuts, sweet potatoes, yard-grass, sorghum and manioc.

We made a round of visits to some of the younger wives, many of them carrying babies with sparkling, bulging eyes, straddled on the mothers' hips. Women generally, enjoy an excellent position and a good deal of consideration in the community. Their children have their heads bound by a ligature of raffia or other fibre, wound around the skull as though it were a spool. The result reminded me of the fashion started in ancient Egypt by the brilliant, long-headed Pharaoh Akhnaton. At the base of the elongated skull, the marks of healed scars remain after the bindings are removed, and the eyes often retain an unnatural oriental slant. The adult women accentuate the shape of their heads by dressing their hair in diverse ways, the most peculiar and characteristic style being the broad, flat platter, woven and plaited around a framework at the very end of the skull, like a university mortar-board but round like a halo.

Head binding and intelligence

The mentality of the race is not adversely affected by the malformation. On the contrary, the Mangbetus are among the most intelligent of all the central African peoples. One little boy, who proved to be Tongolo's favorite grandson and toward whom he displayed real tenderness, was an exceptionally bright child and made friends with every white visitor. He accompanied us to the huts of his grandfather's wives, some of whom, probably preparing for some ceremonial dances, were being painted with black and white stripes or spots, in attractive designs. When dry, this coloring matter, which was said to be the juice of a tree belonging to the gardenia family, looked soft and velvety. The bodies of these women were in addition tattooed and scarified with various designs. Some women had names surrounded by symmetrical designs tattooed on their bodies, but I did not inquire whether this was done by admirers—which proved to be the custom among the women attached to the military camp at Costermansville, which we visited a month later. The baffling habit of nodding "Yes" to any question whatsoever confuses the careless investigator, and it is difficult to learn whether such marks are tribal, or made for medical reason, or to indicate rank in society, or are simply ornamental and meant to enhance the attractiveness of the individual. Some of the older men had large holes for plugs in their ear lobes, but the younger generation no longer practices this form of mutilation, although such dis-

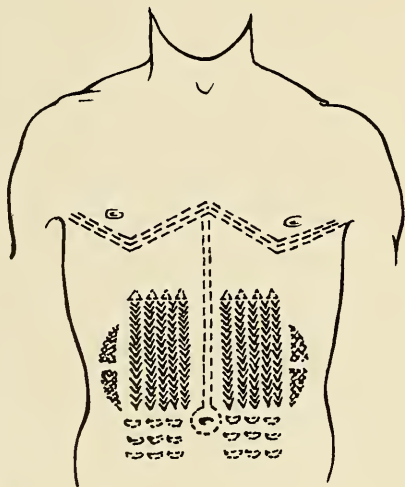
*See *Geographical Magazine* (London), September, 1937.

figurations hardly detract from their dusky beauty. All Africans are fond of marking and cutting their bodies, and the fashion among the Mangbetus may be one recently acquired from the tribes they conquered, for Schweinfurth does not speak of it as a common custom. Moreover, the wives of a chief like Tongolo belong to different tribes and often come from other districts—a fact betrayed by the designs of their *negbes* or bustles. The Medje women made a flat geometric pattern of banana leaf strips, stained black and white; the Majogu wives wove theirs of raffia fibre; whereas the commonest type in Tongolo's district was a thick flat mat or layer of broad leaf strips of uniform length and stained alternately orange, black and white.

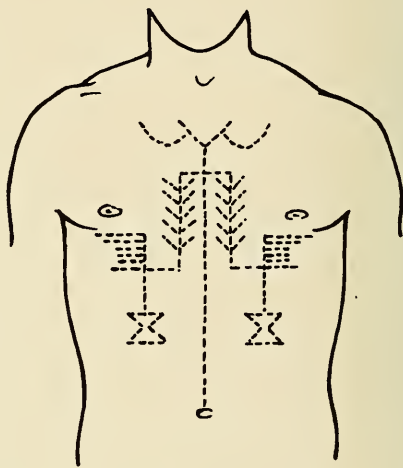
While we were visiting Tongolo's harem, a large number of armed men arrived outside the conference hall to execute war dances and take part in sham battles. The arrows with metal tips, decorated shields and javelins, were all well made, and Tongolo himself led his warriors in their mad charges, while the women hallooed and other onlookers chanted war songs. One felt sure that these splendidly proportioned fellows, often sleek and feline, could be savagely indignant with those who treated them unfairly. The musicians who encouraged them struck triangular wooden drums and blew long horns made partly of ivory. One instrument peculiar to the region, is a painted metal gong, forged in one piece and shaped like two lilies on a single curved stem.

The women in the conference hall could not resist the music and were soon dancing round and round in a long file, clapping their hands or waving their arms in every direction, and singing as though their souls were steeped in a fervor of religious sensuality. Two men danced with them, raising and lowering their shields in time, although holding their arms behind their backs. The entire entertainment was an alternation of savagery and naïveté, which make up their character. The noise of the drums, rattles and horns increased in volume when, after having distributed gifts of cloth, necklaces and cigarettes, we bade Tongolo farewell, and a happy, shouting crowd followed us for a time on the road back to Isoro.

We drove along beautiful lanes, shaded by palms and often cut through the heart of the dense luxuriant jungle. Grey parrots and other birds with brilliant plumage were seen, and we often ran down guinea fowl and francolins, which were almost too tough to serve as food. The lovely leaves of the parasolier (*Moussanga Smithi*) were conspicuous everywhere, and in February species of agaves were blooming. Now and again, a dark, frightened face, framed by the green foliage, would gaze for an instant at the swiftly moving, rumbling machine and disappear. Sometimes these natives were painted dead white as a sign of mourning, and the picture they presented was a wierd one. Lonely burial places by the roadside had articles of wear and household im-



ELABORATE TATTOOING and scarification are a favorite style among the Mangbetus just north of the equator in Central Africa. The design above is tattooed on one of Tongolo's warriors



IN THE SAME TOWN, Matari, where Tongolo is chief, the design above is tattooed on the chest of a Mangbetu tribesman. Note the symmetry and delicacy of the native patterns

plements left on the mound, obviously intended for the use of the departed, but I had no way of learning whether they were Mangbetu graves. The villages we passed were either quite recently built, or abandoned and deserted. The tribes are agricultural nomads, and when the soil around a settlement ceases to be fertile, they move on a few kilometres and plant anew in their primitive, haphazard fashion. To clear the ground for a new village and its plantations, they often set fire to the underbrush, and disastrous forest fires are a common sight. All day, as we motored along, we saw hunters with their bows and arrows, men and women carrying heavy bunches of plantains and bags of raw cotton.

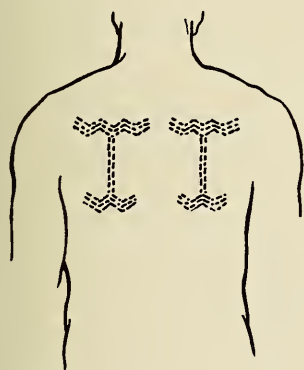
At Abiangama, in a clearing, we came upon the station for which most of them were bound. Here they sold their cotton under government supervision at standardized rates. As soon as it was examined, weighed and paid for, it was removed to the factory close by, to be cleaned and packed by modern machinery. Many of these natives had walked miles weighted down with their burdens, and as soon as they had sold their cotton they rested under the trees and feasted on toasted termites sold by vendors who had bags of them. We did not see an unfriendly looking native in the crowd, and a few drops of eau de cologne poured on their palms sent them into an ecstasy of delight. It was a memorable sight to see the colossal, glistening black frames of the packers emerge from soft white billows of freshly picked

cotton; and it would have been interesting to make inquiries about the entire industry, but we were expected at the leper colony at Pawa, in the distant hills, and were obliged to hurry away.

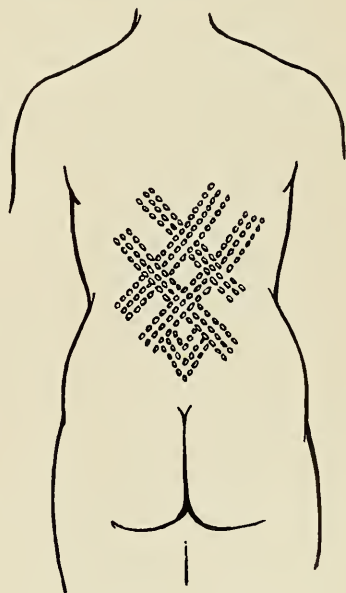
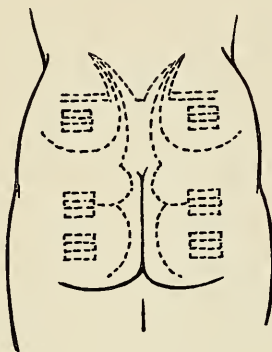
The region we were bound for was superficially very attractive indeed, commanding fine views of the surrounding country. Avenues of chaulmoogra trees led to the village and laboratories, and we were entirely unprepared for the sight of crowds of pitiful remnants of black humanity. Heroic scientists are patiently studying the ravages of the dread disease, and they allow their patients considerable liberty. They are even permitted to marry, for it is known that the children of such unions are not born with leprosy, although they have a tendency to contract the disease. A native chief had been appointed and his subjects seemed surprisingly cheerful. One of the young physicians showed me a collection of live leeches, with which he was trying to establish the proof of his theory that leeches which have once attacked wading lepers can carry the germ by attaching themselves to healthy fishermen. Needless to say we did not leave this depressing community with any feeling of reluctance.

A far pleasanter sojourn was the one at Niapou, named after the famous shrewd chief who rules it. He is recognized as the highest of all Mangbetus, and although his costume closely resembled Tongolo's, his carriage was that of a born aristocrat, a worthy descendant of Nebingbale, founder of the

SCARIFICATIONS like those shown below are bumps of scar tissue standing well above the surrounding skin and are produced by making cuts and preventing their immediate healing. (A Mangbetu woman)



(Left and below) TATTOOED DESIGNS at Matari, the lower one being a characteristic type of which similar examples were seen at Niapou, also in the Mangbetu region



THE PASSION of the Mangbetus for permanent body designs may be a recent acquisition, for Schweinfurth, traveling in the region in the last century, does not mention it as a common custom

dynasty in the last century. To impress us, he had sent his orchestra and a crowd of natives down the road to meet and escort our party to his village, where there was great commotion and everybody was in a frenzy of expectation to see the huge automobile in which we traveled. We learned that covering their mouths as though they were gaping, merely expressed astonishment or embarrassment. It was at once obvious that we were to meet a more imposing personage than the chief of Matari, and the rules of etiquette were here more pompous.

Native orchestra

The musicians were much more numerous and the instruments on which they performed were made with greater skill. Besides the usual rattles, one fellow jingled a large mass of bells attached to a long pole like a bunch of grapes. Others were pounding on cymbals and on the triangular drums ornamented with metal, or on long drums braced between their thighs and covered at one end with snake skin. The most conspicuous instrument was a great ivory horn, about five feet long, covered in part with leopard skin and adorned with the favorite parrot feather pompons. When blown, it sounded like the roar of a wild, infuriated denizen of the jungle. The entire group of performers preceded us to the conference house where Niapou awaited our arrival, seated on a Mangbetu stool placed on a rug of okapi hide, and surrounded by a selected group from his harem of over 400 wives—including the “first,” who governed his menage.

I was struck by his composure and the bland serenity with which his eyes peered into mine. He evidently wanted the traditions of the tribe to be meticulously followed. Practically all the women dressed their hair in the mortar-board style, with long pins of monkey bone or even silver, and many had necklaces, bracelets and anklets of ivory, wire, and beads. Their symmetrical tattoo designs on their chests and backs were often mixed with scarification, and one woman had, in addition, five large circular spots painted on her cheeks and chin. As for their nudity, the European soon acquires an intelligent point of view and is no more perturbed by it than by the sight of a naked animal. A missionary may tell you that one feels this way because the natives have not been baptised and are soulless, but in any case the Lido at Venice is a far more embarrassing place than central Africa.

The palaver, the usual dancing and exchange of gifts took place in the great conference house, near which stood Niapou's private brick residence, its veranda protected from the sun by a projecting roof

supported by wooden columns carved with reliefs of alligators, fish, European rifles and birds, or with a design resembling a series of Mangbetu stools, one on top of the other.

Native arts

I looked everywhere for other evidences of an artistic bent, but found only a few honey-jars in indigenous design, some earthenware pipes and an ivory handled stick in the shape of an elongated native head. Masks, so common in other African regions, I never saw, and it is doubtful if they ever existed. My lamented friend Alexander Jacovleff, who made some brilliant drawings of Mangbetu types in the course of his visit in 1925, collected some well-made carved horns. Cutlass-shaped scimitars of recent make, similar to the one held by Munza as a symbol of rank in Schweinfurth's frontispiece, were presented to us by Niapou. Later, in the charming ethnographical Museum at Leopoldville, I saw a few anthropomorphic Mangbetu carvings, but unfortunately that institution was founded long after the whole of Africa had been carefully combed for European and American Art Collectors.

Today their talents are encouraged by the missionaries at Rungu, whom we visited. Brother Marcolin, one of their number, is quite a clever painter and sculptor, and is the moving spirit among the boys who are artistically inclined. Not only did his pupils make good furniture, household tools and objects d'art, but the rafters of the mission church were ornamented with life-sized Mangbetu heads, excellently carved after Brother Marcolin's clay models. The school and workshops are well-appointed, and it was amusing to note that the enthusiastic young students did not shirk their scholastic duties, even when they wore nothing but a thick shirt of fresh banana leaves—a sign that they had only recently been circumcised. Their native religion is a fairly simple one. Although there are no pagan temples or places of worship, they believe in a supreme being and in the existence of powerful evil spirits who have to be appeased. Accordingly, they wear amulets; and “feticheurs” as well as soothsayers, are consulted and feared. That the spirits of ancestors exert an influence on the welfare of the village is another of their beliefs. The human sacrifices, which in Schweinfurth's day took place on the tombs of chiefs, are now, of course, prohibited; but sinister secret societies are dreaded and respected. On the whole, after traveling among them, I reached the conclusion that they are now like docile animals who are taught to think of themselves as children, without knowledge or power to govern themselves. The highest achievement the most ambitious and intelli-

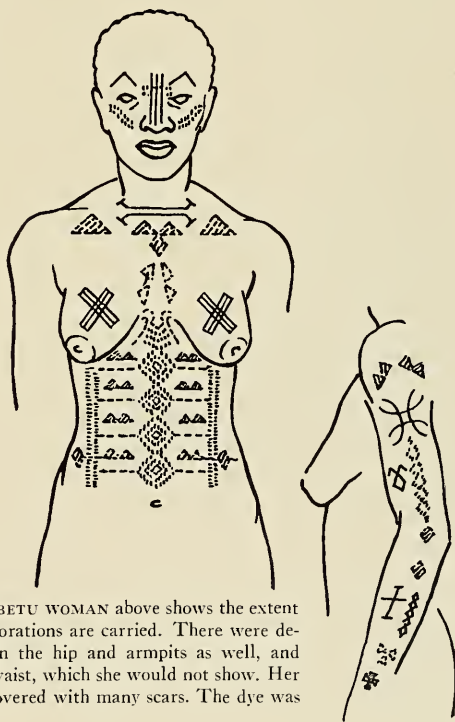
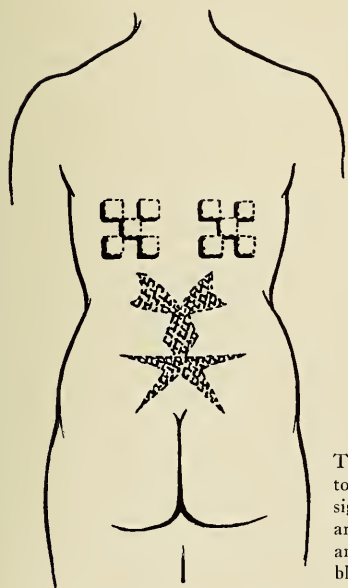
gent can hope to attain is to serve the white man as a bank clerk, a mechanic, a medical assistant, a stenographer or government servant.

From Rungu the moist jungle road—always literally covered with millions of butterflies, which our car mercilessly crushed—ran to a “bac” over the River Dubomokandi. A short distance beyond we motored down an avenue shaded by mango trees and leading into the open square of the village of Ekibondo, named after its chief. Everything here was found to be immaculate and the plaster walls of all the thatched, conically roofed huts were painted with fascinating designs in red, white and black. A few forest trees had been left standing in the village, and the effect of it all is decidedly African. But when I met Chief Ekibondo, dressed in white duck and wearing a wrist watch, I began to suspect that all this charming grouping of forest giants and ornamented huts was done with a keen eye for business.

He encourages women to show how they dress their hair, to pound manioc and other foodstuffs in the open, to pose for photographs and sell their *negbes* and neatly woven hats without crowns. His favorite wife's abode was spotless, and I was fortunate to make a fairly successful photograph of the interior of his conference hall, the roof of which was supported by square columns, carved and painted with animal forms and geometrical patterns.

I felt that Ekibondo was as enthusiastic about “tourisme” as Mussolini himself, and I was tempted to give him a bitter account of white exploitation of primitive paradises. Fortunately, perhaps, there was no time. At any rate, he has not yet built a hotel or rest house for whites, and after our visit we hastened away to reach Gangara Na Bodio, the famous station where African elephants are domesticated and trained and where comparatively comfortable accommodations are provided for traveling Europeans.

(Below) SCARIFICATION (in relief) and tattooing on a woman's back. Whether these decorations are made for social, medical, or purely decorative reasons is not known



THE MANGBETU WOMAN above shows the extent to which decorations are carried. There were designs between the hip and armpits as well, and around her waist, which she would not show. Her arms were covered with many scars. The dye was blue-black

ON EATING INSECTS—*You eat them unknowingly almost every day. If the idea repels you consider that they have nourished mankind for countless centuries without ill effect and are still openly relished in many parts of the world*

By C. H. CURRAN
*Associate Curator, Insects,
American Museum*

AN aversion to eating insects as food is an acquired dietary habit that is peculiar to highly civilized nations. But none of us passes many days without eating some six-legged creatures in one form or another.

One evening while dining at the home of an entomological friend the talk got around to the eating of insects. To prove my argument that all food was liable to contain insects I picked up a piece of lettuce from the salad. With no waste of time I picked off two or three plant lice and displayed them before my host and hostess. My host grinned weakly but my hostess was embarrassed beyond all reason. She protested that she had washed the lettuce personally and had really seen no insects on it. I was the only one present who ate the salad.

Another time we had as a guest at my father's home another entomologist and the subject of insects in food came up during lunch. It so happened that one of the vegetables was spinach, and I explained that this foodstuff was sometimes heavily infested with fly larvae and that I should not be surprised if some should be found in the spinach before us. Casually, I moved my fork across the spinach. Two fly larvae were exposed. Our guest, unlike myself, was fond of the stuff and had already eaten most of his, but he would eat no more. While I did not like spinach particularly, I had been expounding the value of insects as food and felt that my reputation was at stake. I finished what I had and took a second helping. Mine was the only plate that did not have spinach remaining when the meal was finished.

In most foods

Few of our foods do not contain insects in a more or less recognizable form. The insects may be present as eggs, small larvae, or fragments of any of the various stages. The bread we eat may contain fragments of granary or rice weevils, flour beetles, saw-toothed grain beetles or the Mediterranean flour moth and other insects that attack stored grains. The chances

are a million to one that the particles are so small that they would not be noticed, and one might wager another million to one that if the fragments were large enough to attract attention they would pass as nothing more than part of the wheat, perhaps part of the outer, hard coat, or part of the husk.

Rice is one of the most important foods in the world and many millions of people depend upon it as their main source of sustenance. In the Orient and in most tropical countries it is the basic food. Rice is one of the most heavily insect-infested foodstuffs in the world. The rice weevil, the chief pest attacking rice, may be present in thousands without attracting attention, and there is no test that the housewife can make to determine its presence.

Not long ago I had a sample of the finest looking rice imaginable. It was clean, dust-free and pearly white. There was no trace of weevils and to all appearances there was no insect infestation. Yet three months later there was scarcely a whole grain of rice in the entire sample. The eggs of the rice weevil are very small and difficult to find, and the young larva burrows at once into the rice kernel. From then until the weevil reaches maturity there is no indication of its presence.

Cooked to a turn

Last autumn I had the pleasure of dining on a ship that engaged in carrying cargo between New York and India. Among the dishes served were several kinds of curry. Being well aware of the presence of insects in rice, I took particular notice of that served and was not surprised to observe several adult rice weevils, all cooked to a turn. How many larvae were present it is impossible to tell, but the percentage, in relation to rice kernels, must have been fairly high. Upon this occasion I did not call the attention of my host or his guests to the insects and their presence did not prevent me from eating my full share of curry. After all, the curry had been prepared largely for my especial benefit and my host would surely have thought there was something queer had I refused to eat it.

Those who eat relishes made from tomatoes are almost certain to partake of insects because very few

saucers made from tomatoes are free from infestation. The greatest culprit is the corn ear worm, sometimes called the tomato worm, but there are many other insects, such as the small fruit flies, beetles and other insects that are attracted to the ripe fruit. In relishes made from green tomatoes the insect infestation is much smaller, the tomato worm being the chief pest. The young caterpillar bores into the green fruit and feeds upon it. Externally there is scarcely a trace of its presence and even the most careful housekeeper would not suspect the presence of a partly grown larva unless she examined the tomato very carefully.

Olives

Many of us like olives as an appetizer and we eat them without the slightest thought that they might contain the remains of insects. We must confess that the olives sold in America today are practically free of insect remains and that said remains are almost impossible to locate because of the treatment which green olives receive in their preparation. After being picked they are first cured by immersion in a caustic solution for several days. It so happens that caustics are the best solvents for the hard outer skeleton of insects, with the result that the larval remains are either completely dissolved or are rendered soft and colorless. It is only when a large larva is present in an olive that any tangible evidence of the insect remains, but there is always evidence that an insect larva has been at work. This takes the form of small, brownish tunnels through the meat of the olive and no treatment can destroy the evidence. Number one and two olives are practically free of insects and their work, but the lower grades may be rather heavily infested. Few of the latter now enter the country because of the low insect tolerance permitted by the government.

It is utterly impossible to form any estimate of the percentage of blueberries containing insects since this will vary according to the origin of the berries. Most of the commercially grown berries are free of pests, but there are times when even these are infested. The blueberry maggot spends its larval life inside a blueberry, and it is almost impossible to detect its presence in most instances. Most infested berries ripen earlier than those adjoining but this is not always a good criterion since certain berries on a bunch might ripen early. Blueberries are among the healthiest fruits we have and it would be a shame, and a distinct loss from a health standpoint, if people stopped eating blueberries because they thought that there might be fly larvae in them. Even if larvae were present it would be impossible to discover them in cooked berries and besides, people have eaten them

for centuries without suffering any ill consequences.

Both cherries and apples may be infested by the larvae of flies that are closely related to the blueberry maggot, but in both these fruits the evidence of infestation is usually fairly obvious.

The grapefruit, the lemon, the orange and the lime all have their insect enemies and we eat them in whole or in part without the slightest suspicion that we are eating anything but pure, wholesome citrus fruits. These fruits are liable to have on the rind small brownish spots that are actually scale insects, or pale spots if the scales have been rubbed off. Of course, if the fruit has been artificially colored there may be no trace of the pests. There is little likelihood of eating the bodies of the scale insects unless they rub off and mix with the juice but it is not impossible that parts of the tiny tongues may be eaten since these pierce the skin and may enter the pulp.

One insect to ten fruits

Since insects feed upon growing or ripe fruits of practically all kinds it is not surprising that dried fruits are also attacked. After surviving or escaping the attacks while growing they are subject to the depredations of other kinds of insects during the drying process and after they are ready for the market. Some drying and dried fruits have their own particular pests but there are insects that feed readily upon any of them. As a result of this double (or triple) attack there are not many dried fruits that have not been subject to insect damage by the time they are offered for sale. One may gather some idea of the problem that faces the growers and packers from the fact that the insect tolerance on domestic dried fruits is ten per centum—one insect for every ten fruits. This is the standard set by the government, but conditions are not quite as bad as might seem to be the case. Some of the insects are small and the amount they eat is scarcely noticeable.

If insects did not breed in such enormous numbers the housewife would never notice the small ones on dried fruits and nuts. These commodities may be almost free of pests when placed in a store but if they are held for some months they may be heavily infested. And even though free of pests when they reached the store they are likely to become infested while awaiting a buyer.

In all my experience with insects in or on food-stuffs I have only once had any ill effects from eating them. This occurred many years ago: one night after working late I purchased a chocolate bar and began eating it while walking home. It tasted rather peculiar and at the first light I stopped to examine the half that was left. There was no insect but the bar

had served as a feeding ground for one or more caterpillars of the genus *Ephestia*. The fact that I had eaten all the webbing and excrement, while not pleasant to contemplate, did not worry me greatly. I threw the remainder of the chocolate away and continued homeward in a cheerful frame of mind, but by the time I reached home I was quite ill—dizzy and somewhat bilious. Obviously the illness was not caused by eating insects but from the foreign substance on the chocolate.

Insects called delicious

Although we may eat insects unknowingly, not many people would care to sample dishes prepared from insects, and many would probably refuse them even to the point of starvation. Yet according to some people who have dined upon them, there are some kinds that are really delicious. Certain of the termites are said to be very tasty, while white grubs, the larvae of June beetles, have been described as tasteless and insipid.

Not so many years ago, before the advent of aniline dyes, insects were commonly used as food and no one thought anything of it. Some of us may remember back to the days when pink cake was much admired. The coloring matter was, if my memory serves me correctly, quite tasteless, and did no more than give color. This coloring matter, known as cochineal, was the product of scale insects, and there was a huge and thriving cochineal industry in the American tropics. Today the industry is practically non-existent, although cochineal is used locally in Central America as a coloring material.

Water scavenger beetles are also used as food but I am not certain of the use made of them. During the years that I was engaged in the inspection of foreign products entering Canada there were many importations of water beetles brought to my notice. These were imported from China and I was informed that they were used in the preparation of sauces by the Chinese. Apparently they were ground to a fine powder and used as flavoring in certain sauces.

The eating of insects is anything but new. These creatures were undoubtedly among the earliest foods consumed by man, and the practice of eating them exists today just as it did many thousands of years ago. In the depths of the great Australian desert, where the bushmen can eke out only a precarious living, insects play not only an important part in the diet but also in the health of the scrawny dwellers of the wastes. In desert country there is a dearth of fats and since these are required by the human body, the natives suffer severely from their lack. One of

the greatest sources of fats is found in insects—chiefly in the larvae and pupae. Fats are especially necessary to growing children, so, from dawn to dusk, unless they have been fortunate, the children of the bushmen make the rounds of stumps, fallen trees, rotting logs and clumps of grass in search of edible insects. The insects located never see a frying pan or a boiling pot. As soon as found they are popped into the mouth and chewed with the utmost relish. The finding of one insect incites the searcher to renewed activity, because where one occurs, there are likely to be others. Among these people there is no storage of insects for future use. There are not enough of them to furnish the immediate demands.

Bane or boon?

In many parts of the world, however, insects are collected and stored to provide food during seasons of want. When we hear of great plagues of locusts in Africa we are likely to wonder how the poor natives will manage to live, since all their crops will be destroyed. The natives, however, look upon the plague in a very different light. They consider that the insects have been sent by their gods in order to provide food, as manna was sent to the Israelites in the wilderness. Every available man, woman and child sets forth to "harvest" the millions of locusts. They collect them in enormous numbers, kill them and dry them. Even while collecting them they may eat some, discarding only the wings and hind legs, but the vast majority are dried, later to be fried and eaten. By the time the grasshoppers are ready for the frying pan, they have probably accumulated other insects. There are a number of flies that lay their eggs or larvae in freshly killed grasshoppers and these undoubtedly begin to utilize the opportunity, but the constant sun-drying must result in the death of most of the parasites, and they became part of the diet of the natives.

In Arabia, Egypt and other countries that are known as the cradle of Christianity, locusts are eaten today, just as they were thousands of years ago. Moses* described four kinds of locusts which the Israelites were permitted to eat: the locust, the bald locust, the cricket and the grasshopper.

It seems rather strange that cockroaches should not have been used for food, inasmuch as their relatives were, and still are, so highly prized. While cockroaches may look greasy and unattractive, they are certainly as clean as the others. They are really among the cleanest of all insects, their greasy appearance being due to a shiny covering, which is not at all adapted to the picking up of dirt. Besides, like all other insects they clean themselves frequently. It was

*Leviticus XI, 21-22.

not until quite recently that I heard of cockroaches being put to any use by man, and this information came from a correspondent in the Bronx. Among other things the writer says:

"My father told me when I was about eighteen years old that cockroaches would cure 'lockjaw.' He said that the cockroaches were thrown into boiling water, and I suppose the remedy was used by way of the nose. Perhaps it could be tried in the form of drinking the juice. As I recall it, the cockroaches had to be fat and the number used was six to twelve."

It is possible, since the information is from an Irish source, that this form of treatment was practiced in that country in the past, just as other Old World people ate vipers to cure certain diseases. The medicinal value of the reptiles is now known to be without merit, and the same is probably true of the cockroach treatment for lockjaw.

Termites

Next in importance to grasshoppers as food are the termites or white ants. Strangely enough, these are closely related to the cockroaches. The chief reason that these are eaten so extensively in Africa is the fact that they occur in enormous numbers and are easily collected both from their nests and during flight. They are sometimes attracted to light in unbelievable numbers and the natives become greatly excited when certain of the large species appear.

A friend who has traveled in Africa extensively has described to me his first experience with natives collecting and eating termites. He was working in his tent when he heard sounds of excitement outside and thinking that something might be wrong he went to investigate. His native boys were clustered around a light and were enjoying themselves immensely as they jostled each other in their efforts to catch the termites that were swarming about. Not realizing what they were doing, he questioned one of the boys, who reluctantly gave up the chase in order to reply. After watching them for a while, and noting the relish with which they ate the insects, he decided to try his hand. Catching one of them, he placed it rather gingerly in his mouth and instantly emitted a howl of surprise. The insect had sunk its jaws into his tongue. While most termites are small and unable to inflict a bite on a man, some of the large ones are able to pierce delicate skin, and this specimen had lost no time in sinking its jaws into the delicate tissues of the mouth.

The gleeful shouts of the natives did not help the situation, since it placed him in an inferior position. He was determined to master the art of eating live termites if only to save his face. One of the boys

showed him how to hold the insect by the wings, dash it just the right distance into the mouth and snap the teeth together before the termite had a chance to bite first. With a little practice he became adept, and from then on, whenever there was a flight of large termites, he was among those who sought them eagerly and ate them with relish. He informs me that they have a flavor not unlike pineapple and that they are a real delicacy.

Some time later this same man was in Australia and encountered a flight of termites that looked much the same as those he had eaten in Africa. They came in the window in large numbers and he just naturally began catching and eating them, much to the disgust of one of the ladies present. The other lady, however, showed some interest and finally managed to eat one after much hesitation. She too, became an enthusiast.

The African natives do not depend upon random flights of these insects. They know the habits of the termites and are aware of the time when the flights of the sexual forms, the future kings and queens of new colonies, occur. When the flight season approaches they make their preparations. They enclose the termitaria, which project several feet above the ground, in broad leaves, and the termites close the openings between them to exclude light. A second cap is put over this, which leads into a trap. When the termites emerge from the nest they are unable to escape and are scooped out by the natives in huge handfuls.

Tribes fight over termite nests

So important are the termites as food, both seasonally and throughout the year, that the natives of some parts of Africa consider certain termitaria to be their own personal property, and there may be much fighting over the ownership of certain termite nests. Almost annually some of these fights result in death.

Termites are also eaten in India but the practice is not nearly so extensive as in parts of Africa. In India, as in all tropical countries, there is a continuous war against termites, the destruction of termitaria being one method of curbing them. It has been related to me that some of the natives engaged in the destruction of nests search out the queens and that there is much competition in locating them. These queens may be one to two inches long and are quite plump. When one has been found by a native it is seized upon at once and popped into the mouth, in just the same way as one manipulates an oyster. That they are highly prized as a delicacy may be adjudged from the fact that the natives search for them with diligence and devour them with great gusto.

Perhaps the best measure of the esteem in which any food is held is the frequency with which it is served to distinguished guests. When Junker, one of the first white men to visit part of the Congo, entered the Azanda country, one of the chiefs who sought to win his favor sent him as a present 20 large baskets of termites, each load so large that it was all that a porter could carry. Junker reported that the termites made such an excellent oil that a chicken cooked in it tasted as delicious as one fried in butter.

True ants of the larger varieties have not escaped primitive peoples in their search for food. Many American Indian tribes have made a habit of eating the large carpenter ants that are sometimes a pest in our houses. These were eaten both raw and cooked. Even today the practice of eating them has not entirely disappeared, although they do not form an essential part of the diet of any the inhabitants of this country. At the present time they are devoured by a rather limited number of people who eat half a dozen or so at a time in order to quench their thirst. We are informed that the crunching of a few of these creatures is sufficient to satisfy one's thirst on the hottest day.

Relished by Europeans

Ants have been put to even greater use in North Queensland, Australia, where the natives make what is reported to be a very fine drink from the mashed up bodies of the green weaver ant of the Orient. They are crushed in water, and it is said that they make a most palatable drink, relished by Europeans as well as natives. In India and adjacent countries this same ant is made into a paste and is served up as a condiment with curry, while the Dyaks of Borneo mix it with their rice, to which it gives a pungent flavor, owing to the formic acid present.

It is not at all unnatural that the American Indians should have relished the honey ants in all parts of the continent where they occur. These ants are peculiar in that some of the workers become veritable storehouses for honey, their abdomens becoming more or less spherical and so greatly enlarged that the ant is scarcely able to move. They cluster on the ceilings and walls of their nests and disgorge part of their stored-up food to their brothers and sisters as required. The Indians naturally discovered the sweetness stored in these insects and made full use of it. At first they probably ate the ants alive, later gathering them in quantity and crushing them so that they formed a most enticing dish—one which was considered such a delicacy that it was served to guests of distinction as a special favor. The next step in the use of the honey ant was the extraction of

the pure honey by crushing the insects and straining the juices. This was carried even farther. After the honey was extracted it was allowed to ferment, forming what is said to be a highly flavored wine.

Indians of the American tropics, with a much larger ant fauna from which to choose, have selected the queens of the famous leaf-cutting or so-called umbrella ants upon which to feed, eating only the abdomens, either raw or cooked.

Caterpillar diet

It is natural that caterpillars, the larvae of moths and butterflies, should form a very substantial part of the food of primitive peoples, because these are often of rather large size or occur in great abundance. In the Southwest one of these insects, known scientifically as *Colorado pandora*, has long formed a part of the diet of certain Indians inhabiting the Nevada-California region. Whether it is eaten today may be open to question, but it is certain that the Indians made good use of the caterpillars as food not more than 20 years ago. Those who have tasted them do not rate them a delicacy. They are first smoked and then made into a soup, and are described as being rather tough and tasteless.

In Africa many tribes consider caterpillars choice morsels of food, and much time is spent in collecting them. Some of the native tribes recognize 20 or more different kinds of caterpillars that are edible, and are sufficiently well acquainted with the life history of the insects to know the plants upon which they feed and the time of year when they have reached the proper stage of development for collecting.

One of the caterpillars that is greatly relished is a species of *Anaphe*, one of the silk-weaving moths occurring in equatorial Africa. When full-grown the caterpillars of this species congregate and spin a communal cocoon in which to pupate, as many as a dozen often working together. At such times they are easily located and collected. The natives eat the caterpillars and sell the silky nests. Although highly relished, they have a peculiar effect upon some of the natives, poisoning them in almost the same way that toadstools do us.

Little more than a hundred years ago nobody cared whether honey contained grubs or not. Sugar was a luxury and honey was super-sweet. Anything of this nature was prized beyond the fondest dreams of anyone living today, when sugar is such a commonplace article that we never think of it as an essential foodstuff. Honey was so prized that it almost equaled sheep and cattle as a measure of wealth, as may be adduced from Biblical reference to a land "flowing in milk and honey."

It would be possible to continue our discourse on this subject without end, so numerous are the examples of the use of different insects as food in various parts of the world. We know that natives of some of the Oceanic Islands prefer the maggots in their bread-fruit to the bread-fruit itself, and that the Aztecs prized an ear of corn containing caterpillars more highly than one without them.

The use of insects as food has depended upon a number of circumstances, chief among them being, of course, the scarcity of other accessible food. Early man probably depended upon insects as a regular part of his diet, relying less and less upon them as he became more adept at hunting and fishing, and in agriculture. Today, in the United States, flour containing even a trace of insect infestation is considered unfit for human consumption, but there are other countries, and even parts of the United States, where no attention is paid to the presence of pests,

and the people who eat the flour, bugs and all, are no less healthy than we. It is only because we have such an abundance of flour and other foodstuffs that we are so particular. If there should be a shortage of food we could not be particular; we should find it necessary to eat the food or starve.

During the past few years there have been a number of people who have suggested that we should eat insects. They were probably seeking notoriety or being facetious. Some of them have gone so far as to publish menus. There is no "should" or "should not" about the advisability of people eating insects. If they wish to do so there is no reason why they should not, since there are hundreds of different kinds that are perfectly edible. However, it is absurd to urge upon a people blessed with a super-abundance of good, delectable food, the advantage of eating something which is likely to prove less agreeable to the palate than the things to which we are now accustomed.

DO NOT MISS

What man or boy has ever read *Treasure Island* without cherishing the hope that he might one day sail the Spanish Main, master of his own ship? This dream came true for Dr. Cyrus F. Wicker whose **MODERN TREASURE ISLANDS** tells the tale of setting forth on the course of the great galleons in a renovated rum chaser renamed *Pieces of Eight*. In his romantic quest, he followed the actual maps of old-time pirates and was aided by many scientific devices, which, with uncanny precision, could detect precious metals underground, even under water, and tap out softly and thrillingly "Treasure Here!"

America's mongoose is, oddly enough, a bird. So esteemed as to be called "paisano" (countryman) in Mexico, the sharp-beaked Roadrunner not only can beat its weight in rattlesnakes with relative ease, but has actually been known to kill and devour 30-inch rattlers, digesting them piece by piece. Celebrated in the legends of Indians, Mexicans and Southwestern Americans, the bird becomes an engaging hero in J. Frank Dobie's **THE ROADRUNNER IN FACT AND FOLKLORE**, wherein evidence is marshalled to show the pointlessness of trying to eradicate so

many-sided, economically valuable, and delightful a creature.

Roy L. Abbott, that sympathetic tamer of our common wildlife, tells the story of perhaps the most endearing of his many pets in **OLD MR. HIGHPOWER**. "Old Hi" was a black skunk whose long life and ill-timed death on the Abbott farm reveal some fascinating facts about this much misunderstood animal, as well as supplying material for a highly entertaining animal biography.

Why have the number of hayfever cases doubled within the last twenty years? Is it accident, the increasing susceptibility of the race, or does the finger of suspicion point to our prodigal treatment of natural resources? Read the answer in **WEEDS, WASTE and HAYFEVER**, by Roger P. Wodehouse.

Mysterious laws govern the inner life of a **SEA-BIRD COMMUNITY**. Doctor Tinbergen will tell the highlights of four years' experience in studying the family life of the herring gull.

WILD DOGS AND TAME—PAST AND PRESENT—A *panorama of the origin, genealogy and "social" background of the tractable wolf that emerged from the wilderness to become man's best friend.*

By EDWIN H. COLBERT
*Assistant Curator, Paleontology,
American Museum of Natural History*

TO the casual observer the numerous breeds of domestic dogs would seem to have reached the farthest possible limits of diversity among animals that may still be called by one name. And so they have, in one sense of the word. Compare, for a moment, the Great Dane with the Scotch terrier, the old English sheep dog with the Chihuahua, or the greyhound with the bulldog. Certainly there appears to be but little in common between these dogs, at least in their outer form, even though they are all dogs. One wonders what some future zoologist or paleontologist might do with the breeds of modern dogs, were he to find their bones among the ruins of what we are pleased to call our present-day civilization.

Similar psychology

Yet we know that the collie and the Yorkshire terrier and the Pomeranian are all dogs, because we have seen them originate and develop—so to speak—under the controlling influence of man's hand. Moreover, we know that they are all dogs because of their habits, for in spite of the dissimilarities in their appearances, they act much alike—they are all dogs by instinct and by reason of their peculiar psychology and the workings of their canine brains.

And when we get down to such a fundamental comparison as this we bump into the fact that the domestic dog, no matter what his looks may make him, is under the skin nothing more nor less than a tractable wolf—or, to look at it from another angle, the wolf is nothing more nor less than a wild dog.

The origin of the dog is lost in the mists of antiquity, for of all the animals domesticated by man, the dog was the first. Since the time when the question of the dog's origin was first seriously investigated, numerous attempts have been made to ferret out what his ancestors might have been, but despite diligent studies toward this end no definite conclu-

sions have been reached. Indeed, zoologists differ among themselves, and at best they can for the most part only indulge in scientific speculations regarding the ultimate ancestry of the dog.

Generally speaking, most authorities agree that the dog is largely descended from the Eurasiatic wolf. Perhaps the story of the origin of the dog is a complex one, in that wild dogs have been severally and independently domesticated by man at different times in different parts of the world, while on top of this the dog after his domestication has perhaps often been crossed back with various wild dogs at different periods during the rise of human cultures. Certainly we know that the Eskimos, for instance, not infrequently cross their sledge dogs with wolves, to maintain the strength and endurance of the breed.

Background of dog tribe

Which is to get back to a point made before, that the dog is nothing more than a tractable wolf—or tame wild dog, if you will. And to understand this question of the domestication of the dog, it may be well, perhaps, to review the story of the origin and evolution of the dog and his cousins—to get a glimpse at the background of the dog tribe, the better to appreciate those characters that make dogs what they are.

The dogs, the wolves and their relatives belong to a family of carnivorous mammals known as the *Canidae*. This family includes, in addition to the dogs and wolves, the jackals, coyotes, dingos, the various dogs and foxes of South America, the Japanese "raccoon-dog," the numerous northern foxes and the fennec, and finally the African hunting dog, the East Indian wild dog, or dhole, and the South American bush dog. Even to the non-zoologist, these creatures are clearly recognizable as being related to each other, because of their general dog-like or wolf-like appearance. And in addition to these modern dogs there is a host of extinct canids, for the most part known only to the trained paleontologist

THE ORIGIN OF THE DOG

Compiled by Edwin H. Colbert

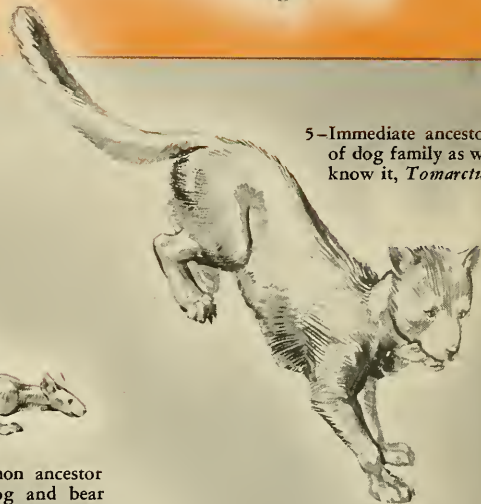
Drawings by Margaret M. Colbert



Bears



4-African Hunting Dog (wild),
Lycaon



5-Immediate ancestor of dog family as we know it, *Tomarctus*



3-First "Bear-dog,"
Dapbaenus



1-Common ancestor of dog and bear (40 million years ago), *Miacid*



2-Grandfather of all dog family,
Cynodictis



6-Early North American hyaena-like off-shoot,
Borophagus

NATURAL HISTORY
Magazine, 1939

THE prehistoric development of the wolf, from which the dog sprang, is typified chiefly by increase in running speed. The dog's ancestor *Cynodictis* (2) of some 20 or 30 million years ago was a slender, short-legged animal perhaps no larger than a mink. This animal began a line of evolution characterized by ever-increasing leg length and the development of an almost unique ability to run down prey mile after mile and seize it. This led to important "social" developments, involving group hunting. Competition, in turn, stimulated the growth of intelligence, along lines quite different, for instance, from that of the solitary cat. *Cynodictis* gave rise to two branches, one leading to the modern African Hunting Dog (4) and one through *Tomarctus* (5) to the wolves and domestic dogs. *Tomarctus* (of some 15 million years ago) differed but little physically from the wolves and wild dogs, but doubtless had far to go in intelligence. In modern times many widely different dogs have been bred, but the intelligence and adaptability of the dog remain distinctive.

—many of them of course very much like our modern dogs, but many more quite different from anything in the canid line surviving to the present day.

The canid or dog family (and here we use the word "dog" in an inclusive sense, to designate the numerous canids listed above) had its beginning some 40 million years ago, during the transition from the Eocene to the Oligocene period of geologic history. Those were the days when horses were no larger than small sheep, and had three toes on each foot, when rhinoceroses were still small, horse-like running animals, quite hornless and probably com-



MIACID

pletely lacking in the ferocity that so distinguishes their modern descendants; when camels were dainty, gazelle-like creatures; and when the first ancestors of the great apes and the man were small, tree-dwelling monkeys.

In those far-off days there lived a small carnivorous mammal known as *Miacis*, the offspring of some very primitive Eocene carnivores that had passed through the heyday of their evolutionary supremacy and were on their way to extinction.

Miacis was a small carnivore with a long body and relatively short legs—not so different in appearance from some of the modern East Indian or African civets, which are but the slightly changed descendants of this primitive ancestor. Perhaps *Miacis* spent a considerable part of his time in the trees, for it would seem probable that the earliest true carnivores dwelt in the primitive forests that sheltered so many ancestral mammalian types. This early carnivore, structurally and mentally in a low stage of development, seems to us to have taken but



FIRST OF THE
"BEAR-DOGS"
(*Daphaenus*)

a slight step in the direction leading to its progressive heirs, yet in spite of its primitive form it had the potentialities that were destined to lead into a

large and varied group of highly advanced mammals.

During the Oligocene period the first canids evolved in North America as the direct lineal descendants of *Miacis*. Of these there were two types, one a large, heavy, long-tailed dog known as *Daphaenus*, the other a much smaller, more slender animal, going by the name of *Cynodictis*.

Daphaenus was the first of the "bear-dogs," an animal as large as a coyote but longer-bodied, with relatively shorter legs, with a massive skull and an unbelievably long, heavy tail. These animals became progressively larger as time went on, until during late Miocene days (some 10 million years or so ago) they grew to truly gigantic proportions. Then some of them followed a line of evolution that involved a marked increase in weight, a secondary change from the typical running habits of the canids to a lumbering type of walk—due to the shortening of the feet—and profound modifications of the skull and teeth. Thus the bears arose, as descendants of the bear-dogs, in early Pliocene times.

GRANDFATHER
OF ALL DOG
FAMILY (*Cynodictis*)



As this first of the "bear-dogs" began to develop in the direction of the bears, the grandfather of all the dog family appeared. This animal, *Cynodictis*, retained the long body and short legs of the primitive carnivores. Indeed, like its ancestor, *Miacis*, it must have resembled to a considerable extent the modern Old World civets. And it was still so close



AFRICAN
HUNTING
DOG (*Lycæon*)

to its earlier tree-climbing ancestors that it retained partially retractile claws, something like those of a cat.

This ancestor of the true canids gave rise to two distinct types of "grandchildren" in lower Miocene days.

One of these canids, *Temnocyon*, was ancestral

to an evolutionary line that culminated in the modern hunting dogs of Africa and India. The African hunting dog, *Lycan*, is a large, mongrel-looking canid with erect, rounded ears, and marked by irregular brown and yellow spots. The East Indian hunting dog, or dhole, is very dog-like in its general appearance, with a long, pointed face, a bushy tail and a reddish coat. These canids, so like ordinary dogs to the casual observer, are in reality of quite an independent ancestry, and it would seem that the peculiar South American bush-dog, *Iticyon*, with an abbreviated face and a short tail, is, strangely enough, related to the Old World hunting dogs.

The other of these two lower Miocene canids, *Cynodesmus*, was the ancestor of a large and varied group of dogs, including our modern Eurasian and American dogs, wolves and foxes, which went through a major portion of their evolutionary development in North America.

Among the offspring of this ancestor of our common dogs (*Cynodesmus*), one branch, completely North American in its distribution and destined to become extinct, developed along a peculiar line whereby its members became very large, and strangely enough, hyaena-like. This does not mean, of course, that they are to be related to the hyaenas, but rather that they developed by *convergence* in a way similar to the hyaenas, because they lived the



"HYAENA-DOG"
(*Borophagus*)

same kind of a life that the hyaenas live today. These dogs were the "hyaenas" of their time, occupying a rôle in North America that the hyaenas, which were just beginning to evolve along their strange line of evolutionary development, were learning to play in the Old World. These "hyaena-dogs," the most characteristic of which were *Hyaenognathus* and *Borophagus*, had heavy, bull-dog like skulls, with extraordinarily strong blunt teeth, adapted to crushing bones, rather than to slashing or tearing, for like the hyaena, these dogs were carrion feeders.

Finally, we may consider the true dogs as we know them, which evolved between upper Miocene and recent times as an offshot from the *Cynodesmus* stem

and had their immediate origin in a genus known as *Tomarctus*.

Tomarctus must have been very dog-like in its general appearance, and with but little change, except for the important one of the growth of intelligence, it grew into the wolves and wild dogs that spread throughout the northern world and surrounded primitive man in the East. From this ancestral form there evolved also, along a somewhat different line, the foxes, and the fennecs, small desert foxes of Africa.

Reducing these facts to their simplest terms, it may be said then that the canids, or "dogs" have followed four general lines or trends of evolutionary development. These were first, the gigantic bear-dogs, the direct ancestors of the bears, dogs in which



FATHER OF DOG
FAMILY (*Tomarctus*)

size was at a premium and giantism seemed to be the goal of evolutionary progress. Secondly, there were the hyaena-like or "hyaenognathid" dogs, which, though true canids through and through, imitated to some extent the hyaenas in their adaptations to life. Finally there were the two branches of dogs as we know them; on the one hand the hunting dogs of Africa and India, very much like the more familiar wolves and dogs but having a quite separate family history, and on the other hand the group of wolves, wild dogs and foxes, which may be considered as the central stem in this tree of canid history.

These were the particular specializations in the



WOLF

canid world. But throughout this melange of varying adaptations to different means of existence, there ran the central, unifying ties in the family history of the Canidae, like a strong warp weaving in and out among the varied threads of a patterned rug. These

were: first, the universal adaptations among all of the canids toward a running mechanism of the body, capable of great speed; secondly, the attainment of a remarkably high degree of intelligence, commonly coupled with an extraordinarily well-developed sense of sociability; and lastly, the retention of a surprising amount of adaptability.

To continue our survey of the physical evolution among the dogs, the running habits so common to these animals must be stressed. The earliest dogs, such as *Cynodictis*, already showed some progress in this direction, although in these primitive forms the legs were relatively short as compared to the length of the body. But from the beginnings of canid history down to the point where man took a hand and produced specialized breeds, the story of evolution among these animals has been for the most part a tale of ever increasing limb length—a series of progressive adaptations for the running down and seizing of prey. In this respect the dogs differ from almost all of the other carnivorous mammals. The bears, their closest relatives, are huge lumbering creatures living for the most part on a diet of absurdly trifling items, and depending, when they do kill, on their great strength and size, while the raccoons, also close relatives, are primarily climbers. Of the other carnivores (except for the cheetah—an aberrant and quite uncat-like cat) only the hyaenas may be classified as primarily running animals. And the hyaenas do not rank at all with the canids when it comes to fast running—for they are not hunters but carrion feeders.

Thus we must think of the dogs—even the aberrant types that long since have become extinct—as the chasers of game, trailing their quarry mile after mile, hour after hour, until by the very diligence of their efforts and the cleverness of their methods they are able to overtake their prey. Of course, these remarks do not apply in their entirety to all of the canids, but they outline the general rule for the adaptations in this family of carnivores.

"Social" intelligence

The running adaptations in the canids have led to a method of life that has been very important in deciding the "social" life of these animals. For, early in the history of their development, these hunters must have discovered that it is much easier for a family to act together in running down a fleet victim than is such a feat for a single individual. Thus was born the habit of family hunting. And from this it was but a short step to the banding together of several families at advantageous times, to hunt as groups or packs.

Now this communal life, so characteristic of most of the dogs, led to the growth of sociability and a spirit of cooperation among the individual members of the group. Therefore, the dogs, instead of being individualists, such as the cats, became responsible members of a cooperative group, all working together toward a common end. Needless to say, animals living a life such as this are bound to exercise their intelligence to the utmost—they stimulate each other, and by working together they learn faster and build up the capabilities of their brains faster than would probably be the case if they were solitary.

Of course, generalizations such as these do not always hold. For among the canids, the foxes are strict individualists, and yet they are among the most gifted of the dog family, when it comes to a question of brains. Perhaps the answer is that the Miocene ancestors of the later canids were already extraordinarily intelligent animals, so that their descendants were bound to grow in wisdom, no matter what direction that growth followed. So it is that the foxes early in their history followed the solitary mode of life; but, living by their wits in much the same way that their wolf and wild-dog cousins lived, they naturally developed a sharp intellect. They became intelligent, as did all of the canids, because—among other things—of their heritage from precocious ancestors.

Hunting by relays

It is interesting to notice a few of the means whereby this sociability is expressed. The tales of hunting by relays are so often told as to be almost trite. A number of wolves or wild dogs will map out a "course" over which the quarry is to be pursued. Then, several dogs will distribute themselves along this course—usually circular—and take their turns in chasing the antelope or deer, until the animal is fatigued to a point of exhaustion. In this manner it is relatively easy for several animals working together to accomplish their purpose with a minimum amount of effort on the part of the individual.

Indeed the spirit of cooperation is so highly developed within some of the canids that there are well authenticated records of wolves supplying food for an infirm and aged member of the pack.

One of the social habits of the wild dogs that is retained by their domestic relatives, is the rather annoying one (to us) of marking trees and posts with urine. I suppose that the average person gives but little thought to the origin of this habit, or its significance. Yet it is really quite a remarkable and characteristic adaptation among the Canidae, for it is a method whereby individuals are able to communicate with each other. The wolf has a series of

bulletin boards scattered through his domain; these may be trees, rocks, bushes or other like objects. To these signposts he pays periodic visits, marking them to show other members of his group that he has been this way, and this is a part of his kingdom. And by sniffing at these posts he is able to determine what other wolves have been past in the last day or two, and whether or not they have had a right to be in his region. He learns whether the other visitors were male or female, young or old, well or ill, unworried or hunted. And through the use of these markers wolves seem to be able to spread the news of danger, so that when one animal is threatened, the entire community soon becomes aware of the threat. Thus an analysis of this habit shows that it is a highly developed trait among the canids, one in keeping with their sociability and their gregariousness, and one that is of the utmost importance in the scheme of their lives.

Examples might be multiplied *ad infinitum*, but perhaps these are enough to demonstrate the rare combination of mental acuteness and cooperation typical of the wild dogs.

It is very difficult, and more than a little bit risky, to dogmatize as to the ranking in intelligence among the mammals, but certainly it is safe to say that the canids are among the most intelligent of the warm-blooded animals. In a large part this intelligence is innate, just as it is among all of the carnivorous mammals. But it is quite definitely augmented by the sociability of the dogs and their relatives, thereby making a combination of qualities that particularly suit these animals to live commensally with another intelligent species—Man.

Then, there is the remarkable adaptability of the canids, a trait that has been of immeasurable worth in enabling them to become suited to their surroundings. Structurally the canids are not highly specialized. Except for their long legs and compact feet as adaptations to running, and their highly developed brains, they are on the whole rather generalized carnivores. Hence they are unusually plastic, both physically and psychically, and are able to adapt themselves readily to changing conditions.

Contrast, if you will, the numerous types of wild

canids with the cats. Cats, whether they be small or large, are generally speaking of one pattern, for these animals became highly specialized early in their phylogenetic history, and have been rigidly fixed ever since. Consequently a tiger and a puma and a house cat are much the same, except as to color and size, whereas the canids in their wild state show a rather wide range of adaptive radiation. This plasticity among the canids is illustrated artificially but none the less effectively by the extraordinarily numerous breeds of the domestic dogs, showing a range in size between the Chihuahua and the Great Dane and a range in form between the bulldog and the greyhound. What a contrast these artificial adaptations among the domestic dogs afford, as compared with fixity of the domestic cats.

But this plasticity in the canids is not confined to physical make-up alone, for these animals—at least the gregarious canids—are remarkably adaptable in their mentality. It is this fact that has made the dogs so amenable to domestication; the dog has been domesticated because he has been willing to conform to the ways of man, not only in his habits but even in his manner of thinking.

To thoroughly appreciate and really understand the domestic dog, it is necessary to become acquainted with his heritage from numerous ancestors, running back in an unbroken line for many millions of years, and to keep in mind the many ties that bind him to his wild relatives of the present day. When we take this comprehensive view of the dogs as we know them, we get an inkling of the various factors of heredity, environment and behavior that have worked together to bring about that combination of characters and traits which we recognize as being typical of the Canidae. Thus we see that the dogs are members of a varied and a highly interesting family of carnivorous mammals—a family of swift runners, characterized by the attainment of a high degree of intelligence, by a general feeling of sociability, and by a trait of adaptability that has enabled them to adjust themselves to a rapidly changing environment. Is it any wonder, then, that they should be the first animals to fall under the all-pervading influence of Man?

One Hundred Aristocrats

of the Dog World

THE DOG was probably the first domesticated by man, and the importance of his faithful help in the progress of the race cannot be doubted. Much of his history is lost in antiquity. It is known from archaeological evidence that man and the dog worked together as long ago as 50,000 B.C. in northern Europe, in the time between the Old Stone Age and the New Stone Age, and his history with man from

SETTERS



1—ENGLISH (England)



2—GORDON (Scotland)



3—IRISH (Ireland)



4—CLUMBER (England)



5—COCKER (England)



11—"THE SETTING DOGGE"

As illustrated in 1621 in Gervase Markham's book, "Hunger Prevention, or the Whole Art of Fowling by Land and Water"

The setter, or "setting dogge" was used to set birds for the net. Netting went out of fashion about 1800

GROUP I SPORTING DOGS



13—LAND SPANIEL

Used for fowling on land

About 1650 we find all dogs were divided in this manner:

(1) Dogs used to find deer or other animals for the chase (Finder or Pointing Hound)

(2) Dogs used to spring feathered game for the hawk (Spaniels)

(3) Dogs used to set game for the net (Setters)

(4) Dogs used to retrieve wild fowl from the water (Water Spaniels)

Their further development as gun dogs has been in keeping with the development of the gun

15—SPAYNELL

Gaston de Foix, who wrote in 1387, first mentioned the Spaniel, and credits it to Spain



POINTERS



16—POINTER (England)



17—GERMAN SHORTHAIRED (Germany)



18—FOXHOUND



19—OLD ENGLISH POINTER



20—OLD GERMAN POINTER



21—POINTING HOUND, OR FINDER



22—SPANISH POINTER



23—BLOODHOUND

than that. But down to the time when "his best friend" entered the pages of writing his story must be pieced together by implication. We can know little of breeds of dogs that may have vanished from the earth since the days of our primitive ancestors, for from their bones it is difficult to reconstruct the animal as he appeared and in many instances even to distinguish him from the wolf. Likewise these

charts do not attempt to describe the various distinct types of dogs that are identified with certain native tribes of the modern world. Historical records are the basis of this presentation, which portrays 100 of the most familiar dogs of today and gives the foremost authentic facts of their origin. The six-fold classification into Sporting Dogs, Hounds, Working Dogs, Terriers, Toy Dogs, and Non-Sporting Dogs is the one conven-

tionally accepted by the Kennel Club of America and by dog breeders, but it does not imply that dogs in one group are necessarily closely related to each other. It is adopted here for the sake of convenience and because no genealogical chart has yet been worked out on anatomical and genetic evidence.

Compiled and drawn by
MORGAN STINEMETZ

SPANIELS



—SPANIELL, OR "DOGGE FOR THE FALCON"

as pictured by Francis Barlow, 1626-1702. The Spaniell was used to flush pheasant, woodcock, etc., when hunting with falcons



Dr. Johannes Caius, the founder of Caius College, and court physician to Queen Elizabeth, wrote the first book devoted exclusively to dogs, in 1570. In this book, "Of English Dogges", he divides the spaniels as follows: "Ther be two sortes, the first findeth game on land. The other findeth game on the water." He divides the land spaniels again as the kind that "serve the hawk," and "seconde, the water traine"

14—WATER SPANIELL, OR FINDER

As illustrated in Markham's book, "Hunger Prevention, etc.," 1621. The dog was clipped to make swimming easier



RETRIEVERS



the Retrievers form a distinct group, and with the exception of the Golden, all trace back to dogs from Newfoundland. How the original dogs got to Newfoundland is not known, but it is presumed they came as ships' dogs.

They were generally accepted theory as to the origin of the Chesapeake Bay Retriever (24) is that he is descended from two dogs from Newfoundland rescued with the crew of an English brig wrecked off the Maryland coast. The American ship *Canton* made the rescue in 1807 and landed the English crew and dogs on the shores of the Chesapeake Bay. The dogs were given to two gentlemen of that region in return for kindness to the crew. These two dogs, a male and a female, named "Sailor" and "Canton," had such great reputations as water-dogs and duck retrievers, that they were mated with nondescript dogs of the neighborhood which were used for the same work. Whether they were ever mated together, is not known.

The connection of the Curly Coated (25), Flat Coated (26), and Labrador Retrievers (27) to the Newfoundland is through a dog known as the St. Johns Newfoundland. These dogs were first brought to England in 1835 by vessels carrying salt cod from Newfoundland. Early writers often referred to them as Labradors. This has caused some confusion, as others claim that the original Labrador was a different dog altogether from the St. Johns Newfoundland, but brought to England about the same time from Newfoundland.

It is believed that the Curly Coated Retrievers were produced by crossing the St. Johns Newfoundland with descendants of the Old English Water Spaniel (a breed known to have existed in England as early as the 16th century) and the retrieving setter. At a later date, the Poodle was used as a cross to improve the curl of the coat.

The St. Johns Newfoundland and the original Labrador, (possibly variations of the same breed)

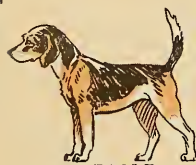
are claimed as the foundation cross for the Flat Coated Retrievers. Added to this, at later dates, were both Gordon and Irish Setter crosses.

The modern Labrador Retriever is claimed to be the product of the cross between the St. Johns Newfoundland and the original Labrador. He is also claimed to be the original St. Johns Newfoundland. Although there is some doubt as to the real origin of these dogs, there can be little doubt that the dogs from Newfoundland helped materially in producing these natural water-dogs.

The Golden Retriever (28) springs from an entirely different line from the other retrievers. He is the descendant of an old breed known as the Russian Tracker. The Tracker first came to England in 1860 and was kept in its original state until 1870. In that year, one cross was made with the Bloodhound to reduce the size. The Tracker was a larger dog than his descendant, otherwise, they are practically the same.

SCENT HOUNDS

GROUP



29—BEAGLE
(England)

Origin of these hounds is lost in antiquity. The Beagle, smallest of trailing hounds, was known in England as early as 1560. Basically its stock is that of the Harrier and Foxhound



30—HARRIER
(England)

This name designated all hounds before pains were taken to breed them solely for fox hunting; assumption being that modern Harriers derive from Foxhounds. The first pack of Harriers formed in 1260 was maintained for 500 years



31—FOXHOUND
(England)

The first mention of Foxhounds was in 1735 in *The Sportsman's Dictionary*. By the beginning of the 19th century, type was well established and packs were numerous



32—BASSET HOUND
(France)

Traditionally of French origin, the Basset really traces to Descendants of the St. Hubert hounds (bred by St. Hubert since 6th century), they came originally from Constantine to the Basset, the Bloodhound was developed in England, crossing St. Huberts with eastern hounds brought home by the Crusaders. So sure is the Bloodhound's scent, he is the whose evidence is accepted in court



33—BLOODHOUND
(England)

GROUP III WORKING DOGS

This general-purpose group is made up of dogs kept and bred for specific uses other than field sports. The accurate known history of most of these breeds does not extend much beyond the date of the first dog show, which was held in England in 1859. The early breeders of these dogs kept no records. They were interested primarily in the dogs' abilities, therefore mated only those dogs having the desired abilities in the highest degree. Eventually, in various localities, they became recognizable as distinct breeds with a highly developed sense for performing certain duties. Their refinement in conformation came at a later date with the beginning of dog shows

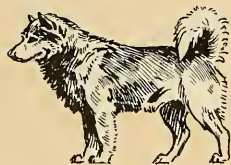
There are two distinct types of this small cattle dog. Both claim ancient ancestry. It is claimed that the Cardigan, with the crooked legs and long tail, was brought to Cardiganshire by the Celts in 1200 B.C.; while the Pembroke, with the straight legs and naturally short tail is said to have come with the Flemish weavers to Pembrokeshire in 1107 A.D. The Pembroke carries a trace of the Cardigan blood due to crosses made about the middle of the 19th century. The Cardigan in turn, carries a slight infusion of the blood of an old type of dog known as the Brindle Herder

39—WELSH CORGI
PEMBROKE (Wales)



40—WELSH CORGI
CARDIGAN (Wales)

SLED DOGS



46—ALASKAN MALAMUTE
(Alaska)

Alaskan Sledge Dog (now Malamute, from the Mahlemute Eskimo tribe) was found in Alaska by Russians long prior to U. S. purchase. Development of a pure strain dates only from 1926. This breed was used on two Byrd Expeditions



47—ESKIMO
(Alaska to Greenland)

The Eskimo dog probably originated in Eastern Siberia. They were taken by the Eskimos to Alaska, Northern Canada, Baffin Land, Labrador, and Greenland. They were used by Peary and Amundsen on Arctic and Antarctic expeditions



48—SIBERIAN HUSKIE
(Siberia)

The Siberian Huskie has been bred true to type in northeastern Siberia as long as earliest inhabitants can recall. He was first brought to Alaska (1904) as contestant in the 408-mile non-stop All-Alaska sweepstakes



49—SAMOYEDE
(Siberia)

Samoyedes have been bred for centuries by the Samoyed people. Introduced into England less than 100 years ago, they were used by both Shackleton and Scott on various expeditions

SHEEP DOGS



55—SHETLAND SHEEPDOG
(Shetland Islands)

Actual origin of the Shetland Sheepdog is obliterated by lack of records. Tradition declares them as old as Scotch Collies which came to the Shetland Islands, to become their probable sires



56—COLLIE
(Scotland)

The Collie, now beautified by breeding, has a cloudy origin, but his shepherd history is long. First shown in England in 1860, his U. S. popularity came later, though a few work collies were probably imported by colonials



57—BELGIAN SHEEPDOG
(Belgium)

Related to a number of Central European herders, the Belgian Sheepdog has two recognized varieties, the one shown (Groenendaal) being the more important. The other (Malinois) differs in coat only. Both used in police work



58—GERMAN SHEPHERD
DOG (Germany)

The German Shepherd Dog is derived from old breeds of herding and farm dogs, and has been intensely developed in the last 45 years. It is widely used in police work

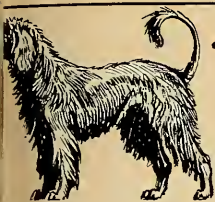


59—BRIARD
(France)

The Briard, an outstanding sheepdog, is recorded as far back as the 12th century and is rarely described in the 15th and 16th centuries. He belongs to a very ancient French strain

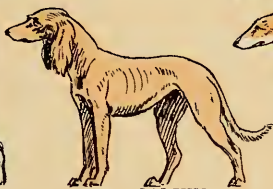
OUNDS

SIGHT HOUNDS



34—AFGHAN HOUND
(Asia)

Modern history of the Afghan Hound from the World War, when dogs were brought back to England by returning officers. Its history goes back to Egypt. How it got to Afghanistan is not known.



35—SALUKI
(Asia)

Carvings in Egyptian tombs support claims that the Saluki (Persian Gazelle Hound) is the oldest known domestic dog. First entering England (1840), they made little headway until imported from Arabia (1895). One of Borzoi's ancestors, the Saluki, came to Russia to slake a noble's thirst for fast dogs mid (17th century). To get needed fur it was crossed with a collie-like native. Result: the Borzoi, well defined by 1750, in sketches of that period.



36—BORZOI
(Russia)



37—GREYHOUND
(England)

Though owing its modern development to England, the Greyhound can be traced back as far as we have any delineations of dogs. Always bred for speed, it was the first dog to be bred to shape, and the first rules for coursing with Greyhounds were drawn up at the request of Queen Elizabeth. The Whippet, "digest-sized" greyhound, was produced around 85 years ago by North England miners from greyhound and various terrier crossings, and later the small Italian Greyhound. He is called "the poor man's race horse".

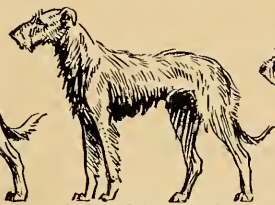


38—WHIPPET
(England)



39—IRISH WOLF HOUND
(Ireland)

Modern Irish Wolfhound dates from 1862. That year, the semi-legendary strain's few members were bred with Scotch deerhounds. Later, the Great Dane and others were admitted.



42—SCOTTISH DEER HOUND
(Scotland)

Probably the longest preserved of the original hunters. Though stemming from Irish wolfhounds, the longevity of hounding deer, as against wolves, kept up the breed's general form despite the deer's speed requiring a lighter, racier dog.



43—OTTER HOUND
(England)

The Otter Hound, first described in the early 14th century as a "rough sort of dog, between a hound and a terrier," did not make its appearance in the U. S. until the 20th century. First exhibited, 1907.



44—NORWEGIAN ELKHOUND
(Norway)

Known for extraordinary scenting abilities, the Norwegian Elkhound's ancestral claims trace back to the time of the Vikings, or earlier. Refinement of the breed began after 1877.



45—DACHSHUNDE
(Germany)

Although recognized as essentially a dog of Germany, there can be no doubt that the Dachshund was found throughout Western Europe at an early date. Official breeding data go back to 1840.

GUARD DOGS



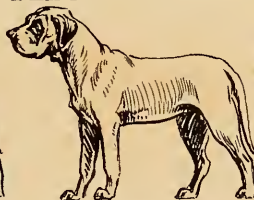
46—DOBERMANN
PINSCHER (Germany)

Developed in the last 45 years, the Doberman traditionally comes from Black and Tan Pinscher, Old German Pinscher and smooth-coated Shepherd, possibly others. Widely used in police work.



51—GREAT DANE
(Germany)

Natively German, the Great Dane has apparently no connection with Denmark. Strongest indication seems to point to the Mastin (big medieval European hunter) as his ancestor.



52—MASTIFF
(England)

The term mastiff originally described a large group of dogs. The Mastiff of today belonged to this group, and it is claimed he was found in Britain by the Romans in 55 B.C.



53—BULL MASTIFF
(England)

About 80 years ago begins the Bull Mastiff's known history; gamekeepers then crossed the Bulldog and the Mastiff to secure a fearsome aid in their continual warfare with poachers.



54—BOXER
(Germany)

The Boxer owes his perfection to Germany. He was developed within the last 100 years from dogs of this type known throughout Europe for centuries.

MISCELLANEOUS



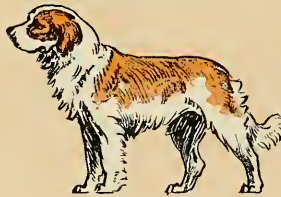
60—OLD ENGLISH SHEEPDOG
(England)

There is no definite information about Old English Sheepdogs before the 19th century. They were developed in the west counties of England as a "drover's dog." Many are still used in police work.



61—NEWFOUNDLAND
(Newfoundland)

The Newfoundland originated in Newfoundland from ancestors taken there as ships' dogs by European fishermen. The breed was developed in England during the last century.



62—ST. BERNARD
(Switzerland)

Records of the St. Bernard date from 1707, at which time, however, it had already earned a reputation for rescue work. It was 1880 before the name St. Bernard was officially designated, though it had been in common use for some time.



63—GIANT SCHNAUZER
(Germany)

First used as a drover's dog, the Giant Schnauzer came of crosses between the standard Schnauzer, herd dogs of South Germany, and later, the Great Dane. Practically unknown outside of Bavaria until 1910, it was introduced to the U. S. only about a dozen years ago.

Originally, any dog small and game enough to hunt game and vermin in its burrow was called a terrier. From this common material the present terriers have developed. Though differing in type, they all have the same character—hard-biting, courageous dogs, small enough to go to earth. With two exceptions, they are distinctly a product of the British Isles

GROUP IV—TERRIERS

Compiled and drawn by
MORGAN STINEMETZ



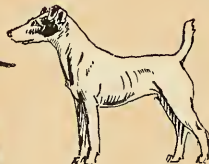
64—WELSH TERRIER
(Wales)

Not Welsh, this terrier springs from the old English Wire-haired Black and Tan (oldest known English terrier) and was so called until 1887. It was first brought to the U. S. in 1888



65—MANCHESTER TERRIER
(England)

The original smooth-coated Black and Tan Terrier, described over 125 years ago, crossed with the Whippet, produced the modern Manchester. It was called the Black and Tan Terrier until 1923, when, because of its development and popularity in the Manchester district, it became, officially, "Manchester"



66—FOX TERRIER,
SMOOTH (England)

The progenitor of the breed seems to have been Col. Thornton's "Pitch," a dog well-authenticated in a picture painted by Gilpin in 1790, and thought to be the result of mating a small greyhound and an Old English Terrier



67—FOX TERRIER,
WIRE (England)

The Wire (called Wire-haired Terrier until 1882) stems from the old English Broken-haired Black and Tan Terrier. Liberal crossing with smooth Fox Terrier brought the predominating white coat



68—AIREDALE TERRIER
(England)

The Yorkshire neighborhood of Aire developed the terrier from a cross English Broken-haired with the Otterhound



69—BULL TERRIER
(England)

As the name implies, this terrier is the result of a cross made about 100 years ago between the Bulldog and the Old English White Terrier (now extinct). The blood of the Spanish Pointer was added at a later date



70—NORWICH TERRIER
(England)

This dog is a newcomer to the U. S. but has been known in England since 1880. There is no definite information as to its origin



71—BORDER TERRIER (England)

The Cheviot Hills, which form the Border country, holds the secret of the origin of this little terrier. The breed has been carefully preserved by Border farmers for many generations



72—DANDIE DINMONT TERRIER (England)

Originating in the Cheviot Hills, this terrier was recorded as early as 1700. The name comes from Sir Walter Scott's "Dandie Dinmont," the farmer in *Guy Riddering*, who owned six of these terriers



73—BEDLINGTON TERRIER (England)

This terrier originated in the county of Northumbria, well over 100 years ago. He possesses certain characteristics—the top-knot, the long drop ears—passed to only one other terrier, the Dandie Dinmont



74—CAIRN TERRIER
(Scotland)

The prototype of the modern Cairn was the old working terrier of the West Highlands and the Isle of Skye. The short legs are characteristic of all the terriers of Scotland



75—WEST HIGHLAND WHITE TERRIER (Scotland)

The breed originated at Poltalloch, Scotland, well over 100 years ago. It is probable that it is of the same basic stock as the Cairns and the Scottish Terrier



76—SCOTTISH TERRIER
(Scotland)

The first Scottish Terriers were exhibited in 1860. Though well established as a breed at that time, there is practically no definite information regarding them before that date



77—SKYE TERRIER
(Scotland)

An old breed from the Isle of Skye which was accurately described in 1570 in the first book devoted solely to dogs, "English Dogges," by Dr. Caius, court physician to Queen Elizabeth



78—SEALYHAM TERRIER
(Wales)

The Sealyham takes its name from an estate in Wales where between the years 1875 and 1891 the breed was developed by Capt. John B. from dogs of obscure origin. First appearance in show was in 1903



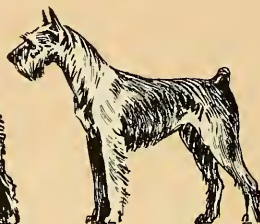
79—IRISH TERRIERS
(Ireland)

Irish Terriers were first exhibited in 1879. Aside from the fact that they came from the north of Ireland, their early history is only speculation



80—KERRY BLUE TERRIERS
(Ireland)

The national dog of the Irish Republic. Originating in the County Kerry, the Kerry Blue Terrier is claimed to have been pure bred for 100 years. They were first exhibited in the U. S. in 1922



81—SCHNAUZERS
(Germany)

This dog bears no relationship to the British Terriers. He is classed as a terrier in this country, but not so in Germany, where he originated, probably from crosses of the Poodle, with Wolf Grey Spitz and Old Pinscher stock

GROUP V—TOY DOGS



PEKINGESE 83—**JAPANESE SPANIEL** (China)
Belongs to the 8th century. First used by the Manchus to reach the West. First shown at the 1860 Exposition in Peking (1860)



Allegedly very old, its actual record dates from Commodore Perry's expedition (1852-54) and delivery of four of the dogs, the Emperor's gift, to President Pierce



84—ENGLISH TOY SPANIEL (England)
Descended from the "Spaniel Gentle, otherwise called the Comforter," according to Dr. Caius (1570). Credited with a Chinese origin



85—MALTESE (Malta)
One of the oldest known breeds, Dr. Caius (1570) wrote of them: "That kind is very small indeed, and chiefly sought after for the pleasure and amusement of women"



86—YORKSHIRE TERRIERS (England)
Developed in Yorkshire and Lancashire, there is no information on origin of this breed. First showing: England (1861) as "Scotch Terrier." Introduced here about 1880



87—TOY POODLES
Today's breed springs from the larger Poodles. That the popular 18th century "White Cuban" came from Cuba is doubtful. But his true "birthplace" is an enigma



POMERANIANS (Germany)
Developed in Pomerania, old Spitz stock at unknown date, the breed was not well known in England until it was first exhibited in the U. S. in 1892



89—PAPILLON (Spain)
Developed from the "dwarf spaniel" (dating from 16th century), these little dogs, favorites of Mme. de Pompadour and Marie Antoinette, were painted by Watteau, Fragonard, and Boucher



90—GRIFFON (Belgium)
Descended from the small Belgian street dog and the Affenpinscher, it was unknown until 1895 outside Belgium. Some say both Pug and English Toy Spaniel influenced this development



91—PUG (China)
Its popularity there plus its introduction to England by the Dutch East India Company, have often given Holland credit for the origin of the Pug. China seems more likely



92—CHIHUAHUA (Mexico)
The known history of the Chihuahua begins about 1850, when specimens of the breed were found in the state of Chihuahua. Believed to be a descendant of the Techichi, a dog of the Toltecs



93—MEXICAN HAIRLESS (Mexico)
Contrary to general belief, Mexico is not alone in having a native hairless breed. The Mexican Hairless strongly resembles a Chinese hairless breed

GROUP VI—NON-SPORTING DOGS



94—POODLE

Though popularly regarded as a dog of France, the Poodle is believed to be of German origin. The clipped Water Dogge shown in the first group (14) bears a striking resemblance to the Poodle and is thought to be one of his ancestors. Where the custom of clipping poodles originated is not known



95—CHOW CHOW (China)

The marked peculiarity of having a blue-black tongue distinguishes this ancient Chinese breed from all other dogs. First English description given in the Rev. Gilbert White's *Natural History of Selborne*, tells of a pair brought from Canton by a neighbor in 1780. Finally popular in England by 1880, it was first exhibited ten years later in the U. S.



96—DALMATIAN (Dalmatia)

There is very little information as to the Dalmatian's lineage, but he is believed to have descended from the same class of hound as the pointer. Old pictures and engravings depict the Dalmatian very nearly as he is today



97—BULLDOG (England)

The Bulldog is entirely British in his origin and development. By careful selection, the modern dog has been developed from the dog used for the once popular sport of bull-baiting. As we know him today, the Bulldog bears little resemblance to his ancestor, and has none of his viciousness



98—BOSTON TERRIER (United States)

The Boston Terrier is an American product, named after the city of its origin. The crossing of a Bulldog and a white English Terrier about 60 years ago is claimed to have started this breed. Inbreeding and careful selection have made him what he is today



99—FRENCH BULLDOG (France)

Several varieties of the small, or toy Bulldog bred in England around 1860, were exported liberally to France. It is generally conceded that these dogs, crossed with other breeds, evolved the French Bulldog. There is little accurate information



100—SCHIPPERKE (Belgium)

Although known to have originated in Belgium's Flemish provinces, little accurate knowledge and considerable difference of opinion have characterized investigations of this breed. Prior to 1888, they were called Spits or Spitske. This country first saw them in 1885



(Above) The homing pigeon begins its downward wing-stroke

How the super-speed camera sees a pigeon's flight

In these photographs, taken at the almost unbelievable speed of $1/100,000$ second, the camera which has proved valuable in discovering technical defects in a wide variety of subjects from golf drives to whirling propellers, turns its eagle eye on the mechanics of bird flight. The photographs were taken by Harold E. Edgerton of the Massachusetts Institute of Technology, who has been largely responsible for development of ultra-speed photography



(Right) The downward stroke in full sweep



(Right) The upstroke. Note the barred shadows on the breast, indicating that the primaries are open

The theft of fire from heaven by Prometheus is typical of legends found throughout the world showing widespread belief in the divine origin of fire.



Illustration by Gustav Wolf

THE STORY OF FIRE

By VIRGINIA S. EIFERT

Its influence on Man's march from caves to skyscrapers—a terrible power of destruction yet one which beckoned our ancestors upward through the ages with a mysterious and often religious fascination

IN THE beginning there was fire. Eons before the first man stood in awe of volcanic flame, the earth had felt its elemental power for destruction and creation. Sun fire made possible the first life on earth, and at the opposite end of an infinite cycle, when it ceases no living thing will survive. In all this, fire has been unchanged. Fire in its very nature is a primitive thing: civilization, culture, and advancement are able to make no change in its composition, its needs or its habits. Flame is primordial.

As we muse in the inaudible presence of hearth-flame, or as we relax around a sparkling camp-fire; as we quake in horror before a roaring conflagration, or as we find peace in the golden silence of church candles—subconsciously we feel this immortality of flame.

The story of fire casts a new light on the whole history of man, his joys, his tragedies, his gods, his very brain. Watch, as the golden tongues curl around the hearth logs: sparks dart upward; beneath, the logs grow red—red as the embers a certain caveman once found in a charred log of the primeval forests. . . .

He understood nothing of fire. It was an unex-

plainable horrifying creature that descended from the clouds and kindled whole forests, or at moments came roaring down the slope of a mountain and destroyed everything in its path. Like the wind, the sun, and the sea, fire was a power which no man could defy.

Not until he dared to take home his red embers and feed them with dry wood and leaves, did the cave man find the first inkling of what fire might be. Now he began to see how beasts avoided his flickering cave and, though the winds were keen outside, how warm the fire made his dwelling-place. He had captured fire for his servant; for the time he was master.

But though he knew how to take firebrands from a place already burning, he knew nothing at all about the magic of making a new fire. If his home fire was in some way extinguished, there was nothing but to travel to his neighbor and borrow some—steal it, if his neighbor was unfriendly. Home came to mean the place where the fire was, the place to come for warmth, protection, shelter, affection, and tolerance. Life centered around the fire, but still no man knew how to make it for himself.

Perhaps it was an arrowhead maker who first

found the secret of fire-making by happening to strike his flint with a piece of the mineral iron pyrites instead of an ordinary stone, and thus producing hot sparks. With dry leaves and tinder beneath his hands, we see him strike the stones together, faster, faster. The tinder blackens, smokes; more sparks make a tiny flame leap up. With exultation in his breast, the cave man knew he had attained a new power. He could command fire to his use, and he consequently felt himself better than beasts, better, in fact, than his fellows.

With growing realization of the new power at his command, he or his descendants perfected the method, invented the rubbing-sticks, and jealously guarded the secrets. Even the women in certain tribes were never allowed to come near when the men made fire.

It is difficult for us to imagine people living without the knowledge of how to make fire, but the Andaman Islanders, south of Burma, are a modern example. Apparently unable to produce it by any means, they have had to preserve their fire from one camp to the next for countless years.

Many of the fire-making methods became complicated and required much equipment, but perhaps the simplest was the two-stick apparatus used by the American Indians, the Eskimos and earlier peoples. It consisted of a flat stick with a groove in which a pointed stick was rapidly rubbed, or of a flat stick with a shallow socket in which a pointed stick was rapidly twirled between the palms. The friction ground out a fine powder, which grew hot and smoldered. Tinder laid beside the groove caught the first fire, and careful tending kept it going. Often a leather thong was used to make a small bow which took the place of the hands in twirling the stick. Most natives could make fire in about 40 seconds.

When man discovered how to make fire, the whole vast field of its potentialities began slowly to unfold before him. The chance incident which enabled him to taste cooked meat will probably never be known, but it is known, at least, that cookery was in use far back among the cave people. There were no cooking utensils or dishes at the time. It was later that a bit of wet clay tossed into the fire was baked to an astonishing hardness; and slowly, as man's abilities increased, simple bowls of wet clay were baked in the fire. Or clay mixed with ground clam-shells was plastered inside a grass basket, and the basket burned away to leave the clay shell as a bowl. Fire, without man's realization of the situation, was urging new experiences upon him—food he had never tasted before, inventions that took form in his primitive brain because the fire was pushing him.

Metallurgy became known through the power of fire. Bronze was discovered when a fire melted certain ores and fused copper and tin to make a new substance. Enterprising minds took up the problem of making more of this usable metal, and the first smelters came into being. Palm-leaf fans or human breath were used as bellows to make a hotter flame. Slowly, fire was paving the way for future civilizations in which metals were to play such an important rôle. It was the spur that goaded minds to action.

Once started, man found countless uses for his servant. Fire-tipped arrows, catapults of boiling oil and pitch, and blazing fire-ships all helped him toward the goal he had always sought—that of supremacy over his neighbor. He used fire for hunting and fishing, and found that beasts and fish were fascinated and confused by the flame. He used fire for signals long before he had a written language, setting fires on hill-tops as the first long-distance messages. On headlands jutting into the sea, he set fires when ships were due. Here was the forerunner of the lighthouse.

Always, however, fire would remain an independent entity, serving when it cared to serve, breaking all bonds of servitude when its wildness craved outlet. Fire would build cities, and would tear them down again. Fire would provide a means to wealth, and without compunction would destroy that wealth, time after time, century after century. Man thought he had tamed the tigrine flame when he could make it at will, but always the supernatural personality with which he came to clothe it, cruelly smiled and bided its time.

That mystery which no one could explain, the docility that so easily got out of hand, the terrible bite that could so quickly kill, the utter extinction once it was gone—all these gave to fire an element of the supernatural which somehow had to be explained. Myths had for centuries explained anything otherwise unexplainable, and myths of fire became many and varied.

Many myths in widely separated regions tell how fire was stolen, and thus reflect some of the conflict which must have occurred in primitive times over the possession of fire. The Promethean fire-legend of the theft of fire from the sun-chariot is one which has found expression in many localities far removed from any Hellenic contact. In some instances the hero who stole fire was a bird, hence to be known as the Fire Bird. The cardinal, the scarlet tanager, the oriole, and the woodpeckers all have been called "fire-birds"—birds whose noble feat in succoring shivering man-kind was rewarded with charred wings, charred tail, or a charred base of the beak.

Myths began to make of fire something more than a humble servitor, more than a protection against

beasts, or a shelter from the cold. Fire Worship rose, a cult which was to supersede all other creeds at a certain stage in the evolution of the races.

Fire worship appeared at one time or another in history in nearly every part of the world, and perhaps had a greater influence on men's future habits than any other early spiritual belief. It seemed to be a part of the mental development of humankind. Just as modern children at a certain period in their lives must be kept away from matches, so also did the human race at times play in fascination with fire. Thus from the first rude adoration of flame, there grew an advanced stage of worship in which man believed that all fire was but the manifestation of the fire god, to which in every land he gave a different name.

At first the tribal fire was the sacred flame. Woman, as the one who seldom went away from home, became the natural guardian. As fire temples and places of worship were erected, women came to have a secondary part as vestals who cared for the flame in the absence of the priests, but had little to do in the actual rites. Fire priests, the rulers of the tribe, were magistrates and doctors as well, and de-

signed strange rites according fire child of the sun, a venerated god-like status.

Amon-Ra of Egypt, affiliated with the sun, had fire-altars for sacrifices. Baal ruled the Chaldeans and Phoenicians. Gibil, a terrible demon who demanded human sacrifices, was the Assyrian fire-god. Agni was the fire-god of Aryan Hindus. Xiuhtecutli, "The Lord of Comets," was Mexican, and to him big teocalis, or fire temples were built. Shulawitsi, probably a form of Xiuhtecutli, was the fire Katchina of the Hopis. Similarly was Hastsezini the Navaho fire god. The Africans, Ainus, Celts, Romans, Incas, and countless other cultures and races had their fire-altars and their fire-gods.

Worshippers could induce in themselves a state of insensibility in which heat seemed incapable of burning. They passed their hands through the fire, and rubbed them on their eyes and cheeks as if to cleanse them. They rose and leaped across the fire, walked through it, pressed the soles of their bare feet against the coals, rolled burning brands between their palms. In orgiastic rites men and women pressed live coals against their breasts, held them in their arm-pits and thighs. Fire walking and these



Drawn by Gustav Wolf

erotic fire rites continue to attract attention in certain parts of the world today and are sometimes difficult to explain.

The fierce Druid priests, imbued with fire-mania, led the ancient Britons in a mad orgy of worship and sacrifice. Fire festivals to promote good crops, fertility, healthy animals and good hunting were held several times a year. Every five years dozens of prisoners of war, criminals, and beasts were put into huge wicker images and burned with great ceremony. It was inferred that the greater number of sacrifices meant a greater fertility of the land. Bodies partially burned were cut into little pieces and scattered over the fields.

In the desert there was fire worship, for here the awful Semitic deity Moloch demanded human sacrifice, particularly of first-born children. Later, the ancient Hebrews worshiped Yahveh in the form of the volcano Mt. Horeb, on whose slopes one day the voice of Yahveh came to Moses out of a bush of fire.

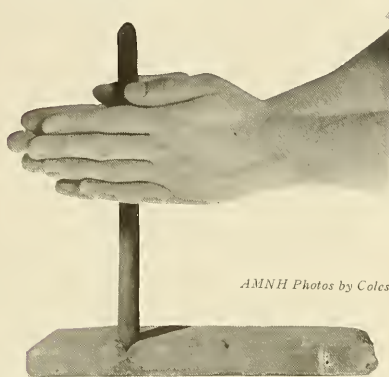
In the midst of these more violent forms of fire worship came the gentler teachings of Zoroaster. About the year 1000 B. C. he found the fire worshippers a scattered and motley lot. It was he who crystallized and unified their customs, and taught them about Ahura-Mazda, God of Light, as opposed to Aingra Mainyu, the Lie Demon of evil, darkness, and filth. He did not believe in self-mutilation or human sacrifice. He tried to teach that fire itself was not a god, but only the symbol of Ahura-Mazda. Fire altars, he insisted, must be only testimonials to the adoration of the one god. But this creed was too tame for a semi-barbaric people. At Zoroaster's death, Ahura-Mazda became a super-being whose original six spirits—Good Thought, Right Law, Noble Government, Holy Character, Health, and Immortality—became ten thousand angels which were constantly opposed by Aingra-Mainyu's ten thousand devils. Elaborate ritual now accompanied the new Zoroastrianism. The priests organized themselves into a hereditary order called Magi, and dur-



1 MAN'S AGE-LONG STRUGGLE to keep warm and have a hot meal have led to the following ingenious inventions. The "fire plough" (above) is one of the simplest and earliest methods known. A slender stick is pushed backward and forward in a groove in a piece of wood. Gradually wood dust gathers in a heap at the end of the groove. By continuous rubbing, sufficient heat is generated to set the dust on fire. The Polynesians may be given provisional credit for the fire plough.



2 PRIMARILY A DEVICE of the bamboo-country Malay, the bamboo fire saw not only illustrates primitive man's almost universal use of friction on wood but the influence of environment on his choice of materials. One half-section of bamboo is notched and another piece used to saw through the notches. As the sawing progresses, heated wood-dust falls down through the cuts and ignites. The natives of New Britain also employ a hard stick against soft wood when bamboo is lacking



AMNH Photos by Coles

3 FORERUNNER of more complicated processes shown above on opposite page, the simple fire drill is operated by rolling the upright stick rapidly back and forth between the hands in a socket in the stationary block. The wood must be very dry, and often the bottom piece is partially decayed, to facilitate the collection of fine wood particles which eventually ignite. As soon as a spark glows, it is blown and fed with dried grass and wood shavings. The process is easy for a good operator with proper equipment kept dry. The Navajo Indians are still adept at this method

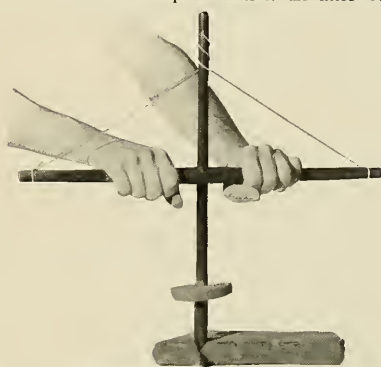
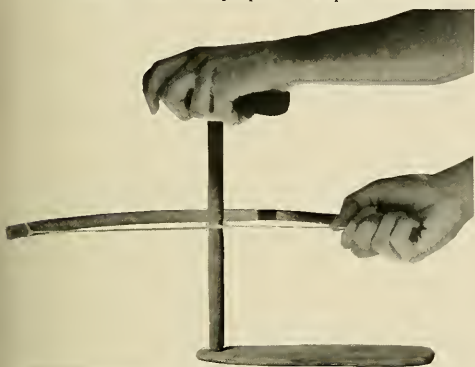
ing the fire services wore thick white veils over their faces to keep their breath from polluting the sacred flame.

They proclaimed such things as fire, water, and earth as holy, but all the body excretions—even breath—were unholy. One dared not spit in the fire—that was sacrilege. Corpses were the extreme in unholiness and, therefore, could not be burned, nor could they be buried in the earth or thrown into water. "Towers of Silence" therefore were built, and here on high platforms open to the sun the dead were left.

In 600 B. C., some years after Zoroaster's teachings, and until the year 1880 A. D., Baku was the center of the fire-worshipping cult. Here a temple fire burned unceasingly and without apparent fuel. Long ago, the story went, a certain man's well dried up, so he lit a torch and held it over the edge to see what had made the water disappear. There was a terrifying roar of flame—the well had become a column of fire. The people worshiped it as a mani-

festation of Ahura-Mazda, the Mighty, and erected a temple over the fire-well. From that time until the early 1800's no one knew what made the well burn, until Englishmen, in calm defiance of Ahura-Mazda, decided that this was not a miracle, but only a natural-gas vent. As if Mazda had been defiled by knowledge, in 1880 the fire died, and no one could ever again ignite the sacred well of Baku. Today, however, 90,000 Parsees in India still worship fire and practice the early teachings of Zoroaster.

All the while that fire worship was filling the religious gropings of humankind, man at the same time was using fire for more than an altar-flame. Already he had found a thousand uses for it. Long ago when that first man brought fire into his home, he paid for his comfort by starting himself, his fellows, and all his descendants upon an age-long hunt for fuel. They had to use what they could get, and use it sparingly. Mesquite roots were dug and burned in Mexico. The Chinese used grass, bound and twisted into compact masses. Eskimos burnt



4 THE INGENIOUS ESKIMO shares credit with Siberian natives and Canadian Indians for development of the four-part bow drill. This instrument may have been suggested by the hunting bow, though it is smaller and rigid. By moving the bow back and forth, the thong which is wound around the shaft causes it to rotate, boring a hole in the stationary piece. The top of the shaft rests in a socket. Sometimes instead of a bow, a second operator works the thong by hand

5 ALTHOUGH EMPLOYED in various parts of the world for boring holes, only the Iroquois Indians realized the possibilities of the pump drill for making fire. The hand piece, fitting loosely over the shaft, is tied at both ends by a cord to the top of the shaft. The shaft is made to rotate by twisting the string several times around the shaft and moving the hand piece up and down. The weight at the bottom adds momentum

6 FIRST POCKET-SIZED LIGHTER: the fire syringe, a far cry from the two sticks of primitive man. This was developed in France for popular use by du Montier some time before 1823. The piston fits into a tube, one end of which is closed. When struck sharply downward with the hand, air compressed within the tube causes heat sufficient to ignite tinder at the bottom. Not until 1827 did John Walker of Stockton-upon-tees, England, dip splinters of wood into a chemical mixture and produce matches capable of being ignited with sandpaper. Where matches exist, the primitive methods are abandoned or relegated to ceremonial uses



whale or seal oil and such meagre wood as drifted onto their beaches. As early as the Bronze Age, charcoal was manufactured from partially burned wood, and was used in small braziers—scant heat, but better than nothing. It is still a favorite fuel in the tropics.

On the plains, in the far north, on the steppes, and in other treeless country, sometimes the only fuel was of animal origin. Bones made a hot, smokeless fire, and the dried, oily bodies of the now extinct great auk, as well as petrels and puffins, were used for fuel by mariners and natives. In lieu of anything else, animal droppings often had to be used, and are burned in many localities even today. Anything at all that would burn has at some time been used for fuel by shivering mankind.

Peat, a light form of bog-coal, was in use long before coal itself became known as a general fuel. Theophrastus in 300 B. C. described coal as a curiosity—a black stony substance that burned with a hot flame. It was used sparingly by Britons in 852, by the Chinese long before the Christian Era, and by the ancient Hopi Indians to fire pottery.

Coal gained favor slowly

Though fire was perpetually hungry, and though adequate fuel frequently was scarce, coal was long in gaining popular favor in America. By chance, one night in 1790, a certain Nicholas Allen built a fire under a ledge of black rock in Pennsylvania and a few hours later was dumbfounded to see the mountain on fire. It was through his discovery and his backing of its use that the great coal industry grew out of the Pennsylvania "black rocks."

For centuries fire had grown brighter, as little by little the style of lamps changed from the first clam shells perchance filled with muskrat oil, to better containers and more refined oils. Candles were another step, though torches long took their places in medieval castles and huts alike, and such things as mullein stalks dipped in lard, yucca stalks, and cat-tails served the purpose in early America.

Fire was still a thing to be coaxed. There could be none without something to feed it, and though oil was popular, it was usually expensive. Whales, the biggest source of supply, had to be pursued far a-sea, and lives were lost on nearly every voyage.

For centuries no one but the Chinese knew about the vast reserve of oil lying in the ground and waiting to be ignited in the lamps of the world. The first drillings in America, in 1859, were opposed with raucous derision. Then, slowly, came the oil boom: oil wells throughout the country, in the ocean, in church yards, and city streets. Oil to feed the impatient hunger of fire.

More than two thousand years ago the Chinese had piped natural gas through bamboo tubes, but nothing so practical was done in the western world till 1792, when in England William Murdock manufactured gas and demonstrated it as a new illuminating fuel to an unbelieving throng. To most of them the idea of lighting streets and homes with this foul-smelling substance was not only ludicrous but downright dangerous.

Religious opposition to light

Ministers of another god than Ahura-Mazda objected that "artificial illumination was an attempt to interfere with the divine plan of the world which had ordained that it should be dark at night." They further added that the proper fear of darkness would vanish, while in lighted streets drunkenness and immorality would be immeasurably increased. Physicians, goaded on by the fanatics, finally came forth with a feeble plaint that gas was injurious. They further elucidated by saying that lighted streets made people stay out late and, therefore, tended to increase colds. Police even objected that horses would be frightened and thieves encouraged; besides, they said knowingly, constant illumination of the streets would rob festivals of their greatest charm. Whether they knew it or not, they were thinking of pagan fire-festivals, when fire was a thing not to be trifled with, but was the basis of an important ceremony that should take place but rarely to uphold its sensationalism.

In spite of objections, gas lighting stayed until the greater god, electricity, replaced it.

Even more difficult to overcome than the problem of illumination was the task of heating. Houses were poorly made, and fires, such as they were, did not send heat beyond a small radius. One toasted his face before the fire, while across the room a basin of water slowly congealed. The first fireplaces developed when someone piled stones around a fire built on the floor; this not only concentrated the heat but made a rest for cooking pots, foreshadowing the stove.

Ancient Rome had gone about using fire to heat homes and baths in a startlingly modern manner. Subterranean furnaces conveying hot air or steam through a system of pipes laid in the floors served to heat whole mansions. The baths had to be hot, cold, and tepid, with a steam room, and comfortable heat in all the rooms. The Romans, of all the ancient peoples, probably utilized fire most efficiently and in the greatest number of ways. Elsewhere heating was a poor farce. To offset chilly rooms, little foot stoves and hand stoves were later invented. They

were much in use even in colonial America, especially in the churches where fire, except where candles and incense were used, was a luxury considered not conducive to the true religious fervor. In China, where fire was scarce and small, the "belly-stove," a small contrivance easily concealed under voluminous wadded garments, was used to concentrate a bit of heat against the vitals.

With fire places, chimneys were invented, though previous to the fourteenth century there either had been a simple smoke-hole which the smoke not always found, or the smoke merely meandered out somehow or hung darkly in the rafters. Meats, hams, herbs, fowls, peppers, dried beans, and other foods were hung from the ceiling to take advantage of this preserving atmosphere of perpetual smoke.

New home for birds

Fire chimneys wrought at least two changes among living things. The first was among the birds, the other, men. For centuries the little grey swifts had nested in hollow trees in America, but with the coming of chimneys they left their trees and ever afterward nested in the sooty abodes of darkness. Up the dark, grimy chimneys of Europe other creatures, boys and men, spent a large portion of their waking hours. The chimney sweeps were a new profession; they were a miserable lot, usually under the whip of a cruel overseer, their wretched lives a black mark against fire. With the advent of chimneys, there also came an increased menace, a menace that had been scourging the people ever since man had been bold enough to cage the flame. Chimneys sent sparks out on roofs; fires were becoming more and more commonplace.

There had been firemen in ancient Rome, called *matricularii*, whose business was to extinguish blazes in the city. Fire engines of a sort were early provided and Emperor Augustus equipped Rome with 7000 fire fighters. But in spite of watchfulness, Rome, perhaps more than any other aged city, again and again was purged by fire.

The greatest of Roman fires was purportedly set by Nero in 64 A. D. For nine days and nights the city was a raging inferno. Fire, as if weary of being worshiped on little altars and pampered in little stoves, broke its bonds and ravaged the city that had adored it.

The old quarters burned; so did the Circus Maximus, where once the Christian martyrs knew torture by fire. The Forum burned, as did countless temples whose altar fires were as nothing against the holocaust. Ancient Rome died in that fire; from it sprang the new city, the fire-conscious city, where

the worship of fire waned. In its ruthless way, fire had made way for the future.

Thereafter, people in all parts of the civilized world began turning their attention to fire-prevention. In England, one of the first crusades against needless disaster came when King Alfred ordered people to cover their fires every night with an iron kettle without any bottom. At the ringing of a bell at eight o'clock, everyone raked his coals into a pile and covered them with the "couvre-feu," as it was called. By and by the eight o'clock bell came to be known as the curfew, and long after it ceased to be an order to cover one's fire it was known as a signal to get off the streets.

Ancient "fire-extinguishers"

In regard to fire-prevention and fire extinguishing, the Dark Ages were very dark indeed. Church bells, certainly one of the most futile of extinguishers, were employed to put out fires. The bells were consecrated with great ceremony, washed inside and out with holy water, anointed with oil, and then rung loudly during a fire. On other occasions, altar-covers, images, or relics of a saint were paraded up and down by priests in front of the burning building, and were blandly considered the most practical means of putting out any large fire. Their success, if any, is not recorded.

Again and again fire set about the destruction of great cities. It burned London many times; burned Moscow when the French invaded it; burned New Orleans and Charleston; burned New York early in its history and many times thereafter; burned Tokyo, burned Paris, burned Martinique. From the effects of an earthquake, San Francisco burned; from the effects of a somewhat mythical cow, Chicago burned. Fire needed little encouragement to devour a city. The ancients had a tale of the phoenix-bird, a splendid creature of every color known, who at the end of its five-hundred years of life flew to Heliopolis, plunged into the altar fire at the temple of the sun, and there died. From its ashes rose a new, a young phoenix, who would live for another 500 years. So it is that a city often rises fresher and finer after its burning.

Until the nineteenth century, fire-fighting in cities did not develop to any great extent. A barrel of water beside the door and fines for dirty chimneys were long deemed sufficient. In America the "fire-laddies" were a fire-cult all their own, and intense rivalries existed between companies. Every fire was a contest to see whose engine could arrive first. The last comer was in disgrace. In fighting fires, the unleashed grandeur of a conflagration got into a man's

blood so that after he had served as fireman a few times, the fierce exultation of fighting the mysterious power of flame was such that nothing short of death, broken bones, or severe illness could keep him away. When the fire-bells clanged all over town the air was filled with the pungent smell of smoke and the odor of burning cedar shingles, no fireman could stay quiet. In known instances men at their weddings, men at their mothers' funerals, sick men hardly able to stand—all raced after the engines and helped or hindered in quelling the blaze. This urge and the rivalry that went with it lasted well past the motorization of fire engines. It was a vivid part of every conflagration, as vital to the scene as the fire itself.

Long before fires tore down cities, they ravaged forests and prairie land. Forest fires, perhaps more than any other, have a terrible effect over enormous areas. Millions of dollars' worth of timber are completely destroyed in a single conflagration; dozens of lives, animal and human, are lost every year in the burning forests of the nation.

Fire has always lurked in forests. Ages before there were any men, lightning was the malicious agent which darted down, touched a tree, and set a forest to crackling. In a similar way, lightning set fire to prairies when in autumn they were thick with tinder-dry grasses. It is said that Indians kindled the prairies to drive game into a more limited section. "Balds," those treeless mountain tops in the balsam-covered Great Smoky Range, are believed to have been caused by Indians who burned off the peaks so that game would feed in the clearing, to be shot when needed.

Nature's antidotes

But nature provides means for healing her wounds, and even utilizes the very agent that causes them. The ripened cones of the Lodge Pole Pine remain on the tree for many years and are often opened by fire alone, to scatter their seeds on areas swept bare by forest fire. With special arrangement to preserve the vitality of their seeds and their power to germinate quickly on burnt soil, these forests are constantly swept bare but quickly rise again undefeated. Fireweed, whose seeds blow on the wind, also rapidly carpets the charred ground; and wind-blown birch seeds sprout and grow quickly, to provide shade for young pine seedlings when at last they begin to grow.

Furthermore, fire has been of immeasurable value in actually relieving some of mankind's physical discomforts. Cauterizing wounds was for centuries the only way to give a patient a fighting chance for life. It was a crude, excruciating method, but it alone

stood between men and deadly infection. Fire as well as being god, servant, avenger and purge, has been physician.

Always a many-sided power, fire could never bestow its fullest benefits while it was hard to kindle. Some time before 1823 a new method of kindling a flame known as the fire syringe was developed for popular use by du Montier in France. This was a small cylinder fitted with a piston, which when struck smartly with the hand compressed the air sufficiently to ignite tinder in the bottom. In 1823 Döbereiner in Germany produced a new lighter which was regarded as an improvement on the fire syringe but which used another principle. He discovered that hydrogen gas tends to ignite in contact with platinum sponge, and built a glass cylinder with a zinc piston. The zinc piston when brought down came in contact with sulphuric acid, and generated hydrogen, which came in contact with the platinum sponge and burst into flame. The same general principle is still used in certain cigaret lighters.

The first lucifer

But before 1827, all fires were ignited by cumbersome methods, some of them as primitive as the ancestors of mankind. It is strange that in all these centuries no one thought of a newer, easier way to make fire. It was left to John Walker of Stockton-upon-Tees, England, to dip splints of wood in melted sulphur, then in a liquid of potassium chlorate, antimony sulphide, and gum water. When dried he was able to ignite these by drawing them through a folded piece of sandpaper. This was the original lucifer match—so named for that sulphurous deity, Lucifer, the Fallen Angel.

The true human value of the match was incomparable. Even the Indians, who had scornfully rejected the white man's inventions and gimcracks, capitulated when they saw how easily he could light a fire with a match. Now the rubbing-sticks and flint-and-steel are left for the remaining primitive peoples of the world—and for the Boy Scouts.

The years following the invention of the match were those of the Industrial Revolution, and fire at this time more than any other was responsible for great advances in culture and progress. Smelters to take ores from rock; kilns to bake bricks, china, pottery, and tiles; steel mills to transform iron into the all-powerful steel; railroads propelled by steam and run on steel rails; coal mines, oil refineries, gas wells, coke ovens, factories, foundries, mills, canneries, meat packers; men's homes, buildings, and businesses—all these required fire to exist.

Through all the vicissitudes of fire it has remained

the same raw, primitive element that molded the world. Since archaic flame first enveloped the earth and left its final strength in volcanoes, fire itself has scarcely been influenced by progress or evolution. New incandescent compounds are created giving flames of different color or intensity, but fire is still the extraordinary and fundamental thing it always was—a phenomenon utterly unlike anything else we see.

Flame is still fascinating, still holds men entranced. A burning building attracts a crowd in a few moments; children surreptitiously play with fire; minds thrill to the deathless Wagnerian Fire Music; all ages enjoy fireworks; camp fires and meals over a raw blaze are popular and produce a peculiar contentment; candle light is used at dinners and meals on special occasions; church services employ incense, altar lights, prayer candles; even the birthday cake and the Christmas tree are small fire-festivals in themselves. And there is always the open fireplace.

Tonight as we gaze into the flickering fire—raw, pagan flame burning within a few feet of beautiful upholstery, a painting or two, electric lamps, a modern radio, a grand piano—it seems strange that such a thing should be in our midst. We sit in contentment before the hearth and muse on how out

of place yet how fitting it is that the fire which the Zoroastrians worshiped, into which the children of Israel were hurled, and which for centuries has lived in the primitive hut and on the altar, or burned great cities—that such a thing live innocently at home in the modern fireplace. It is something of the past which is perhaps unwittingly brought again into human contact.

The benediction which the fire gives out to all who gather near is something which modern man craves. It is a link with the forgotten past, a touch of security symbolized in the home. Yet it is indeed a far cast back to the time when home was truly where the hearth was, when fire was the protector, the comforter, the magician. Men, women, and children today gaze into flames and coals, and think these strange, unlinked thoughts which they do not exactly understand. They are thoughts dwelling in a niche of the mind not often explored. It is the influence of the past, that inescapable thing which makes modern man kin to his ancestors; and though he does not quite understand his feeling, it makes him look upon fire with a tinge of the old worship. It is still the same primitive blaze; still the fire that once enveloped the world; still the elemental flame whose charm is as compelling and mysterious as when it provoked an unreasoning worship.



Drawn by Gustav Wolf



Photo by H. B. KANE

"W's the Woodchuck
Whose life's spent in clover" From *The Alphabet*

BIOGRAPHY OF A WHISTLEPIG—*The animal that is supposed to look for his shadow on Groundhog Day was a curious pet and one that required no care while he hibernated in the home*

By ROY L. ABBOTT

*Professor of Biology,
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I KNEW "Chuckie," the woodchuck or whistlepig, long before he was born. Or perhaps it would be better to say that I knew of his coming, for it was my good fortune to see his parents at their September courtship which led to his birth along with five other brother and sister chucklings about the first of the following May.

I was out tramping that morning and had just sat down to rest momentarily on the rim of the bluff when my attention was caught by a commotion in a smartweed patch a few yards below my feet. Presently two large and enormously fat woodchucks came waddling into view, one seemingly in pursuit of the other. The rear one was larger and darker than the leader, and I learned afterward that this was Mr. Woodchuck. Neither seemed in any particular hurry, so round and round they went in a kind of endless "follow the leader" game and with that peculiar flowing gait that only woodchucks have, keeping up a low whimpering chuckle or half-whistle all the while.

I didn't see the finish of this courtship, if that is what it was, for Mrs. Woodchuck happened to see me, whereupon she at once led the way up the bluff to a deep burrow under the rocks at the base of a tree, where both promptly disappeared. But many subsequent visits to the den showed me that the two "chucks" holed up there for the winter early in October, never showing themselves again until the middle of February.

Woodchucks at home

There are those who believe that woodchucks, mate in the early spring, and possibly they do, for the males, especially, are known to make long and mysterious trips about that time, but at any rate, Chuckie was one of a litter born to that pair of woodchucks about the first of May. But not having met him personally as yet, he was only one of that brood of six that I first saw through my telescope

from behind some nearby boulders about a month later, as they played about their door in the June sun.

The den was under a big elm, and a two-inch root running horizontally across the entrance a foot or so high made a convenient bar upon which the youngsters could play. Minutes on end they would jump up and grab the root with a kind of chin-yourself action, often swinging backward and forward several times before dropping to the ground to tumble over each other and romp like kittens. Old Mother Woodchuck, however, took no part in these activities, contenting herself in looking on, rising to her haunches every now and then to search the landscape for a possible enemy. But watchful as she was, tragedy stalked her family. I didn't see that goshawk myself until he swooped. There was a sudden whirr of stiff wing feathers, a loud warning whistle from the mother as she and the rest tumbled out of sight into their cellar, and then I saw the hawk who, finding his victim heavier than he had expected, slithered off sideways to land on top of a fence post. In sheer exasperation, I shot the bird, but too late to save the chuckling, who had only a wiggle or two left in him when I unhooked the hawk's talons.

Chuckie becomes a pet

Fear kept them hidden the rest of that day, but next morning as I watched, the old female collected the remaining five and led them through a tunnel she had dug under the woven wire fence into an alfalfa field, each infant whimpering anxiously at her heels as if afraid of being left behind. This was the opportunity I had been waiting for, so backing off cautiously, I went around the fence and belly-crawled my way until I was between the woodchucks and their den. Then after catching my breath, I stood up suddenly and with a loud yell rushed straight at the astonished brood. Not making the slightest effort to protect her offspring, Madam Woodchuck circled me on a dead run, plunging headlong into the den without even the ceremony of a final whistle. But the chucklings,

true to the pattern of many another young animal, their eyes fairly popping, "froze" to the ground, seemingly too paralyzed to run. I could have my choice for the taking so, picking out the biggest and fattest, I clapped my hat down on him, and that was "Chuckie."

Except for a few surprised squeals and grunts and a quick snap or two of his white chisel teeth aimed in my direction, he seemed fairly content to hide in my hunting coat pocket until I got home with him. By nightfall he was drinking milk greedily from a medicine dropper and in a day or so was grabbing a milk bottle from my fingers, holding it comically in his black, glovelike hands as he sucked loudly at the rubber nipple.

And how he grew! He seemed to swell visibly overnight, but that was not surprising from the way he ate. He wanted milk about as often as he could get it, and his belly, when he had finished drinking, stood out round and nearly as hard as a baseball. In fact, he appeared to exist largely for the purpose of turning food of various kinds into woodchuck, for after his first few weeks of milk-drinking, he became largely a vegetable feeder. He liked nothing better than to make himself at home in the kitchen garden, often gnawing the center out of a prize head of cabbage or stripping a row of peas closer to the ground than a cottontail could do it. Ripe watermelon, too, was a special delicacy, and as I watched him eat a piece of this, seeds and all, I recalled my father's vexation when he found many fine melons ruined by the woodchucks from a nearby hedge fence. My neighbor complained that woodchucks sometimes killed his young chickens, but Chuckie never paid the slightest attention to them, and I suspect that it is only an occasional depraved woodchuck that has this habit. In fact, maybe the woodchuck that he caught in a trap near his chicken coop and which he proudly exhibited to prove his point was not the real killer at all.

His table manners

But, although I watched Chuckie's diet closely for a long time, even trying him out on various foods such as a young dead sparrow, which he nibbled but didn't seem to enjoy, I believe he liked corn bread and molasses best of all. At breakfast time he would come shuffling with a sort of low whistle out of a little back room from his bed in a box, climb up into a child's high chair, and eat this sticky stuff from a tin plate, smearing his face and chuckle head in amazing fashion and nibbling at his black paws in a way that never failed to get a laugh from his watchers. Usually my dogs watched these eating antics with jealous eyes, but they never

bothered the little woodchuck even from the first, and he always treated them with a sort of cool indifference, as he did also the cats. Indeed, although he would crawl up my pants leg, always hurting me with his sharp claws, when he did so, I could see no affection in his black, hatpin-head eyes, and I suspect I was never more than a bit of animated but harmless landscape to him.

Two of my dogs were great woodchuck hunters, often digging for hours at a single den, at which game they always worked in relays, one digging while the other remained outside and watched. But they never made the mistake with Chuckie that a friend told me his dogs did with a woodchuck. He, too, had a pet 'chuck and one early spring morning he noticed his dogs working industriously far up the hillside. Curious to know what they were after, he went up to see, and just as he looked into the hole, his dog came out with his tail between his legs, closely followed by the pet woodchuck who whistled ingratiatingly as he climbed. My friend gleefully described the discomfiture of his dogs who had made the strange mistake of digging out their fellow boarder.

An ardent sun-bather

After a full meal he would retire to his box to sleep for an hour or two, but he always spent a great deal of time in the sun, liking nothing better than to bask on the back door step or sit for an hour at the entrance of one of the several shallow holes he had dug in the yard. While thus perched on his lookout, anyone of our family could walk right up to him, but let a stranger, man or dog, appear and with a defiant whistle he would plunge into his hole, usually, however, popping his head out again in a few minutes just like a ground squirrel.

There is something uncanny about this first poking of his head. I have watched any number of woodchucks do this, but I always get a thrill from it. One moment I am gazing fixedly past the open mouth of the tunnel, the next the picture has dissolved into the grizzled round head, with its black eyes and nose and twitching whiskers. Save for a few flies shooved out ahead of him, no notice is given of his coming—one instant empty space, then warm, pulsating individuality. I chuckle involuntarily, then the head vanishes as it came.

Scientists have given Chuckie and his kind the name *monax*, which means monk, possibly because of his habit of being alone. But aside from this liking for his own company, there is little of the monk about a woodchuck. Certainly there was nothing spiritual or monkish in Chuckie unless sheer enjoyment of the feel of mother earth and sun-

shine, and taste of good food in plenty are spiritual things. For as Burroughs so well said of a woodchuck, "he is of the earth, earthy." In fact, I never saw that little fellow, lying full-bellied flat upon his mound and soaking up the sunshine, that I did not think that here was a true child of Nature, a creature fairly steeped in contentment.

I never could decide whether he was more a gourmand or an epicure. There were times when he would fairly gorge himself, and then hide away—I suspect in a kind of gluttonous stupor. At others, he would nibble daintily at this or that, a seemingly delicate creature who would never over-indulge.

Also, left to his own choice, he would invariably dive into his den when danger threatened, but when cut off from retreat he would fight savagely whatever attacked him, a goose, an old hen with chickens, a stray cat or dog. I saw more than one dog retreat ignominiously from the sharp rip of his teeth. Lazy and slow and easy-going a woodchuck may well be, but when danger threatens, or necessity demands, he can put his back to the wall and fight and die like a Spartan.

Do woodchucks climb trees?

There has been endless argument among sportsmen concerning whether woodchucks climb trees, but Chuckie would climb low trees and seemed to enjoy sprawling with hanging legs like a fox-squirrel on a wide limb. More than once I have also seen a woodchuck treed by dogs, but these were emergency cases; Chuckie apparently climbed just for fun.

But aside from these rather rare departures from the easy life, Chuckie now and then went in for digging in a big way. I have already said that he dug a number of shallow holes in the yard, but his first major excavation, a real woodchuck den with a huge lookout mound in front and a concealed backdoor, was an achievement of the next spring following his birth. This den was on the steep sidehill back of the barn, but woodchucks do not always dig their dens in such locations as has been asserted by such a great naturalist as John Burroughs. I have found them often along hedge fences in perfectly level fields, sometimes even in bottom lands subject to overflow. Moreover, I have often seen drowned-out woodchucks swimming desperately or sitting anxiously on floating driftwood.

I couldn't see Chuckie's architectural plan, of course, save only the foot-wide entrance, but the size of the mound told me that it was a deep hole, probably 30 feet or more, with several side pockets, and the inner end running upward to above the

level of the door. I know this because I have dug out many a den, but I never found the owner even though I had just chased him in before I began digging. The next day after such a misadventure always showed me where the rascal had dug out from some side pocket in which by counter digging he had walled himself off from my probing spade. For a woodchuck can seemingly bore like a mole into the side of his tunnel and pack the dirt so hard in behind him as to defy detection. Foxes are said to be able to dig out woodchucks although I don't see how they can do it, and I suspect that the old expression of desperation, "it's a groundhog case," was born of the futility and exasperation of some New Englander trying to unearth a woodchuck.

When Chuckie was about four months old and perhaps two-thirds grown, I captured his mother in a box-trap and put her in a large cage made of hardware cloth. The rest of her brood had disappeared by this time; possibly one or two more had met with fatal mishaps, and the others driven off, as Seton believes, by the "recurrent sex-instinct of the mother." She was fierce and intractable and would have nothing to do with Chuckie, whom she had apparently forgotten. And to my astonishment, she actually ate her way through the walls of the cage, breaking each wire of the close-meshed screen by hooking her long, incisor teeth through and jerking powerfully. I patched the hole with other wire, but she kept working at the edges until she had progressively torn away enough of the substantial material to allow a man to crawl through. It was unbelievable. I felt that a creature like that deserved to be free so I let her go.

Hibernates under observation

Chuckie spent his first winter in the little back room off the kitchen, where the temperature never quite went down to freezing. He didn't go into his winter's sleep all at once, but by October he was fat as a ball of butter, and became more sluggish each day. One morning he didn't show up and I found him asleep, curled in a tight ball. It was cold in the back room so I brought him in and warmed him by the stove and he gradually came out of his stupor. But he was not the same, his eyes had a cloudy, sleepy, almost sick look, and the next morning I found him back in his box again, sound asleep, and this time I didn't wake him. I often picked him up while he slept that winter but he never knew it, or at least gave no sign. His body felt cool to my hands, and I knew that his heart, very rapid during the summer, was now beating slowly and feebly, and his blood scarcely moving

through the vessels. He was alive, but barely so, just maintaining the vital spark, so to speak, by a slow use of the fat he had stored up in his body—Nature's way of carrying him through an unfavorable season. It was uncanny to see him lie there almost dead, oblivious to his surroundings, and getting thinner from day to day.

Nor did he waken according to tradition, on Candlemas day, the second of February, to see what the weather held in store for him and us. The spring was late that year and on Groundhog's Day, Chuckie was still asleep and remained so for about two weeks. He and his kind may be unique in having a day named for them, but they are unique also in that they pay no attention to it.

Chuckie never paid much attention to other woodchucks, but I saw a large woodchuck making itself at home in his den one spring, and I suspect that this was Mrs. Chuckie. Also he was absent from the yard on various occasions for a week at a time both in spring and fall, and I know that he hibernated his second winter in the deep den he had prepared the preceding spring. But I never saw any little woodchucks following after him, and I suspect that Chuckie, in common with other male wood-

chucks, was more concerned with the actual propagation of his kind than in looking after their welfare when they came. It is so much easier, in woodchuck philosophy, to lie in the sun.

What became of Chuckie? I cannot say. He stayed around close his first year, but after associating somewhat with his fellows and hibernating in the hillside for a winter or two, the spirit of the wild must have gradually filtered back into his funny little body, for I saw him less and less after that and finally not at all.

An old hunter told me that he once found an ancient grizzled woodchuck feebly digging a shallow hole. He didn't bother the animal but curiosity overcame him and on passing that way again in a few hours, he found the old woodchuck coiled up, dead, in the bottom of the hole. I have never seen anything like this and do not know that it is the custom among woodchucks to dig their own graves, for owing to their many enemies, most of them, like other animals, never die of old age. But I like to believe that even today, Chuckie, a worldly wise old fellow, is still sitting somewhere upon his doorstep in the sun, ready to give his defiant whistle before diving into his den.

INFORMATION TEST

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

Score 10 points for each correct answer. Correct answers on page 127

1. Both the Great Dane and the Welsh Terrier originated in the country for which they are named. True..... False.....	4. Dried fruit in the United States is allowed to contain <i>r</i> insect for every ten pieces. True..... False.....	7. Before coloring matter was manufactured chemically, pulverized insects furnished the pink tint of birthday cakes. True..... False.....
2. Deformation of the head by binding it in infancy renders the Mangbetu one of the most stupid tribes in Africa. True..... False.....	5. On Groundhog Day, February 2nd, all groundhogs promptly awake from hibernation. True..... False.....	8. The Newfoundland dog never saw Newfoundland. True..... False.....
3. The Andaman Islanders are a modern anthropological curiosity because they lack knowledge of how to make fire. True..... False.....	6. The only dog whose evidence is accepted in a court of law is the "Police Dog." True..... False.....	9. Some African tribes fight each other over the possession of termite houses. True..... False.....
		10. The habit of dogs of marking trees is a relic of the days when they thus identified their particular hunting grounds. True..... False.....

HOW BRIGHT IS THE DOG?

It's still a moot point. But the celebrated dog "Fellow" probably did more to elevate the species in the eyes of Science than any other dog. His expansive repertory, including the ability to understand about 400 English words, swept him to world-wide fame and the title of Dogdom's genius



(Above) Fellow and four of the objects he was taught to identify by his master, Jacob Herbert (below)



BRIGHTNESS, like beauty, often lies only in the eye of the beholder. To outsiders a small child may seem an appalling personification of all-around mediocrity, but to its parents that child will likely appear not only beautiful of body but prodigious of mind. It is the same, perhaps worse, with owners of pets, particularly dog owners. Given any small excuse, dog lovers are prone to exaggerate their pet's abilities during its life and even to contrive some sort of apotheosis after its death.

Few have met the man willing to jeopardize what are possibly only affectionate illusions in order to help science discover just how bright the dog is. Such a man, however, is Jacob Herbert who has dedicated a large part of his life to proving the conviction that a dog can be taught to understand human language. To do this he unflinchingly exposed himself for 30 years to the incredulity of his friends, the sneers of his foes, the condescending smiles of scientists. He was thwarted time and again. He was urged to give it up, and did, for brief intervals. But soon he was at it again, running through a small fortune and a whole gamut of disappointments as he pressed to achieve his one great ambition. As he himself says, "It was a fixed cross laid on my shoulders. I had no alternative but to go on trying."

Persistent experimentation with various mongrels throughout his youth

gave him practical lessons in animal psychology, perfected his teaching technique, and later brightened his leisure hours as a successful Danish business man. Then after all his worldly goods had vanished in Denmark's economic crisis of 1908, the obsession remained, buoyed him up and became his inspiration in new surroundings.

He emigrated to America, became a photographer, and having once more risen to comfortable circumstances, turned his every effort to the consummation of his hope. He began working with dogs of all types, always seeking one with a special gift for language. He took no interest in the so-called trick dog. He wanted no acrobat to

perform at the snap of his fingers. He wanted a dog who could understand orders communicated only through the medium of human speech—that and nothing more.

He decided to select from the German Shepherd breed because he reasoned that the temperament and the century-old education of successive generations of these highly trained work dogs showed their aptitude for such learning. He prepared to invest in a scheme to sponsor the mating of two of the finest German Shepherds available, and in return to receive the choice of litter. But here fate gave a twist to his carefully laid plans. Good was to come of the disappointment, but that was kept from him until much later.

All arrangements were made for the breeding, but when the puppies arrived, Mr. Herbert found there had been a misunderstanding, deliberate or otherwise, on the part of the breeder, who informed him that he was entitled to second choice only. This was a serious blow to Herbert's hopes. There was obviously but one well formed, outstanding, puppy in the litter.

"My heart sank," reminisced Mr. Herbert, "and I was just about to leave, making the man a present of my investment, when I turned for a last glance at the little group. One scrawny, little pup, standing in the center, turned his head toward me and looked me right in the eye with a

pleading expression. So I picked him up by the scruff of the neck and said, 'All right, I will take this little fellow here.' And so Fellow was named."

This had been simply a face-saving gesture. Mr. Herbert was prepared to abandon the whole idea and to sell this puppy, whom he had picked purely on whim, for anything he could get. He took Fellow to his studio where he intended to provide food and warmth, find a buyer, and bid farewell to the whole idea. He set Fellow down on the floor. The first thing the puppy did was walk over to the fireplace and squat. "Oh! Oh! Oh!" said Mr. Herbert. Fellow stopped and turned his head. Mr. Herbert picked him up and took him out in the yard, patted him and released him. From that day on Fellow was house-broken!

Introvert

The readiness with which Fellow had learned this lesson in dog training astonished Herbert, particularly since it seemed to have been accomplished solely through the sound of his voice. The puppy's alertness, his evident anxiety to please his master and above all his clearly individual temperament, began to make Herbert think that perhaps the dog was worth trying after all.

Fellow gave every sign of being an introvert, if it's permissible to say that of a dog. True, when he was put out of doors, he showed intense interest in the moving life about him. But it was an intellectual interest. Never did he share in the usual puppy tendency to romp with other dogs. Throughout his life he had a peculiar aristocratic disdain for all save his own breed, and of these only the females could stimulate any sustained interest. Even when inside the studio he seemed to speculate on the happenings of the world outside. With paws on window sill he would stand a half hour at a time gazing at points of interest in the heavy traffic along the street below. All these things, together with his unstinted willingness to learn, eventually caused Herbert to place all his confidence in Fellow as the "master dog" who would at last prove how far the canine mentality could be developed through human speech.

Fellow's training began with physical exercises which, though disarmingly simple, gave Fellow a rock-ribbed development of chest and shoulder muscles. Mr. Herbert clamped a clothes pin in the loose hair

of Fellow's shoulders. He would then say "Catch it, Fellow." And the dog would twist his neck this way and that, never disappointed that the clothes pin was just beyond his reach. Other muscles were strengthened by clamping the pin between Fellow's forelegs, just beyond the farthest point to which he could stretch his sensitive nose.

At the same time Fellow was being put through some intellectual paces. In the field he was taught the fine canine art of trailing as well as the retrieving of objects at a spoken command. These outdoor exercises were often held near the home of one of Mr. Herbert's friends whose name Fellow came to associate with them. When his master pronounced the friend's name, Fellow would at once begin to behave as though he were looking for a taxi, which means of transportation they always used to reach that particular friend's house. Similarly, Fellow learned the names of other friends and if several of them were present in the room, Mr. Herbert would say "go and see Mr. Johnson" and Fellow would select the proper individual without hesitation and without any gesture to help him. Fellow appeared to remember these names. For if the name was mentioned without this person being present, he was certain to look in the direction he and his master would normally take to visit the man.

Trust

All this time Mr. Herbert had been working on Fellow with the most delicate care. Never would he dwell on a single lesson for more than five minutes at a time. Nor would he strike or even speak harshly to the dog for temporary failure to carry out a given instruction. On the other hand there were no tidbits or other bribes awaiting Fellow after a "brilliant recitation."

Long ago Mr. Herbert had learned a lesson in pedagogy from his own father. It was one of those poignant childhood experiences which so frequently exert a strong influence on our matured personalities. His father was teaching Herbert, the boy, to tell time. At first the youngster was fascinated by the numerals on the dial of the big, old-fashioned watch. But as his father prodded him further into the lesson, the boy's concentration began to flag. Young Herbert wavered and became irritable. Then his father slapped him. The psychological shock

was far greater than the physical, but it taught Jacob Herbert a lesson. Not the lesson that his father had intended, but a primary axiom in teaching: that it is useless, if not downright harmful, to press an immature mind once it has shown signs of fatigue. And he felt sure that this was true alike of human and infra-human minds.

Herbert learned another thing from his father's slap. His own reactions to the blow, had made him aware of the tremendous handicap under which any teacher operates when he has shattered the pupil's confidence, if only for a moment. Wholehearted confidence—perhaps the most difficult thing in the world for human beings to inspire in animals or each other—he recognized as the indispensable prerequisite to the attainment of his goal.

Hand and voice

If Mr. Herbert wanted Fellow to go over to the window, he would say in a normal conversational tone, "Fellow, go over to the window." Then repeating his instruction all the while he would guide the dog by gentle pressure of the hands toward the place he wished him to go. Halfway across the room he might say "Wait," and the instant he pronounced the word he would restrain Fellow's progress. And so it went, with Fellow learning rapidly under the combined stimuli of patient speech and easy mechanical suasion. Soon Mr. Herbert had no need to use his hands. He could simply stand in the middle of the room, his hands sunk in his pockets, his eyes on his shoes, and say "Fellow, go over to the window." Fellow would start in the proper direction immediately. "Wait." And Fellow would freeze to the spot. "Lie down." Fellow would comply. "Stand up." Fellow would become erect. "All right, go ahead." And Fellow would be off again on his way to the window.

In this way Fellow learned act after act, word after word, building up a brilliant repertory and at the same time demonstrating an even more dazzling grasp of the simple meanings of words. Of course, none of this could have been accomplished unless Mr. Herbert had nurtured in Fellow an absolute confidence. Each time he asked the dog to do something wholly new, Fellow had to feel sure that he would come to no harm. In short, Mr. Herbert had to convince Fellow that his master was infallible. The result

was that Fellow seemed to grow up believing implicitly in a human world that was purely benevolent. Since such belief is simply not based on fact, it was sooner or later to get Fellow into trouble. Mr. Herbert recognized this danger but could not bring himself to readjust the situation because he dreaded tampering with the magnificent confidence that he had been so long creating. One day came Fellow's disillusionment.

Fellow and Mr. Herbert had gone for a walk. They stopped by the gate of a friend's house to pass the time of day. Fellow stood obediently at his

Fellow staggered to his feet and stumbled howling back to his master—lamed in both front legs.

Luckily, however, the dog was not seriously injured and he recovered in due time. But not without having learned to beware of moving automobiles. The experience seemed to have no further repercussions. Fellow's subsequent behavior indicated that he remained undaunted in spirit and did not attach any blame to his master for the injury.

Mr. Herbert was encouraged from the start by his dog's capacity for "creative thought." Memory, and the

But the bucket has been shifted from its usual place. Rex snoops and sniffs and keeps at it until he locates the specific thing he was sent to fetch.

Now another time the same circumstance arises while Rex is not available. The fisherman calls to his young son: "Son fetch me the bucket I use to bale the boat." The son looks in the usual place. The bucket isn't there. Does *he* snoop and sniff until he finds it? No. He glances about the boat-house a moment, spies a large sponge which will do the job nearly as well and carries it down to his father.

Many psychologists have held that



FELLOW'S PRIVATE LIFE centered around his mate, another German Shepherd named Mary Lou—and their nine puppies. Mary Lou was bought as a companion with whom Fellow

could play after nerve-straining hours of stage work. The aristocratic Fellow would associate with few other dogs and this exercise was important in keeping him physically fit

master's side during the conversation. He had long since learned never to wander aimlessly while his master was momentarily occupied, but always would remain motionless unless told to do otherwise. The automobile traffic was heavy on the street, but because of Fellow's unquestioning obedience Mr. Herbert had no thought of danger. Suddenly Mr. Herbert said something to his friend which sounded to Fellow's ears like "Go across." The dog at once started across the street. Mr. Herbert turned to call him back but too late. Fellow was struck by the front wheel of an automobile and spun around like a top. Mr. Herbert thought, "There goes my dog." But

ability to follow a command have long been recognized as canine attributes, but invention has been considered the prerogative of the master. There is a standard story told to illustrate the essential difference in the workings of dog and human minds. The story concerns two fishermen. They are about to launch their boat for the morning's troll on the lake. Arrived at the dock they find an inch or two of water in the bottom of the boat. One of the fishermen owns a faithful, highly trained dog named Rex. He turns to the dog,

"Rex, go on up to the house and fetch me the bucket. The bucket, Rex. Go on. Fetch me the bucket."

this sort of mental process is the exclusive characteristic of human thought, that man alone can truly think creatively. But what of Fellow? He could and did make new choices, inventing things for himself, on the basis of what he already knew. For example, while working at his photography, Mr. Herbert used to give Fellow a hard rubber ball as a plaything. Fellow did not have the ball long before, entirely without training, he took it into his head to balance the ball on the narrow ledge of one of the studio camera stands. Nor did he soon weary of this type of solitaire if first efforts failed. For the better part of an hour Fellow would keep trying to

make the ball stay on the one inch ledge. Whenever it remained balanced he would stand beneath the ledge and watch the ball for several seconds. As soon as he was certain the ball was not going to fall by itself he would push it off and start all over again. And this was entirely his own idea. Mr. Herbert never had anything to do with it.

Another instance of Fellow's originality occurred when a visitor brought in a rather bad tempered female Shepherd, who had to be tied up for fear she would get into a fight with Fellow. But Fellow made his peace with her at once. Without any suggestion from his master or any previous training in such hospitality, Fellow seized a large restaurant mug in which his drinking water was customarily placed, carried it over and set it in front of his guest.

Later on, Fellow showed an even more startling example of mental fluency. When he was at the zenith of his career, he gave many performances of his prowess for school children. At these special matinees Fellow usually ended his act thus: Mr. Herbert would tell Fellow to go to the front door on an errand. Carrying a package in his mouth, the dog would leave the stage and, passing through one of the boxes, go up the aisle toward the front of the house, as rehearsed. When he had reached the aisle and given his package to the usher, Herbert would call from the stage, "Fellow, someone is going to hurt me," and an attendant would appear on the stage pretending to do so. The dog, when he heard the call, would wheel and dart up the aisle, barking ferociously. The attendant would flee for his life and the curtain would go down on a blast of applause.

In a pinch

But this particular day, when Herbert sent the dog to the front door, some of the children thought the act was over and left their seats. They were blocking the aisle just as Fellow had started back full speed to save his master from the staged danger. Mr. Herbert will finish the story:

"He stopped in his tracks, when confronted with these children, apparently startled; then turned around and shot back to the front like a flash. I was on the stage, at a loss to know what to do, for I believed Fellow was confused. I could hardly believe it when the dog slipped over to another aisle and returned by that route—an

unrehearsed and, therefore, unfamiliar route—to the stage and finished his part as dramatically as usual."

By the time Fellow was four years old he had attracted a great deal of attention in Detroit for his remarkable feats of memory and intelligence. To make absolutely sure that the dog learned to respond only to the exact word itself rather than a group of generally similar sounds, Mr. Herbert had trained him to differentiate between almost identical words like "dollar" and "collar." When asked to retrieve either of these objects, Fellow became so proficient that he never made a mistake even when someone other than his master gave the command.

Only yesterday

It was at this period in the history of American motion pictures that the German Shepherd dog became enshrined in the galaxy of popular screen stars. It was the era of Strongheart, Peter the Great, and Rin Tin Tin. Mr. Herbert's friends thought Fellow ought to take advantage of the vogue and so they formed a small company to sponsor his visit to Hollywood.

Mr. Herbert came to Hollywood at a time when a sort of frontier belligerence prevailed among the various magnates and their subsidiary officials. The contracts he was offered were masterpieces of legal sleight of hand; the attitude of some of the officials was overbearing at best and crooked at worst. Mr. Herbert steadfastly refused to have anything to do with his first few offers. He bided his time until he could find conditions of employment which he regarded as satisfactory and he was determined to give up the venture altogether rather than endanger Fellow's mental or physical health in any way.

Just as he was preparing to leave in disgust, there occurred one of the strange accidents produced by the cut-throat competition among Hollywood animal owners. Peter the Great was shot and killed by the jealous owner of a rival dog. Since the company had contracted for and released publicity on three Peter the Great pictures, they were desperate to find an immediate substitute. They offered Mr. Herbert a \$30,000 contract to have Fellow play in the place of Peter the Great and under that name.

Mr. Herbert accepted the offer and at last he and Fellow seemed launched on the royal road to fame. But here capricious fate that played so great a

part in their lives turned upon them suddenly and disastrously. Fellow became seriously ill of a disease called Black Tongue, now labeled a form of canine pellagra, for which the recent nicotinic acid cure was not then known.

Fellow was an extremely sick animal. Mr. Herbert did everything he could for him and summoned one expensive veterinary after another. But each specialist shook his head and pronounced the same verdict. Fellow could not live. How heavily this blow fell on Mr. Herbert can easily be imagined. He saw his masterpiece about to vanish in a few hours. But let Mr. Herbert tell it:

"As the veterinaries decided he could not live, I threw all their medicines away; using only a stimulant to keep his heart going.

"Of course, Fellow was unable to eat. The only nourishment he could retain was one and one-half ounces of milk and a teaspoonful of honey mixed together. I fed him this mixture, two ounces per hour for eight hours, through the side of the mouth, as he could not take it himself. Then I let him rest for eight hours, and then fed him again in the same manner.

"I took his temperature every hour, and his pulse every fifteen minutes. I gave him an alcohol rub every three hours and talked to him continually, telling him he was going to be all right and stroking his head.

"We had a number of people coming daily to inquire about Fellow's condition. The veterinarians continued to shake their heads; but no one blamed me in the least for doing my best to save my dog.

The Grim Reaper nears

"His respiration was down to five per minute and his heart was pumping between 150 and 160 and very uneven; while the normal heart action of a dog of Fellow's size should be about 80, respiration about 20, when the dog is inactive.

"Meanwhile the Gotham Company was anxiously waiting to see if Fellow's condition improved. I must say that these people were very kind and exceedingly fair; but on the Fourth of July, Fellow had a relapse and I was obliged to tell them not to wait any longer. They then secured another dog and proceeded to make the pictures, and Fellow's contract was canceled.

"The relapse came about in the fol-

lowing manner. It was necessary for me to have some rest, so each day between five and nine in the morning, my assistant sat and watched Fellow to keep him properly covered. Now, if he could, Fellow would always crawl into the tiled bathroom, where he used to lie when he was well; but even in Hollywood the tile was too cold for his poor, bloodless body and was very dangerous.

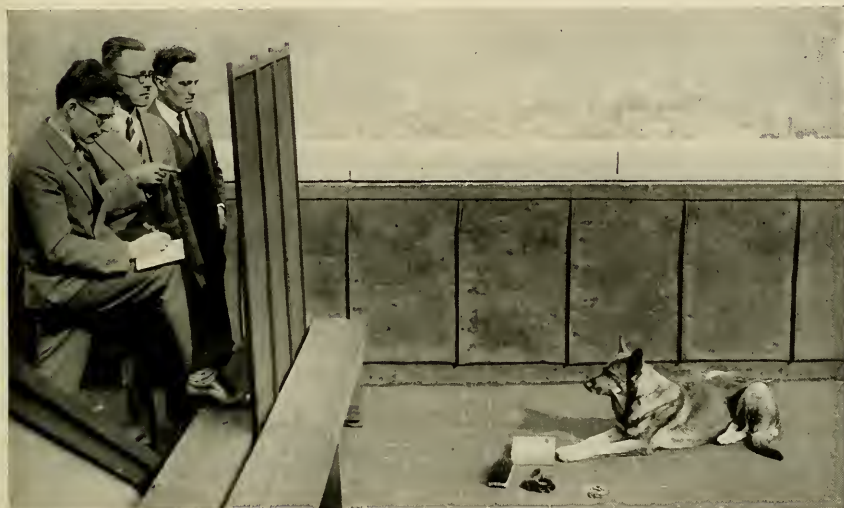
Each morning at nine o'clock the veterinary would come on his first call and I would wake up and be on watch again until five the next morning. The morning of the Fourth of July

but I was not willing to give up even now. Fellow and I had already lost a great deal together and were determined to fight to the finish. I kept on with the same procedure as before; carrying him into the sunshine every day, wrapped in a blanket with only his head uncovered, and telling him that he would be all right; I am firmly convinced that the confidence Fellow had in me was really the incentive that made him fight for his life.

"There came another accident, which upset me considerably. A veterinary, young in experience but of fine character, in taking Fellow's tempera-

shone,' he said. No doubt it did.

"Two days after the thermometer incident Fellow seemed to be at his lowest or turning point. This was the first time during his sickness that I was tempted to give up hope. There was so long between each breath that each one seemed to be the last. I simply couldn't sit still and watch it any longer; so I said: 'Fellow, let's take a walk,' and I thought it would be the last. Though it was nearly midnight, I took him up in my arms and carried him downstairs out to the lawn where he used to exercise before his sickness. Poor Fellow could barely stand on his



ACID TEST of Fellow's ability to associate words with objects was given at Columbia University. The screen hid Fellow's inquisitors as Doctor Warner took notes while Professor Warden

directed Mr. Herbert who unconsciously took the pose he habitually assumed when talking to his dog—eyes down, hands in pockets. This test precluded any visual clues

when the veterinary knocked on my door, I jumped out of bed as usual and found my assistant deeply interested in a detective story. Fellow was nowhere to be seen.

"I found Fellow in the bathroom, cold as ice, with a temperature far sub-normal. I immediately put him on the bed, gave him an alcohol rub and he proceeded from sub-normal to a high fever.

"I just managed to keep my head; but my nerves were tight as violin strings; so I discharged my assistant with as few words as possible and the dog and I faced it alone.

"Well, my contract was gone, and there was very little left of Fellow;

ture, not thinking to hold on to the thermometer, turned around to look out the window. The thermometer slipped into Fellow's bowels. Now, we were in real trouble. There was a piece of glass in Fellow's insides. I can still see how the perspiration broke out on the doctor's forehead. However, we took Fellow to the hospital; and with the aid of a fluoroscope we located the thermometer and removed it. Fellow was none the worse for his experience.

"A man that helped us said afterwards, that he never saw such a change of expression on anyone as on my face when the doctor finally brought the piece of glass to light. 'Your face

feet; but staggered like a drunken man. He could not even see me; his eyes were sunken in his head; but when I put him down on the ground he turned his head in the usual old manner, as much as to say, 'What are we going to do?' To my great surprise he wanted to work; I said, 'All right, Fellow, stand where you are.' I walked down the street a short distance. It was a beautifully star-lit night. I laid my pocketbook down, as I had done so often before, went back to where Fellow stood and told him I had lost something. You can imagine my feelings when this half-dead dog staggered down the street and, with what seemed to be his last effort, re-

tried the pocketbook. I have this pocketbook still with many marks from Fellow's teeth—and when I see it I think of that night. But words are inadequate to describe what I felt at that moment. I picked Fellow up in my arms, carried him back to my room and told him many beautiful things; I was happy.

"Next day Fellow was much better, and began to show that he wanted food. I never felt happier than the day when his eyes came back to the front again."

After his recovery Fellow played in a few "quickies," short movies manufactured as quickly and cheaply as possible. He also substituted for nearly all the close-up scenes in a half finished picture called "King of the Pack," a seemingly small job but one which was later to contribute to his fame. His owner, however, had grown weary of the intrigue, fierce competition and callousness of the Hollywood life. The venture had practically ruined him and nearly killed his dog, so he was determined to recoup his losses as best he could. He turned to the vaudeville stage, a medium which he despised and for which he felt himself ill-fitted.

Troupers

An agent secured him an unexpected engagement in a Los Angeles theater before Mr. Herbert or the dog had had any chance to appear in rehearsal. The stage was set as a blacksmith's shop, and there was an old wagon wheel in one corner. Fellow wandered over to the wheel and sniffed it. It was a real wheel all right and staring with horror, Herbert saw that Fellow was being fooled by the scenery. As his master was trying clumsily to address the audience Fellow started to lift his leg. Herbert yelled at the dog to follow him and together they ran pell mell off the stage.

After this conspicuously unsuccessful debut, the team's stage presence gradually improved and it was not long before they started the homeward trek toward Detroit, financing the trip by free-lance vaudeville work. Mr. Herbert had, of course, to learn the knack of handling some rough and ready audiences who, accustomed to the generally low caliber of vaudeville performances of that day, found difficulty in reaching the intellectual plane on which he wished to demonstrate his dog. One evening Herbert came before the audience with his usual announcement that he was about to

show them the remarkable case of a dumb animal who could understand human language without any assistance whatsoever from its master. One hardboiled "gentleman from Missouri" immediately began to boo and whistle. Said Herbert:

"I appreciate that you don't believe me but you will believe Fellow. If you will stand up I will tell him to go and see you."

Pearls before . . .

The man did not particularly take to this idea, so Mr. Herbert turned to Fellow and said loud enough for the whole house to hear, "Fellow, this man does not believe us. Would you trust him?" The latter question was the customary phrase Mr. Herbert used as a danger signal. Fellow immediately bristled and lunged toward the footlights, barking furiously. This brought the house down and paved the way for a highly remunerative run at that particular theater.

In general, however, Mr. Herbert used vaudeville only as a means of subsistence. He preferred to show the result of his patient training to audiences where it would do the most good and where it would be most sympathetically received. Accordingly in every town he visited he made arrangements to give free exhibitions in all the schools. Each time he did this he was amply rewarded not only by the spontaneous enthusiasm of the children but by the conviction that Fellow, as a product of patient education, was an inspiration to teachers everywhere. Then, too, Fellow, a true actor, appeared to love this kind of work and responded to the enthusiasm of the children, often giving performances far superior to those on the vaudeville stage.

All of this time Fellow's value as a commercial attraction was on the increase. In fact, as he and his master neared Detroit the moving picture "King of the Pack" was released and Fellow was placed under contract for an extended tour of personal appearances in all the theaters where the film was being shown.

Playing in both schools and theaters, Fellow soared to the summit of his achievement. Press notices increased fantastically and school children and theater-goers alike packed halls in which he appeared. Soon the outlying districts were too small for him and Fellow was en route to New York to engage in the top-most bracket of theatrical work.

Shortly after his arrival, the late Mr. Adolph Ochs, owner of the New York Times, asked to see the dog of the hour. Entering Mr. Ochs' private office, Mr. Herbert demonstrated some of the usual work that Fellow had been doing all along. Mr. Ochs said:

"This is very interesting but no doubt the dog has done similar things in other very similar places."

"That is true."

Mr. Ochs then asked: "Could he do something I suggest?"

Mr. Herbert said he believed so but warned Mr. Ochs not to point to anything or to give the dog any other indication of what he wanted him to do. Mr. Ochs agreed. He looked down at his desk and said:

"I would like Fellow to sit down in one of those chairs."

As there were four chairs and a settee in the room Mr. Herbert asked: "Which one?"

"The one next to me," Mr. Ochs said, still looking at his desk. At this point Mr. Herbert decided out of respect for the distinguished audience to stake all on a daring stroke that he had never before attempted. He turned to Fellow and said:

"Fellow did you hear what Mr. Ochs said?"

Without a moment's hesitation Fellow walked across the room, jumped up into the correct chair and sat down. Mr. Ochs folded his fist and struck the table:

"This is the most wonderful thing I have seen in this world."

Science approves

Encouraged by this incident, Mr. Herbert felt that the time had come to bring Fellow before animal psychologists for official confirmation. Professors C. F. Warden of Columbia and Lucien Warner of N. Y. U. agreed to come to the hotel where Fellow and Mr. Herbert were staying and conduct some preliminary experiments. In order to eliminate all possibility that Fellow was being aided by what are known in the technical terminology as secondary cues (such things as signs of the hand, eye, or orientation of the body on the part of Mr. Herbert), they had Fellow receive his orders through the keyhole of a closed bathroom door. Despite the fact that Fellow had never worked this way before and was naturally made somewhat nervous, his performance was judged as completely unprecedented in the experience of the

examiners, both of whom were avowedly chronic skeptics.

Their statement to the press aroused nation-wide interest and at succeeding tests in the Comparative Psychology laboratory at Columbia, Fellow was shown to be a genius of his kind, responding with distinction to many of the 400 words which Mr. Herbert had taught him to obey. Fellow's performance was the more remarkable for the fact that he was admittedly coping with the most rigorous and discouraging conditions that science could provide. Also he had to work for extraordinarily long stretches of time. In a paper subsequently read before the Galton Society at the American Museum, Professor Warden announced that if further tests should substantiate the results already indicated, then Fellow's genius would make it necessary to rank the canine species as a whole much higher in the scale of mental evolution than it had previously been accorded.

The Grim Reaper strikes

At last Mr. Herbert's theory had been bolstered by conservative scientific investigations. But what clear-cut establishment of the Dog's degree of brightness might have resulted from ensuing experiments with Fellow will unfortunately never be known.

It was now Mr. Herbert's intention to prepare the dog for scientific work, since by this time the talking pictures had scuttled outmoded vaudeville, and both Fellow and his master had retired to private life. But the unremitting strain of gruelling theatrical appearances and his exhausting work before the scientists had aged Fellow before his time. During an enforced absence of his master, Fellow became the victim of an abscess on the brain for which his weakened condition rendered him an easy victim. Mr. Herbert returned to take Fellow to a new home and found a dying dog. He wrapped him carefully and transported him by automobile to their new quarters in Massachusetts. The evening after their arrival Mr. Herbert took the dog to his bedroom:

"It was heart-rending," he said. "When the last moment came, Fel-

low sat halfway up and looked me in the face, as if to ask, 'What is this?' I told him, 'Fellow, it is all right,' as I had told him so many, many times before. Fellow believed me and laid his head down quietly—and died. He had never doubted for a moment the word of his beloved teacher, by whom he had never been fooled."

Fellow's body was presented to the American Museum of Natural History. Here it was mounted and will be placed in the new Hall of Animal Behavior. It will form part of an exhibit of the mechanism of the mind.

The magnificent brain which had surpassed that of any other member of his species on record was bequeathed fittingly enough to science, being today part of the splendid collection of Professor Tilney, a famous New York brain specialist.

We will let Dr. Lucien Warner, who experimented with that brain in life, have the last word.

January, 1939

"Much has been made of Fellow's exceptional intelligence, and unquestionably he was in this respect superior to most of his kind. The only dogs which have, to my knowledge, approached the level of reasoning he displayed have been the products of an extensive selective breeding experiment made in Mont Pelerin, Switzerland for the sole purpose of producing highly intelligent dogs to be used as guides for the blind. This experiment extended over a period of six years and involved the production of over a thousand animals, each of them trained and tested to determine its possible place in the breeding program. Fellow was not the product of such an elaborately planned effort to produce intelligence, yet he was a dog genius. Obviously, then, Nature, when the whim strikes her, can compete successfully with Man's genetic experiments.

"Much has been made of Fellow's intelligence, yet the more I think of that fine animal the more I realize that he possessed a characteristic in many ways even more unusual than his intelligence, and one which we, in our wonder at his reasoning, overlooked when we were giving him psy-

chological tests. I refer to the motivation which aroused and controlled much of his behavior. Comparative psychologists have examined and classified the drives or urges which activate animals. Some urges are positive, like the desire for food, water, or sexual satisfaction. Others, such as the desire to avoid shock, pain or fright, are negative. Was Fellow working in response to any of these? I think not.

"Some cynics may say that Fellow worked only because Mr. Herbert fed him his meals, and that the hunger drive determined his behavior. I know this not to be true, for I noticed that Fellow was fed just as promptly and well on those days when, for one reason or another, he did not do his best work. Since he was fed whether he was lazy or industrious it is obvious that feeding could have had no motivating effect. Food is not a reward if it is given for both good, and bad work. Others may suppose that Fellow worked because of fear of punishment. But, as a matter of fact, he was never punished, unless a look of disappointment in Mr. Herbert's eyes or a note of sadness in his voice is to be called punishment.

"No. The motive which was the main-spring for the long, arduous hours of work I have seen Fellow do was not one which comparative psychologists are accustomed to list. Therefore, there is no technical name to apply to it. There is, however, a sentimental term which I consider sufficiently exact. Fellow worked for love. It pleased him to see his master proud and happy. It pained him to disappoint his master. It is easier, I believe, to understand the display of intelligence in animals, than it is to explain the appearance of unselfish love as a motivating factor.

"Certain animals, particularly the apes, surpass in intelligence even a genius of dogdom. But I seriously doubt whether there is any animal which outranks the dog in its desire to please man. And Fellow is remembered with great affection by many of us because he displayed this endearing trait to an extraordinary degree."—
Signed LUCIEN WARNER, Ph.D.

By D. R. BARTON.

YOUR NEW BOOKS

ANIMALS WITHOUT BACKBONES • THE UNVANISHING NAVAJOS
MARVELS OF INSECT LIFE • THE LAST OF THE SERIS • MEXICO'S
EMERGENCE • FERNS • ECLIPSES OF THE SUN AND MOON

ANIMALS WITHOUT BACKBONES

----- by Ralph Buchsbaum

University of Chicago Press, \$5.00

THIS attractively arranged book is apparently in perfect accord with President Robert Hutchins' modern educational ideas and is the latest publication of the New Plan Scientific Series. Though following to a certain extent the story book method of treatment characteristic of our present-day children's natural histories, it nevertheless contains sufficient zoological data to give it the rank of a first class beginners' text book. The order of presentation is excellent throughout and, while the novice is duly warned of taxonomic problems to come, his mind is not burdened by keys at the end of every descriptive chapter which in many of our older text books are so condensed as to be almost meaningless. As its title implies, the book's scope is entirely limited to the invertebrates.

The author's style is unusually clear and direct and the important biological terms are plainly brought out in bold faced type. Accompanying the text is an excellent series of photographs many of them from models in Darwin Hall prepared by the Department of Living Invertebrates as well as a wealth of fine pen-and-ink sketches and diagrams by the author's sister, Miss Elizabeth Buchsbaum.

All in all, this is a book which should be hailed as a distinct educational asset by every zoology teacher and as an open sesame to the world of invertebrates for every would-be zoologist.

GEORGE H. CHILDS.

THE UNVANISHING NAVAJOS

----- by Belle Shafer Sullivan

Dorrance & Company, Philadelphia, \$2.50

THE Navajos, our largest tribe of Indians are also, because of their justly famous "Navajo blankets" and beautiful silverwork, one of the best known American tribes. Mrs. Sullivan gives us data about the size of the tribe, how they have, contrary to the history of others increased from approximately 9,000 in 1869 to nearly 45,000 today; how their lives have been so greatly influenced by the small amount of rain and by the topography of the country they live in; how they have wrestled a meager living from the desert. And she tells us what the Indians themselves and the Indian Bureau at Washington are trying

to do about improving their conditions.

Although the Navajos occasionally plant small patches of corn, beans, squash and melons and irrigate those patches in a primitive manner, they are primarily a roving pastoral sheep-raising people, reminding one in some ways of the Lapps. "Wells or waterholes are associated with their trails" and they travel at different seasons over the same trails, driving their sheep to fresher and greener pastures. Soil erosion, however, together with the increased number of sheep to pasture and no additional grazing lands, has brought about an acute problem, one that the Government is trying to help these people solve. The Navajo has struggled hard to increase his sheep and is fearful of starvation if he allows the Government to reduce their number.

Much of the information contained in this book is known to students of Indian life, but it is not always easy to obtain general information upon a particular tribe of Indians in one compact work. Here is such a book, easy to read, simple and direct. One could have wished that the author had woven into her story more of the folk-lore which she only touches upon here, and that the photographs included a few close-ups of good Navajo types.

TE ATA.

A HISTORY OF MEXICO

----- by Harry Bamford Parkes

Houghton Mifflin Company, \$3.75

IT is a source of great gratification to the reviewer that, at last, there has appeared a book on Mexican history, which he can unqualifiedly recommend to the traveler, the tourist, and the student of Mexico and her people.

No country has been subjected to more diverse types of government than Mexico, and each of these systems resulted from the establishment of a new social and economic order. Far too often these changes arose, not from evolution and change within the country, but by direct importation from Europe and North America. Consequently, there exist in modern Mexico, conflicting class and economic conditions, representing stages in the last four centuries of European and North American history imposed on the long, slow, but equally diverse evolution of the numerous Indian cultures. Under such circumstances an individual leader could assert his dominance without the support of the mass sanction implicit in a more unified society.

Mr. Parkes closes his volume with a discussion of modern trends in Mexico and describes the great efforts made by President Cardenas to unify the country and to

free it from the thrall of highly individualistic and selfish leaders; treating realistically the problems arising from the expropriation of the land and the relations with the United States. As if under laboratory conditions, one sees the effort to impose on a country a coherence of point of view, not felt by its inhabitants.

GEORGE C. VAILLANT.

THE LAST OF THE SERIS

----- by Dane Coolidge and
Mary Roberts Coolidge

E. P. Dutton and Co., \$2.50

THE home of the Seri Indians is on an island in the Gulf of California and on part of the adjacent mainland. These Indians have held a place in literature ever since a distinguished scientist thought he saw in them a good example of the hidden primitive. His readers took him literally and so from that time on the Seri were looked upon as sub-human, and as such came to the fore in romance. Now once again a literary man adds to their prestige, but reveals them as human and not strikingly different from other Indians living in United States and Mexico, speaking their own language, observing their own traditions, wearing wretched white man's clothing, earning money when they can, getting drunk when they have a chance, and so on. They liked the authors of this book who gave them food and money for telling what they knew, for singing songs and drawing pictures.

The authors seem to convey the impression that the information given is radically different from what one would get from other Indians, but the text of the book shows the reverse to be true; the Seri are a typical Indian tribe even as to their individualities.

CLARK WISLER.

MARVELS OF INSECT LIFE, A popular account of structure and habit

----- by Edward Step, F. L. S.

Robert M. McBride and Co., \$3.75

THIS is an American printing with a few additions, including an introduction by Raymond L. Ditmars, of a well-known book. The title fairly describes the contents. The emphasis is on the marvelous; but much about insects is marvelous. There are more than 600 illustrations most of them good. Few of the species mentioned occur in the United States but the book makes an interesting supplement to American texts.

F. E. L.

FERNS OF THE SOUTHEAST-ERN STATES

----- by John Kunkel Small

The Science Press Printing Co.
Lancaster, Pa.

DOCTOR SMALL, the author of this book, knew the plants of southeastern United States better than any one has ever known them. Not only botanists, but naturalists and lovers of the out-of-doors will welcome a manual of the ferns of this region which has never before been adequately covered,—about thirty of the species described and figured have never before appeared in any volume devoted to American ferns. All the known species have been treated, from the tiny Filmy-Fern (*Trichomanes punctatum*) whose leaves are less than an inch long, to the Giant-Fern (*Achrosticum danacaeifolium*) whose leaves in favorable localities often measure twelve feet in length. The word "fern" is used here in its broadest sense, to include the relatives of ferns or fern-allies as well. Included in the book, we have not only the ferns as commonly understood, but also the Adder's-tongue Ferns, the Water-clovers or Peppertwort Family, the other water-ferns, the Horsetails or Scouring-rushes, the Psilotum Family, the Club-mosses, the Spike-mosses, and the Quillworts.

The area covered is that south of the Virginia-Kentucky line and east of the Mississippi River, and this region, which Doctor Small calls the Southeast, has been found to contain well over fifty per cent of all the ferns known in the entire United States and Canada. In addition, Doctor Small believes that there are most probably new species of ferns yet to be discovered and suggests promising localities in which to search.

The drawings by Ruth Sinclair George are probably the best that have ever been made of our ferns; they are so carefully and accurately done that a student will be able to identify most species with their aid alone.

Fifty years of study of ferns and other plants have gone into the making of this volume, and the results of numerous field-trips during more than a third of a century are woven into it. For those who wish to add to their knowledge of the ferns and their relatives in this region, this manual is now and, we believe, long will be the best book on the subject.

CLYDE FISHER.

COMING INTO BEING AMONG THE AUSTRALIAN ABORIGINES

----- by M. F. Ashley-Montagu

E. P. Dutton, \$5.00

THAT a child owes its direct origin to a spirit invading the mother and is in no way physiologically connected with its parents represents a belief widely distributed among Australian aborigines. Dr. M. F. Ashley-Montagu marshals in a scholarly fashion the published evidence for this concept and places it in its social context.

H. L. S.

LIFE, HEAT AND ALTITUDE

----- by David Bruce Hill

Harvard University Press

THERE was a distinct need for just such a simply written book as this on the physiological reaction of man to extremes of heat and altitude. Doctor Hill has combined the results of his own researches in the laboratory and the field with those of other workers. H. L. S.

MAN AND HIS BODY

----- by Howard W. Haggard, M. D.

Harper & Brothers, \$4.00

MAN and His Body, is, I believe, the first encyclopedia of medicine written for the laity. It contains a fund of valuable authentic information concerning the human mechanism and its workings. It should by all means be placed on the list of important books to be read, especially by college and medical students.

WILLIAM HALL HOLDEN, M.D.

YOU'LL DANCE IN TAHITI

----- by William C. Jackson

G. P. Putnam's Sons, \$2.50

THIS is an account of a visit to Tahiti by a party of Americans. A special little Tahitian world has been created to accommodate visiting tourists and this Mr. Jackson and his companions explore superficially. H. L. S.

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CANDLEDAY ART

----- by Marion Nicholl Rawson

E. P. Dutton & Co., \$5.00

THE folk art of the American people from colonial to Civil War days is understandingly interpreted, bringing the reader a picture of the times through the familiar household objects which were painstakingly wrought and lovingly decorated by our forebears. Here is the story behind the earthenware, pewter, glassware, candlesticks, doorknobs, andirons and furniture pieces so sought by the antique collectors of today. Liberally illustrated.

THE SAVAGE HITS BACK

----- by Julius Lips

Yale University Press, \$5.00

PROFESSOR LIPS embodies a novel and entertaining idea in this book. Most of us are familiar enough with European representations, graphic and plastic, of natives, but few know what we look like to the natives. Here the "Giftie" is given us in abundant examples drawn from a varied portfolio. The natives have their innings.

H. L. S.

ECLIPSES OF THE SUN AND MOON

by Sir Frank Dyson and R. Wooley

1937 Oxford at the Clarendon Press, \$5.00

TO early man eclipses were terrifying, unexpected, mysterious phenomena that encouraged superstition; to modern man they are welcome, predictable events that increase human knowledge.

The historical development and latest results of all important phases of eclipse work are surveyed in an excellent small book by the late Astronomer Royal and the Chief Assistant of the Greenwich Observatory. In just 150 pages, the monograph (one in the International Series on Physics) includes a wealth of material that can be found nowhere else under one cover.

The evaluations of the authors merit respect, for they are clearly stated and for the most part founded on careful analysis of all published studies. For instance, in regard to the Einstein test at the eclipse of May 29, 1919, "The authors had no hesitation in regarding the observations in Principe and Sobral as verifying Einstein's prediction of a deflection of 1.75" at the Sun's limb." Yet they "rediscovered the published findings" after receiving a criticism from Russell and included in the book the results of Campbell and Trumpler for the eclipse of September 21, 1922, as well as those of Freundlich in 1929. Then they conclude, "There can be no doubt that Einstein's prediction has been verified by observation."

Obviously this is not a book for the lay reader. (For him are recommended

Eclipses of the Sun, by S. A. Michel, and *Handbook of Eclipses*, by Mrs. Isabel M. Lewis). *Eclipses of the Sun and Moon*, by Dyson and Wooley is for the student of astronomy and the occasional serious amateur who is willing to struggle through or hurdle over sines and cosines, involved formulae and complicated diagrams. These readers will find it especially important as a summary of knowledge of the outer layers of the sun and how they are made known to us at times of eclipse.

DOROTHY A. BENNETT.

BIOLOGICAL SURVEY OF THE MOUNT DESERT REGION. PART VI

----- by William Procter
Wistar Institute Press

TO the scientist, Maine's rock-bound island of Mount Desert is known and appreciated as being one of the most remarkable areas of similar size anywhere in the temperate region. The great variety of physical and ecological conditions have produced a fauna and flora of almost unparalleled richness.

Despite the fact that the island was the birthplace of one of America's foremost students of insects, Prof. Charles Henry Fernald, and that it has been visited and collected over by numerous entomologists, any comprehensive published record of the insect fauna was lacking until the appearance of Part I of this series of Reports on the Insect Fauna, by the late Charles W. Johnson, published in 1927. This work was instituted jointly by Doctor Procter and Mr. Johnson, and its publication proved a great incentive to students to continue to probe the island's insect mysteries. In the intervening years, and especially since the completion of his work on the Marine Fauna (Parts II-V of the Biological Survey, 1933), Doctor Procter has devoted his entire time and energies to a study of the insect fauna of the island. The result is the splendid volume that has just appeared. This beautifully printed and edited work is very appropriately dedicated to the author of the basic list, Mr. Charles Willison Johnson.

The vast amount of ecological and habitat data that are provided in conjunction with all groups is a feature of unusual value in the new work. This is based primarily on Doctor Procter's first-hand knowledge of the insects in question and cannot fail to be of the very greatest value, both on the island and elsewhere. It is certain that no one has a greater familiarity with the insect fauna of Mount Desert than has the author, who for many years has virtually combed every inch of the island at all seasons. As a result of this intense collecting campaign, it would seem that future additions must consist primarily of the more neglected and microscopic types, especially in the Homoptera, Diptera, and Hymenoptera, though further important discoveries may well be made in almost all orders and major families.

The work will long remain the "Bible" of our knowledge of the insects of Mount Desert.

C. P. A.

Reflections on Reflexes

By CHARLES H. COLES
Chief Photographer, American Museum

THE dream of every camera designer makes an enticing subject of study. All that he desires in his dream camera are four simple requirements: simplicity of operation, ability to take any kind of picture under any condition, extreme portability, and, finally, a device to give the operator at the time he takes the picture a clear impression of what it will look like when finished. The reflex camera comes closer to fulfilling the last requirement than any other construction.

The reflex camera has maintained its popularity over a score of years and continues to enjoy an ever-increasing number of advocates every day. The reasons for this wide-spread acceptance are not hard to find when some of the advantages peculiar to the reflex camera are analyzed.

Principle

The basic idea of the reflex camera is this: a box with a lens in one end has a mirror set into it so that the image from the lens is thrown against the top of the box. The top of the box is cut away where the image falls and a piece of ground glass inserted to receive the image. A collapsible hood is built up around the ground glass so that the image may be more easily seen by a person looking down at it. If a picture is to be made, a lever

on the side of the box is depressed and the mirror swings upward out of the way under the ground glass. The beam of light from the lens passes into the back of the box where it strikes the surface of a cloth roller blind. This blind has a wide slot cut across it and, as the cloth is rolled from one spool to another by a spring, a sensitive film just behind it is exposed.

The Single Lens Reflex

The camera just described belongs to the "single lens reflex" family, whose oldest member is the Graflex. The single lens reflex is made in all sizes, from those that take pictures 5 x 7 inches to those that use the 35-millimeter motion picture film and make pictures 1 x 1½ inches in size. Shutter speeds up to 1/2000th of a second are obtainable in reflex cameras and lenses of focal lengths as high as 30 inches may be purchased. Lens speeds in excess of f/2.5 are rare on reflexes of the single lens type.

Though the trend is toward compactness, the advantages of the single lens reflex are too important to allow it to be ignored. The ground glass screen shows the operator almost exactly what the finished picture will look like, provided that the color of the image is disregarded. The edges of the picture may be accurately placed with the assurance that the heads of people being photographed will not be cut off. This accuracy in defining the limits of field are very important when using telephoto lenses. The picture is presented right-side up and on a flat surface, just as the final picture will appear. The image will be reversed from left to right, but this is of small concern. Those objects that appear sharply focused in the hood will appear the same way on the finished print. Depth of field may be seen directly and adjusted with the lens diaphragm.

The disadvantages of the single lens reflex are several in number. The cameras are usually bulkier, for a given size negative, than any other camera, because the swinging mirror requires space in which to move. Small diaphragm openings are awkward to use because the illumination on the ground glass becomes too faint to see the image well. This defect is very severe in the smaller reflexes that have only short hoods over the ground glass. Unless the eye of the operator is very good in seeing fine detail at close distances, it is difficult to focus the image sharply on the ground glass. Further, all pictures have that "looking up" angle peculiar to waist-level operation. Another defect of the single lens reflex is peculiar to that type of camera alone. The image of the object being photographed disappears just before the moment of exposure when the mirror swings up. This means that you are never quite sure just what the subject looked like when the picture was taken, especially in the case of action pictures.

The Twin Lens Reflex

This popular type of reflex overcomes some of the defects of the single lens cameras. Suppose that we have a box camera

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consisting of a lens and shutter at one end and a sensitive film at the other. On top of this camera we fasten another camera that also has a lens in front but no shutter. Inside the box a stationary mirror is fitted that throws the image made by the lens onto a ground glass on top of the camera. A hood around the ground glass completes the upper camera. There remains only one thing to do: arrange both lenses which are of equal focal length to focus in and out together. Now, when we look into the ground glass on top we see our scene toward which we have pointed our camera. By moving the upper lens to bring the image into sharp focus on the ground glass we automatically bring the lower camera into exact focus on the sensitive film. All that has to be done, then, is to snap the shutter and the picture is made.

The best known camera of the twin lens reflex type is the Rolleiflex. The undiminished popularity of this camera and others of similar construction indicates the completeness with which these cameras fill a need. As with the other type of reflex, the ground glass image is very exact right to the edges of the picture, the image is flat, right-side up, and very quickly focused. A small lens to magnify the image when focusing is usually built into the hood of the ground glass. The image on the ground glass is always bright, because the viewing lens is kept wide open and it never disappears as it does on the single lens camera. To avoid that "looking up" or child's viewpoint which is always associated with a camera operated at waist-level, "sport finders" are usually built into the twin lens reflexes to permit the use of the camera at eye level.

Not all the points of the twin lens reflex are on the good side of the ledger, however. The camera is bound to be slightly more expensive because two lenses must be purchased instead of one, although the lens on the finder camera is usually of a cheaper construction than the photographic objective below it. The camera is slightly more bulky than other cameras that take the same size picture, but not nearly as much larger as one would imagine. Interchangeability of lenses is virtually non-existent in twin lens reflexes, but usually very few amateurs have occasion to change lenses.

The difference in viewpoint of the two lenses might be thought to produce some parallax errors, but these difficulties have been very cleverly circumvented by the manufacturers of the better cameras.

Which Reflex to Choose

The reflex camera is an instrument of such superior performance in almost all branches of photographic work that it is surprising that more of them are not in active use. They have always been the preferred camera in England, where so many of the finest technicians and pictorialists are to be found. A guide to help the prospective purchaser of a reflex might be useful. If a camera that takes a negative larger than $2\frac{1}{4}$ inches square is required, or if it must operate up to $1/1000$ th of a second, a single lens reflex is indicated. If synchronized flash pictures are to be made, if no change of lens is required at any time and if extreme close-

ups are not anticipated, the twin lens reflex is the logical choice. The latter type is small, light in weight, and an excellent general-purpose camera.

Arnold Genthe, the famous artist-photographer, in a recent talk made the statement that a pictorial composition could be found more easily and quickly with a reflex than with any other type camera. Certainly a reflex camera is recognized as supreme for nature photography.

Answers to Questions on page 116

1. False. The Great Dane is natively German and the Welsh Terrier springs from the old English Wirehaired Black and Tan. See charts on pages 99 and 100
2. False. The mentality of the race is not adversely affected; on the contrary, the Manxmen are most intelligent. See page 74
3. True. See page 104
4. True. See page 85
5. False. The exact date of awakening depends on the weather and on individual physiological differences. See page 116
6. False. The Bloodhound is. See chart on page 98
7. True. See page 86
8. False. The Newfoundland originated in Newfoundland from ancestors taken there as ship's dogs. See chart on page 99
9. True. Termites are prized in certain parts of Africa as food. See page 87
10. True. See page 94

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LETTERS

SIRS:

I should like to take this opportunity of expressing my congratulations to the editors of *NATURAL HISTORY* for the extremely fine manner in which they have continued to present natural history. I am a graduate in the field of geology and geography but like many other graduates, I was forced to turn to the business world for employment. . . . Through *NATURAL HISTORY* I am able at least to keep posted on what is going on in the field of Natural Science.

Auburn, N. Y. J. ROBERT MORTON.

* * *

SIRS:

I have read with great interest the article by Stefansson in the January number of *NATURAL HISTORY*. A few years ago I read about a stone being found near the Great Lakes—I believe in Minnesota—with a record of the travels of the Norsemen upon it. Can you tell me if this stone is genuine?

St. Davids, Pa. GEORGE L. HARRISON.

Dear Mr. Harrison:

Replying to your inquiry of the 5th, concerning the so-called Kensington Stone, found in western Minnesota in 1898, I can say only that we have not seen the specimen. Our opinions therefore are second-hand, based on the published account, and the reviewer's comments following the publication.

In 1932 Mr. H. R. Holand of Ephraim, Wisconsin, after about twenty years of study, published a 300-page book entitled *The Kensington Stone*, in which he describes and discusses the find from all angles and concludes that the stone is genuine; in short, that it proves that Norsemen had been in the region in question as early as 1362.

The principal review of the book was by Wm. Howgaard, Professor of Naval Architecture at the Massachusetts Institute of Technology, whose comments were favorable.

As a matter of fact, another stone bearing runic inscriptions was reported in the *New York Times*, November 18, 1937, as having been found on the shore of Lake Winnipeg; but before it could be studied it was stolen. Again, last summer some iron remains (swords, etc.), were found somewhere near Toronto, which have also, I believe, been claimed as of Norse origin. Incidentally, Mr. Holand, in his book, shows several iron axes and spear-points said to have been found in Minnesota and Wisconsin and which are supposed to date from about the

same time as the inscribed Kensington Stone.

The question pertaining to these finds must be answered by European specialists. My own opinion as an archaeologist, dealing with Indian relics only, is not worth much. But in any case there is nothing inherently improbable in the claims made.

N. C. NELSON,

Curator of Prehistoric Archaeology.

* * *

SIRS:

As an Associate member and as an interested reader of *NATURAL HISTORY*, may I draw your attention to the expression on p. 15 of the January issue, "St. Rupert's drops," which should read "Prince Rupert's drops." The inventor, Rupert, Prince Palatine (1618-1682), could by no stretch of the imagination lay claim to the title of Saint, and he was moreover a member of the Reformed Church, skeptical of canonization. On the other hand he was proud of his princely title, and was a scientist of some note at the court of his equally unsaintly cousin, King Charles II of England. Prince Rupert's drops were already known in Germany when the Prince introduced them into England.

Ottawa, Canada.

SYLVIA SEELEY.

Correction appreciated.—Ed.

* * *

SIRS:

I want to second the request of W. A. Mitchell as published in Letters, issue of December, 1938, that you give us an article on the evolutionary history of plants.

Palo Alto, Calif.

MRS. F. J. FROST.

FREE OFFER

Readers interested in the cultivation of unusual plants may be interested in a goodwill gift offered by the Government of Peru to the citizens of North America, consisting of a package of seeds of a plant known as *The Mutuy O'Pacte*. This is a small plant bearing flowers of exquisite fragrance and exotic loveliness that is native to the mountains and highlands of Peru. It is, therefore, hardy and can be grown throughout the latitudes of North America. Anyone in the United States or Canada desiring a packet of these seeds can obtain it by sending their name, address, and a loose stamp to the Pan American Society of Tropical Research at New Orleans, Louisiana, U. S. A.

SIRS:

The coming of my copy of your magazine is one of the bright spots of the month. Everything in it is worth while.

Will you please tell an amateur photographer by what process the cover of the January copy was printed? Is it anything that I could try myself, or could I get next year's Christmas cards printed from one of my negatives?

JANE SEWARD.

Roosevelt Junior High School

New Brunswick, N. J.

* * *

The cover in blue and silver re-

ferred to above was reproduced from a regular glossy photograph. Two plates or engravings were used, one a positive (for the blue) and the other a negative (for the silver). Thus the shades of gray and black in the original picture are printed in shades of blue, while the white and light gray areas are reproduced in silver by the negative plate. The silver ink is printed first, and the blue on top of it.—Ed.



Photo by Ralph C. Taylor

Mysterious Steps in Purgatory

SIRS:

I learn from Mr. R. T. Bird, who visited me last November, that the dinosaur tracks illustrated above are undoubtedly new to science. The question remains, what strange dinosaur of Cretaceous times left them behind him?

I had heard of these tracks and been interested in them for some time, but because of physical incapacity had not dared hope it would ever be possible to see them. They are located in the Canyon of the Purgatoire, a wicked little river in an inaccessible section of southern Colorado. Finally with the kind assistance of Frank J. Meyer and Dr. Louis S. Snyder, an expedition was organized and we reached the spot.

This violent little outlaw of riverdom has figured prominently in the lore of the peaks and plains. Purgatoire River is unfriendly toward man and beast. A few men have tried to dam it; numberless men whole-heartedly damned it!

Channeling down through all the Cenozoic and Mesozoic eras and even Upper Permian horizons of more than 200 million years ago, this river had buried countless secrets of the silent ages—fossil fishes and shells, petrified wood, deposits of coal, and more recently fragmentary remains of a lost detachment of Spanish explorers who disappeared in that section in the early 1600's. But when in 1935 it was reported that tracks of prehistoric animals had been found in Purgatoire, many of us were skeptical.

The prints, roughly circular, measure



Photo by Louis S. Snyder

25 inches across, and strides of corresponding rights and lefts average around seven feet. While it has been suggested they are possibly sauriped footprints, still there is little to bear this out, as the trail is typical of a biped.

They were originally made in soft mud-like material, which apparently hardened more quickly than would normally occur, to form stone of the type known as "oolite."

Rival claims to discovery led me to question Miss Betty Jo Ridenour who was alleged to have found them first. Miss Ridenour, however, disclaimed the honor and said that the most important of the tracks were found by her father and Ralph Owens, the district hydrographer at the time, while exploring and surveying in 1935. JOHN STEWART MACCLARY.

Pueblo, Colorado

NATURAL HISTORY

The Magazine of the American Museum of Natural History

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ROY CHAPMAN ANDREWS, Sc.D., Director

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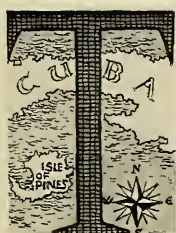


AMNH Photo by Coles





MODERN TREASURE ISLANDS



Thrillingly the latest scientific instruments tapped out "Treasure here," as the remodeled rum-chaser, *Pieces of Eight*, followed the lure of ancient pirate maps in the romantic Caribbean

By CYRUS FRENCH WICKER

WHAT man or boy has ever read *Treasure Island* without cherishing, deep in his heart, the hope that some day he would sail the waters of the Caribbean in his own ship, skirt perilous reefs and palm-crested keys with their beaches of yellow sand, explore low wooded islands, the haunts of pirates and buccaneers—perhaps even see the three peaks of Treasure Island itself above the horizon? Who has not dreamed of dropping anchor off Haulbowline Head and then like Jim Hawkins touching with his own hands a treasure chest filled with guineas, doubloons and eight-sided onzas of Spanish gold!

Now it is a fact that treasure islands are much nearer at hand than we think and can be reached by the adventurous of all ages for whom the dream has

not died. They lie off the southwest coast of Cuba, from Cape San Antonio in the Yucatan Channel to the Isle of Pines. On them may still be found pirate booty and Spanish gold and to them I have recently made a trip of exploration, combined with a certain amount of amateur treasure hunting, a search that made use of ancient pirate maps and modern scientific metal-detecting instruments and which ended in success and the finding of real treasure.

The scene is, of course, the western Caribbean, along those rocky cliffs and hidden bays, coral islands and lonely sand beaches discovered by Columbus and well known to Alvarado and Cortez. Drake and Hawkins, Blackbeard and Lafitte and L'Ollinois—could they repeat their voyages today—would find these shores unchanged and conditions the same as they were in the days of Spanish discovery and conquest. These, too, are the very keys and islands that witnessed the sailing of gallant treasure fleets, the beginnings of African slave trade and the darker years of privateers, buccaneers and pirates that followed.

Through the narrow passage of the Yucatan Channel sailed annually two great treasure fleets of

(Left) TREASURE FROM THE SEA

Bracelet money from Africa's Gold and Ivory Coast, which may once have been used to lure natives onto slave ships



Spain; one the *Galeones*, under the command of a general, carrying Inca treasure and the accumulated wealth of the Andes: gold from Maracaibo and Peru, silver from Potosi, pearls and emeralds from Margarita and Guyaquil, transported by sea to Panama, thence across the Isthmus to Porto Bello and stored in the strongly walled city of Cartagena, there to await the time of shipment to Spain. Cartagena!—its walls so high and costly that a king of Spain remarked that they ought to be visible from Madrid!

To this channel came also, from Vera Cruz in the west, a second fleet, the *Flota*, bearing treasure from the temples and mines of Mexico, having an *Almirante* in command and sighting Cape San Antonio as the first land in Cuba before bearing away northeast to Havana, there to join the *Galeones* and sail with them to Spain.

Picture for a moment the sight these combined fleets must have presented as they sailed out of Havana harbor bound for the Golden Tower at Seville. Twenty or more great galleons, their sails emblazoned with the cross of St. Iago; a dozen sturdier ships of war, their fighting towers and lofty poops crowded with armed cavaliers and *arquebuseros*; swift sloops or "pataches," used as dispatch boats to announce the coming of the fleet or as scouts to warn of pirate attack; galleys propelled by oars and manned by slaves—and in the holds treasure beyond computation! Three billions of dollars, it is estimated, in gold and silver alone (worth many times that much today) and in addition uncut jewels, rubies and emeralds, sapphires and pearls, a treasure beyond anything ever known on earth before, carried from the New World to the Old during the three centuries of Spanish rule.

Wealth for the fighting

Is it to be wondered that this immense wealth, concentrated in the holds of a few clumsy, slow-moving vessels—some of it almost certainly to be had with luck and a little fighting—excited the cupidity of desperate men from all over the world; that English, French and Dutch adventurers, Spaniards too, and Portuguese, calling themselves privateers, buccaneers or plain pirates, swarmed to these coasts, established camps and lookouts on outlying keys, concealed their ships behind mangrove-covered islands and up winding estuaries, sallied out to make captures and escaped as swiftly from pursuit into shallow waters where larger vessels could not follow?

The principal camp and general headquarters for several important groups of these pirates was the

Isle of Pines, largest and nearest to Cuba of all the neighboring islands and one preferred because of its commanding position, fresh water springs and rivers and, above all, for the abundance of wild cattle and hogs on which buccaneers and pirates alike depended for their food. During more than three centuries—from 1520 to 1830—outlawed men here fought and robbed and killed, built forts and strongholds, captured and burned vessels (murdering their crews and kidnaping the women), established communities and camps and buried their loot; hiding it in swamps, under the roots of big trees, behind sand dunes, beside springs of sweet water and in caves and holes in the limestone rock. Here, too, they early organized a pirate "economy" and communal life, electing a pirate chief who, from Santa Fé, near the center of the Island, directed operations and received percentages and rake-offs from the various groups of rascals scattered among the neighboring keys. Under his central leadership they built their own forts of stone (from which it proved almost impossible to dislodge them with the artillery of the time), maintained an army for defense and even a pirate fleet, numbering at times 20 or more vessels, lying in the Júcaro River near Santa Fé: a force powerful enough to engage in major operations, attack a fortified city of Cuba or the mainland, or even engage the convoy of a treasure fleet itself.

Shades of Long John Silver

Still another hold possessed by the Isle of Pines upon our imagination, stronger even than the knowledge that it was the home and treasure house of pirates, is that it may well be the actual "Treasure Island" of Robert Louis Stevenson. One has only to turn to the map of Treasure Island as it is drawn on the frontispiece in any edition of the book and compare it with a map of the Isle of Pines to recognize the resemblance at once. The deep curving bay, the narrow peninsula almost encircling it, the rounded mainland "like a fat dragon standing on its tail"; even the three hills, "Foremast, Mainmast and Mizzenmast," which on the considerably larger scale of the Isle of Pines become three mountain ranges; all are the same and make it highly probable that gentle Tusitala had a map of the Isle of Pines before him as he wrote. Certainly no place in the Caribbean could have been chosen by him so appropriately for the site of buried treasure. On the Isle of Pines and the adjacent keys has been buried—and recovered—wealth beyond anything that Billy Bones or Long John Silver or Flint himself ever dreamed.

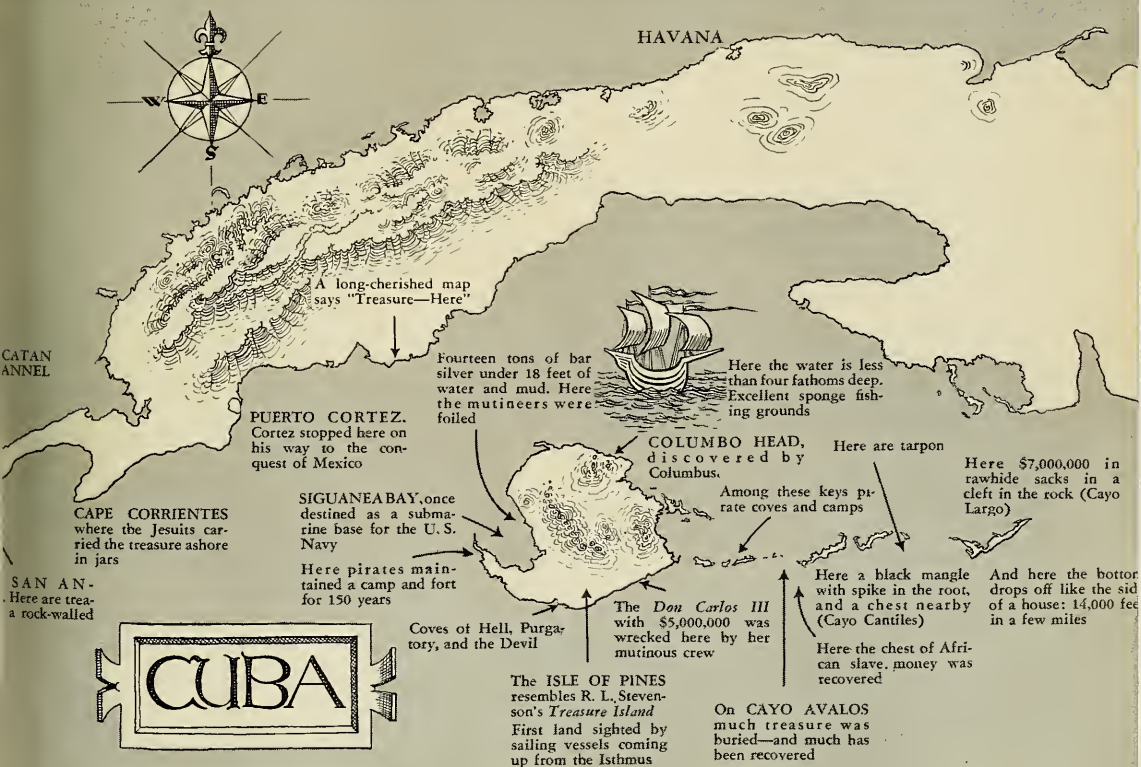
The loot gathered by these pirates during the

centuries in which they lived, practically unmolested, in their fortified cities and encampments, was enormous. No governmental force was strong enough to dislodge them; no other pirates could rob treasures buried safely underground. Much of it was spent, of course, in days or weeks of riotous living in Port Royal or Tortuga; but for the most part the captured treasure was buried near the camps in such a way that in emergency it could be quickly dug up and carried off. Jars or chests of treasure were never buried deep or in inaccessible places and the sites were marked in most instances by easily recognizable trees or springs; the treasure being buried so many paces distant by compass bearing or, more often, toward the rising or setting sun. Bronze spikes were driven into the trunks or roots of trees; chains led underground, or cannon balls were placed over the spot and covered lightly with earth for readier finding and recovery. Charts and maps were sometimes drawn by the more literate, signed by entire groups of pirates and setting forth with terrible oaths the penalties incurred by anyone betraying the secret or going to the spot alone.

Typical of such charts is the following, which I have in my possession; translating it, of course, from the original Spanish and changing the names and the actual location:

"In the year 1673; in the Keyes of the An-nunciation is an island called Cbest of the Dead Men, which has the form shown in this plan. [Here follows a map of an island with two daggers and a cross and the word 'here'.] Entering at the North you will find an almacigo (buttonwood) tree at 6 paces from the beach which has a spike at the height of one yard. With that at your shoulder go 43 paces forward and you will find a Yana tree which has two spikes; one in the root and the other half a yard high. Turn your face toward the rising sun and, with a rod, measure [so many] times and you will find a mound of earth; dig there a half yard deep and you will find a jar with 6 thousand ounces of gold [approximately \$200,000.00]; a chest of gold in bars; a casket of jewels engraved with the initials of the Princess of Castels Vels (in Catalonia) and which is worth more than all the gold; eight sword hilts set with diamonds; a crucifix; three pairs of solid gold candlesticks; also 28 flint-lock muskets and pistols. Let any of us removing this divide it equally among those whose names appear hereon, or with their families if they are dead."

Here follow the signatures, or marks, of fifteen pirates. Query: could this be the origin of the



"fifteen men on the Dead Man's Chest"; which last might quite well have been the name of an island and not a chest at all?

Many of these charts or *deroterats* have come down to our own time, preserved through generations by private families, in notarial documents, in convents and Church treasuries, or in the hands of Fathers to whom they have been entrusted by dying and suddenly repentant pirates. Sometimes the land has sunk or been washed away and treasure once buried on land may now lie in shallow water, to be found only with modern instruments. Discovery of other locations is possible through listening, in the night hours, to the tales of fishermen and sponge fishers, cattlemen and *guajiros* relating boastfully or in whispers, according to the courage of the narrator, how Juan or Pedro, coming on strange marks, had seen the chain or uncovered a corner of the chest but, alarmed by sudden lights and noises, had fled rather than disturb the spirits of the dead. Or how Antonio, foolhardy and unwise, laid hand on the treasure—and the awful things that happened to Antonio here and to his soul hereafter.

X marks spot

Piecing together such bits of information, especially where they coincide with authentic charts and maps, proves fascinating occupation. I have a number of such documents, originals or copies, written in several languages, some complete with directions and "crosses marking the spot" where the treasure is hid. They tell, intriguingly, of hardwood trees, *júcaro*, *guayacan* or *jobo*, with bronze spikes in their trunks and chains leading to jars buried so many "varas" deep in earth or sunk to the beds of rivers. I love the hand-drawn illustrations: the inevitable skull and crossbones of the Brethren of the Coast, the frequent Masonic symbols, the daggers and full-rigged ships and rising suns, and one, in particular, prophetically showing a man hanging from a gibbet!

Experience and disappointment have taught me that the trees were blown down long ago; that the spikes are lost or removed and the chains rusted away; that nothing remains, perhaps, but an old man's tale of where his grandfather found the tree and drew out the spike and showed his grandson where the roots had been; or, as happens more than once in the tales, that demons made the earth transparent, lifted for a moment the slab of cement that covered the chest and showed the trembling countryman its glittering contents before maliciously closing the earth again and vanishing in flames. As such demons usually demand that the finder kill one of his companions in order to secure the trea-

sure for himself, it is considered bad luck to be around when treasure is discovered and the society of habitual treasure finders is generally shunned.

Whatever treasure is likely to be found by pure chance or accident has already been discovered and removed. For the rest, instruments must be employed: diving equipment for under-water work and, for land, balanced induction or radio and audio frequency devices, the latest developments in metal-detectors, which cannot lie and which pick up iron or silver or gold at varying depths, indicate its nature and mass, and lead unfailingly to the desired object, if it be of metal, whether it be between walls, in the earth or under water and sand.

Treasure locations

Of such I provided myself with five before setting out on my trip; all different, each claimed by its designer to be the latest word in scientific invention. Three for use on land are improved ore-locating instruments; one for under water is similar to that used by our Miami Harbor Police for detecting small metal objects like knives and revolvers lying on bay bottom. The fifth, eccentric and undependable infant of the group, is purely psychological; the modified and glorified offspring of an ancient line of water-finders and witch-hazel twigs. I distrust but cherish it because it has worked where others failed, because it calls from astonishingly long distances and because it sometimes tells me truths flatly contradicted by science. I have experimented with all in turn, improving, discarding or combining them until my collection ranges all the way from the Spanish dip-needles and forks to devices of uncanny precision able to detect metals from a distance, trace them underground and tap out softly and thrillingly "Treasure—here!"

A seaworthy boat, too, was essential to the success of the trip; something that would stand up in all kinds of weather yet with draft shallow enough to thread the narrow channels between the keys. At the close of prohibition there was an opportunity to buy a 36-foot former Coast Guard patrol boat, ex-*rum* chaser, with 150 H. P. Speedway engine, solid mahogany hull, copper sheathed, fully equipped with wireless and radio and with a four-berth cabin aft. I bought her, rechristened her the *Pieces-of-Eight*, converted her into a comfortable cabin cruiser and with my ancient maps and modern instruments set out to explore the little known south coast of Cuba, Pinar del Rio province and the Isle of Pines.

My eldest son, Bill was crew; I was navigator; a former Chief Petty Officer of the Coast Guard acted as engineer until replaced in Cuba with a



(Above) BILL, THE AUTHOR'S SON, sitting on pirate cannon. One man spent years here vainly seeking treasure. He often sat on this same cannon mourning his failure. The gun's mouth was sealed by cement; but he never thought to look inside. After he died someone broke the seal to find the cannon crammed with gold and jewels

THE MOST ROMANTIC drama ships and men ever played in American waters was the guerrilla warfare waged against Spain's organized 16th century imperialism by that immortal group of international pirates called privateers. Relentlessly preying upon the unwieldy, treasure-packed galleons, they diverted the flow of gold and fatally undermined Spain's only serious drive toward world power. Scene of this epic struggle and cradle of American piracy was the Caribbean. Among its insular waterways later pirate fleets, equally glamorous but of less historic moment, hid in "pirate coves" like that above. Eventually they were policed out of existence by Britain—the homeland of such master pirates as Drake and Hawkins. But before they vanished, these desperadoes bequeathed a folklore which, abetted by such master tale-spinners as R. L. Stevenson and our own Howard Pyle, inflamed the world with visions of sunken treasures still extant and there for the taking.

Into the vanished pirates' wake recently sailed the *Pieces of Eight*, remodeled rum-chaser owned by author Cyrus F. Wicker and equipped with every treasure-hunting device known to modern science, as well as several age-yellowed and awesomely skull-and-boned maps of proved validity



ONE THAT GOT AWAY. (Left) Holding the long-linked bronze chain that once bound a treasure chest. The buccaneers buried their hoard on dry land, but the shifting sands of time conspired to guard their secret, forcing the treasure diggers (below) to struggle fruitlessly waist-deep in water 100 yards from shore. One man managed to seize the chain, but the rotted metal snapped, letting the chest slip deeper into the slime

(Below) THE PIECES OF EIGHT, a modern treasure ship. Doctor Wicker once found that the gold-lust can still make desperadoes of seemingly peaceable seamen. Like Jim Hawkins (but not in the apple barrel) he overheard his crew plotting to murder him the instant the treasure was hoisted aboard. Unlike Stevenson's hero he had the authority to stop the expedition right there





(Below) TREASURE TROVE. What looked like a mere chunk of coral turned out to be a mass of African slave bracelets and other ornaments encased in a leaden chest. Too heavy to lift were cannon believed to belong to the sloop of war *Albany* lost without record for almost a century



(Left) ONE OF THE CREW grasps the lacquered antenna of the electrical metal locator that indicated the whereabouts of a treasure chest sunk beneath 14 feet of water and mud.

Below, the author's son and the expedition diver scramble athwart the overwhelmed dinghy, the *One Eighth*, after successfully diving for the sunken chest.

The treasure lay near treacherous reefs whose records of disaster rival pirate scuttlings in the damage done to shipping. The reef juts out from a key east of the Isle of Pines—itsself a celebrated buccaneer stronghold and possible locale of *Treasure Island*. Here the coast is as dangerous to navigation as ever and is but thinly populated by natives scarcely more civilized or less truculent than the pirates themselves. Some sections are sheer wilderness, where a disabled craft could float off-shore for weeks without hope of aid—a region made to order for mutinies

(Lower right) WHEN TREASURE was located electrically, the diver shed outer clothes and plunged overboard, but a minute later was frantically clambering back up the ladder. A long, razor-jawed barracuda swimming silkily about the vicinity of the chest had made for the underwater flash of his white-clad figure. Barracuda rush voraciously toward anything white that moves, but appear indifferent to dark objects. Accordingly, the diver donned blue jeans, a helmet and black gloves

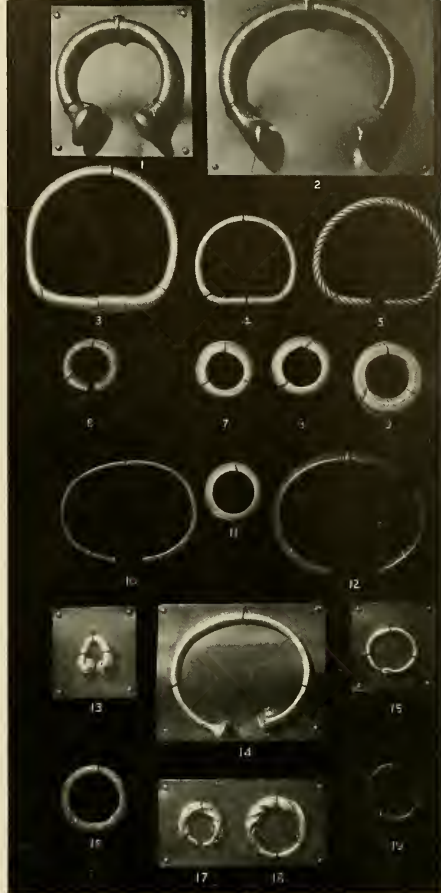




(Above) ONCE OVERSIDE, the diver maintained his connection with the vessel by rope and oxygen line. From the wreckage of a slave ship he salvaged the coral encrusted masses of ring money shown below

(Right) A COLLECTION of ring and bracelet money revealing the astonishing antiquity and prevalence of the type recovered from the treasure chest. Note the similarity of item 14 in this collection, an example of gold bracelet money from Ireland estimated to have circulated no less than 300 B. C. Comparison of the treasure with items 1 and 2 in this collection enabled numismatists to identify the coral encrusted bracelets as genuine ring money from Africa's Gold and Ivory Coasts. The treasure is believed to have been used to lure natives onto slave ships

- Other items at right:
 3, 4, 5—W. Coast Africa
 6—Japanese
 7, 8, 9—Lu Chu Is.
 10, 11, 12—Senegal
 13—Third century B. C., Pannonia, Europe
 14—Ireland, about 300 B. C.
 15—Dacia, S.E. Europe, about 200 B. C.
 16—Gaul, about 200 B. C.
 17, 18—Ireland, about 300 B. C.
 19—Benin, Africa



Courtesy of Chase National Bank Collection of Monies of the World

(Below) PUZZLING at first was the fact that this money, used to buy slaves, was found in a *returning* ship. Dark pages in slave-raiding history yield the answer. Greedy captains eliminated middlemen by luring friendly blacks aboard with offers of ring money gifts; then got them drunk and weighed anchor, carrying off slaves and presents alike



(Above) AUTHOR'S FRIEND holds a section of the lead treasure chest. Below it is the mass of mingled coral and bronze bracelets as it first appeared. Note the living sea fern on the right. Contents of this salvaged treasure chest are destined for museums



Cayman Islander, and I took on a Cuban-Honduran pilot who also served as diver. For him there was a complete diving equipment—brass helmet, rubber suit, lead belt, iron shoes and a double-action Fairbanks-Morse pump with 150 feet of armored hose; also a Dunn helmet for shallower under-water work. With charts and sextant on the bridge, *Bartholomew Sharp* and *Exquemeling*, famous pirate chroniclers, in the cabin library and light and heavy fishing tackle aft, we sailed south from Miami, touched at Key West and Havana, turned westward to Cape San Antonio, entered the Yucatan Channel and followed the Cuban coast eastward to Cape Corrientes, Puerto Cortez, Galafre, Coloma and the Isle of Pines.

The dangers

To those who would trace in reverse this route of the treasure fleets I would give this word of advice. While the illustrated folders describing the Isle of Pines as a tourist resort give it an appearance of tropic luxuriance that even understates the facts, the south coast of the island and particularly the arid keys to the east of it, where the treasure lies, are a different proposition. There is nothing soft and luxurious about the keys. They present not the balmy tropics of the novelist but a stark reality of difficulty and danger. There are hidden reefs, shifting sands and treacherous tidal currents; there are sudden gales and, in the season, hurricanes. If trouble comes, there is no help. If the engine breaks down or runs out of gasoline or oil, you may drift for weeks without seeing a soul. If you run out of water you die of thirst in a vast loneliness. You must, therefore, make adequate provision beforehand and pick your equipment with care; also your companions and crew.

Finding gold sets some people crazy; you never know what you or they will do. One of my earlier trips was suddenly called off when, a week at sea, I overheard two of the crew planning to murder me and my son the moment we located a treasure. We were to be knocked on the head at the same instant and thrown overboard, the diver left on the bottom to drown, while the two conspirators sailed off with yacht and treasure, planning to sink the one and escape with the other in the dinghy to one of the Cayman Islands; a thing which could quite easily have happened. Needless to say, that adventure stopped at once; although I had good reason to believe that what I sought was there—fourteen tons of silver in bars in the rotting hull of a ship sunk in eighteen feet of water and soft mud.

At Key West we took on provisions, gasoline to capacity and a couple of extra drums (gasoline costs

38 cents a gallon in Cuba), charts, mattresses, bedding and cabin equipment, an alcohol cooking stove (to avoid all risk of explosion and fire at sea); also a centrifugal sand and water pump for recovering chests sunk in quicksand. Tools included pickaxes, shovels, sounding rods, block and tackle, a chain hoist, glass bottom buckets, spare anchors, a sea-anchor, the dinghy, and new electrical devices, the ultimate in geophysical surveying outfits, which I had the dickens of a time getting through the Cuban customs.

In Havana there were permits to be obtained, extending the courtesies of the Cuban government to enter and leave their ports. Cuba grants such permission to foreign yacht owners, members of recognized Yacht Clubs, upon making application to the Comandancia del Puerto at Havana. There is no charge for this permit and it may be extended for successive periods of 30 days by applying to the Comandante in any port where the vessel happens to be. A mere formality, granted promptly and with extreme courtesy by the Cuban officials, but one not to be neglected or real trouble will commence at once and follow you into every part of the island.

Delayed by a "Norther"

Formalities of clearance being completed we sailed from Havana and made Bahía Honda the first day, a splendid deep-water, almost land-locked harbor some 60 miles to the west. Bad weather on the following day forced us into Esperanza, a port 50 miles farther west, with a very tricky entrance and dangerous reefs. A full-fledged "Norther" developed and for three days we lay at the dock alongside the two Cuban gunboats *Patria* and *Baire*, exchanging courtesy visits, teaching the officers how to play poker and learning in turn how the Cubans play dice. In the end we were even up. I make no comment; each to his own game. It is not the first time America has played poker with Cuba and taken its clothes—and lost them back again at dice.

From Esperanza all the way to Cape San Antonio we followed a three-fathom channel inside a fringe of reefs that protected us from the great rollers raised by the storm and gave us relief from the fierce current. Outside of this reef the current flows northeastward with increasing speed until it reaches the Florida Straits and becomes the Gulf Stream, averaging better than five miles an hour, so that the inside channel proved a blessing. Toward the south the country seemed uninhabited and uninhabitable; no sign of villages but only sharp, conical mountains rising out of dense forests of hardwoods that had never known the ax: mahogany and coco-bolo and

stands of towering cedar. As we approached the Cape, however, the land changed, became low and rocky, with limestone cliffs full of holes and caves and topped by a thick tangle of thorn bushes and scrub.

Cape San Antonio itself was once an infamous pirate hangout and the few inhabitants appeared to be their legitimate successors. Half savage, sullen, suspicious, they looked like bad actors in case we should attempt to find any of the treasures with which the numerous caves nearby are said to be filled. Having a chart for one such we wanted to spend at least a day in exploration inland, but did not stay long ashore, nor would I attempt to do so without a number of well-armed companions. I did see with glasses at the foot of nearby cliffs what looked exactly like the wall of cemented rocks described in the chart, placed there to hide the entrance to a cave in which is said to be hidden half of the treasure taken from the Cathedral of Merida in Yucatan; the other half being buried on Cape Corrientes, 30 miles farther east.

Murder for \$3,000,000

We paid a visit to this Cape later and there we found, after long search, broken pieces of the earthen jars and wooden chests in which a treasure had been carried by the Jesuit Fathers on their ill-fated journey to Havana. They had been attacked by pirates off Cape San Antonio, their three vessels sunk and all on board murdered save three survivors. These three, by strategy and the self-sacrifice of the rest of their number, managed to get half the treasure ashore at the Cape where it is still, tossed into holes in the limestone rock and covered with stones and earth over which have grown dense thickets of thorn. Somewhere near those broken jars and boxes is gold valued at three million dollars and the crown and jeweled robes of the Virgin of Yucatan!

At Puerto Cortez, around the corner from Cabo Frances and 30 miles east of Cape Corrientes, are said to be three wonderful treasures, the most interesting one a chest buried on land and bound by a chain to a giant júcaro tree, but now out in the water. Both chest and chain were found eight years ago; but the chain was pulled out of the chest in the effort to raise it, the markers lost, and the chest itself covered by the current with a few inches of sand and mud.

This whole region is full of caves, many of immense size, some of which I entered and explored. One has a stone image which the natives call an "idol," and fragments of pottery of interest to

archeologists and anthropologists as they are the remains of pre-Columbian native life. I must not forget the Cueva de Dios; so-called because in it are concealed twelve life-sized statues of the Apostles in solid silver and a Virgin and Child of solid gold; not entirely an impossibility in view of the vast wealth of the early Church in Mexico and Yucatan, some of which is recorded to have fallen into the hands of pirates on the way to Havana.

That brought us to the Isle of Pines, the principal objective of our trip. The interior of this island merits an article by itself; but on this trip we were concerned only with its south coast and the adjoining islands, reefs and keys. Stopping only to refit, we sailed south around the island, passing outside of Siguanea Bay, once favored as a submarine base for the United States Navy. There are dozens of so-called harbors along the south coast, mere shelters or quite open roadsteads only a little less dangerous than the reefs themselves. At Cabo Pepe we stopped to pick up cannon balls and fragments of shell, probably some of those hurled at a pirate fort which existed there as late as 1828. We explored Caleta Lugo, where there was once a big slave market, Caleta Grande, Carapachebey (carapace—turtle shell), and the three bays called Hell, Purgatory and The Devil, indicating how they were regarded by fishermen taking refuge from the dreaded hurricanes.

Ship's graveyard

Not all of the reputed treasure of the pirates came from captured vessels. A great part of it came from wrecks, for the south coast of the Isle of Pines is a graveyard of ships. Near Punta L'Este, the extreme southeast corner of the Island, is a hidden reef a quarter of a mile from shore on which vessels, thinking they are safe, strike without warning. One such ship was the *Don Carlos III*, which we visited and searched.

She was a Spanish frigate and sailed from Spain for Mexico in the 1820's with \$5,000,000.00 in minted coin, gold and silver, with which to pay the Spanish army in Mexico. Revolutions and the war of independence were in progress, and pay—in hard money, "duros" the Spanish call it—was needed to ensure the loyalty of the troops. Only about 3½ million in money was actually on board; the rest had vanished in commissions before leaving Spain. Still there was enough to make her a wealthy prize. She arrived safely in Cuban waters but, whether by accident or the treason of the pilot, ran squarely on the reef and passed over it into shallow water, a quarter mile from shore. The mark of her keel is clearly visible in the reef after a hundred years.

She settled easily just inside the reef in eighteen feet of water. We stood on her deck, which is awash at low tide. There is no evidence of shipwreck; but strangely enough none of her officers survived. All the crew got ashore safely and could have carried the treasure in small boats across the quarter mile of calm water at their leisure. Probably it was a simple act of piracy; the ship was wrecked, the officers murdered and the treasure disappeared. The coast for miles around was, and still is, uninhabited. The crew managed to live for five weeks on provisions brought from the ship and water from a spring. At the end of that time they were found by a Spanish warship sent out from Havana to look for the *Don Carlos III*. All knowledge as to the treasure was denied. Instead of putting the crew through the third degree, the greater part of their number were summarily shot or hanged and the rest taken to Havana, to rot in prison.

A smuggled chart

Only one map giving the location of the treasure has come down to our time. No doubt others were made, some of which may still be in existence. This one was smuggled out of prison by one of the crew and reached his wife in Spain. It reads (translated and with certain omissions):

"Off Punta del Este; Isla de Pinos. The 1st line ship [Nao] Don Carlos III. On shore three trees; in the center a big Yana. It has a bronze spike in the root and from this a chain underground—20 paces North, a quarter East, a little lake. 10 paces toward the rising sun a little mound. From this, two keys are visible in line, east and west. Nearby a spring of sweet water. In the shadow of the mound, on the side toward the spring, are three barrels gold coins (onzas, Alfonsos and centenes) in holes in the rocks. Loose gold and silver money to the amount of twenty millions [pesetas?] is thrown in holes within a radius of ten paces."

We have gotten as far as discovering the site of the three trees and what was probably the spring, and believe the $3\frac{1}{2}$ millions are nearby; but the ground is covered with dense brush and thorn thickets and has to be cleared so that the instruments can work. Then there is the question of water, and in all seasons the mosquitos are terrible. Another thing: while exploration is comparatively safe, taking into account the ordinary risks attending life in the tropics, finding gold might do strange things to people; you never know how they will react. Re-

member what happened to the officers of the *Don Carlos*?

Our next objective was Cayo Avalos, 30 miles east of Punta L'Este and a really grand place to explore, it having been a pirate hangout for centuries and the first land sighted on the direct route from Jamaica or the Isthmus to Cuba and Havana. A man named Brown had lived on that Key for years, hunting for a chest with an authentic pirate map, but he found that some of the marks described in it were gone, more particularly two big trees, near the treasure, which had been blown over by the hurricanes and later burned. He found the first markers easily: two cannon lying with their muzzles touching, quite near to shore and uncovered at low tide, making a sort of arrow-head pointing inland to a flat rock on which were carved numbers and a face looking toward a lagoon just back of his house. Brown tried to drain the lagoon but died fifteen years ago, and his house blew down in the 1926 storm.

My pilot's father had often sat with Brown on those cannon and both had noticed without especial interest that the mouths were stopped with what looked like cement. They did nothing about it, however, and after Brown died and the others had left, some inquisitive person came along, pried out the cement and found both cannon filled with gold coins and jewels. If they had only known that it was a favorite custom of the infamous pirate Lafitte, who knew these waters well, to place his loot in cannon, seal them up with cement and drop them in shallow water for later recovery!

Buried in quicksand

Our pilot, when a boy of twelve, walking along beside the lagoon 100 yards from his house, saw an iron cannon ball lying in a sort of depression where it looked as if the sand had fallen in. He called his father and uncle and with machetes they dug and found first some boards laid lengthwise, with writing burned into them and the word "Mexique." They lifted these and found a flat slab of cement and under that the top of an iron chest, covered with tar. Water filled the hole at once, as it was quicksand, almost at sea level. Having only machetes, the more they dug the deeper the chest sank. The father thought it was the work of angry spirits and caught and killed their two dogs, letting the blood run down into the hole to break the enchantment. He then leaped into the hole and caught hold of the handle at one end of the chest, hanging on until his face went under water; then he quit. As he said, they couldn't "overcome" the water. The

chest had been there ever since, said our diver; nobody having ever attempted to get it up, principally, I think, because they were afraid of spirits. Many people knew about it but could never find the exact place. The island is uninhabited on account of lack of water and the mosquitos, which are deadly in the rainy season. The pilot said he would take us to the place if we went in daylight and took along a sand and water pump, together with timbers and scaffolding and boards to shore up the sand and conquer the water at least enough to enable us to raise the chest and break it open.

We spent the night in the shelter of Rum Key and arrived off Avalos at dawn, going ashore at once. Our pilot showed us to the place, 600 feet from his former home, a hole completely filled with water and with ominous signs of planking, rather new planking, lying around. We got the pump and pipe ashore in the dinghy, carried it a quarter of a mile through the jungle (it weighed 300 pounds when we started and a half a ton before we arrived), set it up at the edge of the hole and started to pump. In ten minutes it had lowered the water and sand four feet and with a rod we probed around and struck what seemed like a broad box cover. Another two feet and we saw what it was; a heavy ten by twelve timber six feet under ground and around it many twelve inch boards. Someone had beaten us to it—the treasure chest was gone!

A few months too late

We pumped sand and water for four feet more, down to ten or eleven feet, uncovering a square coffer-dam, and reached the hardpan where the chest had lain. The timbers were almost new, certainly not over two years old and not Cuban wood either, but Georgia pine. It must have been a big expedition, well equipped and recent. But after fifteen years to be beaten out by a few months!

To compensate us for this disappointment our diver told us of something that he knew was there; a chest lying open, on the outside of a reef five miles from Avalos, at the edge of deep water where he and his brother-in-law had seen it, while salvaging copper and brass. It was in fourteen feet of water and they had seen many glittering objects lying around, sticking up out of the coral. They had tried to get some, skin diving; but the current was too strong and the coral too hard for them to break it loose. Now that I had a diving suit. . . .

We sailed out to the reef the same afternoon; but there was a strong wind blowing, and the whole Caribbean Sea, driven by the constant trade winds, was piling great rollers on the outside of the reef.

keeping us from getting out there in the big boat. My son Bill and the diver went out in the dinghy and got directly over the spot where the chest lay. They sighted it through the water glass, with two cannon lying beside it; and, the next instant, were overturned in the breakers and carried over the reef clinging to the dinghy. It was 20 anxious minutes before we could pick them up. Bill said afterward that all he thought of was Huckleberry Finn when the river steamer hit their raft and Huck dove to let a 30-foot wheel go over his head. When the dinghy turned a somersault, he and the diver didn't wait for it to come down; they just went for bottom and stayed there!

The breakers had tumbled them about a bit going over the reef, but Bill insisted on going back. Skin-diving, he brought up a chunk of coral with a bronze bracelet embedded in it. After that there was no thought of quitting. For four days we kept going out to the reef by day and anchoring in the lee of Avalos at night. Always the wind continued and the breakers pounded on the outer reef.

The fifth day the wind veered and we got out there again in the dinghy, buoying the spot; and on the sixth day we had four hours of calm!

"Treasure here"

We put out at dawn from Avalos, ran the *Pieces-of-Eight* out through a gut in the reef and anchored her with three anchors; one in the bow and two in the stern, carrying these last out to either side in our dinghy, the *One-Eighth*, and dropping them so that the stern was right over the buoy. When we used the water glass there was plenty to see! The chest was there, open on one side, and bracelets and bangles and triangles and wedges were lying nearby, buried in the coral rock. Beside them was a corner and side of what looked like an unopened lead chest. The instrument, lowered over-side, gave a tremendous pull, showing the presence of much metal.

Hastily we dressed the diver in blue overalls and a blue shirt and put black gloves on his hands. This was a necessary precaution against barracuda which we could see swimming in the water around us. Barracuda will strike savagely at anything white that moves fast in the water, like a hand or bare foot; but for our diver in dark colors and moving slowly there was not much danger. He went over-side in a mist of bubbles, and we lowered to him a crowbar and a bucket. Through the water glass we could see him breaking up the coral and freeing the bracelets. Presently he turned to the unopened chest itself. This last he could not get up intact, as it was completely buried in hard coral; but he tore off

Continued on page 171

OLD MISTER

TRIPLETS

Photo By HENRY B. KANE



HIGH-POWER

A fighter when he had to be and something of a cannibal, this black skunk made an engaging house pet. The warning lift of his tail sent all grounded foes scurrying but wasn't proof against attack from the air.

By ROY L. ABBOTT

*Professor of Biology,
Iowa State Teachers College*

IF a common skunk can at the same time be called uncommon, Old Mr. High-Power certainly deserved that distinction. For, save a tiny white star in his forehead, and the merest touch of white on the tip of his tail, he was shiny black—a rare thing among his kind—and uncommon also in that, although in full possession of his natural weapon, in the two years I knew him he discharged that weapon only twice, both instances under extreme provocation.

I trapped and watched skunks ten years before deciding to adopt one as a pet. But I believe I would have gone right on trapping them for their hides and admiring them at a distance, if I had not called one evening at the cabin of an old hunter whom I had not seen for a long time. And I nearly fell over myself trying to back out of that cabin when I found its owner flat on his back and calmly stroking a huge skunk sprawled like a kitten across his chest.

"Don't knock the door down, sonny," my friend called laughingly. "Old Meph won't hurt you."

A strange plaything

He wouldn't either, and to my astonishment I soon found myself playing with him—the first time I had ever laid hands on a live skunk. Then and there I resolved to capture one and make a pet of him, willy nilly so far as he was concerned. That's how I came to know Old Mr. High-Power, or "Hi" as I later called him for short.

I laugh even now as I recall how I found him. I had started to our little town that morning when I met Swaggard, the neighborhood simpleton, head swathed in bandages apparently just returning from the doctor's office.

"What's the matter, Swag?" I hailed him.

He stopped his horse and answered in a word.

"Skunk."

But I pressed him for details.

"Well, it was this way," he began. "I was diggin' out a den o' skunks over on Gedney yesterday," he jerked his fingers toward a woods to the left, "and I got ten of 'em. But I thought there was another one

in there, so I got down on my knees to look—and there was!"

The poor fellow was so blinded from the effects of his chemical bath, I believe he never saw my facial contortions as the result of his tale, and after I had recovered from a seemingly violent fit of coughing, he added:

"But the one that got away was a beaut—coal-black."

Going after "Hi"

He drove on then, but he had told me enough. I wanted that "coal-black" fellow, and I soon found him, for the marks of his broad flat feet showed sharply clear in the thin February snow. I couldn't tell his color, of course, from his tracks, but his size was evident enough; he had left the devastated den and had holed-up in an abandoned woodchuck burrow not a quarter of a mile further on. From the many tracks about I judged that he had found it necessary to collect grass and cornhusks for a bed before putting up for the night.

My spade cut the light frost crust, and I knew I would meet the owner presently, but I met him sooner than I expected. Hearing a slight stamping sound at my rear, I whirled quickly and there stood Old Mr. High-Power, himself, not ten feet away, the most beautiful skunk I have ever seen. The woodchuck had made a back door to his burrow and I hadn't noticed it. My digging had aroused the skunk—probably still nervous from his recent brawl—and there he was looking at me with black, expressionless eyes and making little impatient thumpings against the soil with his fore feet. Long experience with skunks had taught me that this foot-stamping was the first of three warnings which every self-respecting skunk gives to those who would hurt him, the second would be a raising of his tail and the third, a loose spreading of its tip in that position—after that it would be everybody for himself. The animal was facing me head-on, but I was not deceived by that; I knew he could elevate his tail, twist his body sharply to one side, and fire my way quickly with deadly accuracy. What to do?

Well, I suppose I might have retreated inch by inch without drawing his barrage, but my cupidity was aroused—I wanted that skunk! Slowly I began unbuttoning my old hunting coat, my antagonist as

yet not going beyond the foot-stamping stage. But just as I wiggled my second arm from its sleeve—up went the tail and likewise my blood-pressure. But again my black beauty hauled down his battle-flag, and stared at me as I began to inch toward him, coat spread vertically in front of me and with the wild intention of falling flat upon him when close enough. And as I live, I did just that.

I have read since that Frank Buck once did the same thing with a King Cobra that had him cornered, but he could hardly have held that serpent to the floor with more earnestness than I held that skunk. In fact the creature was nearly suffocated when I finally shook him out of my coat into a box in the barn—and with not a trace of odor on either of us.

Rarely the aggressor

Why didn't he "shoot" me, when as I said, he came out his back door and found me digging at his front? The answer to that is that although a close relative of the weasel and the fisher, both fierce and aggressive fighters even against odds, the skunk is rarely an aggressor—he avoids a clash whenever possible. If the other fellow wishes, he will do battle to accommodate him, but usually not otherwise. How then did I escape when I approached to throw my coat over him? I haven't figured out the answer to that. I have no hypnotic eye for skunks; three at least, have sprayed me with their musk in the past, and this fellow could hardly have been out of ammunition from his "skunking" of the unfortunate Swaggard the day before. For he probably accomplished that feat with a single charge, and most skunks are capable of firing half a dozen rounds in quick succession. Maybe he couldn't quite decide just what my intentions were, and once my coat was over him, he was seemingly helpless. A skunk, according to some naturalists must have his tail elevated to manipulate his weapon, and both Burroughs and Seton claim that it can't be brought into action when he is being carried along by the tail.

But, however that may be, I like to believe that my escape was due entirely to Old Mr. High-Power's naturally good temper. Skunk breeders tell me that skunks show good and bad dispositions as individuals just like other animals, and "Hi" must have been one of the sweet-tempered variety, for I was petting him within two months.

Not that I forced myself upon him, Oh, no! My first advances toward his cage were very discreet. I always approached slowly, talking calmly and soothingly to him and stopping shortly whenever he commanded, so to speak, by threatening movements of

his tail. I never knew whether it was my soft words, my slow movements, or the sparrows and mice that I tossed to him that had the most effect in winning him, but I do know that to be able to pick up and carry around a seven-pound wild skunk in three months—and this without fear and trembling—gave me a real thrill. The one nasty bite he inflicted upon me was meant, I am sure, for a mouse instead of my fingers.

My dog, a big Shepherd, hardly knew what to make of my new-found pet, especially when that glossy-black fellow began to waddle after me on short walks into the fields. "Shep" knew skunks by personal contact, having killed several in his time, and he also knew their power. I have seen him hit squarely in the face by a full blast from a skunk's gun, but although on such occasions he was always violently sickened, and his eyes appeared inflamed, he was never more than temporarily injured by it. Mills, who has studied skunks for years, believes that some animals are permanently blinded by it, but I have never seen any such sequel as that in the case of at least six dogs and two humans who were struck in the eyes by this powerful chemical. One man who told me of his experience was fortunate enough to have running water at hand which he immediately flushed into his face and eyes; my dogs, too, always swam if possible after such an encounter, the cold water appearing to lessen the irritation.

Fifteen-foot range

Hence, on such occasions, when "Shep" saw the skunk tagging along behind, he seemed to know that this particular skunk was inside the law and not open to attack. But he didn't allow this knowledge to effect either his dignity or his discretion, and I got many a laugh from watching his behavior. Experience had taught him that the effective range of a skunk's weapon is about fifteen feet, and he always kept just outside that distance, but beyond his close observance of this spatial relation, "Hi" did not exist for him. Whenever the skunk moved his way—often I felt with friendly intent—"Shep" always had business in the opposite direction, but always too, without showing that the skunk had anything to do with his retreat.

It was fun on one of these walks to watch "Hi" at his hunting. I had long known from examination of the stomach contents and the dung of these animals that their food was largely insects, but here I had a chance to see one of these capable hunters in action. "Hi" would leap on a grasshopper with as much enthusiasm as you or I might hook a five-pound pike, and would often grab two or three at

once while holding another victim down with his feet. He was clever at mouse-catching, too, and though usually silent would sometimes emit a sort of growling snarl as he pounced upon one.

A varied diet

I tried him on various foods. He would eat a considerable variety, insects and mice chiefly, as already said, but in addition berries, fish, frogs, birds, lizards and even turtle eggs. Seton seems to feel that this last item proves the skunk of great value in keeping down the snapping turtle, that fierce destroyer of fish, young ducks and aquatic life generally.

I found also, to my surprise, that "Hi" would kill and eat his own relations. My traps had often yielded skunks dead and partly eaten but with no odor about, and I was always unsuccessfully questioning myself as to the perpetrator of these deeds. But one evening a boy brought me a live civet cat or little spotted skunk he had caught in a box-trap, and out of curiosity I dropped it into "Hi's" cage. "Hi" started toward his little cousin at once but with no particular sign of hostility, and "little cousin" at once started in the opposite direction. Round and round the cage they went, and I watched eagerly at a decent distance. But the affair appeared to be only a walking contest, so tiring of this, I went to dinner and promptly forgot all about my experiment until the next morning when, to my vexation, I found the civet cat dead and partly eaten but with no odor whatsoever. This led me to question other trappers and I believe, from what they told me, that the killing of one skunk by another is not so uncommon, especially if one happens to be caught in a trap. Male skunks will sometimes fight until one is killed, and according to Seton, many skunk-breeders have found to their sorrow that they will occasionally kill and eat their own progeny much in the manner of a tom-cat.

In all my observation of "Hi's" eating habits, however, I never got over marveling at the chemical wonders his little body could perform. He would devour a mouse or a cricket, inoffensive and non-smelly creatures in themselves, and straightway transform them—some into skunk-flesh, it is true, but some into one of the vilest smelling substances known to man. N—butyl mercaptan, C_4H_9SH , one naturalist calls it, but under any other name this volatile, yellow-green substance would smell just the same.

With respect to the absence of odor at the site of a skunk-duel, one great student of these animals assures me that there is apparently a gentleman's

agreement among skunks not to use their gas-projectors upon each other, even in a duel to the death. But in all my experience with "Hi" I saw only one instance as proof of this.

I was visiting a farmer that morning whom I knew only slightly, and he chanced to have a deodorized skunk in an open pen. This skunk, a big male, bristled up to the fence when he saw "Hi" sniffing about—I had just taken him from my hunting coat—and the farmer thinking, I suppose, that my pet was also weaponless, at once suggested that we see what happened if we put them together. We did see what happened—a most glorious fight, the first contest between skunks I had ever seen.

A heated round

The two opponents took their time about coming to grips; there was no headlong rush as in the case of dogs. Instead, they sort of backed up to each other, then whirled quickly in a vicious dive at the neck. Once together, they circled about shouldering each other like a pair of hogs fighting, each trying so far as I could see to knock the other off his feet and then get in a killing thrust at the throat. But they were so well matched neither seemed able to get the advantage, and I stood doubtfully by as the farmer leaned over the two gladiators and gleefully clapped his hands as they whirled and snarled until both decided to call off the contest, temporarily at least. This was a good time to end the battle and I pocketed "Hi" at once, but I never told that farmer how much he owed to "Hi's" forbearance in the use of his weapon.

"Hi" had the free run of the barnyard on our farm, and to my mother's horror, occasionally went into the house. Not that she was personally afraid of him, but she was constantly thinking of what might happen should a strange dog suddenly appear at the kitchen door about the time "Hi" was coming out. I thought about this, too, and so tried to keep him in the barnyard which was fenced with high chicken-wire. But "Hi" could climb this wire with ease, and seemed to enjoy crawling over it, but I never saw him attempt to climb a tree. Seton claims that every country boy knows that a skunk can't climb trees, but I have found their sign on the tops of rather tall stumps, and Enos Mills, the Yellowstone Park naturalist, tells of finding a skunk thirty feet up a tall pine, and while Mills was up there confronted by his dilemma, another skunk came climbing up from the ground. Hence there is apparently a strong difference of opinion about the skunk's climbing abilities. I saw one once up a telegraph pole, although I am not sure as to what va-

riety, it being too dark to see clearly. I heard the creature's claws first scratching on the pole, and then could see its bulk. I thought it was a cat at first but a few well-directed pebbles changed both that thought and the atmosphere immediately. It was a skunk without doubt, but it may have been a civet cat.

As "Hi" jauntily roamed about our barnyard, his tail part way up—a kind of flag at half-mast, so to speak—he was an interesting study. Surrounded by other creatures, he was alone, none the less, a pariah from which all the rest stood aloof.

But "Hi" showed no sign that he was being snubbed or let alone; the other creatures around him apparently didn't exist for him either. Indeed, his black eyes, except for their sheen, always reminded me of the sewed-on, shoe-button eyes of a nursery plaything; they gave almost no hint of what was going on in his little head. In fact, I doubt that very much was ever going on there that we might call thinking. He seemed to take it for granted that he had the right of way, and the elevated tail is thought by many to be Nature's automatic warning signal for the rest of her creatures to beware.

Behind the times

However that may be, it is easy to see that skunks have not kept pace with the times; the thousands of their crushed bodies seen along our highways and railroads is ample proof of this. Secure as they have been for centuries in the possession of a terrible weapon, and long used to shooting off any enemy by a mere tail-raising threat, they haven't learned—and how can they when they are dead—that an automobile or a locomotive cannot be shooed.

"Hi" was a freak in color as I have already implied, most of his kind being strongly marked with white, and anyone looking at one of these animals for the first time, especially from above, might well believe that Nature had fairly outdone herself in making him conspicuous. The white stripes down his back stand out astonishingly clear against the glossy black of the rest of him, and this, coupled with a white-tipped tail usually held aloft where all may see, would seem to advertise that here is a creature to be seen and hence, looked out for.

But Thayer, who has made a study of color-patterns in animals, believes that the screamingly loud coat of a skunk is really a camouflage, Nature's method of rendering him inconspicuous to those upon whom he would feed. Thayer's pictures of skunks taken, say, at the angle from which a field-mouse might see him, do present some curious effects. The white stripe down the face does seem to

divide the animal, giving it an unnatural appearance, and the white of the skunk's back does melt astonishingly into the skyline above, leaving the rest of the body to look like a lump of earth. But the trouble with this theory is that a skunk feeds largely on grasshoppers and these are helpless at night when he hunts them most.

It was during one of "Hi's" tours of the barnyard one late November morning that I discovered two things about him almost simultaneously. One was that he could be soundly thrashed by an animal no larger than himself, and the other was that in spite of his good temper he really would use his weapon under sufficient stimulus.

"Hi" vs. a cat

I was currying the horses that morning when the thing happened. A terrific yowling suddenly broke loose in the hayloft above my head, a shower of chaff came through the cracks, and then a thumping as of something rolling downstairs. Luckily the barn door was open which led to the stairway, and before I could guess what was going on, a whirling black and gray ball of something rolled out of the door of the stable. It was "Hi" and an infuriated mother-cat—he had probably meddled with her kittens. She was making his black fur fly with her raking hind feet, but he finally broke loose, and in spite of my shouting struck her fairly in the face with a shot of musk as she came boiling in again to the attack. That terrible stroke finished her, of course, so far as further fighting was concerned, and nearly finished "Hi" also, for father was furious at the odor and strongly threatened to make me get rid of my pet. That individual, however, quickly withdrew for the season to nurse his wounds in his den in the hillside back of the barn, and I didn't see him until the next spring.

Interestingly enough, after "Hi" reappeared that spring, I noticed another skunk apparently making itself at home in his den and he discreetly kept away from it. I figured out that this other skunk was his mate and that she was about to raise a family. So I kept close watch, and sure enough I saw the old female with half a-dozen skunklings make appearance about the middle of June. The youngsters were probably about a month old then, for they are blind and hairless at birth, and of course, must spend their helpless period in the nest. But wobbly as they were when I first saw them, they even then instinctively knew of their potential powers, and threatened me with quick raisings of their tiny flags whenever I approached—and that, too, before they had developed any ammunition.

I believe the old female was puzzled—if a skunk

is ever puzzled—by the way “Hi” played around me. But at that she watched him closely also and chastised him severely with tooth and claw whenever he got too close to the young ones. I got many a laugh at her solicitude. If one of the skunklings came too far my way, or showed too much curiosity about anything not to her liking, she would cuff him or jerk him by the scruff of the neck with an earnestness he couldn’t fail to understand.

But food was plentiful so the family grew rapidly, and by November were seemingly mature although actually much lighter in weight than their mother, each weighing perhaps three or four pounds. Occasionally, I saw “Hi” wandering around with them, and I have no doubt he and the whole crew would have denned-up together that winter if I had not shut him up in a root cellar on what was perhaps his last trip to the barnyard. I didn’t want to run the risk of having him dug out and killed by some hide-hunter.

One morning in April of the next spring, however, we detected a terrific odor of skunk musk coming from the direction of “Hi’s” den back of the barn.

“Better go and see what’s happened up there, sonny,” my father announced smilingly; and following my nose, I had no difficulty in arriving at the scene of the tragedy. And tragedy it was to me, for I found only a portion of my pet’s body lying in the leaves. Knowing that there were no foxes or wolves in the vicinity, my suspicions turned naturally toward some winged killer, for I had several times found skulls of the little spotted skunk in the pellets of the Great Horned Owl.

The big owl that I shot a few hours later not only smelled vilely of skunk, but—finally overcoming my repugnance—I performed an autopsy and this showed plenty of black hair in the bird’s stomach. Doubt has been expressed that the “winged tiger” ever kills a full-grown skunk, but to me in this case there could be only one conclusion.

CONCERNING ADAPTABILITY

One of the most useful survival traits for living beings is an ability to change behavior in the face of new circumstances. The skunk fails in essential particulars to do this. A decorative and undeniably beneficial little fur bearer, despite evil fame, it has been able to humor its bumptiousness far too long for its own good. Other animals yield it the right of way, except, perhaps, on the very first occasion of meeting; seasoned wolves, lynxes, even bears, make a detour when a skunk stands in the path. The Great Horned Owl, with a poor smell, or none, may be, indeed, the only creature completely devoid of respect for the skunk’s defensive offense.

Beyond intimidation, because imbued with a sense of immunity rare in nature, the skunk expresses its inflexible philosophy by standing pat before the thundering charge of motorcars and railway locomotives. Neither its mother nor its personal experience has taught it any better. The joust takes place in the dark, because of the skunk’s nocturnal predilections, and the occupants of the juggernaut, alas! know nothing about it until after the event.

As for the skunk, it never knows anything about it at all, whence the black-and-white hairy patches on the road. Thus, out of strength comes forth weakness, which was erewhile true of the dinosaurs.

—R. C. MURPHY in the *Herald Tribune*, August 15, 1937.

WEEDS, WAST

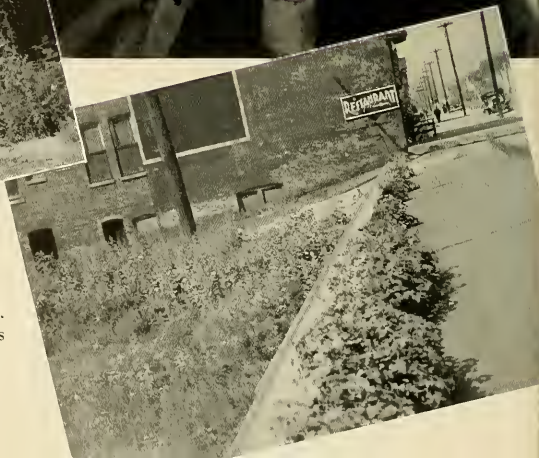


(Above)
SHORT RAGWEED

(Right) A CHIEF CAUSE of hayfever: the candid camera catches the ill-reputed giant ragweed shedding its pollen. The ragweeds were originally thinly scattered plants, which served Nature as a sort of rescue squad to "heal scars" in disturbed soil cover, and were insignificant in hayfever. Man's recent land abuses have put a heavy burden on the rescue squad, and the ragweeds have increased enormously. Their powerful pollen "factories" are now out of all proportion to the shortened distance between plants to the increasing misery of hayfever sufferers



HAYFEVER WEEDS defile 40% of some cities. Hayfever hotbed above was eliminated as others can be by park-flanked highways



AND HAYFEVER

Showing that hayfever is a man-made disease, preventable through conservation measures which every citizen—hayfever victim or not—should take to heart for the general betterment and beautification of our native land

By R. P. WODEHOUSE

*Scientific Director of Hayfever Laboratory
The Arlington Chemical Co.*

HAYFEVER in the United States is unquestionably on the increase. It is estimated that about 3% of the population now suffer from it, while twenty years ago the number was estimated at between 1½ and 2%. It is sometimes said that the reason for this is that we are more enlightened now than we were twenty years ago, and that more enlightenment leads to the proper diagnosis of more cases. Undoubtedly this is partly true, but not entirely. The real reason is that the weeds from which hayfever pollen is derived are increasing in abundance, with the result that the amount of pollen in the air is increasing, the number of those affected by it, and often the severity of their affliction.

There are now over three million people in the United States who suffer from hayfever for a period of from two weeks to five months out of every year, unless they are protected by clinical immunization. And to this number there is from year to year a slow but persistent increase.

Many hayfever resorts which used to offer their guests immunity from the late summer hayfever are now compelled to state their claims a little dubiously. Wishing to investigate some of these resorts, I made a trip late in August to the northern part of the lower peninsula of Michigan, a region which two or three decades ago was a very satisfactory hayfever refuge. Getting into conversation with one of my fellow passengers on the train and learning that he was a local resident, I inquired about the hayfever situation. He replied that this part of Michigan had the best hayfever resorts in the country, and that a lot of the passengers on our train were coming here to escape the hayfever farther south. Noticing that the road we were traveling was flanked on both sides with short ragweed just coming into flower, I asked where these hayfever resorts were.

To my surprise he replied that they were "all through here." I remarked that it seemed a strange hayfever refuge with so much ragweed about, whereupon he contended that he had lived here 30 years without ever seeing any ragweed. So I undertook to point it out to him as the train sped along. But

he was quite unable to see any of the ragweed that was slipping by, although he did admit that he had heard that there was some along the railroad track. In the course of our conversation I found that he was on his way to open up a hayfever resort of which he was the proprietor. Possibly this had something to do with his inability to see ragweed. Later, as I traveled about the region by car and on foot, I saw much ragweed and met several people who readily admitted that they had hayfever. Yet this was a region once recognized as a hayfever resort and is still trying to maintain its reputation as such.

Shortly afterwards I visited one of the islands off the shore of this part of Michigan, which has the reputation of being a hayfever resort. I traversed the whole island looking for ragweed but failed to find a single plant of either the tall or short. In the evening I met some people on the street who had come to the island to escape the hayfever of the mainland. They were so happy at the pleasant prospect that they were singing a song with a lilting melody. I could not catch all the words, but the refrain was:

Ah-kachoo, ah-kachoo
We'll be swell
In a day or two.

I hope they were. At that time I had every reason to believe that they would be, and next morning as we left the island even ventured to remark to a fellow passenger lounging on the deck of the boat that at last I had really found a hayfever resort. This apparently bland remark galvanized him into an upright position.

"What hayfever resort? Where?" he said.

When I named the island we were just leaving and said that I had been all over it and found it to be free from hayfever weeds of all kinds, he lapsed back into his steamer chair with a look of injured disappointment. He said that he had been there the previous summer and suffered the worst attack of his life. "It is all right," he said, "if the wind does not happen to blow off the mainland."

At one time this lower peninsula of Michigan was clothed with the world's most magnificent stand of pine, spruce and hemlock, dominated by towering giants of the white pine for which Michigan was once famous, a delight to behold and exhaling an

invigorating and health-giving fragrance. Now, what do we find there? The world's largest pile of sawdust, which the residents seem to be proud to show the visitor, and ragweed exhaling its noisome pollen, and denuded land which one of the local residents facetiously remarked was good only to sell to suckers from Chicago. But I would not subscribe to this latter view, for the forest is coming back and in time may clothe the soil again, and once more hayfever may be banished from the region, if we will but let it.

Hayfever, as it occurs today, is essentially modern, and the result of human interference with the plan of nature, the by-product of relatively recent advances of civilization. It is true that it occurred to some extent in earlier times but it appears to have been so rare that it was regarded as little more than a curiosity.

Early-spring hayfever

In the northeastern United States hayfever occurs in three seasons, according to the flowering of the three classes of plants which cause it. In the early spring there are a few cases attributed to trees such as elms, oaks, birches, and poplars, which flower very early, while still leafless (see Chart A). Cases of tree hayfever are rare in the Northeast, but in the South where pecan trees are common their pollen claims a few more victims, as does that of boxelder in some cities of the Middle West and Rocky Mountain states. But perhaps the most important tree of all is the mountain cedar of Texas and Mexico. When it flowers, generally about Christmas time, it scatters great clouds of pollen, and sometimes the unsuspecting gather its greens for Christmas decorations. For this they are often rewarded with an attack of hayfever as the flowers, matured by the warm, dry air, fill the house with their pollen. But mountain cedar is quite exceptional; most trees are of slight importance.

Early-summer hayfever

Of much greater importance than trees are the grasses. These flower in the late spring and early summer, starting shortly after the trees have finished, and give rise to the type of hayfever now commonly called "rose cold." Virtually all the cases of early-summer hayfever in the eastern states are due to the pollen of just five grasses: sweet vernal-grass, June grass, orchard grass, timothy and redtop. In the South and West where the climate is too hot and dry for these grasses their places are taken by Bermuda grass and Johnson grass (see Chart B).

It is astonishing that of the 1100 or so different

kinds of grass which are native or naturalized in the United States only seven are responsible for any considerable amount of hayfever. The pollen of any grass can be irritating to the hayfever patient, yet all other grasses are negligible compared with these seven leaders. This is because the others do not produce enough pollen. The native prairie grasses which grow close together, almost touching each other, require little pollen to reach across the gap of an inch or two generally intervening between neighboring plants. Hence, through long adaptation to life in the prairies, which are believed to be 20 or 30 million years old, these grasses have adjusted their pollen production to their meager requirements—scarcely enough to be of any consequence in hayfever. On the other hand, plants which are in the habit of growing farther apart must produce more pollen to be effective across the greater intervening distances. This increase is not directly proportional to their distance apart but follows the law of inverse squares. Thus, plants growing 100 inches apart must produce 10,000 times as much pollen as those only one inch apart, and so forth. And, conversely, when plants which are adapted to growing 100 inches apart find conditions favorable to their growth in mass formation, only one inch apart, they may produce 10,000 times more pollen than they need. Though this is a theoretical consideration incapable of proof, it harmonizes with the fact that so few species are active in the production of hayfever. The only transgressors are the normally hundred-inch plants growing at distances of one inch.

Of the seven leading hayfever grasses not one is native to America; all are immigrants; sweet vernal, June grass, orchard grass, timothy and redtop from Europe; Bermuda grass from India or the Mediterranean region—it is not quite certain which—and Johnson grass from north Africa. We should, however, have no resentment against these intruders, for all are valuable plants, and if kept under control they need cause little trouble.

Timothy, which is generally regarded as the most important hayfever grass, was brought to America in 1747, before it was cultivated in Europe. Now it is grown in masses practically throughout the United States, 56 million acres being devoted to its pure culture and 19 million to it and clover. It has also escaped from cultivation and occurs as a weed in many places, where it grows in mass formation. I do not know how timothy grows wild in its native country, if, indeed, it still does; but the native American alpine timothy, which is very much like it, can be found growing wild in the Rocky Mountains. It is seldom abundant, the plants tending to grow individually or in small clumps. If such was

HAYFEVER POLLENS—*Chart A* EARLY SPRING

Compiled by R. P. WODEHOUSE for NATURAL HISTORY MAGAZINE 1939



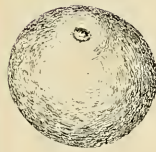
RED OAK, white oak and birch (*below*) illustrate the abundant pollen developed by plants accustomed to growing far apart. The worst such hayfever plants come in summer.

These branches were cut in the evening and placed in water. In the morning when the sun struck them they were tapped with a pencil and photographed



Most early-summer hay-fever in the eastern states is caused by the pollen of the five grasses shown here. In addition, Bermuda grass and Johnson grass occur in the South and West. All are naturalized citizens

(Below) JUNE GRASS, brought from Europe by the Colonists



(Above) POLLEN GRAIN of Timothy, greatly enlarged. Approximately 750 of these grains placed side by side would extend only one inch

(Left) The Timothy plant itself, a grass which was introduced in 1747 and spread in mass formation. Sweet Vernal grass (right) is of little economic value and starts off the grass-hayfever season (April-May)



(Below) REDTOP, a hay fever agent brought to America by the Colonists before it was subjected to cultivation in Europe. This grass flowers at the same time as Timothy (June, July) and is a valuable agricultural grass of slightly acid soils



(Below) ORCHARD GRASS: a troublesome cause of hayfever. This tall, robust plant sheds its abundant pollen in May and early June



HAYFEVER POLLENS—Chart B

Compiled by R. P. WODEHOUSE for NATURAL HISTORY MAGAZINE 1939

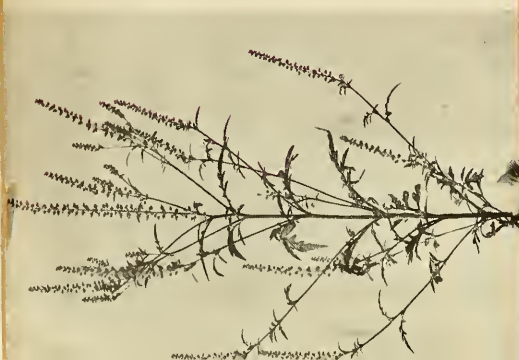
LATE SPRING AND
EARLY SUMMER



POLLEN AREAS
INDICATED BY
NUMERALS
WITHIN LINES

1 Sweet vernal grass
2 June or blue grass
3 Orchard grass
4 Timothy
5 Redtop
6 Bermuda grass
7 Johnson grass

Levett Bradley

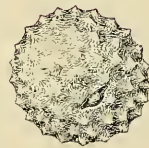


Over half of all hayfever in America is caused by the short and tall ragweeds. Both grow only in disturbed soil and disappear when land is either properly utilized or left to Nature. (Left) Short ragweed



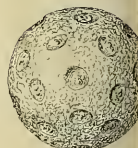
(Right) TALL WORMWOOD, a hayfever plant pioneering in bare sand. Where the ragweeds are unimportant or absent, the wormwoods, sagebrushes, and mugworts take their place, particularly in the Rockies, the Great Basin area and the Pacific Coast

(Above) COCKLEBUR, a secondary cause of hayfever closely related to ragweed and usually affecting the same victims. Like ragweed, it is a pioneer of waste places



POLLEN GRAIN OF SHORT RAGWEED

(Left) SAGEBRUSH, which causes much hayfever in the region west of the Rocky Mountains. This coarse, bad-tasting shrub is unpalatable and hence avoided by stock. Excessive grazing, therefore, favors its growth



(Right) TALL RAGWEED growing in Westchester County, N. Y. A few years previously this ground was disturbed in grading for a road, with this result. Now a new four-lane highway, flanked by parkland, has



T



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Herons, Cormorants
are useful in Nature's cha

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ckly settled parts of North
y exterminated our Otters,
mal still thrives in English
aburbs of large cities

More than 40 species of migratory
shore birds, permanently protected
in the United States and Canada,
may be shot without bag limit at
West Indian islands



Several species of gorgeous Parrots
and Macaws, peculiar to individual
islands, have been harried to ex-
tinction in the Antilles

Seal, practically
lonial days and
1912



S. O. S. FOR A CONTINENT

Compiled by ROBERT CUSHMAN MURPHY
President of the National Association of Audubon Societies
FOR NATURAL HISTORY MAGAZINE, 1939

Owing to rapid settlement and reckless exploitation, North America has suffered more from improper land use and the uprooting of Nature's balance than any other continent within so short a span of human history. Certain of the evil procedures and their consequences are indicated on this pictorial map.

—Black Whale, a symbol of a commercial fishery now almost extinct.

Here unscrupulous traders have been busy since the early days of the fur trade, and they are still busy today. They have been busy with the fur trade, and they are still busy today. They have been busy with the fur trade, and they are still busy today.

It has been estimated that 100,000 head of the Prairie Provinces' bison have been killed since the late 1800s. The bison was once a common sight on the prairie, but it has been almost exterminated.

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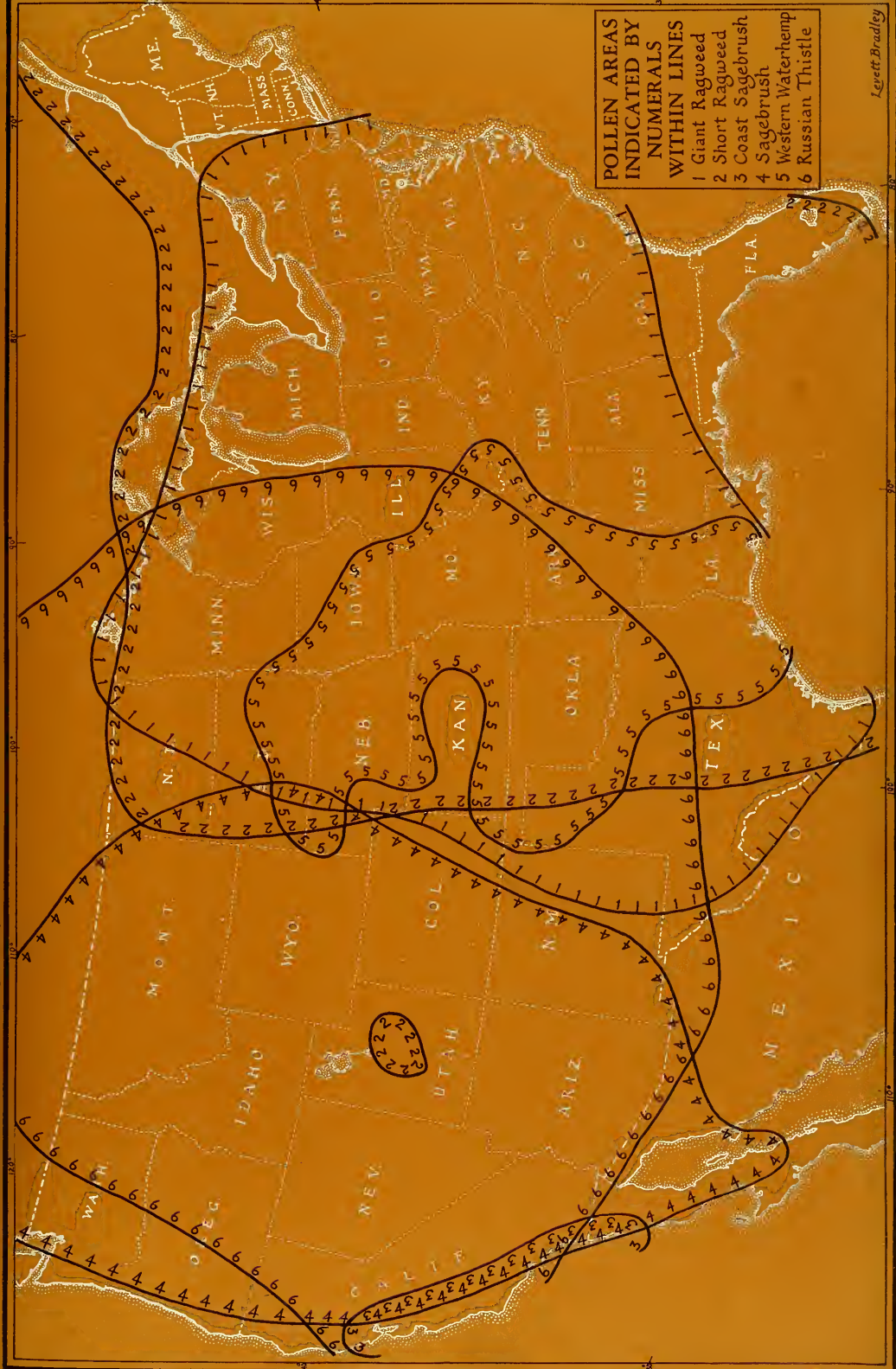
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Drawn by JOSEPH M. GUERRY



HAYFEVER POLLENS-Chart C | SUMMER

Compiled by R. P. WODEHOUSE for NATURAL HISTORY MAGAZINE 1939





Drawings by LAURENCE BLAIR

THE Indians had no hayfever. Neither would we if we lived in the primeval forest or on the native prairies, as did the aborigines of North America before the coming of the White Man. In those early days the land was clothed with the climax vegetation, a stable and balanced society of plants.

Everywhere the earth was protected by its enriching cover of trees, grass or shrubs best suited to the soil and climate, leaving scarcely any room for hayfever weeds. Some of them did not even exist on the North American continent, being brought over only later by the first settlers from the Old World, and those, like the ragweeds, which are native Americans, found scarcely any room, for they can flourish only in disturbed soil, of which there was little. They occupied only the most recessive positions, barely able to hold their own, and of no consequence in hayfever. It is doubtful if they were ever even noticed by the Indians. Pre-Columbian days were hard days for the ragweeds.

Such surroundings served the Indians well. But not the White Man. So with little thought of the morrow he saw fit to tear off Nature's earth mantle, and he laid the soil bare. Some of it he covered again, at least partly, with farm crops, with grass for pasture, with orchards, with wheat and other cereals, from which he reaped rich rewards, for these are the legitimate uses of the soil. And soil, if properly cared for and not robbed of its humus, can serve us to the end of time.

But much of the land was left uncovered, exposed to the ravages of wind and rain, with the result that the precious layer of top soil, our greatest natural heritage, is washed away to clog our streams and reservoirs, leaving the land barren, eroded and useless. Farm crops cannot be grown on such land. The plants of the climax vegetation cannot even grow there again until the land has been rescued. The weeds are Nature's rescue squad; and the need for rescue introduced a ragweed boom.

Sort Ragweed

Ill Ragweed

Timothy

Cocklebur

ledtop



Hayfever, A Man-made Disease

Resulting from land-misuse, hayfever weeds lead the way as Nature's rescue squad in the restoration of balanced vegetation

By R. P. WODEHOUSE

Like the hardy pioneers of our own kind, the weeds ask but little. They do not languish like other plants for the deep rich soil that has been washed away. They do not care if the ground they find is rich or poor, moist or dry, acid or basic; all they ask is the wide open spaces where weeds can grow like weeds, and here they find them, for all else has been killed and the soil rendered fit only for weeds. They quickly cover the naked soil with a rank growth which clothes and protects it, arresting the destructive forces of erosion.

But the weeds carry within themselves the seeds of their own destruction. They gather and hold the humus which is washed to them by the rain, and their foliage affords the protection that the delicate seedlings of other plants need; and as they die their remains enrich the ground so that other plants may grow. So as they live and die they invite the competition which weeds cannot endure.

Ragweeds are among the commonest pioneers which serve as Nature's rescue squad. Left to themselves they do not generally last long; sometimes it is only a matter of a few seasons, sometimes more for when the soil has been completely destroyed it may take ten or more years before enough loam can accumulate again to support the ragweed competitors. But sooner or later the pioneer stage comes to an end, as the grasses and other more permanent plants gain the upper hand; the succession moves into the late-weed-and-grass stage. At this stage hayfever weeds play a relatively minor part. It is a tolerable condition and may even be useful for grazing. Gradually this stage gives way to the next, and this in turn to the next, and the next, leading always toward the restoration of the climax. But the process of soil building is slow so that it may be centuries before it is actually attained. *But of the whole succession only the early-weed stage is really important in hayfever.*

the original habit of our adopted European species, it is easy to see why timothy produces so much more pollen than it needs under its present conditions.

The story of timothy is typical of the other grasses. June grass and redbud were brought to America by the Colonists, the latter before it was subjected to cultivation in Europe. Orchard grass was introduced in 1760, Bermuda grass probably before 1807, and Johnson grass in 1830. They found a congenial climate in America and plenty of space where the competition was not too severe. As a result they were able to flourish in masses as they had probably rarely flourished before. But they did not abandon their old habit of producing enough pollen to reach effectively across much greater distances. They are hundred-inch plants growing at one-inch intervals.

Late-summer hayfever

Of still greater importance is the hayfever caused by our own native weeds. More than half of all the hayfever in the United States occurs in late summer and is caused by the pollen of the short and giant ragweeds. The victims of ragweed hayfever, of which there are nearly three million, sometimes

gain the reputation of being minor prophets, for they can generally predict to a day each season when their afflictions will begin. This is because the ragweeds are "short-day plants"—plants which are brought into flower by the waning days of late summer. So deeply grooved is this response that they invariably flower at the appointed time, regardless of their size or age when the day arrives. In the northern part of their range where the season is short and the plants get a late start, they may flower when only a few inches high, while in the South where the growing season is long they may reach a height of ten feet or more before flowering time arrives. Also in the North the short days of summer arrive earlier than in the South, consequently, paradoxical though it may seem, this type of hayfever begins earlier in the northern latitudes than in the southern.

In the Rocky Mountains and beyond, where the ragweeds are unimportant or absent, their place is taken by the sagebrushes, mugworts and wormwoods, characteristic of the mountains, the Great Basin area and the Pacific Coast, and by the salt bushes and oraches, characteristic of the arid plains of the Southwest (see Chart C), and there are other local plants too numerous to mention. Though all of these are native American plants, it is because of man's interference with nature's plan that they are growing in an unaccustomed abundance—hundred-inch plants at one-inch intervals.

One plant of this western region, the Russian thistle, is a newcomer to the continent. Though it is less than a century old in America, it is a pernicious weed and among the most important causes of hayfever throughout the plains and prairies from the Mississippi River westward almost to the Pacific Ocean. Not actually a thistle, it has earned for itself the name from its spine-tipped leaves. It is also called tumbleweed because in the fall of the year the plants break off from their roots and are rolled about the ground, distributing their seeds as they go. It is estimated that a single plant produces 20,000 to 30,000 seeds, so it is well assured that Russian thistle will have first chance at any openings that occur in the vegetation cover of the plains and prairies.

There are other plants which contribute in some degree to the production of hayfever, but the seven grasses, the two ragweeds and the related false ragweed and bur ragweed, the sagebrushes, mugworts and wormwoods, and Russian thistle account for so nearly all of it in North America that without them hayfever could be little more than a local phenomenon of academic interest. The seven grasses are useful agricultural plants when kept within



Photo courtesy of Boyce Thompson Institute

RAGWEED'S PUNCTUAL POLLEN

Ragweeds are brought into flower by the shortening days of late summer, regardless of age or size. Right-hand plant was artificially given short, August-lengthened days and was fooled into producing pollen ahead of left-hand plant, flourishing under longer daylight. (Specimens are short ragweed)

(Below) PRIME CAUSE of hayfever: bare and eroded land due to destruction of cover vegetation. Nature rushes to the rescue of areas like this gully in Alabama with ragweed, Mexican tea, and other weeds. Nature can be assisted and hayfever victims relieved by planting other reclamation crops which do not cause hayfever. Thus the CCC boys now are planting the Oriental kudzu vine which does a better job of rescuing than ragweed



RUSSIAN THISTLE growing on waste land near Chicago. This virile recent immigrant will probably punish man severely for future disregard of proper land economy



WEEDS, WASTE AND HAYFEVER



TALL RAGWEED and other weeds taking possession of a clay dump near Chicago. In the foreground is cocklebur, also an important hayfever plant. Weeds like these are the first to grow in such barren soil. Other harmless plants could be substituted. So, if you must disturb the soil, plant something else quickly before the hayfever weeds get started

IN THE DRIVE against hayfever two solutions are offered. Let the land go back to its natural state, or cultivate it intensively as shown in this Florida grapefruit grove below. Here beggar weed, alicia and Mexican clover enrich the soil between the fruit trees without causing hayfever

Protect the soil cover of vegetation; or cultivate useful plants



bounds, causing most of their trouble when assuming the rôle of weeds. The others are ordinary weeds which, even apart from their hayfever proclivities, constitute a great national liability.

Hayfever due to soil abuses

Hayfever is nature's reply to man's destructive and wasteful exploitation of natural resources just as much as is soil erosion, wind erosion and floods. It is less spectacular than the great gullies carved out of hillsides by running water or the disastrous dust storms that bury farm buildings and move whole farms into the next state, or the floods that sweep away bridges. These are nature's answer in her boisterous mood. In her more subtle mood the answer is hayfever. And so softly it comes that few of us ever suspect that it is the answer to our thoughtlessness or greed.

The enormous abundance of ragweed occurring in America today is a comparatively recent development and undoubtedly the result of human activity. That this is so is revealed by the records of the peat bogs, for the pollen which falls in them is quickly entombed and fossilized, preserving for all time the pollen records of the surrounding vegetation. The surface layers of these bogs show that ragweed pollen is being deposited in abundance today, but the deeper layers which were laid down before the coming of the white man fail to reveal any ragweed pollen. The plants were here, of course, because they are known to be native Americans, but they were so scarce that they contributed no discoverable pollen to the peat deposits of those early days.

The days before the coming of the white man were hard days for the ragweeds. They are plants which can flourish only in disturbed soil, and soil disturbances in those days were rare. Almost the only places where they could be counted upon to occur with any regularity were along the rivers and streams where the water undercuts the banks, exposing fresh soil, and in the flood plains where the established vegetation is periodically covered with silt. The giant ragweed is well equipped to take advantage of such situations because it has an aquatic seed capable of floating in water for days, and this in spite of the fact that the plants are in no way aquatic. Outside of such places, under the original conditions of balanced vegetation, the ragweeds occupied only a recessive place, being suppressed by the more dominant types of vegetation, and often barely able to retain a foothold. Consequently much pollen was needed by them to reach from plant to plant. But with the coming of civilization all this has changed; a "ragweed boom" has developed.

Ragweed and soil recovery

The profusion of ragweed plants in vacant lots, waste places, roadside ditches and neglected farm land, gives the impression that the ragweeds are aggressive invaders. True, they flourish in almost any kind of soil, rich or poor, wet or dry; they are not even particular whether it is acid or basic. But this is their principal survival factor, for they cannot stand competition from other plants. Ragweeds are pioneers but not invaders. When land is stripped of its normal vegetation the ragweeds are among the first plants to reoccupy the denuded areas. This they do quickly and effectively, often gaining complete dominance. In this it must be admitted they perform a useful service in holding the soil against wind and water erosion until it is taken over by other more permanent plants. Their rôle of pioneering fulfilled, they readily give way to the pressure of other species, provided, of course, the ground is left without further disturbance. Their function is to initiate the succession by which nature tends to restore the original balanced vegetation.

A slightly different rôle is played by the sagebrushes and related mugworts and wormwoods. They are bad-tasting plants with a strong aromatic odor, which causes them to be avoided by grazing animals as long as there is other provender, with the result that excessive grazing, by removing the competing grasses and other herbage, leaves these weeds in undisputed possession. Many thousands of acres of good pasture land have in this way become converted into almost pure stands of sagebrush, pasture sage, coast sagebrush, California mugwort and such, which are almost useless economically and the source of much toxic wind-borne pollen.

These are the ultimate causes of hayfever: the destruction of the natural forest or cover of other vegetation, improper agriculture, the ploughing of lands unsuited to agriculture and their subsequent abandonment, excessive grazing and other processes destructive of our natural resources and often leading to soil erosion, but supposed to be inherent to Progress in America. Truly hayfever is a man-made disease, the by-product of a shiftless and unorganized advance of civilization.

Paul Sears, in his delightful little book, *Deserts on the March*, has said that civilization is a disease of continents. Certain it is that civilization has altered the face of the North American continent, marking it with ugly scars where the soil has been washed from the hills to be deposited in the lakes, ponds and reservoirs by water in its uncontrolled rush to the sea, and where the good earth has been blown away leaving barren desert, through the lack

of protective covering of vegetation. Truly these are the diseases of continents. But it is no less true that the land possesses a remarkable capacity for recovery from her injuries, providing the disease has not been allowed to progress too far. Nature does not even need a doctor to effect complete recovery, though a little intelligent assistance on our part can enormously speed up the process; all she insists upon is to be left unmolested to nurse her wounds.

If land which has been completely denuded, as in agriculture, is abandoned, it is rarely immediately repossessed by its former owners, having been generally rendered unfit for their occupation. Instead the new occupants are at first the annual weeds of rapid growth, such as lambsquarters, pigweed and the ragweeds. These rapidly clothe the land, forming a plant society which we may call the pioneer or early-weed society. It is flimsy in character and of temporary duration unless the soil disturbances are repeatedly renewed. But if the soil is again disturbed it persists as long as the disturbances are continued. This is generally the case in vacant lots where earth and rubbish are dumped, along country roads where the edges are scraped each summer, and in farms where crops like wheat and oats are harvested in the early summer and the land allowed to revert to weeds during the latter part of the summer. To this early-weed stage belong nearly all the worst hayfever weeds. But if the land is left to itself the protection which the pioneer weeds afford is quickly taken advantage of by other plants of a more enduring character. The new seedlings shoot up ahead of their shade-giving predecessors next spring, for they can live through the winter maintaining a good root system to give them a vigorous start, whereas the pioneer weeds are annuals and must start afresh from seed. And it is only a few years before the pioneers find themselves pushed aside and occupying the same recessive position in the new community that they did in the old association before the destruction of the original ground cover. This is the late-weed stage.

The late-weed stage is the second step in the recovery of the soil from its man-inflicted injury. It is characterized by such plants as the beard-tongue, sowewort, yarrow, brome grass and other grasses, most of them nearly or quite harmless in hayfever and many of them even of some use as fodder. These also, if left to themselves, soon give way to still another set of plants, forming the mixed-grass-and-weed stage. Each year thereafter sees a change in the character of the plants which occupy the region, always reaching toward the climax, which is the association of plants best suited to the climate and stable in form when left to themselves. This, in

brief, is the ever moving plant succession whereby nature tends always to restore the land to its original condition, clothed with a stable and balanced vegetation in which hayfever weeds play no part.

Farmers long ago found that they can check the plant succession at any stage they wish and hold it there as long as they like or put it in reverse, by limited or controlled interference. Thus, in grazing land by limiting the number of animals per acre they can maintain the land indefinitely at the late-weed-and-grass stage, which is harmless in hayfever but perhaps the best for pasture. But many farmers, hoping to squeeze just a little more out of their acres, sometimes add too many animals or graze for too long periods without giving the land a rest, and so depress the succession to the late-weed or even to the early-weed stage, defeating their own ends and causing themselves and their neighbors misery with hayfever.

But the blame for hayfever by no means rests entirely with the farmers. Every town or city has its vacant lots, waste places, roadside ditches, dump heaps and such, often constituting as much as 40% of its area. The numerous activities inherent to the growth and development of all American cities continually disturb the soil of these, keeping them almost constantly in the early-weed stage. This condition is undoubtedly also largely contributed to by public-spirited but poorly informed citizens who attempt to ward off the impending disaster by cutting or otherwise destroying the ragweeds and incidentally all of their competitors, thus preventing further progress toward recovery in any of the areas which might happen to escape other hazards. Though these weedy areas are small compared with the thousands of acres of farm land permitted to grow ragweed, they are relatively much more important for, occurring in the midst of densely populated communities, they cause many more people to suffer. Yet if all such areas could be left unmolested it would be only a few years before the ever moving succession would carry them to a higher stage and hayfever would be a thing of the past.

The cure

To permit the return of all soil to its natural conditions is not compatible with civilization nor with human progress in any form. But there is an alternative and that is to cultivate the land intensively. You do not see hayfever weeds growing in city parks, in properly kept gardens, in well-managed farms nor, in fact, anywhere that the soil is put to its legitimate use and economically managed. For

Continued on page 178

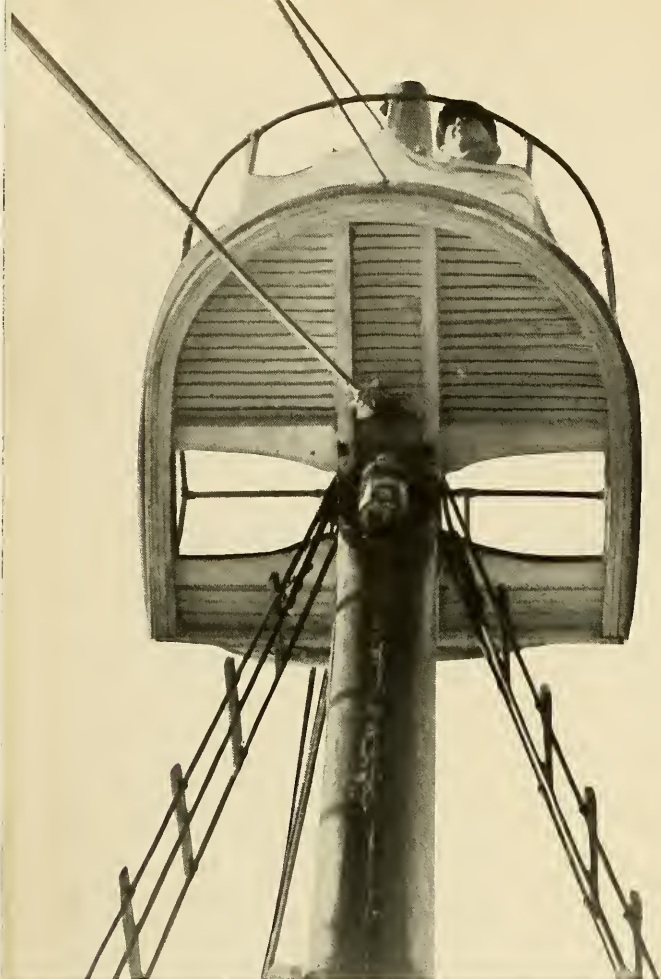
FISHING

A huge industry in which Nature, striving to keep these fish the most abundant on our Atlantic Coast, is slowly being bested by men and machines. Though yearly hauls often come close to a billion, few Americans have ever heard of the fish called menhaden

TWO O'CLOCK in the morning aboard a menhaden steamer. The stillness is only broken by the quiet and business-like commands of the captain. "Cast off stern." "Hoist purse boats to davits and tie them fast."

The jangle of the bell in the engine room is heard and immediately follows the muffled roar of the Diesel engine. There is no impatient clambering about and mournful blasting of the air horn. Men are calm and efficient and eager to be off. The crew goes about their tasks in almost sinister silence and in a few minutes comes the order, "Cast off bow lines," and the helmsman is guiding the boat out between the flashing buoys of the Beaufort Chan-

MENHADEN are a small, oily, and extremely prolific fish. From crow's nests like that at left, fishermen of the North Carolina coast and elsewhere spy the rusty patches of sea revealing menhaden schools and direct the average yearly haul of $\frac{2}{3}$ billion comprising a million dollar industry. (Below) A fleet of specially built menhaden craft



OR FATBACKS

By SIDNEY SHAPIRO

nel, off for the shoals to the south of Cape Lookout in search of menhaden.

This fish is by far the most abundant on our Atlantic Coast but this fact is rarely realized and makes the story of the men who "go down to the sea" for menhaden particularly interesting. There is scarcely to be found a menhaden fisherman who does not take pride in his boat and is not aware of the glamor that the actual fishing for "fatbacks" may have for an onlooker. This coupled with the well-known Southern hospitality led to an almost unasked-for invitation for me to accompany the *Kingfisher* on one of its daily runs to the fishing grounds.

Plans for the day were to strike for the waters off Cape Lookout shoals where innumerable schools of fish had been reported the previous day. Menhaden operators have not resorted to the scientific methods used by the cod and halibut fisheries of the North Atlantic Coast or the tuna fishermen of the Southern California Coast. Modern radio information plays no part in their fishing operations. Conversation passed along on the boat docks by the fishermen during the course of an evening's relaxation as to the presence of schools of fish and the weather conditions supply menhaden captains with all that they think is necessary for them to catch fish. Several years ago the Navy Department by means of seaplane surveys and wireless ventured to show the industry how the steamers could be directed to schools of fishes without the usual loss of several days required in cruising about large areas of water before schools could be sighted from the

Photos by Eubanks



(Above) PURSE BOATS lowering to pursue a large school. These boats were designed by a Cape Cod fisherman to carry and maneuver "purse nets," so-called from their functional resemblance to the draw-string type of a woman's purse. Motor-driven, the boats soon overtake the school, surround it, and (below) set their 1000-foot-long net. Once the fish are inside, the draw string at bottom of net is hauled tight to shut off that line of escape



THEIR PURSING completed, the crew (above) lay to, waiting for the steamer to come alongside. When it does (left) the task of raising the fish begins. This scene was filmed off North Carolina where negro crews predominate. Menhaden fishing produces uneven muscular development, magnificent torsos dwindling to unimpressive legs. Menhaden boats traditionally work close to shore, preferably at daybreak. Sundown, technically, is just as good, but does not fit in with factory schedules



(Left) BRINGING THE FISH TO THE TOP: a stirring sight. With each heave, the deep-throated chanties of negroes boom out on the tangy morning air while the fish thresh about violently. Just right of picture's center is a small shark caught while feeding on the menhaden. Sharks are often thus trapped and, curiously, can then be suffocated to death while still under water



(Left) "HARDENING" is the menhaden fisherman's term for this process of packing the fish solidly in preparation for bailing. The apparent glare in the net is actually white suds formed from excessive oil exuding from the menhaden's bodies. In this oil lies most of the menhaden's commercial value. Factories convert it mainly into soap, but linoleum and paints take their share, and some European firms use it in margarine. The leftovers, formerly salvaged only as fertilizer are now being mixed with standard feeds for pigs and other farm animals

(Below) BAILING OUT. The motorized bailing net has a capacity of over 2500 fish and loads the catch into the trawler in short order. Daily hauls of menhaden often reach 600,000—a figure made possible by the highly mechanized methods of what might be called "a mass reduction industry." For though Nature strives valiantly to offset these tremendous inroads, her productivity cannot long keep pace with Man's organized destruction



masthead of a vessel. The results of this experiment were extremely practical and encouraging but were never adopted by the menhaden operators.

The intended fishing grounds were in sight as day broke. Schools of menhaden are best sighted during the early morning or late afternoon, but the former time is preferred, as it enables the boats to bring their catches to the factory before nightfall. Soon after, the captain and his mate went aloft to the crow's nest. From their lofty perch would occasionally come directions. "Bear to port two points." "Set course due south." "Bear about."

Before long I was told to look to starboard where an immense school had been sighted. Gradually I began to perceive what experienced eyes had detected instantaneously. A rust-colored patch of water could be faintly seen in the distance slowly passing across the animated surface of the water. Thousands of fish closely packed and assembled as if marshaled for a military formation—a perfect mark for the experienced fisherman.

While still aloft the captain commenced a series

of orders which in the space of seconds saw the two motor-driven purse boats and the striker boat lowered away. Soon came the command to cast off and the boats were heading for the school, the captain and the mate each standing in the stern of their boat and directing their crew. The huge purse net, close to 1000 feet in length and 40 to 50 feet deep was already in place to be payed out; half the net being neatly arranged in each purse boat. The purse net as its name implies is worked essentially as is the old-fashioned woman's hand purse.

The origin of the purse net goes back to the Gloucester fishing days of the Eighteen Sixties. For centuries before that time fishermen had caught mackerel by using a hook and a glittering snare fashioned into one piece. The fish were caught by trolling through a school, and for an unexplicable reason mackerel would leap for this hook in preference to the ordinary bait-on-hook method. The seine was devised by the Gloucestermen as a time-saving method to trap an entire school. After the net had been used to surround the school the lower



(Above) FROM NET TO SHIP'S HOLD in one swing of the crane. So long as the oil is worth money, the menhaden can count Man their worst foe, ranking him far above the shark or blue fish. Fishermen who do not think seriously of conservation would enjoy more security in the future if they did. Said one to the author, "God put these fish here; if we find them and take them, nobody ought to stop us."



(Left) The menhaden himself; referred to locally as "Fatback" and by other names. Though a member of the herring family, most palates would cringe from his oily taste, and despite his abundance in our waters, he is one of our least known fish

end of the net would be pulled together as in a purse so that the mackerel could not escape by diving under the net.

With use of such a large unwieldy net came the demand for a rowboat that was seaworthy, speedy, and large enough to carry a seine. Isaac Higgins, who had settled in Gloucester, soon devised the seine boat which satisfied these requirements and at the same time combined the best principles of the whale boat, the life boat, and the canoe. The purse net used by the menhaden fishermen, except for size, is essentially the same as that used by the early mackerel fishermen. Likewise for the purse boat except that modern advances have added a motor engine to it.

Surrounding the school

As the school of fish was being approached the striker boatman, standing at his oars in his small roundbottom skiff detached himself from the purse boats and headed for the apex of the school. Beating his oars about in order to head off the school, which could be seen clearly, he endeavored to stop it sufficiently to permit the purse boats to surround the school with the huge and cumbersome net, at the same time signaling the movements of the fish to the captain with his oars. At the opportune moment the two purse boats, which had been lashed together, separated and went off rapidly in opposite directions, meanwhile paying the net out and finally meeting and tying together at the opposite side of the school. Then followed action almost faster than the eye could follow but necessary because of the danger of the school "pulling out," as they refer to the escaping of part or all of the fish, before the net could be pursed.

Men of the two boats quickly exchanged the ends of the purse line and fastened them to snatch blocks. With the drawing together of this line the school had been closed off, and now began the process of concentrating the fish into the bunt. This bunt is the center section of the net and is strongly reinforced so as to bear the weight of thousands of fish without giving way. Looking down into the enclosed area of sea water one could see the now bewildered school first "strike" against one side of the net and then as if at a given signal wheel about and "strike" blindly at another part of the net. If fully terrorized the fish might have brought their weight of thousands of pounds to bear with disastrous results upon the net.

At first the crew, which was composed entirely of negroes, pursed the net hand over hand, taking in the slack rapidly; but as the pulling became more difficult because of the increasing weight upon the

net, the captain ordered pursing by strokes: all the men pulling in unison. While the net was being pursed the "seine setters" in each boat were taking in as much of the cork line as possible. Soon the danger of a "strike" by the school was over, for the area necessary for it to gather the full momentum of its weight was being markedly restricted as the net was being gathered in. Meanwhile the striker boatman had stretched the cork line of the net in the region of the bunt over the bow of his boat so the bunt of the now heavily laden net would not sink.

When the pursing had been completed, that is the wings of the net webbed in until the bunt was reached, the two purse boats were slackened and made fast bow to bow. In the meantime the steamer, which had been laying to, approached at the captain's signal and closed in to form the third side of a triangle with the two smaller boats, enclosing the netted fish. The cork line of the bunt was made fast to the side of the steamer by means of small hooks.

Chanting at their work

Now came what to this observer was the most exhilarating sight ever experienced, that of "bringing the fish to the top." Imagine such a picture—negroes pulling in unison with each stroke, deep throaty chantings accompanying their efforts, thousands of fish milling about in the bunt of the net, oil from the fish helping to create a soapy foam, and finally the noise of the threshing about of the fish blending with the song of the negroes. These men seemed to be in a complete trance as if dazzled by the money that was theirs only for their efforts. Some mysterious fire possessed them and they poured it forth in their old sea chanties. The inexhaustible efforts of these men have given to each a torso worthy of the Nubian giants but has left their underpinnings weak and seemingly incapable of supporting such magnificent bodies.

When the fish had been packed solidly by stretching the bunt of the net (a process known as "hardening"), a dip net capable of holding a few thousand fish and operated by a hoist engine was brought into play and the fish transferred at a rate of about 2500, for each dip, to the hold of the steamer. The first "set" had taken about 45 minutes and 80,000 fish were aboard the boat.

Immediately we were on our way in search of more menhaden. About us could be seen rust-colored splotches traveling slowly over the surface of the water. Today was unusual. Schools were so abundant that the captain and the mate spent precious moments deciding which school would yield a larger

number. Occasionally a school of menhaden would pass under the steamer giving the observer a glimpse of the incalculable nature of the life existing within the bounds of the ocean.

It was on the fourth "set" that I saw the incredible number of 182,000 fish trapped and brought aboard the boat. To me this would have been unbelievable unless seen, and more unbelievable is the statement by the skipper of the *Kingfisher* that many times in one "set" he had obtained enough fatbacks, 600,000, to load his boat to capacity and yet be unable to take aboard thousands of fish remaining in the net because of lack of space in the hold or on the deck of the boat.

Uses of menhaden

What about the menhaden and why the catching of such huge numbers? It is surprising how little known this fish is when it is realized that it is the most abundant along the Atlantic Coast and is caught in far greater numbers than even the cod and halibut. In its general appearance the menhaden (*Brevoortia tyrannus*) is somewhat herring-like although deeper and more robust than the better known relative. The oil which is cooked out of the fish is used commercially for the greater part in the production of soap. Smaller percentages of the total yield are used in the manufacture of paints and varnishes and linoleum and oil cloth. In the Old World, fish oils are used widely in the preparation of margerines and lard products. This practice has not been adopted in this country. Until recently the scrap and meal remaining after the oil is cooked out, was used almost entirely for fertilizer purposes. Now a great deal is being used in mixed feeds for poultry, swine, and cattle, and the amount going to fertilizer is steadily decreasing.

The menhaden is known by various and sundry names along the Atlantic Coast. In the vicinity of Beaufort, North Carolina, it is known as the fatback, in allusion to its extreme oiliness. Elsewhere it is known as the mossbunker, bonyfish, alewife, poggy, and many other terms peculiar to each locality.

Menhaden steamers work well within sight of land; often as close to the beach as the ocean bottom will allow them. Typical steamers have been built expressly for this type of fishing. They are of wooden construction with an extremely high bow, supposedly of more advantage in rough water and permitting a greater view of the sea from the pilot's house. Aft the main deck and gunwhales slope down sharply so that the midship and stern of the boat are just above water level. This low deck facilitates loading the fish from the net into the hold. Many years of fish oil oozing into the planking of the

ship and decomposing there have given menhaden boats a well remembered odor, making it advisable for a casual and uninured observer to stay to the windward side of the boat at all times.

Menhaden fishing requires on the part of the fishermen an enormous outlay of energy and a necessity to work at unabated speed but only when the fish are running. The days are gone when purse boats were guided about by oars, and nets worked entirely by the use of hands. But even today with the motor-driven purse boats, electric winches and hoists, fishing for a livelihood has not been made physically lighter and uncertainty is ever present. Modern methods have only aided the fishermen in making larger catches possible and completing his devastation of ocean life in a shorter time.

For many days boats may cruise about without the least indication of the presence of a school; the indications being the familiar rust-colored streak slowly moving across the surface or the disturbance created by the school when it is swimming close to the surface of the water or is being preyed upon by the sharks or bluefish and occasionally the mackerel. Scarcely a "set" is ever made that these fish are not found in some number among the menhaden. One small shark, about three feet in length and weighing 25 pounds was found to have eaten 22 menhaden when cut open.

Preying sharks "drowned"

An interesting sidelight was the captain's statement that a shark can be smothered in water. During the "hardening" process when the fatbacks are being brought to the surface and packed solidly before the dip net is brought into action, trapped sharks are very often smothered completely by the unbearable weight and pressure of thousands of fish packed solidly about them. Yet a shark out of water will cling tenaciously to life and thresh about long after it has left its own medium.

The question of conservation does not seem to be an important consideration for the majority of the fishermen. To them it is true that there are lean as well as plentiful years and if there are no fish in one vicinity they merely move on with their boats to a place where fish have been reported. For years the menhaden industry has occupied a top place in the fishery output of this country. In 1935 the menhaden fisheries gave employment to about 4500 men and paid wages amounting to \$2,500,000. About two-thirds of a billion fish weighing approximately 389,002,000 pounds and valued at \$1,440,000 to the fishermen yielded scrap, meal and oil worth \$2,635,892 in that year. Yet this was a below average year. The peak year of 1922 doubled these figures.

The question uppermost is: can 150,000,000 fish of a single species be taken, without risk of depletion, from the waters of the North Carolina coast alone each year? Nevertheless this enormous number and like numbers to a total of two-thirds of a billion are being taken from other waters along the Atlantic Coast. And the only justification for this given by the men who do the fishing, to quote a captain of the menhaden fleet, is that "God put these fish here with the intention of having man use them. If they are there and we find them and take them, nobody [meaning government restrictions] ought stop us." Actually the reproductive capacity of the menhaden is so large as to almost justify this statement and to make it possible to catch such enormous numbers year after year. But without realizing that their manner of catching the fish often prevents the full capacity for reproduction from being attained, the fishermen will catch as many fish as they are able to to the full limit of present-day restrictions as long as there is a market for them.

Statistics prove that nature itself is not able, even with the amazing reproductive powers of the fish, to compete with the destruction that man himself is occasioning. Since the peak year of 1922 there has been a marked but nevertheless steady decline in the number of menhaden caught, not entirely due to the use of substitute products or to the increase of the sardine and Alaskan herring oil yield of the West Coast but more to the fact that there are fewer fish to catch. This observer has seen steamers take aboard fish the oil capacity of which is negligible and scarcely worth the effort of the men. But the nature of man is to take aboard rather than return empty-handed. Another contribution to the depletion of the population is through the use of the long haul nets in taking food fish. These nets strip the water bare of all fish of all sizes, and very often in the catches of these fishermen can be found hun-

dreds of fatbacks and foodfish no longer than the length of one's finger.

The migrations of these great schools of menhaden has long been the subject of controversy among those interested. The schools appear with the coming of warm weather and remain until the waters have cooled off. Thus they appear along the coast successively from early spring in Southern waters to late May or June along the coast of Maine, and disappear in like order from Maine about September to along in January off Cape Hatteras. Below Hatteras they are more or less in abundance throughout the entire year. Fishermen and scientists have both conjectured where the vast schools of fish go when the inshore waters become too cold. The most accepted theory is that during these periods of cold the fish remain in the temperate strata of the ocean waters known to exist under the Gulf Stream and between it and the American coast, rather than moving in a southerly direction as do birds.

An indication of the tremendous migrations of menhaden was offered me by the reminiscences of an old sea tar. His story of the September 18, 1901, run at Beaufort, North Carolina, is extraordinary. Schools of fish had been entering through the narrow inlet of the bay for days previous, but finally the congestion in the bay became so great that the fish began to leave. Sharks and bluefish preying on the fatbacks helped increase the commotion. Schools of terrified fish, unable to find the narrow exit to the bay drove themselves up on the shore. In the course of that day eleven million fish were scooped up by the natives to be sold to the factories. I cannot vouch for the exactness of the story. Put it down, if you like, as just another "fish story," but I can vouch for the fact that very often schools of menhaden are driven up beaches clear of the water line by the voracious bluefish.

DO NOT MISS

KERRY WOOD rose to the front rank of Canadian nature writers as the author of a distinguished narrative *The Geese**, which won international recognition. Following his absence of more than a year from these pages, **NATURAL HISTORY** is again gratified to present his latest work **BEHIND THE DAM**. This story of a colony of Canadian beaver is told with Mr. Wood's unsurpassed talent for conveying a poignant feeling of the drama of wild-life in its pure state. The author's powers of observation are much too keen, his schooling as a naturalist too thorough, to allow any tawdry "humanization" of his characters. These are real beaver. They pit tooth and claw and their remarkable engineering skill against the manifold dangers which Nature, in all her vast indifference, sets in their path. And in the progress of the tale they become quietly and unconsciously, the symbol of their kind.

**NATURAL HISTORY*—November, 1937.

America's mongoose is, oddly enough, a bird. So esteemed as to be called "paisano" (countryman) in Mexico, the sharp-beaked Roadrunner not only can beat its weight in rattlesnakes with relative ease, but has actually been known to kill and devour 30-inch rattlers, digesting them piece by piece. Celebrated in the legends of Indians, Mexicans and Southwestern Americans, the bird becomes an engaging hero in J. Frank Dobie's **THE ROADRUNNER IN FACT AND FOLKLORE**, wherein evidence is marshaled to show the pointlessness of trying to eradicate so many-sided, economically valuable, and delightful a creature.

Charles E. Mohr's **I EXPLORE CAVES** will appeal to anyone who likes a good story. Here are exciting journeys through Nature's spectacular country of the blind where strange creatures live and die never seeing the light of day.

MODERN TREASURE ISLANDS

Continued from page 143

one side and corner and pried out the contents with the crowbar, holding on to the anchor rope with his free hand to keep from being swept off his feet. What a thrill as he passed up bucket after bucket full of coral-encrusted bronze and copper bracelets and rings and triangles! Nothing around but open sea and blue sky; Avalos Key five miles away; breakers on the reef behind us not 50 feet away; our boat with three anchors out and a forest of ropes overside—air line, life line, bucket line and lines for the crowbar and dinghy anchor to which the diver clung—; ourselves pumping or watching through the water glass while the diver, fourteen feet below, pried out chunks of treasure from a lead chest and passed them up in the bucket. It was Howard Pyle come true.

Finally the diver pried up a great mass—all that was left—two feet long by a foot wide and eight inches thick, and sent it up intact. It is now in the United States destined for the museums which have examined it and found that the rings and bracelets are African money, used for centuries in the slave trade in Sierra Leone, Benin and the Gold and Ivory coast. Bracelet and ring money, identical with this, has been used for centuries and is still found in Africa, from Abyssinia to the Grand Bassam.

The most exciting thing was when the diver at last came up, his eyes bulging, and announced great "bottles" lying close by. We shifted the stern a little and the bottles came into view. They were shell guns; long mortars with short muzzles and certainly of bottle shape. They may, indeed, be all that is left of the *U. S. S. Albany*, which sailed from Aspinwall, on what is now the Canal Zone, for New York via the Yucatan Channel in 1854 and was never heard of again. She carried eighteen cannon and four shell guns; and within a radius of 150 yards I saw with my own eyes and counted

eighteen cannon and two shell guns. They may very well be from the *Albany*, and Avalos reef may hold the secret of a lost United States frigate as well as treasure from an African slave ship and who knows how many wrecks more ancient still; perhaps the bones of galleons belonging to the treasure fleets of Spain that sailed so close to these uncharted shores.

But why should ornaments and African money be brought back from Africa? This may be the answer. It is recorded that one Juan Gomez, a slave dealer living on the Isle of Pines, sent nine or ten ships annually to Africa carrying guns and cotton goods, powder and hatchets and knives; that he bought thousands of slaves from Arab dealers, and that when he wanted a cargo cheaper still it was his custom to anchor off a native African village, give trinkets and bracelets (their form of money) to the natives, get them to come on board for a feast and when they were well drunk tie them up and bring them back as slaves. Some of his captains may have taken back their bracelets, once the negroes were on board and helpless, to use on subsequent voyages. That is how they happened to be on board this ship, bound probably for Caleta Lugo.

At any rate we were at length successful and brought back something besides maps and experience to show for our weeks of exploration among the treasure islands. Errol Flynn, who was on the Isle of Pines, at Nueva Gerona, while I was out on Avalos reef, offered anything he had if someone could direct him to treasure. If he had found what we found and had gone back to Hollywood with a chestful of bracelets—African money from a slave ship wrecked two centuries ago off the Cuban keys, on the route of the Spanish treasure fleets—the news would have gone around the world. I hope he comes back next winter. I can take him to where he and others can find both treasure and high adventure off the modern treasure islands: Cuba, Cayo Avalos and the Isle of Pines.

DO NOT MISS

Readers of *NATURAL HISTORY* have already made the acquaintance of a number of extraordinary household pets which Professor Roy L. Abbott has made of some of the smaller animals of the North American wild. His remarkable knack for penetrating the intimate personalities of half-tamed creatures is again demonstrated in the biography of courageous **OLD ZIP COON**, perhaps the most bizarre pet ever to have the run of the Abbott house. The adventures of this likable raccoon will be published in a future issue.

In **A PICTORIAL HISTORY OF A BITTERN'S NEST**, A. Dawes DuBois describes the trials of a "candid camera man" intent on recording the family life of this fascinating member of the heron family. The mother bittern was

so camera shy that she actually "growled" at his approach—warning enough from any bird—and when he persisted, forced him to pay for the pictures with his own blood! But Mr. DuBois feels the pictures were worth it and upon their near-future appearance in *NATURAL HISTORY*, we believe that readers will enthusiastically agree.

Botanists, professional, amateur and potential, will be scarcely more delighted than the general reader with Mrs. Olive Earle's **RUGGED INDIVIDUALISTS OF THE PLANT WORLD**. Her remarkable pictorial skill abetted by ample textual information provides a display of some of the more extraordinary adaptations which a wide variety of plants have made to environment, both exotic and domestic.

In BLACK

Extraordinary natural camouflage has been developed by identical animals in two adjacent areas of New Mexico, one a black lava flow, the other gleaming sand dunes, white as the Arctic snow

By JOHN ERIC HILL

*Assistant Curator of Mammals,
American Museum of Natural History*

IT is commonly known that many animals are colored so as to blend with their environments and, unless they move, to be almost invisible. When the background is such as we see most of our lives we do not marvel at the concealing coloration of animals. However, when extraordinarily colored backgrounds are found, inhabited by animals colored like them, this protective phenomenon is striking.

In the Tularosa Valley, in southern New Mexico, there are two unusual environments situated close to each other, a black lava flow and an area of white sand dunes, each with mammals that blend with their respective backgrounds in color. The most interesting are black pocket mice and white ones, members of a southwestern American family, intermediate between the squirrels and the mice proper, having fur-lined cheek pouches and peculiar teeth.

The lava bed or malpais is about 40 miles long by two to five miles wide. Most of this lava is probably not over a few thousand years old and very little weathered. The surface is unbelievably rough and broken up: there are piles of lava blocks, fissures, wells and dykes. The bubbling and swirling of the molten lava is congealed, and

reminds one of the inferno it was when it poured from the crater. Progress on such terrain is slow and often painful. Footing is insecure on the balancing blocks, and the jagged lava cuts and abrades leather boots in unbelievably short time.

The crevices and cracks of the malpais form the only shelter of the mammals, for the material is hard as cast iron. In the crannies the wind-borne dust and weathered lava collect and offer soil for an abundant and varied flora.

Peculiar animals of the lava beds are a blackish rock squirrel, black pocket mice, blackish big-eared mice and black wood rats. The malpais pocket mice belong to a rock-dwelling species, *Perognathus intermedius*. Normally this species is grayish brown, but the race from the black malpais is uniformly blackish, almost matching the malpais, in color. The other dark mammals show a wide range of variability, from slightly darker than normal to almost black. All of the dark mammals have normally colored relatives in the mountain sides and on the rocky buttes which occur in the northern half of the valley.

In the Pleistocene period there was a large lake in the southern third of the Tularosa Valley. It was "dead," without outlet, and its waters became supersaturated with alkali. When a warmer, drier period came, the lake evaporated, leaving an enormous deposit of gypsum (calcium sulfate). The hot winds have desiccated the glassy crystals of gypsum, forming a sand-like substance. In texture this substance is not quite like sand or salt, but resembles both, and it is piled together by the wind into dunes of gleaming white from 20 to 50 feet high.

The ripples caused by the wind on the dunes are

HOME of this New Mexican Pocket Mouse are the lava beds below. Though otherwise perfectly normal, millennia of natural selection have protectively blackened his fur

Photographs by J. E. and H. S. Hill



and WHITE

as attractive as those the sea forms on the beach. The brilliant desert sunsets tint the dunes with gold, rose, lavender, and mauve, the white sand reflecting the hues of the sky. The day may be feverishly hot, the night is always fresh and cool. Moonlight on the white sands is many times brighter than elsewhere on the desert, forcibly suggesting the deep northern snow drifts, their peace and repose without the piercing cold of the snow.

Only two mammals, a white pocket mouse and a pocket gopher, are restricted to the sands, and a kit fox is most numerous there. The only mammal colored like the sands is the pocket mouse, although kit fox and gopher are extremely pale. Two whitish lizards, *Holbrookia* and *Sceloporus*, and several extremely pale insects are found there.

The white pocket mice are not in any sense albinos. Their eyes are beady black, the tips of the guard hairs are blackish and a faint tinge of dilute yellowish pigment is present. The pocket mice match the color of the sands closely in daylight, and at night they vanish completely when they stop moving. About 100 individuals of the white race have been taken in the Tularosa White Sands by various collectors, but none have been captured outside this area, except on the whitish quartz sands immediately adjoining the gypsum. These pocket mice are close relatives of the small yellowish *Perognathus apache* which inhabits the sandy valleys of New Mexico, Arizona and northern Mexico. Specimens of this species, normally colored, have been reported from the Tularosa Valley, but at some distance from the sands. The white pocket mice occur near the margins as well as in the interior of the dunes, frequenting the rabbit bush and salt grass clumps for the seeds which form their sole food. Their tracks can be followed from one bush to another, often traversing several hundred yards of barren dunes.

The paleness and darkness of the rodents which so closely parallel the environment is not limited to the Tularosa region, but here the extreme examples are placed so closely together and in such similar climatic conditions that the adaptations are more

striking. What can best explain the development of these correlations? The animals do not apparently differ from their close relatives elsewhere in the valley in any character except that of coloration. Skull characters, teeth, and proportions are not distinguishable.

Direct external influences such as humidity, temperature, and light cannot be very different in the adjacent areas. Most of the plants occur elsewhere in the range of the normally colored animals, and individuals of both types of pocket mice have been kept several years on bird seed and are not modified to their artificial diet and surroundings. Mammals cannot adjust themselves to the colors of their environments by the effect of these on the nervous system as do many other kinds of animals. Color in mammals depends on pigment granule deposited in the hair when it is growing, and can change only by deterioration once so deposited.

The explanation that seems most satisfactory is that small, heritable, chance variations occurred in the populations of these rodents. The individuals which inherited darker coloration on the lava and paler coloration on the white sands had a small but real advantage against predatory enemies over those of the same species which were normally colored, or which varied in unadaptive directions. Result: more of the protectively colored individuals lived to reproduce and in time the populations of these regions came more and more to agree in coloration with the environment. A very slight advantage multiplied by the thousands of mouse-generations since the Pleistocene would be quite effective. And in certain cases this process is probably still going on, as indicated by the variability of some of these animals.

UNDER THEIR SKINS, both black and white mice look much alike. But long dwelling on snowy fields of gypsum (below) has turned this one white



WHAT IS IN A NAME?

A rose by any other name might smell as sweet, but . . . To your not-too-distant ancestor, a personal name was no mere label for telephone directories. It was his soul, The Word, Life itself, and he would not tell it to you for the whole wide world!

“DON’T give your right name” is an all too common byword of our dishonorable times. Smith, Brown and the like are so associated in our minds with aliases hastily adopted in shady situations that even people who come by them honestly sometimes arouse suspicion. For instance, were a certain British Captain to tell a present-day Indian girl his name was John Smith, she’d doubtless smile knowingly and prepare to keep a sharp eye on him. But a few centuries back, the Indian girl told that doughty colonist her name was Pocahontas, and credulous Captain John appears never to have doubted her for a moment. Yet, very likely, Pocahontas was bluffing. We will never know what her name actually was, but there is much reasonably good evidence that it wasn’t Pocahontas. Why this subterfuge? Was the precolonial savage a far “cagier” person than is commonly supposed? Was the princess just “a smart girl trying to get along?”

No, the answer is simple enough. Scarcely anybody in aboriginal America ever gave his right name. Such reluctance is, in fact, an old American custom.

In attempting to explain this, it is, strange though it may seem, pertinent to consider a few primitive notions about ordinary human respiration. The respiratory tract in all unenlightened physiology is conceived to be the passageway of the immortal spirit. Few of us can forget those school nights spent slowly piecing out our Latin translations. Remember the disheartening number of English meanings each Latin word seemed to have? Remember, particularly, the word *spiritus* than meant (among other things) both “breath” and “spirit” or “soul”? Thousands of school children annually sigh over *spiritus* and pronounce the Romans “nutty” to have had only one word for two ideas that seem so far apart as breathing on the one hand and having a soul on the other. But, in that case, nearly all the primitives and ancients were or are



nutty. For the vast majority of their languages insist on the same word for “breath” or “soul” or words so nearly alike that there can be small doubt of their original identity.

A case in point is the Malay native who, immediately after he sneezes, is apt to shout, “Soul come back here.” A sneeze in Melanesia signifies that a far-away voice has called the sneezer’s name and, since the name is more or less synonymous with the soul, that it is responding by taking leave of the man’s body. This is a serious predicament, and we get therefrom some inkling of why most primitives are rather secretive about their names. Even contemporary Greeks preserve the notion by expressing the hope that the distant name-caller “may split” whenever one of their number sneezes. And we exalted moderns are not quite clear of the ancient belief either. Watch what you say the next time a friend sneezes. Your *Gesundheit* or “God bless you” is simply a bit of abracadabra to forestall an enemy’s gaining possession of your friend’s soul.

So vulnerable a region as the respiratory tract was understandably a matter of great concern to the primitive. But his idea of its proper care and use differed markedly from our own. The good Ojibway mother, for instance, never cautioned her young son that smoking would stunt his growth. Rather she likely gave him a daily tobacco ration almost from pa-

poose-hood. But late and soon she lectured him never to give his right name. That would be, she said, the surest way to dwarf his stature and wreak general havoc in his life.

Queer people these Indians? Perhaps. But it isn’t their exclusive idea. Roughly the same parental advice is handed out in Africa. Among the Kaffirs if a son goes wrong—grows up to be, let us say, a thief—they have a perfectly simple household remedy to re-route him on the straight and narrow path (Warden Lawes please note). Here’s the recipe. R assorted medicinal herbs gathered from the tribal preserves. Heat in the family cook pot to a racing boil. Lift the lid and repeatedly shout the errant lad’s name into the pot until well mixed with the curative herbs. Clamp the lid on tight and allow the mixture to boil thoroughly. Presto! the boy is reformed.

But why? Well, the Kaffirs are convinced that the thief and his name are just about identical. Of course, having your name boiled up in a mess of healing herbs is a good deal less harrowing than climbing into the pot yourself. But it isn’t a mere symbolic cure. Not in the least. The Kaffirs are unshakable in their belief that the name is the spiritual essence of the person.

Returning to our hypothetical good Ojibway mother, we find that some of the soundest maxims in our own upbringing are nothing short of rank heresy to her. Our childhood squabbles, you recall, were often set at rest by the observation that “sticks and stones may break my bones but names will never hurt me.” Not so, says the good Ojibway. She’d rather see her son take a severe stoning any day than have an ill-wisher call him by his true name. If a kindly stranger were to ask the name of the young Ojibway, he might conceivably get a friend to tell it. And then, in return, he would probably tell the stranger his friend’s name. This odd method of introduction is really not very different from

proper procedure in our own social functions. Daughter doesn't tell her name to every kindly appearing Tom, Dick and Harry that comes along, you know. She, too, must be introduced by a third party. Of course, our rationalization of the process differs from the Ojibway's. He takes it very seriously. What he fears is a whole complexity of unseen malevolences in the environment which can most conveniently be described as evil spirits. If he lets his own name out of his mouth, the very spiritual essence of his being is automatically bound and delivered to any one of the enemies lurking in the natural and supernatural world who cares to take advantage of it. But if a friend utters his name, there can be no evil intent, only a friendly service, and no evil can come of it. There you have it. Two Ojibway boys are standing side by side. If the boy called Hooting Owl were to utter the Ojibway words for "hooting owl," that would be spirit. If his companion utters them, it's merely breath. Hence the well-nigh universal linking of the two ideas. For essentially the same performance has been witnessed the world over.

Horses

The curious thing about it is that this elevation of one's name to the level of the immortal spirit is one of those fascinating phenomena that have arisen among many diverse people who have had absolutely no contact with one another: to choose some among the many, the Eskimo and the Fijian, the Inca and the Hindu. Obviously, then, the reason for it lies in a common primitive psychology. However, we need not hesitate before so abstruse-sounding a field of inquiry because there are many survivals of primitive thinking conveniently lodged in our own contemporary speech. Take our terms for a horse family: horse, mare, stallion, foal or colt. Do they show any common denominator? Positively not. The word "colt" and "horse" have only the letter "o" that is mutual. The ratio is roughly the same for the rest. "Foal" and "mare" sound no more alike than "mole" and "bear." And when our primitive ancestors coined the words, they did not particularly want them to sound alike, because they made no connection between them. A foal and a mare were simply two distinct animals.

In short, primitives often find it extremely difficult to see the relation-

ship of any one act or phenomenon to another. It is a matter of record that some tribes have no single word for "cow" but content themselves with "white cow," "brown cow," etc. Moreover, our familiar Mobicans had a word which meant "cutting stone" another for "cutting wood," but no word at all for just "cutting." Now, these oddities boil down to the plain fact that primitives lacked the capacity for abstract thought. Take the Latin word *equus*. Under this abstract term, zoologists have grouped and classified all the variations and mutations occurring within the whole array of animals who show sufficient measurable likeness to be contained in the horse family. Clearly, primitives who did not perceive the value of inventing a group-term for a horse family would seemingly find such an intellectual achievement a thousand light years beyond their scope. They knew what "flying" was, but to think of "flight" was utterly impossible. What the primitive saw at the moment was all there was. There simply wasn't any more.

From the modern point of view,

ILLUSTRATIONS
by
IRWIN J. WEILL



then, our remote ancestors were not very bright. But before you consign them to the category of worthless dolts, consider how their concept of the name permeated some of the highest civilizations ever to arise on earth.

Most of the great Oriental cultures including the ancient Egyptians and Chinese provide conclusive evidence

that names had holy powers which necessitated extreme care in the use made of them. More than 3000 years ago, the cultivated Babylonians who contributed much to Man's early knowledge cherished the "Don't give your right name" doctrine. Their cuneiform scriptures reveal that men commonly had two names. The right or true name was often thought much too sacred for utterance in commerce and other routine aspects of life. Only at the most solemn ceremonies did the owner ever tolerate its free circulation. The name must never be spoken in trivial circumstances. In other words, it must not be taken lightly or *in vain*. Originally, then, the commandment "Thou shalt not take the name of the Lord thy God in vain" was not calculated merely to forestall any ill-bred and discourteous infringements, rather it was a taboo against light-heartedly evoking the actual presence of the most terrific power in the universe. The wandering Israelites, neighbors of the Babylonians, treated this injunction with all the respect we moderns have for signs reading: Danger 50,000 Volts.

Such prohibitions, you understand, did not apply to the Babylonian's non-sacred name—his label for ordinary use or, as we might say, his "handle." And the American slang "handle" is, paradoxically, quite apposite here because it seems to convey as nearly as we can what these ancients and primitives thought their names were. To them they were handles, sometimes as much a part of them as their limbs, things that some malignant force or person could get hold of. And if once he did get hold of the name, he could twist the owner's destiny any way he wished.

A cycle of Cathay

Keystone of most philosophical thought in the ancient Orient are the Vedic commentaries "First verily are words produced and the mind runs after them," and "The world originates from the word." We see at once that such tenets beg the question "Who uttered the first word?" Their answer is, of course, God. God spoke and the world was created. Now then, when he spoke, what did he say? Why, he *named* the world. And the creatures of the world? He named them in order and they came into being. The name, therefore, becomes synonymous with creation, with Life itself! In fact, the name is the true or real existence. It follows logically that the Babylo-

ans regarded everything that was not named as being purely illusory and having no existence at all. Scholars have traced a definite linkage between the Name, the Word, and the Greek concept of Logos, and this ancient oriental line of reasoning leads straight through to no less intellectually immortal a personage than Plato himself. For to Plato the word or Name was eternal, its owner of the moment being merely a sort of transient tenant—something like the short-lived person, George Windsor, as against the long-lived name, King of England.

Of course, the collective oriental wisdom from which such lofty concepts spring might be thought of as a great reservoir fed by many rivers. These rivers symbolize the vast flow of primitive folklore passed on by preliterate peoples. In other words, the wise men of the East may be pictured mid-way between the primitive and Plato.

This brings us right back to what the primitive thought about the Name. It was he that originated the Babylonian notion that whatever was nameless had no existence. Accordingly, if a native mother in Borneo had a baby who died before the time of the big naming ceremony (with us, the christening) she would probably mourn no more than if the baby had been still-

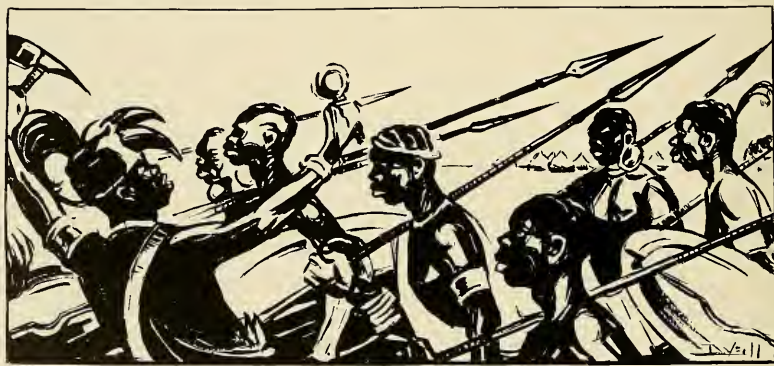
has been preserved in various forms by many primitive tribes, who seem to infer therefrom a number of ridiculous secondary "truths." The African elephant hunter, for one, believes that by changing the name of his quarry, he can radically alter its habits. When he comes upon an elephant, he will cry out, "It is a stone." This charm is calculated to endow the beast with the qualities of stone—that is, immobility—so that it can easily be captured. The same idea, by the way, lies behind such favorite names as "Strong Eagle." Any man so-called is believed to acquire the qualities of the bird. And the manipulation of deity names is a form of prayer frequently found in primitive religions.

In order to secure the benevolence of a notoriously violent god, worshippers expect to alter his disposition by changing his name. Thus, the Vedic god Rudra (the howler), dreaded breeder of hurricanes, plagues, and general destruction, was placated with a new name, Siva, the gracious one. Accordingly scholars surmise that adjectives like "Love," "Compassion," "Justice," etc., so commonly bestowed on deities, are often quite the reverse of their original names. Wishful thinking of this sort is also evident in the frightened savage who, when unexpectedly confronted by a lion, shouts

a lion, he calls, "Lion, Lion," believing that by so doing he lures the creature nearer. Fearing a similar effect, the Chinese at certain seasons refrain from using their name for fire, and residents of Madagascar their name for lightning. Both fear that utterance of the name may invite a calamity. Likewise ancient Scandinavians, engaged in fermenting "home brew," would never say "water" lest their beer turn out watery.

As is indicated in many of the foregoing cases, two kinds of human names are used, one possessing special spiritual significance and the other used for ordinary labeling convenience. "Pocahontas" was surely one of the latter sort, as was "John Smith," and it is this category that we, the quasi-civilized, have preserved, while largely discarding the other.

Several names resulted from the custom in some quarters of taking on new names as the primitive grew older. For instance, at puberty a savage might abandon his childhood appellative with appropriate ceremony, and take on a new one. Later on, if he slew an enemy, he might adopt the enemy's name to signify that all the deceased's property belonged to him. Still later, a chief might confer another new name as a reward for unusual bravery, just as Europeans were



born. And even though the child might have been one year old, it was regarded as never having lived.

Since many primitive religions consider that the world was created by the Great Spirit's naming it, and that Man was similarly brought into being, it is quite natural for some sects to suppose that Adam named the animals. Hence Adam's power over the beasts of the field. He had their names! This notion of naming-power over animals

"Lion is not there." An even more astonishing example is the war-time function of a priest among the Bechuana of South Africa. This might be termed the origin of the smoke screen. What the priest does is trudge along beside the marching warriors steadfastly shouting, "The army is not seen."

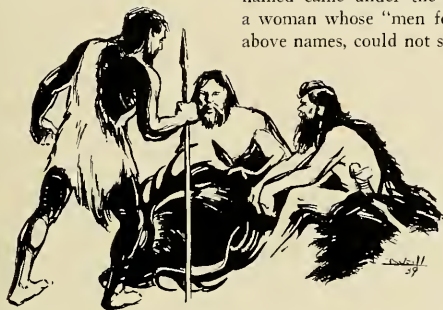
Conversely, the opposite effect can be achieved by bellowing the name as a summons. If a savage wants to kill

once knighted by their sovereign. Or he might, so to speak, "buy knight-hood" (it is nowadays often a merchantable commodity) by paying for a large tribal feast at which the medicine man would re-name him and after which he would live briefly in solitude to return an altogether new man.

With some American Indians, if a man's credit were poor, he might pawn his name for a year, during which

time it was used by another. And he could redeem it only by paying an exceedingly usurious premium. Nor has the idea that the name has specific cash value by any means been abandoned, since many contemporary corporations are accustomed to list their "good names" among their assets. When one company sells out to another, its "good name" or "good will," built up through costly advertising, commonly brings as high a price as more tangible property.

Furthermore, the changing of names "for business reasons," so familiar to us, was often practiced by the savage.



However, not being a business man, he changed his name usually to change his luck in hunting or because he believed his former name to be in some mysterious way accursed. That such feelings have persisted to our own time cannot be doubted. Today when a member of a race against which there is a historical prejudice changes his name, he is certainly trying to avoid a curse. More specifically there is the strange case of Rex Glenwood and Edward Streitback. According to *The New York Times* for July 9, 1922, Glenwood rescued Streitback from drowning. The latter was duly grateful and promised to do anything within his power to repay his rescuer. Whereupon Glenwood asked that Streitback take his name. The name, it appeared, was hoodooed. But the bad luck was attached to the name only and not to the individual. So Streitback manfully lived up to his promise, changed his name to Rex Glenwood, and seems to have endured several years of hardship and misfortune. Eventually the hoodoo wore itself out. The real Glenwood was reported convinced that the bad luck was over and done with and, therefore, he asked the return of his name. And the substitute Glenwood apparently was glad to get rid of it.

The feeling that certain circumstances demand a change of names is so deeply ingrained in the human psyche as to have radically conditioned much social and particularly language development in many parts of the world. It is quite easy to see why. Consider that primitive women were often forbidden to mention the names of all male relatives. Now, of course, the men's names were almost always the tribal words for common objects like (Long) Grass, (Heavy) Shield, etc., or animals like (Lone) Buffalo, (Fleet) Antelope, etc. Consequently the objects and animals so named came under the taboo. Thus, a woman whose "men folks" had the above names, could not say "The buf-

it appears, a joyous, unrepressed lot and when the day's work was over they sang. There was no set pattern to their singing. It was simply spontaneous self-expression.

In addition to the rendering of formless arias, earliest Man probably used his vocal powers to imitate sounds around him—wind, surf, the cries of birds and animals. Not only was drama born in his re-enactment of the chase, but song, poetry, and language all appear to have evolved from campfire recitals after the day's forage in the hunting grounds.*

Out of his singing came sound combinations that pleased the senses, stuck in the mind, and became names. If a savage happened to have just brought in the carcass of a new animal the tribe had never seen before, his cohorts would, with unassailable logic, call the new animal after him—the man who captured it. It was a sort of invention called after the inventor. Thus, we see that the names of animals were in all likelihood originally the names of men.

No juniors

Between these earliest days and a more advanced stage in primitive society, the name gradually acquired its occult and sacred significance. The process appears to have been inextricably bound up with the development of ancestor worship, in that naming the new-born after the dead is customary in every quarter of the globe. Naturally there are notable exceptions. Anyone who has ever tackled a Russian novel will painfully remember the number of "vitches" (suffix meaning "son of") so liberally sprinkled among the characters' names. But in a typical matrilinear society, that is, one in which the bridegroom became a member of his wife's clan, the husband forsook his original name and was more or less of a nonentity until his first child was born. Then when the babe was named, let us say, "Long Grass," the father became known as "Father-of-Long-Grass." There were no "juniors" in such tribes. And there is the case of a childless man who was called "Father-of—" and then the name of his favorite dog, no less. Sometimes fathers simply used the name of their children in this way apparently to save themselves the trouble of thinking up a name for everyday use (keeping their true or sacred name a dread secret of course). They did this

Continued on page 184

*For earliest drama, see the *Indoor Explorer* for November, 1938.

WEEDS, WASTE AND HAYFEVER

Continued from page 163

however regarded, weeds represent waste. Nature demands that the land be clothed. If we do not like the weeds of her choosing we may select our own. For example, if it becomes necessary to strip the land of its protective cover we may sow a cover crop before the natural weeds can take possession. In the citrus groves of Florida are planted cover crops of the Florida beggar weed and other herbaceous legumes. These completely exclude the ragweeds from the groves and at the same time enrich the soil through their nitrogen-fixing root nodules. They even escape from the groves and crowd out the

ragweed from the sides of the roads which skirt the groves, for ragweed cannot compete with the Florida beggar weed.

It has been said that only two types of landscape are tolerable, that left to itself and that brought completely under control. These are all we need for human happiness. The correction of uneconomical misuses of the soil is strictly in accordance with the principles of land conservation, and with the highest development of civilization and the use of our continent. The best prevention of hayfever is to leave the land unmolested or to cultivate it properly and make it pay dividends. Anything between means weeds, waste and hayfever.

INFORMATION TEST

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

Score 5 points for each correct answer. Correct answers on page 184.

1. A purse net is the device used by trappers to capture skunks. True..... False.....	8. Ragweed sheds its pollen earlier in northern states than in southern. True..... False.....	15. Popular opinion is so strong against the trapping of song birds that they are amply protected throughout the New World. True..... False.....
2. The most abundant fish on America's Atlantic Coast is the (a) Cod (b) Menhaden (c) Mackerel	9. Rabbits can bring about the destruction of birds. True..... False.....	16. A shark can drown in water. True..... False.....
3. A skunk usually warns his victim before he sprays. True..... False.....	10. Menhaden fisheries provide (a) A staple food (b) A commercial oil (c) "Ersatz" caviar	17. City dwellers are often the worst victims of hayfever. True..... False.....
4. New York State is largely indebted to the beaver for its fertile farmlands. True..... False.....	11. Skunks apparently will not use their "spray gun" on each other—even in fights to the death. True..... False.....	18. A famous Indian princess probably didn't give her right name to Captain John Smith. True..... False.....
5. Nowhere in the United States or its possessions has billboard advertising been totally eliminated. True..... False.....	12. When California gunners shoot hawks, they automatically deplete the supply of quail. True..... False.....	19. Bitter experience has taught the skunk that his "spray gun" is of no avail against high speed automobiles. True..... False.....
6. Modern treasure hunting has been facilitated by (a) The "electric eye" (b) The radio tube (c) The X-ray	13. Among some primitive tribes fathers were frequently named for their first child instead of vice versa. True..... False.....	20. Hayfever is essentially a nation-wide punishment for our failure to adopt a sound conservation policy. True..... False.....
7. One of the surest ways to avoid attack by the vicious barracuda is to wear as much dark clothing as possible. True..... False.....	14. Wholesale uprooting of ragweed throughout the country is the best means of eradicating hayfever. True..... False.....	

LETTERS

SIRS:

Permit me to offer congratulations and felicitations upon the extraordinary February issue of *NATURAL HISTORY*. It really astonishes me that you could have thus surpassed your past high achievements and have included so much interesting and well illustrated material within the covers of a single number. It is all so readable from cover to cover.

I shall be frank to say that I have not read many numbers of the magazine from cover to cover, partly because a voluminous professional literature and numerous duties, as well as numerous hobbies, keep about eighteen hours of each day pretty well occupied, and partly because some of the material has not just then appealed to me. But this number is exceptional—maybe because hobbies and dogs are always interesting. And the "Story of Fire" is also good.

I did not like at first the change of format. This number illustrates the worthwhileness of the change. It appeals to this editor of prosaic technical treatises.

ARTHUR BEVAN.

State Geologist of Virginia,
Charlottesville, Va.

SIRS:

. . . I have taken home the February issue, because, as I flipped through the pages I couldn't lay it down.

How long have you been publishing as interesting an issue as this one proves to be? It is very exciting in its readability.

F. R. DAVIS.

General Electric Company,
Schenectady, N. Y.

* * *

SIRS:

Please refer to an article in the December issue of *NATURAL HISTORY* by Carl F. Kauffeld entitled "How Snakes Are Born."

At the bottom of page 373 are two pictures supposedly representing the hatching of bull snake eggs. It is the lower of these photographs to which I wish to refer.

I have hatched a good many snake eggs, including those of two species of *Pituophis*, commonly called Bull Snake. In no case have I seen the tail sticking out of the shell. After the baby snake has stuck his head out he may withdraw it completely if startled, even though a great deal of his body is also out, but he gets

back in the shell by pulling backward, not turning his head around and crawling in head first.

Once the snake is entirely out I have never seen one crawl back into the shell, which would have had to take place to account for the picture, unless I am supposed to believe that the pictured snake stuck out both his head and his tail.

I believe the picture is a fake.

C. B. PERKINS.

In Charge of Reptiles,
Zoological Society of San Diego, Cal.

* * *

DEAR SIR:

These are *actually* bull snake eggs hatching. The species happens to be *Pituophis sayi sayi*—one with which you are possibly not familiar since it occurs on the eastern side of the Rocky Mountains.

It is, indeed, unfortunate that animals have a disconcerting way of frequently deviating from the stereotyped behavior with which man credits them. The snake in the photograph did not leave the egg at any time previous to the taking of the picture. It merely followed a common practice of snakes in doubling back into the same opening, and later decided to push out the head. Meanwhile the whole body had been outside the egg without the snake's having ever left the egg entirely. There is nothing improbable in all this. The photographer was merely fortunate enough to catch both the head and tail out of the egg—nothing "faked." The picture was chosen because it was unusual.

Two keepers, one photographer, the director of this institution, and I, myself, can vouch for the authenticity of this picture.

CARL F. KAUFFELD.

Curator of Reptiles,
Staten Island Zoological Society, N. Y.



SIRS:

In your January issue, the writer read with interest the article by Robert B. Ekvall on Tibetan pheasants.

The writer lived for some years in China and during the winter of 1935-36 was a member of an expedition trapping Tibetan white eared pheasants, but not Ma-chi of which Mr. Ekvall writes. These birds were shipped from Tibet to Shanghai and to San Francisco to be propagated.

The enclosed photographs show a Tibetan with one of the white eared pheasants and, also, Minya Konka, one of the highest mountains outside the Himalayan range, to illustrate the type of country in which the birds are found.

New York City. F. G. HARDENBROOK.

Above. Homeland of the white eared pheasant: Minya Konka, 24,891 feet high, little known until climbed in 1931 by an American party

Photos by F. G. Hardenbrook

*Right. A Tibetan white eared pheasant (*Crossoptilon c. crossoptilon*) caught by F. G. Hardenbrook and party in November, 1935, for propagation purposes. The largest one taken measured 35 inches from beak to tip of tail feathers, with a 38-inch wing spread*



SIRS:

Nearly everyone has heard of the jumping frogs of Calaveras County by way of Mark Twain, Bob Burns and others. The Leaping Lampreys of the Rogue River, Oregon, do not seem to have become so widely known; yet to the writer, who has been an ardent fisherman for a half century, these lamprey eels form one of the outstanding of his fishing observations.

The first dam on the Rogue River, which the Chinook salmon meet in running in from the sea, is the Savage Rapids Dam, about five miles above Grant's Pass, Oregon. The river is a famous salmon and steelhead stream; and the dam, which is about 25 feet high, is provided with two fishways of the ordinary "ladder" type.

When the salmon come in in the spring they are accompanied by a run of lampreys, which not only eat salmon spawn but also attach themselves to the grown fish whenever they can feed on them. The appearance of the lampreys at the fishway usually precedes that of the salmon by a few hours to a day. The local saying is, "No eels, no salmon." The run occurs in the Rogue River any time from the middle of March to the middle of May, depending on weather and water conditions. The last two years it has come early in May.

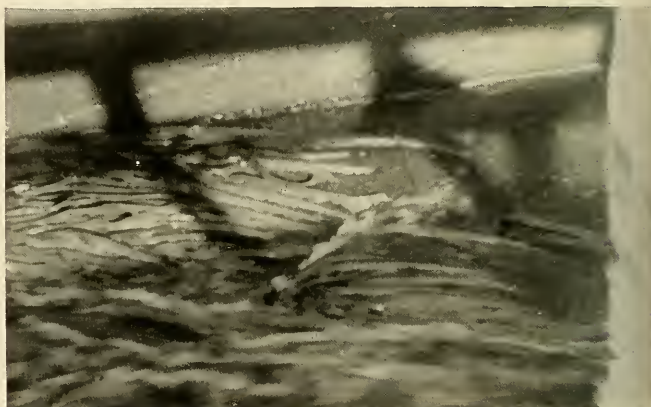
The salmon, of course, have no great difficulty in swimming up the swift water in the fishway, resting as they like in the pools between the crosswalls or baffles. But the "eels" do not seem to be able to go up the swift current so readily, and they climb along the edges of it by attaching themselves to the walls, or even climbing directly over the baffles from pool to pool. Some of the more adventurous individuals even try to climb the buttresses of the dam itself.

In the side of the flume above the fish ladder itself is a water waste-weir for emergency purposes. There is a vertical concrete wall about eight feet high from

the rocks, then a sloping wooden flooring rising perhaps two feet in its length of eight feet, and then a vertical wooden wall of about eight feet. A good many lampreys climb the concrete wall and the wooden

EDITOR'S NOTE: These lamprey eels, in spite of their name, are not eels at all, or even fishes in the technical sense of the word, any more than whales are fishes or bats are birds. They and the hag-fishes are the last living representatives of a class of water-living vertebrates that preceded the fishes. Their ancestral stock (the highly varied Ostracoderms) left their fossil remains in rocks ranging from 400 to 300 million years in estimated age.

Every boy or other fisherman has caught "suckers" with varying degrees of enthusiasm and is familiar with their sucking disc. The mouth of the lamprey appears similar though it really is a completely different structure from the sucking disc of "suckers" and works in a different way. No true eels could attach themselves or climb as the lampreys do.



flooring, then go up the vertical wooden wall as far as it is wet. But they do not get over the upper board, which is dry, and eventually fall back into the stream below. One of the photographs shows a mass of these lampreys on the flooring. The edge of the concrete wall is at the right of this picture, and two of the "eels" can be clearly seen with their tails hanging over the edge, over which they have just climbed. Careful examination shows that they hang on by the mouth alone, the area of contact being distinctly heart-shaped, point up.

By watching closely one can observe the technique of these individuals that climb out of water. An "eel" comes up and clings to the wet surface by its mouth. Its

body then curls sidewise from a straight pendant position to simulate a long "S." Then, releasing the mouthhold, a new one is caught immediately, from one to two inches above or aside, as the body straightens. Sometimes the repetition of jumps is surprisingly quick, and at other times only after long rests. But there are no errors. All are safe hits.

One lamprey came up out of a pool in the ladder and attached itself to the concrete crosswall. Hanging by the mouth alone, it worked its way by small "leaps" up the wet surface until entirely out of the water and around the end of the wall into the pool above.

WALTER WILSON CROSBY.
Coronado, Calif.

NOTICE

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

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by Vilhjalmur Stefansson, with an Introduction by Stephen Leacock

Macmillan Company, \$3.50

DO you like stories of Arctic exploration and adventure, do you like detective or mystery stories? If you care for either, then you will probably like this book, for in it Doctor Stefansson has combined these two strong human interests. He has written a series of historical and scientific detective stories based on Arctic travel.

The book has five sections or chapters arranged chronologically, each one dealing with a famous incident in the history of exploration whose meaning or explanation up to the present have been either unknown or regarded as in doubt. The book deals successively with the fate of the European settlements in Greenland; with the question of whether Thomas Simpson was murdered or committed suicide just as he was on the point of completing his discovery of the Northwest Passage; with the Franklin expedition; and the last two chapters deal with Arctic exploration by air, with the fate of the Andr  e party that made an attempt to reach the North Pole by balloon and with the loss of Levanovsky's plane while attempting a crossing from Russia to the United States.

In illuminating and explaining each of these adventures, Doctor Stefansson brings to bear all of the printed and recorded information, often unearthing material that has been overlooked by other writers. Not content with this, he is frequently able to quote letters and communications from commentators and participants that have not previously been published.

In fact, no one else could have written this book and made it so interesting and so valuable. No other person now living combines to the same degree the skill of an historical scholar with the great, practical experience in years of successful work as an Arctic traveler and explorer. No one else commands the same range of information about travel by land, sea and air in the Arctic; about the weather conditions, ice conditions, Arctic animals, Arctic people, physiology, diet and technical equipment.

All this is important, but the greatest value of the book is Doctor Stefansson's knowledge of how men behave under conditions of Arctic travel, which makes his interpretations of psychological motives and human character sound and illuminating.

The stories will have obvious attraction for the general reader, but almost every page has on it information of extraordinary value to the specialist: to the historian, the explorer, the practical Arctic traveler, the aviator or the student of human behavior.

The book has no index, but it has an excellent bibliography covering the sources for each of the chapters.

LEONARD OUTHWAITE.

WILD COUNTRY

----- by F. Fraser Darling

Macmillan Company, \$2.75

"A BIOLOGIST," writes the author, "is the sort of fellow who coughs uneasily if you call him a naturalist." He himself may take pride in his position among naturalists, while he has no need to defend his claims as a biologist because

he has already attained distinction in the complicated field of animal behavior.

Wild Country represents Darling in his off-moments, during which sheer exaltation in a life out of doors becomes the keynote of what he photographs and richly describes. Nevertheless the spirit of scientific curiosity and objective analysis is always present, so that the brief and pleasant essays abound in illuminating ideas.

Exquisite Leica photographs of the varied life of island, mountain, sea, and moor, in or around Great Britain, form the basis of this book. As Darling writes, "The scenery of rural England is man-made but it does not become self-conscious." Entire lack of the same fault is a refreshing characteristic of the author's text.

The photographs illustrate bold scenery, sandpipers, petrels, gulls, wild flowers, British woods, geese, cormorants, fallow and red deer, guillemots, gray seals and a dog. The text, aside from its charm and joyousness, includes significant notes on the increase of the fulmar, the importance of a high death rate in nature, the specific variability of "wildness" among closely related animals, the factors of interspecific competition and those controlling choice of prey among predatory organisms, the ability of animals to make fine discriminations, the destruction of natural products by man in Scotland during the past two thousand years, the strange responses of deer, seals and other mammals to human scent and many more matters, all set down in a most palatable manner.

R. C. MURPHY.

POISONOUS PLANTS OF THE UNITED STATES

by

Walter Conrad Muenscher

The first general study of the field to be issued in twenty-five years, this volume covers many new discoveries. Seventy-five drawings simplify identification. \$3.50

•

WILD COUNTRY

by

F. Fraser Darling

A highland naturalist's notes and pictures of creatures of island, mountain, sea and moor. Unusual photographs illustrated by an engaging running commentary. \$2.75

THE MACMILLAN COMPANY
60 Fifth Avenue . New York

ANIMALS OF THE SEASHORE

----- by Horace G. Richards

Bruce Humphries, Inc., \$3.00

HORACE G. RICHARDS, Research Associate of the New Jersey State Museum, compiled this book as a beginner's guide to the marine invertebrate life of the Virginia faunal zone which includes all the Atlantic seaboard between Cape Cod and Cape Hatteras. The author is obviously an ardent seashore naturalist who is primarily interested in inspiring a similar interest in others, and refers particularly to the New Jersey coast because here is where his chief interest as a collector has been centered. His aims are more to whet the zoological appetite than to satisfy it and his book lives up very well to these modest claims.

As a reliable field book, however, it

falls short in several respects. The descriptions of species, while denoting familiarity on the author's part, are on the whole too vague to enable the beginner to grasp clear cut differences and, though the material has been arranged in the usual systematic order, insufficient space has been allowed for an adequate consideration of the major categories.

GEORGE H. CHILDS.

THE SILK ROAD

----- by Sven Hedin

E. P. Dutton and Company, \$5.00

IN 1933 Doctor Hedin was commissioned by the Nanking Government of China to survey possible motor routes from the two rail heads in northwestern China, Kweihsia and Sian, across the deserts to Urumchi, the capital of Sinkiang Province. The party, which included two Chinese engineers and several Swedish assistants, left Peking in the fall of 1933 and returned, after many exciting experiences, early in 1935.

Three popular stories have been written about this expedition by Doctor Hedin. The first is called *The Flight of Big Horse* and deals largely with the political situation of Sinkiang at the time and with the warfare into which his party was plunged. The present volume is the second of the series and the third entitled *The Wandering Lake*, which is not yet translated into English, treats of that extraordinary Central Asian depression

known as the Lop Nor Basin and of the Tarim River which ends in Lop Nor itself. Like Doctor Hedin's first book, *The Silk Road* is largely an account of the difficulties of motor travel in this region and of the continental strife, observed at close quarters, which has been going on in the province since the assassination of Marshal Yang Tseng-sin in 1928. This volume, however, admirably supplements the first one and devotes several chapters to Hedin's forced detention for several months in Urumchi. The work is written in the author's usual forceful and entertaining style and he has added a most useful Appendix, dated June 1938, in which he gives a history of this troubled province during the last five years. The volume is illustrated with photographs and a folding map.

W. G.

TROUT

----- by Ray Bergman

Penn Publishing Co., Philadelphia, \$5.00

BERGMAN starts his book with fish stories—good ones too—and leads you deceitfully (like a wily trout) to some fine streams, the Beaver-kill and Never-sink, to share with him some of the fun

he is getting every spring. He makes you want to get some of this fun and then, when good and hungry he shows you the rods, the reels, lines, leaders and flies. He does this carelessly and with little effort until you—completely muzzled, cannot bite back.

You decide definitely there and then to give up movies and other luxuries and begin immediately to put aside some coin so you can raid the fishing stores. Otherwise, the 15th of April will catch you flat on your back.

But he has a kindly intent in showing us so many flies out of his book of knowledge. He shows us that things which educate the heart are more valuable than those things that educate the brain. The heart came first.

Bergman opens up not only his Fly Book, he opens up to us his kindly thoughts of what he thinks about along a brook. He speaks of nature as comprising many things—to get one of these you must know them all and their correlations. To "go a-fishing" you must be a part of brookside nature—the air, the water, the time of year, the food that comes up from the stream bottoms, the grubs that drop off the trees, the insects that fall from the air, how the trout sees these things, how

Continued on page 174

"MAGNIFICENT"

... says the N. Y. *Herald Tribune*, "one of the best photograph books of the year."

ANIMALS WITHOUT BACKBONES

AN INTRODUCTION TO THE INVERTEBRATES

By Ralph Buchsbaum

Natural History says: "... should be hailed as a distinct educational asset by every zoology teacher and as an open sesame to the world of invertebrates for every would-be zoologist."—George H. Childs.

"Excellent," *Saturday Review of Literature*. "... not a popularization but a textbook of science; yet because of its simplicity, its beautiful modern design, and its interesting presentation, it is entirely suitable for and will appeal to non-scientific readers."

456 gravure photographs
312 line drawings

\$5.00

THE UNIVERSITY OF CHICAGO PRESS
5750 Ellis Avenue, Chicago, Ill.

THE COVER THIS MONTH



This painting of a Brook Trout (*Salvelinus fontinalis*) by Francis Lee Jaques is one of the 80 designs selected by the National Wildlife Federation for a series of poster stamps issued in full color in commemoration of National Wildlife Restoration Week, March 19-25, 1939.

This is the aristocrat of native game fish, the "speckled trout" of cool clear streams in forested country. Originally, the eastern brook trout, as it is sometimes called, was found from Maine to the mountain streams in Alabama, and westward through the upper Great Lakes region into Minnesota. But it has been planted in many waters. The brook trout, like many other fish, takes its coloring largely from its surroundings. In shady streams with dark bottoms, brook trout

are dark olive and black on the back and sides, with scarlet spots; and in the fall mating time, the male has a bright red belly and the fins are marked with red and orange. Casting the fly, either sunken or floating, is the most sporting method of catching brook trout. The record is 14½ pounds, but any angler regards a one-pound trout with great respect.

Distributed in the interests of Conservation, the full series of 80 stamps can be secured at \$1.00 a set from the National Wildlife Federation, Investment Building, Washington, D. C. A descriptive album to receive the stamps is offered at 25¢, including also a set of last year's stamps.

Flashlight Pictures

By CHARLES H. COLES

Chief Photographer, American Museum

AN amusing catch question was asked recently on a popular radio hour that ran something like this: Which of these animals can see better in absolute darkness: a cat, an owl, or a bat? After some wild stabs in the dark to guess an answer, it was suggested that in absolute darkness none of the animals could see at all, light being required for vision.

The camera also requires light to take pictures, although with long time exposures astronomers have taken pictures of objects so faint that we can never see them directly through a telescope. When it is necessary to cut down on the length of exposure, however, more light is required to affect the film in the camera. In the case of action snapshots a great deal of light is necessary to enable the cameraman to speed up his shutter sufficiently to stop the action he is photographing. Another consideration makes the requirement for more light even more imperative. In action pictures it is very uncertain just how far the subject is going to be from the camera, hence the lens must be stopped down to a point where the depth of field of sharp focus extends over the area to be covered in the exposure.

To pour enough light upon an indoor subject to enable rapid snapshots to be taken requires lighting equipment similar

to that used in Hollywood motion picture studios. This arrangement would be highly impracticable, cumbersome, expensive, and uncomfortable. The answer to the problem is flashlight photography.

For the photography of moving objects with flashlight, the synchronized flash equipment is the easiest and surest to operate. There are two general classifications of synchronized flash apparatus: the electrical and the mechanical.

Electrical type

The electrical apparatus consists of a tubular case containing two standard flashlight cells, a reflector to direct the light of the flash bulb, and a magnetic shutter-trip device. In making a picture the photographer closes an electrical contact at the back of the battery case which fires the flash bulb. The closing of the electrical circuit also actuates the magnetic trip which operates the shutter release on the camera. The timing of the shutter trip is so delayed that the picture is taken only after the flash has been allowed to reach its peak of illumination. The best known of the electrical type flash equipment is the Mendelsohn Speed Gun.

A more recent development of the electrical type is the addition of a light sensitive cell placed in the reflector back of the lamp. When the lamp reaches its peak illumination, the light sensitive cell operates the magnetic shutter trip. Greater accuracy in timing is claimed for this type of equipment.

Mechanical type

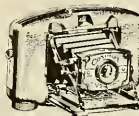
The mechanically operating flash gun has the battery case and the reflector just as the other apparatus had, as well as a shutter-tripping device. This device contains a plunger that operates the shutter through the hole that the cable release normally occupies. The cable release is attached to the trip device. The camera is operated by pressing the cable release in the normal fashion which causes a spring driven disk to whirl in the synchronizer. A contact is closed which fires the bulb and then the shutter is tripped a predetermined time interval later. The best known of the mechanical type is the Kalart Synchroflash.

Uses of the synchronized flash

The synchronized flash lamp has simplified certain phases of natural history photography enormously. Previously the sun was the brightest source of light used, but it was not always conveniently available, particularly at night. Artificial light was weak and if used in sufficient quantity for snapshots caused no end of discomfort and fright to subjects. Flashlight powder was extremely hazardous.

The flash bulb has changed all this. There is no danger of fire, the light can

VOGUE CAMERA

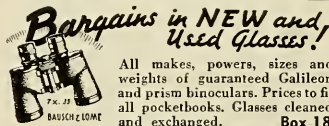


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Richard C. Gill and many others engaged in scientific research use the Rolleiflex almost exclusively. But one does not have to be an expert to get beautifully composed, critically sharp pictures with this amazing camera. It shows you each picture before you make it. And it gives you twelve negatives in the practical $2\frac{3}{4} \times 2\frac{1}{4}$ " size on a roll of 120 film.

Everything is streamlined, entirely out of the way and fully protected. Blanks and double exposures are eliminated. Gets into action in a jiffy—makes pictures in rapid sequence when necessary. Built-in self-timer operates on all speeds from 1 second to 1/500th.

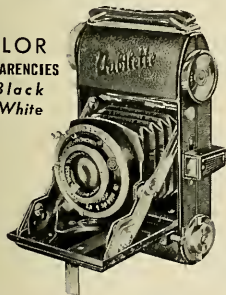
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be directed with reflectors and so be more efficient, and action may be easily stopped by the speed of exposure. At a distance of six feet from a medium sized bulb a light intensity of over twice summer noon sunlight is easily obtained and in a direction that produces no detail-hiding shadows.

In photographing small fish in aquaria, the depth of field of the lens is very restricted because of the large bellows extension required to obtain reasonably large images on the film. Here the synchronized flash permits the lens to be stopped 'way down and still function at a shutter speed of 1/200th of a second. The flash bulb may be placed directly over the tank, almost touching the water.

When taking pictures of wild life at night, an electrical contact is arranged so the animal in nibbling the bait closes the contact and operates a synchronized flash of the electrical type. In this way the apparatus requires no watching except to reset it.

The synchronized flash has also been used in the daytime when heavy shadows obscure the subject. In deep woods or near sunset, a flash will yield a good picture when other methods fail. A deep reflector will send a beam with sufficient intensity for more than a hundred feet for a full exposure with a fast film in the camera. Color pictures usually require sunlight for best color, but a flash will also produce a beautiful result with ease. There is no exposure problem. At a given distance, with a certain film, there is only one diaphragm stop that should be used. The instructions with the lamps tell you that.

The nature photographer who really wants the best pictures will nowadays equip himself with a synchronized flash outfit and be ready for anything that might come along.

FIRST INTERNATIONAL ROLLEI COMPETITION

Owners of the "Rollei" type twin lens reflexes may be interested in the new prize contest in which 500 cash awards are announced. Burleigh Brooks, Inc., 127 West 42nd St., N. Y. C., will supply information.

YOUR NEW BOOKS

Continued from page 182

he thinks—in a word, you must be a trout.

The book verges from philosophy into the most particular choosing of your tools for this outdoor trade. Rods, reels, lines, leaders, flies are gone into carefully and you are told emphatically that rod, reel, leader and fly must be matched with your own mind and body so that when you cast no part screams from over-strain. There must be no *felt* strain of any particular part in your cast. Don't get slovenly when casting and don't hesitate to come to your knees for a low cast. When tired out, find a shady tree.

A real fisherman is an artist. He enjoys his art—even if rewards are few. The patience of the writer when he talks to you—and he always treats you as a beginner—is enormous. He does not presuppose that you know anything. He brings you up like a child from the pinhook days to the dry fly. He refreshes your memories and adds to them as if he thought you worth-while.

One of the best things in the book is the help you get in verbal pictures and actions describing Bergman's personal brookside experiences and technique which you can try out on similar waters of your own streams.

The drawings and colors are excellent and there you are.

A splendid book!

WILLIAM L. SMITH.

WHAT IS IN A NAME?

Continued from page 177

because it was believed young children had no opportunity to make enemies and that evil spirits intended them no harm. Therefore, their names were safe to bandy about.

However, "carrying on the family name" is elsewhere common enough. Some people share the new-born baby until it cries and proceed to mouth a succession of ancestor names. The name pronounced when the child stops crying is considered the name it wants to own. In most cases this is not blind wilfulness, but is conceived to mean that the particular ancestor spirit so named has at that moment entered the child's body.

THE NATURE WRITERS

A guide to richer reading

— by Herbert Faulkner West

Stephen Daye Press, \$2.00

AS indicated by the sub-title, here is a book for the lover of the out-of-doors, prepared by the Professor of Comparative Literature at Dartmouth College. It does not include professional guide books, nor any nature poetry, and, with few exceptions, no fiction; but it does comprise some two hundred and fifty of the author's favorite nature books. It is this reviewer's opinion that all naturalists will agree the books are well chosen.

One cannot help wondering, however, why certain books have been omitted. Since *Birds of America* (unfortunate title since it is the same as that of Audubon's magnum opus) edited by Gilbert Pearson, is included, why leave out *Lives of Game Animals* by Ernest Thompson Seton—easily the best work on the subject? Since *Tarka*, the *Otter* by Henry Williamson is included, why not *Bambi* by Felix Salten? And *Stickeen* by John Muir? And *Wild Brother* by William Lyman Underwood, and some of the books by Ernest Harold Baynes?

But one should hardly expect any work of this kind to include all of his favorites, although it may contain most of them. It is really a valuable guide.

CLYDE FISHER.

Juniors, strictly speaking, are on the other hand very infrequent. In some places it is considered sheer folly to call a babe after a living relative for fear of killing the original owner. The "name-spirit," having a new abode on earth, has no further need of the relative and may cause his death.

There is plainly, therefore, a great deal more in a name than at first appears, and it seems advisable to think of the oft-quoted "What's in a name?" as coming straight from the simple, lovesick heart of Juliet rather than from Shakespeare. Personally, the writer feels that the Bard had more sympathy for his other famous utterance on the subject which comes to us in the mouth of Iago, "Good name in man and woman, dear my lord, is the immediate jewel of their souls. . . ."

Indeed, the primitive mysteries surrounding the name persisted beyond Shakespeare's time even up to the last century in remote parts of Scotland. Numerous cases there were reported of peasants inexplicably unwilling to give their names to the butler when they were summoned to visit the manor house. And in the same general district the teaching of peasants to write their names met with an odd difficulty. Illiterate Scots were perfectly compliant when the forms required them to write their surnames only, but doubtless for fear of revealing the sacred part, they often blantly refused to spell out the name in full. Finally, recording clerks were forced to accept initials as a compromise. And, lest there still be magic in it, we, too, will play safe. . . .

D. R. B.

This is the first of two articles on The Name. Next month, a discussion of modern names, their sources, original meanings and ties with a primitive past will appear in these pages.—Ed.

Answers to Questions on page 178

1. False. It is a device to catch menhaden. See page 167
2. (b). Menhaden. See page 165
3. True. See page 145
4. True. See "S.O.S. for a Continent"
5. False. Billboards are eliminated in Hawaii. See "S.O.S. for a Continent"
6. (b). The radio tube. See page 136
7. True. See page 138
8. True. See page 160
9. True. See "S.O.S. for a Continent"
10. (b). A commercial oil. See page 169
11. True. See page 147
12. True. See "S.O.S. for a Continent"
13. True. See page 177
14. False. See page 163
15. True. See "S.O.S. for a Continent"
16. True. See page 169
17. True. See page 163
18. True. See page 174
19. False. See page 149
20. True. See page 162

LETTERS

SIRS:

Your article in the March issue on skunks and their destruction by automobiles and locomotives is very pertinent.

However, I doubt that it is their temperament that makes them stand fast to their destruction, or that they have a chance to consider the use of their natural weapon. We have occasion to travel a great deal through the countryside, and a great deal of this is after dark in the autumn and early spring when the days are short and skunks are still getting about. My chauffeur, who is largely Indian and who has been driving a car in this part of the state since cars came into general use, tells me the skunk is blinded by the bright light approaching rapidly.

His contention is borne out by the fact that our car has been saved many a spraying, and many a skunk life has been saved, by his rapidly flicking off and on the car lights. This takes but a second, but in every instance the skunk has disappeared by the time he can flick the lights on again—and you can judge for yourself the necessary length of time to complete this double action of the finger.

Others to whom I have recommended this brief act have told me that they have been saved much annoyance by the same method. Only an experienced driver could attempt it, however, while his car was traveling at the same speed, as one usually comes on these night travelers when rounding a curve—or perhaps it is because the rural sections have many curves.

HERBERT A. ROBERTS, M.D.
Derby, Conn.

SIRS:

I have read with great interest two articles in the March *NATURAL HISTORY*: Modern Treasure Islands, and Old Mister High-Power. Having recently read an account of search for pirates' gold on Oak Island, off Nova Scotia, this article was especially fascinating. It brings treasure hunting up-to-date.

The story of Mister High-Power, while not so romantic, was illuminating. Nevertheless, I prefer cats and dogs as pets. . . .

I was greatly interested in Stefansson's article in January. When my ship comes in, I hope to buy his book.

I. T. HAWK.
Augusta, Ga.

THIS MONTH'S COVER DESIGN

The Night-blooming Cereus (*Cereus grandiflorus*) is a climbing member of the cactus family. The flowers, which have a wonderful fragrance, begin to open at dusk and are in full bloom about eleven o'clock; they fade with the morning light. Each flower lasts but one night. In Bermuda there is a legend that a certain plant, growing over the wall of an old churchyard, comes into bloom every year on exactly the same date. May the tenth is said to be its anniversary.

SIRS:

Please accept my hearty congratulations on "S. O. S. for a Continent," included as a supplement in the March, 1939, issue of *NATURAL HISTORY*.

A pictorial presentation of educational matter such as this seems to be especially effective, and Dr. Robert Cushman Murphy has done a splendid job, summarizing in convincing word and colorful phrase the critical status of our once immeasurable natural resources.

In order for its telling message to reach as many people as possible, I think this chart should be displayed on bulletin boards in schools, libraries, civic clubs, etc., throughout the country. It would have been fine if this suggestion had been printed on the chart. At any rate, the thought should be broadcast as much as possible.

Will you please advise me if separate copies of the chart are available for distribution, and, if so, price at which obtainable?

J. M. HEISER, JR.,
Chairman, Conservation Committee,
Texas Nature Federation.
Houston, Texas.

SIRS:

. . . As grand climax, would your "S. O. S. for a Continent," which holds everyone spellbound to whom I show it, be available with related material . . . for an educational exhibit in one of the sections of the New York World's Fair?

HELEN WITTE.
Glen Ridge, N. J.

SIRS:

I want to congratulate you on the excellence of the "S. O. S. for a Continent" which appeared in the last issue of *NATURAL HISTORY*. If it is possible to secure an unfolded copy, I should like to have one to have framed for my office.

CARL W. BUCHHEISTER.
Massachusetts Audubon Society,
Boston, Mass.

SIRS:

In the latest issue of *NATURAL HISTORY* Magazine there was a supplementary map showing the conservation needs throughout the country. Would it be possible to send me this supplement? I would be very glad to pay for it.

KENNETH HANAU.
Yonkers, N. Y.

MY COMPLIMENTS ON YOUR
MARCH GESTURE TO WILDLIFE
MILLARD SMITH, Director,
National Wildlife Restoration Week.
Washington, D. C.

SIRS:

I like your pictorial map, "S.O.S. for a Continent" so much that I should like to get extra copies for use in my classes.

Do you sell extra copies? If so, how much do they cost?
EDNA CRAIG.
Newburgh Free Academy,
Newburgh, N. Y.



NOTE: Bring a camera, for Alaska's scenery challenges the world.

YES, you'll want a camera in Alaska to keep a permanent record of such tangible wonders as weirdly carved totem poles; glaciers towering from the water's edge; your ship gliding into silent, sunlit fjords. Inland you'll discover a storehouse of strange scenes, with Matanuska Valley, Mt. McKinley, wild game, gold mining, malamutes and the Yukon River. And these are only a few of the unlimited photographic opportunities.

But a camera can capture only part of Alaska's charm. Intangibles, too, are woven into Alaska's pattern. On every hand there are evidences of the legendary lore of the Indians, the glamorous story of the Russians, the stirring days of the gold stampede.

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SIRS:

The conservation map (S.O.S. for a Continent) is a fine piece of work. Is it possible to get a supply of these maps? There are several organizations in town that would like a copy. Will you kindly let me know if it is possible to get a supply of them and, if so, the price.

F. J. TREMBLEY.

Department of Biology,
Lehigh University, Bethlehem, Pa.

DEAR DR. MURPHY:

My compliments to you, sir, for so vividly picturing extinct and scarce species of North American wildlife in the NATURAL HISTORY MAGAZINE.

THOMAS H. BECK.

P. S. I note you omitted whitefish in the Great Lakes.
The Crowell Publishing Company,
New York, N. Y.

DEAR DR. MURPHY:

Congratulations on your wild life chart of North America.

I wish the Museum could issue several hundred copies. It would be helpful to conservation if widely distributed.

Perhaps other natural history institutions could be persuaded to take many copies and help locate them where they would do the most good. The foolish sportsman magazines need a lot of in-

struction, and many other organizations too numerous to mention.

C. H. TOWNSEND.

New York, N. Y.

SIRS:

The pictorial chart entitled, "S.O.S. for a Continent" included in the last issue of the NATURAL HISTORY MAGAZINE, is a very valuable contribution to the cause of wildlife conservation. It tells in an impressive manner an extremely important story in a limited space.

Is it possible to obtain additional copies of this chart? If so, will you inform me of their cost and from whom they should be ordered?

RALPH T. KING, Director
Roosevelt Wildlife Forest
Experiment Station.

New York State College of Forestry,
Syracuse University,
Syracuse, N. Y.

SIRS:

. . . I read with much interest comments on your pictorial map in the current NATURAL HISTORY on the subject of conservation. We cannot have too many sane articles of that kind presented to the public. . . .

T. GILBERT PEARSON.

Chairman, Pan-American Section,
The International Committee for Bird
Preservation.

NOTICE

A limited number of these charts "S.O.S. for a Continent," are available for distribution at 10¢ each, including postage. Garden clubs, camps, and other groups interested

in Conservation may order them at \$7.00 a hundred, or \$20.00 a thousand. Those interested are requested to write to NATURAL HISTORY MAGAZINE as soon as possible.—Ed.

ONE OF NATURE'S WONDERS

A white giraffe on the Masai reserve. A picture from the film taken by George G. Goodwin on the Snyder-Macnab 1938 East African Expedition. Note the black ghost markings on the neck brought out by the camera and not perceptible to the naked eye.



SIRS:

Kindly accept my sincere thanks for the extraordinarily splendid article in the February issue of NATURAL HISTORY by Virginia S. Eifert—"The Story of Fire."

This is an outstanding article and I shall be pleased if you will convey my sentiments to the author. The subject has been thoroughly covered in such a short article, and the poetic feeling has been brought out to a nicety. Again many thanks from one who likewise has been intrigued by this mysterious element, and who has lectured on "The Romance of Fire" for several years.

FRANK A. SCHILLING.

Los Angeles, Calif.

SIRS:

As an associate member of your worthy organization I find your publication NATURAL HISTORY exceedingly interesting and of great educational value to me.

HARRY A. MILLER.

Edmond, Oklahoma.

SIRS:

I am very much excited about the hay fever article—it is certainly well done, as is the whole issue. Everything is most readable.

The origin and relationship of the dogs in the February issue came at a most opportune time because of our dog show here. I am also glad to have the article for use in my classes at college.

RUTH HOFFMAN.

Elmira College, N. Y.

SIRS:

You cheated us this month. You furnished only ten questions! For the pleasure of my family, I completed the usual number and enclose them herewith. Can you answer them? I enclose the answers as well, just in case!

The arrival of your magazine is eagerly awaited each month and enjoyed by us all.

KATHERINE E. BACKUS.

Toledo, Ohio.

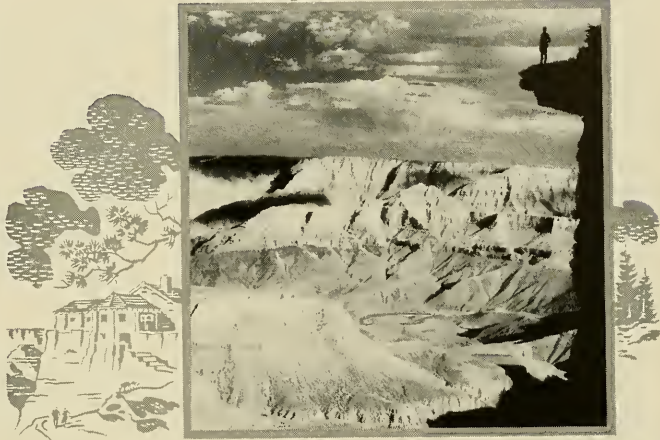
INFORMATION TEST

Ten additional questions from the February NATURAL HISTORY

1. Nature hobbies require a gift and long training.
True..... False.....
2. The orange feathers used by Mangbetu chiefs for personal adornment are plucked from a rare, brown parrot.
True..... False.....
3. The Mangbetus belong to a pygmy tribe of South America.
True..... False.....
4. White is a sign of mourning among the Mangbetus.
True..... False.....
5. Since blueberries are infested with insects whose presence it is almost impossible to detect, these berries should not be eaten.
True..... False.....
6. Insects supply an important source of fats to the dwellers of the Australian desert.
True..... False.....

Continued on page 244

MAGNIFICENT *Mysterious*



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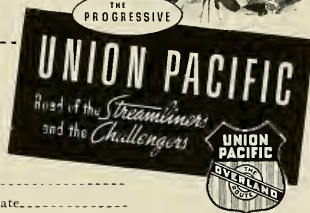
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NATURAL HISTORY

The Magazine of the American Museum of Natural History

FREDERICK TRUBEE DAVISON, President

ROY CHAPMAN ANDREWS, Sc.D., Director

VOLUME XLIII—No. 4

★ ★ ★ ★ ★

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I EXPLORE CAVES

By CHARLES E. MOHR



Exciting journeys through Nature's spectacular country of the blind, where a world of strange creatures are born, live, and die without ever seeing the light of day

My interest in exploration in the mysterious underground world of sightless creatures began when I was in college in central Pennsylvania. I read that a newly described species of cave bat, *Myotis sodalis*, had been collected in a cave not far off. I had heard of this Woodward Cave, so went there to look for the bats.

It was early winter and the proprietor of the cave took me directly to several clusters of hibernating bats. They stirred sleepily as I gathered several handfuls and stuck them into a knapsack.

The bats seemed so cold and helpless that it didn't occur to me to confine them carefully. I merely dropped the knapsack into the rumble seat, closed it, and drove back to college. When I opened the rumble seat, though, there was an exodus of bats. All but three escaped, and in my chagrin I put these aside and promptly forgot about them.

Days passed before I remembered my specimens and investigated. To my despair I found them dead. They were dry, virtually mummies. Instead of destroying them, I laid them aside, and months later I showed them to Earl L. Poole, at the Reading (Pa.) Public Museum. He examined the mummies and told me that they weren't *Myotis sodalis*. Two were common species. The third, however, he recog-

nized as being a least brown bat, *Myotis subulatus leibii*, the smallest, rarest, and least known bat of eastern North America.

What a series of accidents! By chance I had picked possibly the only least brown bat in the whole cave; it was one of three which didn't escape; it mummified instead of rotting, and I took it to someone who recognized it.

I learned that less than a score of specimens had been taken since John James Audubon and John Bachman described it in 1842. You can be sure that I hurried back to Woodward Cave to look for more. It was not until the following winter that I found the second there, but searching elsewhere I eventually found least brown bats in eight more caves in that immediate neighborhood. Yet in 70 other Pennsylvania caves which I have visited in the last seven years, only one has been seen.

Strangely enough, a circle within a 15-mile radius would include Woodward and these other eight caves, and in them I have found 185 least brown bats. All but two dozen I tagged and released. Best returns were secured in Aitkin Cave where I have recovered 26% of the least bats tagged there in previous winters.

One small cave in which I tagged bats made me



All photos by
Charles E. Mohr



(Above) THE SMALLEST, rarest and least known bat in eastern North America. It was this least brown bat (*Myotis subulatus leibii*) that spurred the author eight years ago into his intensive cave explorations. Hibernating head-down like all bats, its black ears and nose make it the most dapper

UTTER DARKNESS and the silence of eternity surround the naturalist who is lured into Nature's secret vaults. Cave exploration is no vocation for one who fears tight places, but it offers the answers to some of the most challenging mysteries of Nature

(Below) WINTER OCCUPANTS of a year-round bat hide-out: social bats (*Myotis sodalis*) hibernating along the water-worn corridors in mighty Nickajack Cave, in eastern Tennessee. In summer they are replaced by gray bats (*M. grisescens*) which give birth to young here



(Right) GENTLE when handled though horrendous in appearance is the lump-nosed, long-eared bat (*Corynorhinus rafinesquii*). The much enlarged ears, though doubtless well designed by nature "the better to hear you with," proved a disadvantage on one occasion. Firing a shotgun into a circling flock, the author marveled at his marksmanship when all fell. But they soon took to wing again. Evidently the ears amplified the concussion sufficiently to knock them unconscious. (Virginia and West Virginia, but usually rare)

I EXPLORE CAVES





THE MYSTERIOUS TRAVELS of American bats are practically unknown. The numeral on the ear tag worn by this one represents his regular winter address, as proved by his return four times to Aitkin Cave. In April he is believed to migrate down from the Allegheny Mountains, but his exact summer home can be determined only by the sharp eyes of someone who catches sight of the tag and reports it

feel distinctly uncomfortable for there was an ugly over-hanging rock at the entrance. I held my breath as I passed under it and was relieved to get out under the open sky once more. Later in Aitkin Cave a half mile away I found one of the least brown bats I had tagged back there. The explanation for the wanderer's presence came when I revisited the smaller cave. The entrance was sealed by the tremendous block.

Practically nothing is known about the travels of any American bat, but banding and tagging may eventually furnish much valuable information regarding migration and other activities. The least

brown bats probably migrate down from the Allegheny mountains at the end of their hibernating period, in April. Some of the little brown bats, *Myotis lucifugus lucifugus*, which I have tagged and carried away from their summer roosts, have returned 60 miles within four days.

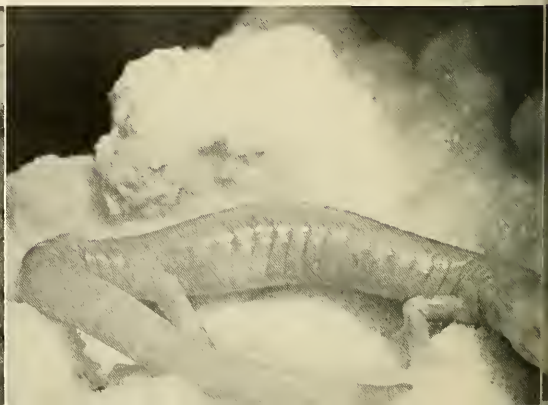
Many species of bats occupy caves only during hibernation. The queer lump-nosed, long-eared bat, *Corynorhinus rafinesquii*, is an exception. One summer I visited beautiful Burkes' Garden, in the southwestern tip of Virginia, where a breeding colony of *Corynorhinus* occupied a small cave. Needing a few for museum specimens I climbed toward the colony hanging from the ceiling of the cave. Just as I reached for them, they flew. Climbing down, I fired my shotgun in the direction of the circling bats. To my surprise they all fell. Congratulating myself on this unexpected sharp-shooting, I stooped to pick them up, but again they took wing and eluded me. Evidently the large ears had amplified the concussion enough to knock the bats unconscious. I had hit a couple, however, so secured my specimens.

Persistent squeaks from the ceiling attracted my attention. Looking up I discovered a couple of baby bats hanging there deserted by their mothers. Most of the female bats carried their single offspring with them, as I learned by catching some in a net. The baby bat clung to the mother's breast tightly with teeth and toes. Cave bats have few enemies, so a low birth rate is sufficient to maintain the race. One offspring a year is the usual number for most species of cave bats.

"You should visit Bat Cave in winter," Mr. E. L. Damron, manager of Cascade Cave, Ken-

(Below) SNEAKING UP on a blind cave salamander along Mystic River in Marvel Cave, Ozark Mountains. Only two species of blind salamanders are found in America, and they are the rarest of all the strange inhabitants of caveland

BLINDNESS overtakes the Ozark blind cave salamander (*Typhlotriton spelaeus*), for as it metamorphoses its eyelids fuse together. The adult (below) is lungless and breathes through its unpigmented skin, colored pink by the blood coursing through it





BLOOD-RED GILLS, spindly legs, and angular head contribute to the exotic appearance of the only other blind cave salamander of America (*Typhlomolge rathbuni*). This rarest cave salamander has been found only in an underground stream

near San Marcos, Texas. Its tiny eyes are beneath the skin and so are functionless. Scarcely half a dozen scientists had seen it in its native haunts previous to the capture of this 4-inch specimen, a giant for this species

tucky, once told me. "There are bushels of bats there every winter."

His story didn't excite me because "bushels of bats," in my experience, averaged about 50 individuals. Then, learning that Dr. W. A. Welter, of Morehead, Kentucky, had banded 2000 bats there the previous March, I decided that it might be worthwhile visiting in winter. I made a tentative date to return to see the hibernating bats.

I kept the date, one Christmas eve, and after a hair-raising ride over a winding, slippery mud road, reached Bat Cave. There were hundreds of bats in the first room and I quickly spotted a banded specimen. While I photographed the clustered bats, Dameron reconnoitered. He came running back, shouting, "The walls are covered with bats! You never saw anything like it!"

He started back; I was right behind him. We entered a wide, low room. In half a dozen places there were dense mats of bats. We counted the number of bats in the largest. There were 40 across, 300 the other way—a total of 12,000 bats! So tightly were they bunched that only their little faces and ears stuck out.

All about us were other clusters, none quite so large but several only slightly smaller. Another room had again as many. Comparing estimates, we agreed that there were between 80,000 and 100,000 bats hibernating there. This, by all odds, was the largest bat colony in the East. Examining the bats I discovered that with the exception of perhaps a thousand *Myotis lucifugus lucifugus* in the outer chamber, the bats were all *Myotis sodalis*, the species which I had set out to collect in Woodward Cave, seven years before.

There are hundreds of miles of caveland so inaccessible that humans have never visited them. There are several thousand caves which have been explored only by adventure hunters or by scientists seeking to unravel the mysteries of the vast subterranean world. Caves unnumbered honeycomb the great limestone regions of the earth.

In this strange other world a host of living creatures are born, live and die without ever seeing light. Absolute stillness, deeper than the calmest night we know, is broken only by the spatter of dropping water. Warmth is unknown, but so is freezing cold. No spot on earth has less varying temperature.

Many of the inhabitants of caveland have no eyes. Those which do, have no use for them. But they have other senses developed so finely as to defy our comprehension. They move more rapidly in absolute darkness than we can in daylight. If they emerged into our world of daylight they would perish, some in no more than a few minutes.

For years I had dreamed of finding the rarest of all the strange inhabitants of caveland, a blind salamander. I knew that there were only two species of such salamanders in America. One, the Ozark blind salamander, *Typhlotriton spelaeus*, I had seen in Marvel Cave and half a dozen other caves in the Ozark Mountains of southwestern Missouri. The second, *Typhlomolge rathbuni*, discovered in an underground stream in central Texas in 1895, had been seen in its native haunts by scarcely half a dozen scientists. I was determined to see it and to photograph it alive.

I had come half way across the country to Ezell's Cave, near San Marcos, Texas, to search for it, and now, testing the rope on which I was to lower myself 40 feet into the entrance chamber, I felt the surging thrill of anticipation. In less than an hour I might see *Typhlomolge*.

My guide, Dr. C. S. Smith, of San Marcos, was less hopeful. One scientist, he said, had spent a whole summer there without capturing any. Another man had seen but one during two weeks spent in visiting the cave.

Doctor Smith's son, Jean, promised to guide my fellow naturalist, Kenneth N. Dearolf, and myself to the underground river. So down the rope we went, finding convenient toe-holds in the irregular cavern walls. Then at the bottom Jean squeezed his



(Left) HIBERNATING. This big brown bat clings effortlessly to the rough cave ceiling, using its feet and its thumbs. The four fingers are much elongated and joined together by the membrane of the wing, which at rest is folded back so as to be scarcely noticeable. Bats are covered with fur and are mammals, not birds as some persons believe. (*Eptesicus fuscus fuscus*, Veiled Lady Cave, Pennsylvania)

(Below) NOT AN ALBINO BAT, just a wet one. Most "albino bats" turn out to be ordinary ones covered with droplets of moisture which glitter like crystals in the rays of the flashlight. This Pygmy Bat hibernates seven months, a record sleep (Stover Cave, Pa.)

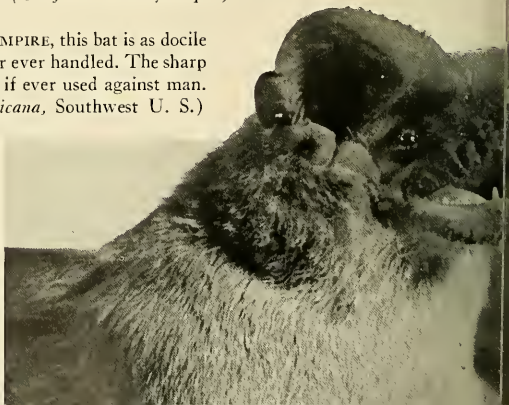


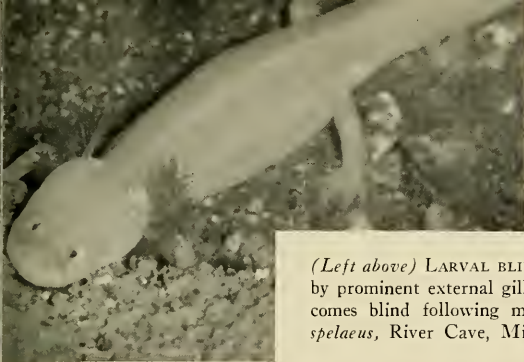
(Below) WATER UP TO HIS ARMPITS forced the photographer to carry his camera equipment on his shoulders to get pictures of the bat colonies in this cave. Nickajack Cave in Tennessee was one of the first great caverns to be explored, and its bat guano deposits were worked for nitrates during the War of 1812. The tremendous limestone ledge which roofs this historic southern cavern is 60 feet above the cave stream, and the entrance is 175 feet wide



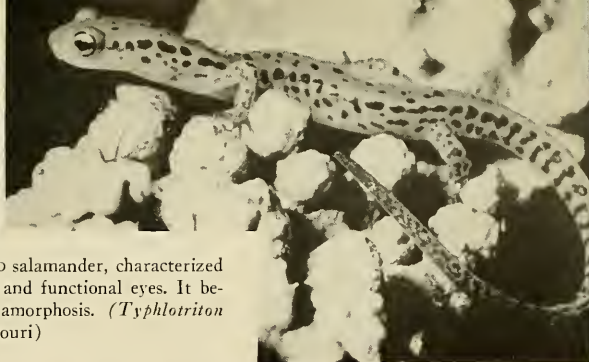
(Left) LONG-EARED MOTHER carrying baby. When leaving their cave at night to feed, these bats in southwestern Virginia sometimes carry their young as shown, at other times the little one is left hanging to the ceiling. Adults of this species have a wing-spread of nearly a foot, and ears an inch and a half long. (*Corynorhinus rafinesquii*)

(Below) NO VAMPIRE, this bat is as docile as any the author ever handled. The sharp teeth are rarely if ever used against man. (*Tadarida mexicana*, Southwest U. S.)

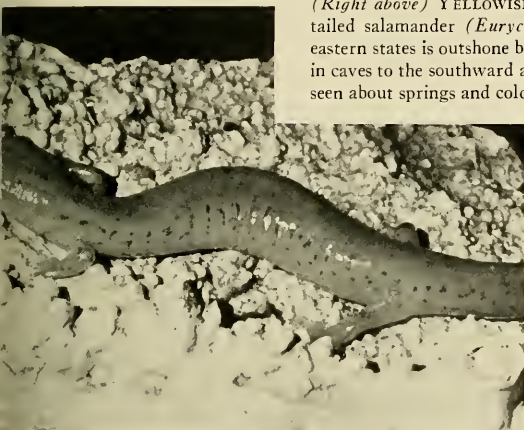




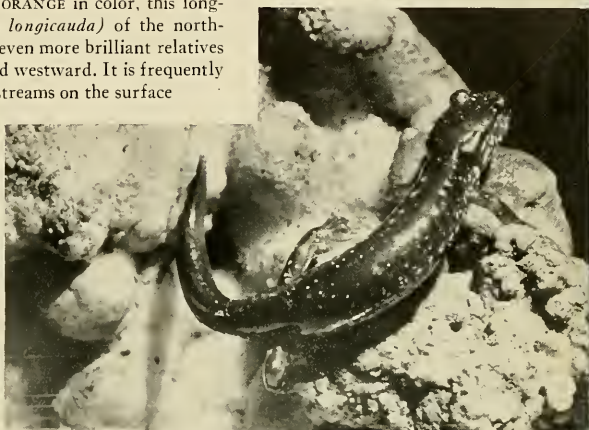
(Left above) LARVAL BLIND salamander, characterized by prominent external gills and functional eyes. It becomes blind following metamorphosis. (*Typhlotriton spelaeus*, River Cave, Missouri)



(Right above) YELLOWISH ORANGE in color, this long-tailed salamander (*Eurycea longicauda*) of the north-eastern states is outshone by even more brilliant relatives in caves to the southward and westward. It is frequently seen about springs and cold streams on the surface



(Above left) PURPLISH-RED and seven inches long, this cave salamander (*Gyrinophilus duryi*) was found at the type locality, an underground waterfall in Cascade Cave, in northeastern Kentucky. Like other lungless salamanders it must be moist to permit respiration through its skin. Drying results in death



(Above) A STOUT-BODIED Wehrle's salamander found in Arbuckle Cave, West Virginia. It resembles the common slimy salamander but has several paired brown spots on the back. It reaches a length of six inches, though a one-inch and a three-inch specimen were found.

(Below) AN IRREGULAR STRIPE down the back distinguishes this from the red-backed salamanders of the East. It has been found in a few Kentucky caves, particularly at Mammoth Onyx Cave. It is comparatively small, averaging about four inches in length (*Plethodon dorsalis*)



(Right) THE GREEN SALAMANDER exhibits a rare color among salamanders, though one that is well adapted to lichen-covered trees which the creature often climbs if it ventures out of the cave. Coincidentally, the specimen was collected by N. B. Green. It has well developed eyes adapted to dimly lighted entrance passages (*Aneides anacis*, first found in Nickajack Cave, Tennessee)

(Right) BEST-KNOWN, widely distributed, and among the most strikingly colored of cave salamanders, this orange species has huge dark eyes which indicate a highly developed optic sense, useful in the dimly lighted "twilight zone" (*Eurycea lucifuga*, Blood Cave, Kentucky)



way into a jumble of rocks and led us downward a hundred feet by a series of crawls and squeezes to the top of a steep incline. A pebble, rolling down the slope, splashed 20 feet below us. We had reached the "river."

This clear, motionless water was the abode of *Typhlomolge*. Eagerly we turned our flashlight beams over the surface of the water and along its boundaries. Hopefully we probed into the increasing depths of the water with our fingers of light. Not a sign of life could we find.

An hour later we had explored every corner of the little room and every inch of shore-line. Then, abruptly, a minute white organism flowed upward on the side of a rock. It was flat, white, and about an inch long. We recognized it instantly as a large planarian, three or four times the size of the cave flatworms we had collected in Pennsylvania and Kentucky. No such creature had ever been described from Texas. It was a new species!

Standing knee-deep in the pool, I scooped it into my hand, then into a vial. The blind salamander was forgotten as we watched the planarian flow along on the inside of the vial, lengthening, twisting, becoming wide, then slender as it slid over the smooth surface.

We left the cave with our prize, photographed it, then carefully pickled it. Early the next morning we were back. Still no salamander could we find. Dearolf settled down to watch the pool. Scouting around I discovered a low passage. It didn't look big enough to get into but a mud-caked string, left by some other explorer, led through it. I followed. I was glad that I had shed all my clothes except shirt and shorts. Sometimes my heels touched the ceiling while my toes scraped the floor. If I'd worn a sweater I might have stuck. Worming my way along for half an hour, I was thankful when I saw the passage open into a room. It had a pool in it. My knees trembled as I stood up and searched the water. There must be a salamander here. I was possibly only the second person to reach this room. Surely life must be undisturbed enough here. My search was fruitless; there was no sign of life. Dejectedly, I inched my way back to the main room.

No, Dearolf hadn't seen a salamander either, but he had captured an isopod, a white, blind, aquatic arthropod related to the pillbugs. It was a creature totally different from any of the numerous isopods we had found in eastern caves. Its name was *Cirolanides texensis*, its length, about half an inch.

Tired and hungry we left the cave to return again the next day. This time life was more abundant. Almost immediately we captured a cave shrimp, *Palaemonetes antrorum*, a creature so transparent that we discovered its presence by seeing its shadow on the bottom of the shallow pool. In only one other

cave, Mammoth, had we previously seen a cave shrimp. Another isopod swam toward me from the depths while Dearolf was catching a second planarian. Still another water creature, a blind white amphipod, *Eucrangonyx flagellatus*, came swimming toward us and was captured.

Our headlamps were giving us some trouble, and we needed more flashbulbs for pictures so we climbed out again. Later that day we made our fourth descent. We had scarcely reached the water when I saw another planarian floating on the surface well out from shore. I waded out in the shallow pool and captured it.

Then, just as I turned toward shore, I saw it—a blind salamander close to my knee in half a foot of water. The sight took my breath away. The creature was beautiful, exotic, with silky white body and brilliant, tufted blood-red gills. Never had I seen anything like this spindly-legged, angular-headed amphibian. My teeth chattered with excitement as I pleaded with Dearolf, across the room, to hurry with the net. Afraid to wait I leaned cautiously toward the salamander moving an open bottle toward its head, hoping to drive it into my trap.

In a flash it was away, swimming swiftly toward a deep crevice. Vainly I tried to scoop it out of the water. It was gone and I had stirred a thin film of mud in my pursuit. Then I saw it, its silky white body gliding through the murky water toward the middle of the pool. I scooped again with my hands and missed; again, and the weird beast was flopping in my hands and up onto my close-pressed wrists. I was begging Dearolf to hurry, and in another moment he was there with the net and a vacuum bottle, in which to keep the creature alive in the temperature to which it was accustomed.

We didn't breathe until we had our captive safely in the bottle. Fully four inches long, it was one of the largest ever captured. The next few hours we spent in photographing our prize, marveling at its queer posture, recording on motion picture film its exotic coloration and its weird movements. At close range we could see that the creature had tiny eyes but that they were beneath the skin, consequently sightless.

In Ezell's Cave we found also our first cave frog, *Syrrophus marnocki*, whose cricket-like call led us to its hiding place in a tiny crevice. We heard these secretive amphibians in half a dozen central Texas caves but frequently we were baffled in trying to locate the source of the ventriloquial chirps.

Blindfish are the most famous of all cave inhabitants. In search of them one New Year's Eve, I stood alone at a cave in Spring Mill State Park, Indiana, where a generation ago Professor Carl Eigenmann had studied blindfish. Entering the cave during a terrific downpour and wading in the turbu-

lent cave stream, I soon saw two of the Indiana blindfish, *Amblyopsis spelaeus*. The ease with which the stocky, four-inch-long fish moved along in the strong current amazed me. Even through the murky water the deep pink color of the skin, evidence of a rich blood supply, was plainly visible.

Outside the cave I saw the concrete pools where the famous ichthyologist had studied *Amblyopsis* and had determined that the fish was not a live bearer as had been supposed. Several observers had reported that when adult females were kept in aquaria, suddenly young fish were seen swimming in the water.

Eigenmann discovered that *Amblyopsis* lays eggs, but in a strange manner. The oviduct opens below and between the gill slits and the eggs are deposited in pouches in the gill cavities. There the eggs are carried for a month before they hatch and another month passes before the young fish have absorbed all the yolk in their yolk sacs and are ready to swim out into the water.

The eye of the young fish begins to develop normally, but development gradually stops; then degeneration begins. The adult fish has nothing left in the way of an eye but a bit of pigment and a few fragments of cartilage.

Early one summer night in 1937, Dearolf and I led half a dozen interested cave guides on a hunt for Eigenmann's blindfish, *Typhlichthys osborni*, in Hidden River Cave, Kentucky. Seven hours we worked in that cave, wading waist-deep in 50° water most of the time. Our lights picked out many of the slender, two and three-inch-long blindfish. We captured several of the elusive ghosts, later transferring them to a tiny, natural pool in the neighboring Mammoth Onyx Cave. There they may be seen by tourists who would not care to wade for hours waist-deep in cold water, and our reward was to see their wonderment.



MOST FAMOUS of all cave inhabitants is the blindfish. Totally sightless, it finds its food by heightened chemical and touch senses, centered in tiny ridges on the head. Originally thought to bear live young, careful observations finally proved that *Amblyopsis spelaeus* lays its eggs in its own gill pouches, whence the living fish emerge two months later



(Above) A SUBTERRANEAN ANGLER catching blind cave fish in Hidden River Cave, Kentucky. Seven hours of work here, wading in 50° water most of the time, rewarded the explorers with several of the blindfish shown at lower left. These were transplanted to a tiny pool in Mammoth Onyx Cave, where tourists can observe them without discomfort



(Left) THIS BLINDFISH (*Typhlichthys osborni*) is native only to Hidden River Cave. Small in size, most blindfish measure less than three inches. Collectors represent their chief hazard. Most scientists believe that tailing sight sent the ancestors of these fish to sheltered spots and ultimately into caves where the loss of the eyes was completed

An interesting change took place in the fishes' actions in their new environment. In their original haunts these blindfish were extremely sensitive to any vibrations. The tap of a flashlight against the rocky stream bank sent them darting to cover. After they had been in the small pool in the well-traveled cave for a few weeks, however, they became accustomed to vibrations and showed little or no reaction to them. They never react to light.

Examining *Typhlichthys* at close range, we noticed the complex set of sensitive nerve endings, or papillae, which form little ridges on the top and sides of the head and jaws. These organs are known to be sensitive to potential food substances. Their effectiveness is evidenced by the finding of other species of fish, crayfish, and many smaller aquatic forms in the stomachs of blindfish.

The question whether the ancestors of the present blindfish were sightless when they entered caves or developed blindness afterwards, has long interested scientists. Those who have studied the problem most fully believe that modern species have descended from fish which were developing blindness before they entered caves. They explain that the closest relatives of modern blindfish are light-avoiding species which live in muddy ditches, or in crevices in the rock, or under stones. These fish have poorly developed eyes but possess tactile and olfactory organs of increased sensitivity. While these fish may swim out into open water, they are no longer able to cope with the species normally living there. It is believed to have been such retiring species which have entered caves and, finding the environment only slightly different from their former one, were able to survive there.

Blindfish have been found also in some of the Ozark caves, but only a couple of specimens have ever been preserved. Spurred on by the realization of their rarity we investigated every report of "white

fish." But like Byron Marshall, of Imboden, Arkansas, who has seen blindfish in only one of the 150 Ozark caves which he has explored, we found little foundation for the stories.

Last summer we received a "hot tip," followed it to a cave near Springfield, Missouri, and found ourselves looking into a branch-choked, manhole-like entrance. Clearing it we descended, using a rope and bracing our shoulders and feet against opposite walls. At 30 feet we encountered a small underground stream which immediately plunged into a large room below.

The only descent possible was at the very edge of the waterfall. Thirty feet of light, knotted rope just reached the bottom. Down the rope I started, hand over hand. The walls curved away; I began to swing on the rope. In a moment I was under the falls. The water blinded me, choked me, chilled me, soaked me, filled my boots, and knocked me off the rope—all in a split second.

I landed on my side on a rock pile and painfully crawled away from the pounding water. Having lost sight of me, Dearolf was shouting anxiously. Finding no broken bones, I shouted back that I was safe. My electric headlamp still worked so I started moving around to get warm, exploring the cave while I gathered courage for the climb up the rope.

Soon I discovered a white crayfish, the loveliest creature imaginable. I captured it and then another. With one in each hand I discovered more. Wading knee-deep in a muddy pool I saw a white blindfish sinking slowly out of sight right in front of me. Dropping the crayfish I scooped desperately with my cupped hands. It escaped me. I was heartbroken.

Suddenly I realized that the water was rising. The roar of the falls and its volume seemed to have trebled. Dearolf was shouting, but I couldn't understand him. Unknown to me, a small creek above which we had stepped across was swelling enor-

THE SLIMY SALAMANDER (*Plethodon glutinosus*) when handled exudes a liquid suggestive of Duco cement. Most abundant and widely distributed of cave salamanders, 35

specimens have been seen in one small cave in Georgia, 44 in an Arkansas cave. It is common above the surface, but the only eggs ever seen were in two Missouri caves



mously. I'd been down here too long already, I decided; I'd better see if it was possible to climb out of the place.

I couldn't raise my foot high enough to reach the first loop of the rope. Removing my water-filled boots helped. I sent them up first. Then with the rope down again I took a deep breath and started climbing. I must have gotten halfway; higher I couldn't pull myself. The water was icy, pounding. Desperately I hung to a big knot, knowing that in another moment I'd be down on the rocks again. But as I dangled, choking, my toes touched a ledge. Kicking against it, I swung in a widening arc until I could pull myself onto it, out of the falls. It was a very small ledge, and my knees shook so I thought I should surely fall off.

Out of sight but not far overhead Dearolf called encouragingly. I couldn't stay there forever, so filling my lungs with air I swung out into the falls, and climbed. This time I made it. I found Dearolf soaked too. Water was pouring in from above. When we reached the surface we saw a 50-foot torrent tearing across the meadow.

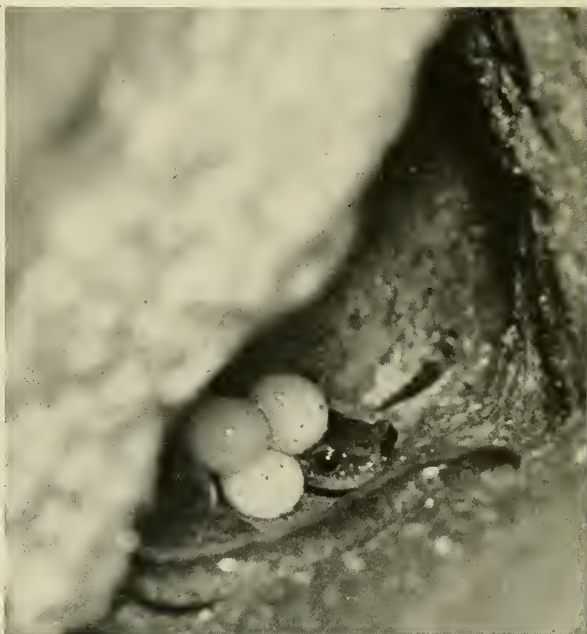
We returned three weeks later, placed a beam and ropes so that we could descend farther from the falls. We were drenched anyway. The fish was in exactly the same place as before, but this time I had a net, and soon, the fish. It is probably a new species.

Salamanders cannot endure heat and dryness so it is not surprising that many kinds seek the cool, moist atmosphere of caves. The only eggs of the slimy salamander, *Plethodon glutinosus*, ever seen were found in two Missouri caves. Recently the first eggs of the cave red-backed salamander, *Plethodon dorsalis*, were discovered by guides in Mammoth Oynx Cave, and called to the attention of my friend, Dr. E. R. Pohl, superintendent of the cave. Last summer I succeeded in photographing the eggs



(Above) ON LOCATION in Mammoth Onyx Cave, Kentucky, where the first eggs of the red-backed salamander (*Plethodon dorsalis*) were recently discovered by guides and photographed by the author. A power line for lighting equipment is a rare and valued aid to the cave naturalist. Unable to endure heat and dryness, it is not surprising that many kinds of salamanders seek the cool, moist atmosphere of caves. Their food is chiefly insects, of which they find an abundant supply in most caves

(Below) THE AUTHOR PHOTOGRAPHING red-backed salamander eggs in a crevice. Guarded by the mother salamander as shown at right, three creamy white eggs lay in each of five nests discovered in a small area, the first such ever reported to science. Half-inch-long larval salamanders hatched out in three months





ELONGATED ANTENNAE, which widen the zone of awareness, compensate for the loss of sight in this blind cave beetle (*Neaphaenops tellkampfi*) which spends its entire life in darkness. Nature has also provided it with numerous sensory hairs which transmit sensations through the insensitive body covering. Not only their eyes but the optic nerves and even the optic lobes of the brain are missing, yet these quarter-inch-long creatures scurry about with a rapidity that is amazing. Naturalists who collect these curious creatures usually set traps for them

as they lay in small crevices guarded by the adult salamanders. There were five nests in a beautiful fluted column only a few yards from the blindfish pool. Each fissure contained three creamy white eggs, each less than a quarter of an inch in diameter.

Having seen similar eggs laid by the common red-backed salamander (*Plethodon cinereus*) in logs and attached to the underside of flat rocks, I wondered what effect the cave habitat might have on the development of the eggs. Doctor Pohl watched them daily and learned that they hatched in exactly three months. Warmed to some extent by the sun's heat, the eggs at the surface hatch in two months. The unvarying, 58° temperature of the cave atmosphere doubtless accounts for the slower development of the cave species.

Salamanders eat insects, and they find abundant food in most caves. Among the many cave insects which we have seen are a number of unusual beetles. Some types, such as the rove beetles and the ground beetles, occupy the dimly lighted entrance passages. Since there is enough light to enable them to see, they showed no marked adaptation to subterranean existence.

There are blind beetles, however, which spend their whole lives far inside caves. We found a few such beetles in Carlsbad Caverns and in an isolated cave in central Texas, while in the Mammoth Cave area scores of caves had large populations of blind beetles, *Neaphaenops tellkampfi*. We found dozens of the quarter-inch-long insects running with such rapidity over the sandy banks in Hidden River Cave that we could hardly believe that they were eyeless. As a matter of fact, they lack not only eyes, and optic nerves—even the optic lobes of the brain are gone. The membranous flying wings have been lost, and their covers, the elytra, have fused together.

In compensation for their loss of sight, these beetles possess lengthened antennae which widen their zone of awareness, and numerous setae, or sensory hairs, which transmit sensations through their insensitive body covering.

Other blind beetles we found in Tennessee, Vir-

ginia, and West Virginia caves, but since they are scarcer there and seldom seen we set traps for them. A trap consists of a vial, or glass, partly filled with liquid preservative. In the center, above the liquid, hangs a tiny container of bait, consisting of decaying meat or cheese, or a combination of both. The traps are buried to the brim and covered with coarse screening to keep out the numerous crickets. The smaller beetles fall through the screen into the preservative. Although we usually visit the traps within a month or two, fairly well preserved blind beetles have been found in traps a year later.

Sometimes the traps are flooded by rising cave waters. Then we may find in them small aquatic animals such as isopods, horizontally flattened crustaceans; and amphipods, vertically flattened members of the same class. Both forms are colorless and blind and usually less than an inch long. They live almost everywhere that underground waters flow.

Strangest of the white inhabitants of cave waters is the minute, eyeless flatworm, a planarian, many of whose relatives are internal parasites of higher animals. The cave forms are not parasitic, and although they can stretch their flattened body into various shapes, they seldom measure as much as half an inch in length. Dearolf and I were excited when we discovered several blind planarians in a Pennsylvania cave. Though they are known from caves in half a dozen states, these flatworms are few in number. A dozen individuals represent a large population—except in Bat Cave, in northeastern Oklahoma, where we found tens of thousands of flatworms.

We located the cave by the penetrating odor of many bats, while we were 75 feet from the thickest-obscured entrance. Inside we wallowed warily through a quagmire of water-soaked bat guano where a small cave stream flowed over the accumulated excrement of centuries. The shallow water was almost solidly creamy white in places—amazing concentrations of thousands of flatworms (*Sorocelis americana*) and hundreds of isopods (*Caecidotea macropropoda*). We had difficulty achieving enough stability in the veritable quicksand of guano to per-

(Right) GREATLY LENGTHENED antennae and elongated legs indicate this palid cricket's fitness for subterranean life. Eyes have not disappeared, but *Hadenoeus subterraneus* has little or no use for them in its deep retreats. Long accustomed to the unchanging temperature of caves, it cannot survive above ground.

Like the katydids to which they are related, female cave crickets have long ovipositors through which they lay eggs in moist earth

(Right, below) BEAUTIFUL MARKINGS on legs and body make this long-horned grasshopper perhaps the handsomest cave dweller. With antennae several times as long as its body, it is well fitted for subterranean life, though it is also occasionally found outside of caves. It has well developed eyes, but is wingless. (*Ceuthophilus stygius*, Maitland Cave, Pa.)



mit taking close-up pictures of this unique zoological community.

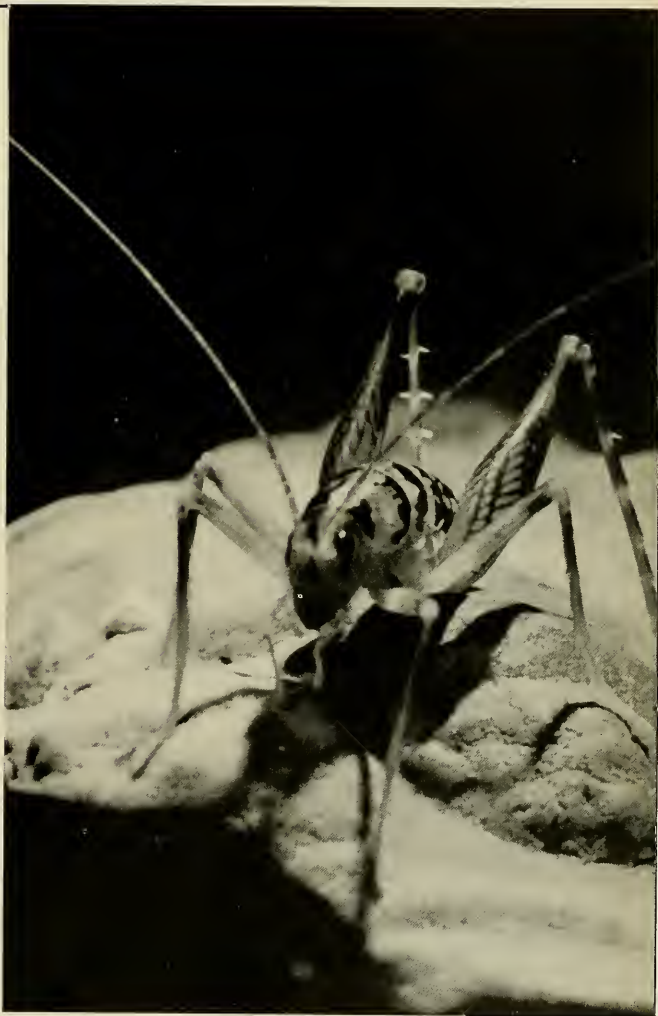
We found that cave flatworms are extremely delicate. If they are exposed to sunlight, even for a few minutes, they die and begin to disintegrate almost immediately. Sharp changes in temperature are fatal almost as quickly. We carried them in vacuum bottles to keep them alive.

Animals which live in the twilight zone of a cave must endure greater shifts of temperature than those which live in the deeper reaches where the temperature never fluctuates. For instance, there are two genera of cave crickets: *Ceuthophilus*, which live in the dimly lighted region; *Hadenoeus*, far within the cave.

Last winter I had occasion to collect a dozen of each. I left them in my car overnight and though the temperature did not fall below 40°, all of the *Hadenoeus* were dead the next morning; all the others were alive. Coming from a region of constant temperature, they could not endure the fluctuations commonly experienced by *Ceuthophilus*, which inhabit the entrance passages.

These so-called cave or camel crickets are really katydids, yet they cannot sing as do their relatives at the surface. Their chief adaptation to cavernous life is a tremendously elongated pair of antennae, four times the length of the body. These they use to feel their way along. All of these insects have conspicuous dark eyes, while the body and legs of *Ceuthophilus* have a beauty of color, pattern, and form that is outstanding among cave inhabitants.

The study of cave life is my hobby. Perhaps it is the same urge that carries other people to the Arctic or the tropics, for here likewise one enters a world completely different from what we are used to. And the animal life one can observe is as fascinating in its marvelous adaptations as any that can be found. Strange experiences have been my lot in the seven years I have explored Nature's underworld. The thrill of finding rare and exotic creatures and the stirring sights of subterranean splendor are never to be forgotten.



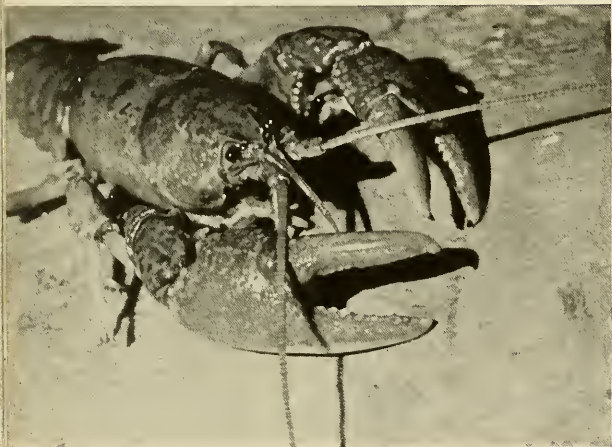


(Above) MOST SLENDER of the blind cave crayfish, this one measures about three inches in body length, and has five-inch antennae. It has been found only in Gum Tree Cave, in central Florida.

It has eyes but the nerves have degenerated, leaving it blind. Deaf also, it would be an easy victim for a host of creatures if it lived at the surface. In the cave it apparently has no enemies. (*Cambarus acherontis*, collected by Dr. H. B. Sherman)



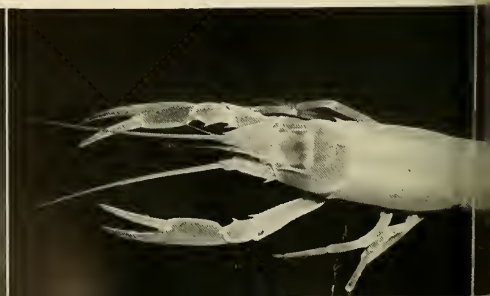
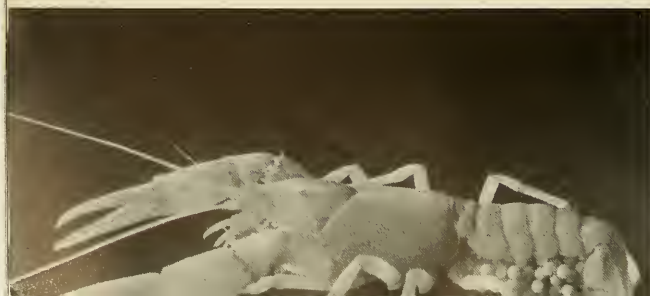
ONE OF THE MOST BEAUTIFUL of cave inhabitants and one occasionally seen by tourists in the Kentucky caves, is the blind species *Cambarus pellucidus* shown above. It is fairly common throughout a score or more caves, while all other white crayfish are rare, being known only from a cave or two. (Mammoth Onyx Cave, Kentucky)



LARGER than the above, the crayfish at left has eyes and is similar to surface crayfish, though it is found in caves over a wide area in the eastern states. (*Cambarus bartoni tenebrosus*, from Hidden River Cave, Kentucky)

(Below) FIRST EGGS. Hazardous exploration in an extremely wet cave brought Charles E. Mohr and Kenneth N. Dearolf unexpectedly upon the first female cave crayfish ever found carrying eggs beneath her abdomen. Both searchers were completely drenched, but successful in their collecting. (Moore's Cave, Springfield, Mo.) Cave exploration sometimes combines the perils of deep sea diving and mountaineering, requiring the use of ropes and strong resistance against frigid water

(Below) APPARENTLY RATHER RARE, this crayfish was found in Nickajack Cave's broad stream during only one of four visits, when the water was especially low in July, 1937. The author found it also in Wonder Cave, at Monteagle, Tennessee—the first time it has been reported anywhere except at the type locality, Nickajack Cave. (*Cambarus hamulatus*)





COLORLESS, BLIND, and usually less than an inch long, the tiny crustacean above is a small relative of the crayfish and closely allied to the sandfleas. These amphipods occur in many caves where there are permanent pools of water. They are scarce in pools where blindfish live, and must be eaten also in considerable numbers by salamanders. (*Synpleonia clantoni*, Veiled Lady Cave, Pa.)



(Above) SPELEOLOGIST DEAROLF OBSERVING planarians, isopods, and amphipods. Of these smaller cave creatures, which live almost everywhere that underground water flows, the strangest is the minute, eyeless flatworm. So delicate is this planarian that if exposed to sunlight even for a few minutes it dies and begins to disintegrate almost immediately. The collector must keep them in a thermos bottle



(Left) BLIND CAVE ISOPOD. These white, eyeless crustaceans, distant relatives of the crayfish, are found almost everywhere in caves when spring-fed pools occur. "Big animal eat little animal" is the rule in caves as elsewhere, and the isopods, though less than an inch long, fit into this endless chain of food-taking, relying themselves for nourishment on still smaller inhabitants of the same pools. (*Asellus*, sp.)

(Right) A MOTH, an inch long, that is found in many caves, both in Europe and America. The water droplets, like those shown earlier on plants, form by condensation and glitter in the beam of the flashlight. Like many other insects, moths, especially, enter caves only to hibernate. (*Scotoryx libatrix*, Morgan Cave, Pennsylvania)



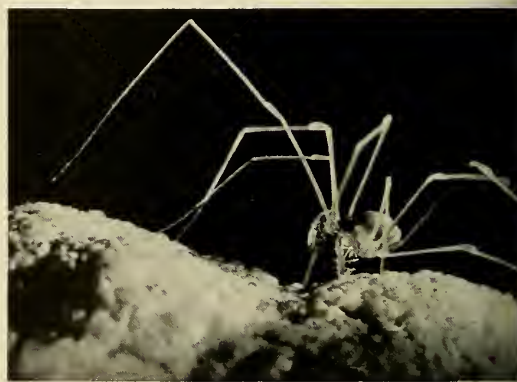


(Above) SCREECH OWL: the only bird seen in caves, with the exception of the phoebe, which often nests just inside

the entrance. A family of owls is occasionally seen eating bats in Hidden River Cave

(Below) THE SKUNK of the cave world. Daddy-long-legs often congregate by the hundreds in tangled masses which sway up and down in a strange "dance." They emit a nauseating odor when handled

(Below) BLIND CAVE SPIDER. Harmless except among creatures their own size, these tiny spiders, scarcely half an inch across with legs extended, possess formidable jaws for an animal so delicately constructed. (*Phalangodes armata*, Mammoth Cave)



(Below) LIKE ALL CAVE SPIDERS, this form, *Meta menardii*, is utterly harmless. It spins its few strands of web around the entrance of caves and in other dark places. While caves

are popularly imagined to contain the most dreadful creatures, nothing in this entire collection, typical of cave citizenry, could be called dangerous



NATURE ALONG THE SIDEWALKS—*Let your daily walk become an "African safari" amid the wondrous cycles and varieties of Nature*

By ROY L. ABBOTT

*Professor of Biology,
Iowa State Teachers College*

IT just happens that the place where I live and the place where I work are separated by a mile and a half of space and every week day morning I travel this space on foot along the cement sidewalks. Most of my 25-minute walk—for I take it leisurely—lies along the outer part of a small city, and I vary the route from morning to morning by going around this or that block in a different way.

On no two mornings are my walks ever quite the same; the scenery and the incidents of them vary with circumstance and season. Last night, for example, it snowed a little—just enough to hide yester-

day's dirt and grime, and so this morning I am striding hurriedly across a cold, clean-carpeted world. I am earlier than usual, some of the houses are still dark as I pass, but early as I am, others have been out before me. I amuse myself by reading the signs in the snow, by imagining where each person has been going—workmen, mostly, I suppose—this big-footed fellow who just preceded me must have been in a hurry, judging by his stride. He turns his toes out too widely to be an efficient walker, and one heel drags badly as I can see from its cut in the snow.

But this other fellow who passed along even earlier than Big-foot was not carrying a dinner pail, I am sure. For he went on all fours. Yonder where

QUARTET IN FOUR FLATS

Photo By HENRY B. KANE



he nibbled at that catalpa-pod, he left the finger-long imprints of big, hairy hind feet, and just ahead of them the dainty dimple marks of his front feet, the kind of tracks you might expect any animal to make. But look there where he started to run—now his tracks show hind feet in front and front feet behind—the queer but unmistakable sign of a cottontail. I move on smiling as I recall the picture of a boy who came to me once, astonishment written all over his face.

"It's funny," he said in a baffled tone, "but I tracked a rabbit up to where he was sittin', and he wasn't there." He hadn't yet learned that the novice is likely to track a rabbit backward.

An impersonator

I am still looking for rabbit tracks, when my attention is diverted by a high, clear call, "Pee wee! Pee wee!" from somewhere overhead. I stop and gaze upward. It is too much mid-winter to imagine this to come from a real pewee. Some other little fellow must be imitating him. Ah, there he is now, pecking bravely at a cone on that spruce, a chickadee or black-capped titmouse. To me, he does a better job of the call than the real pewee himself. But usually these little fellows are in a flock—where are the rest? Yes, there's another one—no, it's a downy woodpecker! Mistaken again, for this bird is moving down the trunk headforemost. No woodpecker ever did that—although dozens of people have told me they have seen them do it. But they were looking at a nuthatch, perchance, as I am doing now. He crawls around the trunk, peers at me with bright questioning eyes; and voices his nasal "Yank! Yank!" as if gibing at my mistake.

I stare up at him and the chickadee in amazement. It is zero weather, and their slender feet and long ankles are bare—mine none too warm in rubber and leather and wool. True their feet are largely bone and skin, but they contain blood and nerve and can freeze for all that. How do these birds survive the nights? The heat of their bodies can come only from food as mine does, and their food is only where they can find it—pine cones, weed-seeds, insect eggs, and the hapless grubs and caterpillars which they may uncover from crannies in the bark—cold stuff, all of it! And, why do they persist in staying here in this frozen country when a few days' flight would land them under warm skies? But they answer only "Pee wee" and "Yank! Yank!" to my questions, so I leave them, and pass along a block or two of sidewalkless street, hearing still their dauntless calls as I go.

Here, across the path at the side of the street,

some other creatures have been running. Tiny beings these, their tracks a delicate stitching in the snow, crossing and re-crossing from one mat of grass to the next—meadow-mice, for the most part, I know. For these furry, chuckle-headed mites are everywhere in field and roadside—though seldom seen by man—creatures seemingly destined to turn vegetation into flesh, and this flesh in turn to be eaten by some other creature.

Before my very eyes indeed, is evidence of the tragedy of the meadow mice, for along my path, in and out of that brush pile over there, and through the culvert to the other side of the street, a line of tracks stretch in tireless sequence—their worst enemy, the weasel skunk has been on the prowl. He doesn't hesitate about invading the city limits to get food. Doubtless even now, sated with mice, this little, spotted, evil-smelling killer is holed up somewhere, probably under that barn yonder, waiting drowsily for the night.

A gourmand

I scuff my feet through two or three thick tufts of grass—and make a quick grab forward as a flash of umber-brown disappears into another tuft just ahead. Too late! My fingers clutch only grass. That was another mouse-hunter on the trail—the short-tailed shrew. How this half-blind, tiny creature can "do in" a meadow mouse quadruple her size is a mystery to me. One that I kept captive actually killed and ate two of them in one night—a feat of gourmandizing I have never seen equaled!

More tracks, a downy woodpecker—this time for sure—hammering against a telephone pole, a solitary crow winging bleakly overhead, a flock of pigeons wheeling sharply above a barn—almost before I know it, I am at my place of work for the day. I glance back regretfully along my path, tomorrow may not hold so much to see.

How different is a morning in May along these same sidewalks! The dull grays and somber browns of dead weed-stalks and leaves and dry grass have given place to a dozen shades of green. A million seedlings are crowding each other for a place in the sun. The iron-hard soil of a few months back is springy now. I step off the solid walk and get the feel of the soil and sod with my feet. The very air is different! I sniff it eagerly, and poor as is this human nose I carry, I catch the heavy odor of plum blossoms and the clean tang of newly-turned soil. No nuthatches and chickadees now, but in their place unnumbered robins and bluebirds and grackles.

I stop momentarily and watch a gardener plowing. His team is coming toward me, now they are turning awkwardly at the end of the field, their

eight legs and hoofs seem to entangle, and one horse lays his ears back in anger as the other crowds him. A regular caravan of grackles is plying to and fro from some nearby pines to the garden. A few of them alight near the farmer and stride with quick steps after him, watching eagerly for grubs or other provender turned up by the share. Resplendent in burnished coats of purple and green, some of them perch on the fence posts and watch me with alert yellow eyes, until with a cluck of lips to his horses and lines around his waist, the farmer starts again down the field. Two other similar but much larger and more cautious food-gatherers sit in a nearby tree awaiting my pleasure in moving on. They can see clearly that I have no gun, but it is simply against the rules for a crow to take any chances.

It rained last night and hundreds of earthworms have crawled across the sidewalk as I can see from the glistening, slime-path each left behind. But hundreds of others are stranded upon the walk, and the robins are feasting. Yonder a yellowish female gathering breakfast for her brood has her beak so crammed she surely can't pick up another; just ahead, and heedless of my presence, two full-breasted males are taking time off from their worm-gathering to see which is best able to kick the other into submission. The blows from those thin legs seem puny enough but presently one decides to quit and takes off speedily, the winner in vociferous pursuit. High above me, a golden-winged woodpecker is making the chips fly from a dead maple, stopping every now and then to send out his long-drawn call, "Flicker, flicker, flicker."

Mr. Thirteen Stripes

Out in a bit of pasture to my right, a pair of rat-size creatures are racing madly about, their tails raised like flags. The chase leads straight toward the walk, one slides across it and sits bolt upright at the edge. I can tell from his cock-sure attitude that Mr. Thirteen Stripes, the ground-squirrel, is sitting at the edge of his hole. He dives headlong at my approach giving a final defiant whistle as he goes under. If I had time I would set a snare of string in his hole and pull him out of there just for fun, for I know he simply can't resist sticking his head out in a minute or two if I will only wait. Instead I merely jump up and down on the walk, and chuckle at his faint whistles of alarm as I hurry on to my office.

My mile and a half of sidewalk in mid-summer is different still. There has been no rain for weeks. The ground is now almost as hard from dryness as it was from the grip of winter's frost; big cracks

gape in it as if hungry for moisture, dust lies thick upon everything and rises as a fog from beneath my pounding feet. A workman digging post-holes along a field is bringing up nothing but powder-dry soil from a depth of three feet. He shakes his head negatively and rather pitifully I feel as I inquire:

"Any worms this morning?"

It is early morning in August, but the air is heavy and still; it will be terrifically hot by noon. Scientists say that heat has weight, but they hardly need to tell me that for I can feel its weight this morning. Even the leaves hang droopily as if they too felt its weight or had evaporated more water yesterday than they had gained back during the night.

In the summer's heat

I know that the trees house plenty of birds, but few are to be seen. Those that do show themselves are already holding out their wings from the heat. Somewhere a mourning dove is cooing tiredly, and a cuckoo insistently drones his plea for rain. But the radio announces, "No rain in sight," and the huge, flat-bottomed fair-weather clouds billowing up from the southwest give evidence of the truth of the prophecy.

But not all creatures seem to be equally bothered by the heat this morning. In a clump of giant-rag-weeds yellow with pollen, an enormous garden spider is hanging in the middle of her orb-web shaking it vigorously as if to tell me to be gone. I pick up a grasshopper and toss him against the web. In an instant she is on him—a wide band of silk is shot forth from her spinning apparatus and almost before I can realize it, the powerful grasshopper is swathed tightly—perfectly helpless. Her much smaller and timid mate remains discreetly on the opposite side of the web and takes no part in the capture.

The sidewalk is so hot I can feel it through my shoes, but the ants are running all over it apparently unmindful, and the air is buzzing with bees. I know, too, that on a hard-packed bit of Sahara—a vacant lot just ahead—some big wasps will be digging holes with jaw and feet as I arrive, as if the question of heat never entered into their lives. I stand and gaze at them enviously; their bodies gleam in the sun, but not from sweat, and my clothes seem to stick to me all the more exasperatingly as I watch. There is not much fun along the sidewalks for me this morning and I am glad to enter my cool office.

And who doesn't know the joy of a walk in the fall—even along a sidewalk? My mile and a half of space has taken on new aspects now, new pleasures. For blocks ahead of me along a pasture fence, hundreds of long white threads are streaming straight

out from the fence posts. It is cobweb season, and the young spiders are ballooning. The sticky webs bend uncomfortably across my face—I rub them aside and walk over to a fence post. Yes, there the balloonist is now, a young spider with posterior end upraised spinning a thread out into the air. The wind catches it and pulls and lifts on him. When the thread is long enough he will let go his hold on the post and go kiting or parachuting off into space, possibly only a few rods if his kite-tail gets caught, possibly many miles if he is lucky—one of Nature's methods of scattering her children. Absent-mindedly I pick up the white globular head of a ripe dandelion, puff against it and watch its dozens of seeds go floating away, each hanging to its own 'chute. Man is new at this flying game, I muse, but the plants and the animals have been at it for thousands of years.

On this fall day too, I do something that I've wanted to do for a long time. Just across the fence in a grassy backlot, an old garage door—possibly the aftermath of a Halloween prank—has been lying for nearly a year. I crawl through the wires and lift suddenly on its edge. I am not disappointed. Half a dozen black beetles and a small centipede or two go wriggling away from the light, but I am not looking for them. My eyes are fixed upon a mass of brownish-gray fibers—the finely chewed remains of an old gunny sack. It is a mouse's nest, the size and shape of an oriole's, opened at the end, too, and from that open end a head protrudes—the head of a white-footed mouse! Slowly he comes forth inquiringly, nose twitching and eyes bulging—eyes that, except for their shining, look artificial, for all the world like the heads of black-headed pins. Mr. Whitefoot decides to abandon his nest and creeps silently out along one of his many runways. I lower the roof of his domain quickly and hope that I do not smash him. I walk on slowly, thinking about those mice I used to plough-up in the fields, and how the old female would make a frantic dash from her nest often with two or three of her young ones still hanging to her teats and dragging alongside as she ran.

Harbingers of winter

The fall rains have come now and the ground is soft once more. The dominant greens of spring and summer are beginning to fade, and splashes of red and yellow are again the mode. Many birds are now in sight. A tall hedge across the road is thick with robins this morning. Hosts of juncos—those sure precursors of winter—are here, too, their outer white tail feathers flash as they dive in and out of the

hedge. As I pass a big elm, I catch a flash of red at its base, then a scratching as of hasty toenails against rough bark. I glance quickly upward, and sure enough, there he is, a glorious fox squirrel peering down at me with black, questioning eyes. I snap my fingers at him and he at once vanishes behind the trunk in true squirrel fashion as I walk on reluctantly. There are so many things to see this September morning!

So it goes. These are but samples of what I have seen on a morning of each of the year's four seasons, samples of what anyone may see. Not on any one day, perhaps, or on any several days in succession, but Nature has a way of showing herself finally to those who persist in hanging to her apron strings.

Sometimes, indeed, my walk is scarcely more than a kaleidoscopic picture of inanimate nature—clouds and frost and rain and wind—the animals not choosing to show themselves that day. But even these make my mile and a half enjoyable, especially the wind. My father used laughingly to tell me that a hog could see the wind, and although we both accepted this idea for what it was, even today it is not difficult for me to think of the wind as an entity—a tangible, palpable something trying to "blow the man down." "Shingebis the Diver" wrestling with the North Wind is not far below the surface—in spite of my science.

Familiar friends

Sometimes my walk and its incidents are but repetitions of those of yesterday. I often see the same birds and other animals from day to day—come to know them by little peculiarities of color or form or manner, as they doubtless learn to know me. One rabbit, for example, persisted in coming back to his nest in the grass of a parking, even though I always went around that way to see him and, of course, disturbed him each morning. After a time he hardly more than cocked a sleepy eye at me as I passed.

Sometimes, particularly in spring and fall, I spend most of my walk gazing into the sky, watching for migratory birds. But a single flock of mallards driving down wind with the green heads of the drakes glistening in the sun, or the sight of a lone goose honking his solitary way, more than repays me for much stumbling as I tread with eyes in the air.

As a child I once heard an old man make the rather terrible and pathetic remark: "I am ready to die for I have seen everything twice." I know now that that man never learned to look at Nature with an understanding eye. For with her, as Antony said of Cleopatra, "Age cannot wither nor custom stale her infinite variety"—even along the sidewalks.

AFRICA'S LOST TRIBES IN SOUTH AMERICA—*An on-the-spot account of blood-chilling African rites of 200 years ago preserved intact in the jungles of South America by a tribe of runaway slaves*

By MORTON C. KAHN

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AMONG the most interesting groups of primitive people now existing in the Western Hemisphere are the wild Bush Negroes or Djukas of Dutch Guiana in South America. As is now well known, these people are descended from African slaves who successfully revolted against the Dutch Colonial Government beginning some 200 years ago. They fled far back into the jungle and as time went by cast aside almost all of the civilization which they had learned from the white man, reverting spiritually and materially practically entirely to the culture patterns of their West African forebears. In the far interior of this South American colony of the Netherlands one finds a culture which is in many respects more West African than that now encountered in the portion of the Dark Continent whence these negroes originally came as slaves.

Today there are six tribes of Bush Negroes living on the borders of the great rivers which drain down to the sea from the remote Tumac Humac Mountains on the Brazilian frontier. The most inaccessible of these groups and the one which has clung most tenaciously to the customs of its ancestors is the upper Aucaner tribe, inhabiting the banks of the far Tapanahoni River.

Some of the intimate ceremonies and customs of these people differ from those of the other Bush Negro Tribes which I have studied, and have not been heretofore described as far as I am aware.

In the first place it will be noted that these primitive people do not lead the idyllic existence often pictured as usual for jungle inhabitants, but are cursed with manifold fears, superstitions, restrictions and even caste within the group itself. As far as the individual tribes are concerned it may be said that they hold themselves entirely aloof from one another. Even though their tradition is almost identical, they seldom intermingle and practically never intermarry.

Each nation is divided into several clans or "lo's." Among the Aucaners there are twelve of these. However, unusual interest is attached to but four of them. The two most aristocratic clans are the Otter lo and the Missi-Jon lo. The members of the Missi-Jon hold

the other clans in contempt, and it is forbidden that a Missi-Jon member marry outside of the lo. The Otter people may marry whom they please. That is an hereditary privilege of the clan.

It is also customary to choose the Gran-man or king of the entire tribe from among the Otter people. In contrast to these aristocrats there are two pariah lo's who are under the power of the Gran-man and must do his bidding. These are the Pinnasi and the Dju. It is alleged that the curse of the Grangadu, the sacred spirit, rests upon them, and members of these clans are treated with the utmost contempt and charged with the meanest tasks. A Pinnasi negro is treated worse than a dog. This condition seems to be accepted without comment and as one of the many burdens of life.

The Idol of the Grangadu

The sacred idol of the Grangadu or great spirit which figures prominently in the ceremonies that are to follow, has now stood in the village of Dree Tabikki (The Three Islands) for more than 60 years, as far as I could determine. Prior to that time it had been buried for so long that no living Bush Negro could remember when the burial took place, and not a few of these people seem to be quite old. Story has it that this great god signified a desire to have a respite from the turbulent and blood-shedding times of the wars of the rebellion, but it seems more likely that the god was hidden in the early period of these negroes on the Tapanahoni River to keep it from falling into the hands of the hostile Dutch and Indians. After the Aucaners were firmly established in their present territory, no longer fearing their former enemies, it is said that a spirit of unrest came over the youth of the tribe, even going to such an extent that the young men refused to share with their families the game and fish which they had been able to capture in the jungle.

Realizing the seriousness of this deplorable condition, one of the early kings, Gran-man Osensu, called a great krutu or council of his wisest and most powerful advisors. They deliberated matters for many days, and it was finally decided to visit Zandoree, the sacred ground, and to dig up the fetish of the Grangadu which their ancestors had buried there so long ago. It was felt that the presence of this powerful god would

cause the restless young warriors to realize their errors and to mend their ways.

The fetish was duly dug up and ensconced with elaborate ceremony in the village where it has stood ever since as the most sacred symbol of the entire Aucaner tribe. Needless to relate the younger generation promptly turned over a new leaf. The most sacred and unspeakable name of this great god is Asigu. It lives in a little hut especially provided for it, surrounded by sacred implements and vessels of various kinds which are liberally smeared with pembedotee, the sacred white clay. Some of these implements are also decorated with the *papa moni* or cowrie shells which have been known to be possessed of magic properties by nearly all African people from time immemorial.

The fetish of the god is simply a pole of hardwood, some six feet in height and about twelve inches in diameter. At the top is a crudely carved human visage. There is no attempt to reproduce a body, arms, feet or legs, and the entire pole is wrapped around with several layers of cloth and straw.

The Bush Negroes execute the most exquisitely beautiful wood-carvings, but expend no effort whatsoever on thus decorating their idols. During previous expeditions when I inquired about this very striking contrast I was given two answers. One idol-maker told me that he had no idea how the god really looked and was, therefore, unable to reproduce his features accurately. Moreover, that the wooden figure is only a resting place for the spirit of the deity and is not the god itself. Another stated emphatically that if the god was a good spirit he would not care whether or not any special pains were taken to embellish his emblem, while if he were a bad one he would continue to be so, regardless.

Death and burial ceremonies

Among all the Bush Negro Tribes it is believed that no one excepting very old people dies a natural death. Death is due to having been bewitched by some member of the community. Among the Aucaners death may also be caused by having been struck down by the god Asigu because of some offense to him. Before burial of the deceased all of the tribes attempt to discover the person who has been guilty of witchcraft, while the Aucaners also attempt to discover whether the dead person had given any offense to the god. These ceremonies, of the upper Aucaners particularly, differ from those of the other tribes which I have studied.

One afternoon upon entering one of the remote villages I was taken to a hut where a young man lay who had been severely crushed by a falling tree. The

injury was so extensive that nothing could be done. His women folk were gathered about him weeping, as the most casual observer could foretell that death was not far away. Late that night I was awakened by a most frightful din, and I learned that the young man in question had died. The noise was the weeping, wailing, and shrieking of his relatives. Early the next morning the Bush Negroes built a little raft upon which the body was placed after having first been wrapped in bands of cloth. They then carried the corpse before the idol of Asigu. Somewhat later a procession appeared from behind one of the huts, headed by the high priest and his three assistants. This small group was followed by the Asigu lying supine upon a small carrier borne by two husky blacks. Then came the corpse borne upon its bier by two other villagers, who were immediately followed by another known as the "Speaker for the Dead." Many of the people were smeared white with *pemba*, the sacred clay, while not a few had red spots superimposed on the white.

The high priest spoke, addressing the dead. (If the latter is to answer "Yes," then the Speaker nods his head in assent). The high priest began—"Habbe Wissi?" (Have you been bewitched?) "No." "Well, have you done something for which Asigu should strike you down?" "Yes." "Are you sorry for all this?" "Yes." The high priest then spoke—"Asigu, I come to you so that you can enlighten us as to the death of this young man. All of us in this small and humble village beg you to do so."

The villagers, who until now had listened attentively, started to clap their hands and shout "Help us, help us. Thank you, thank you." This monotonous repetition lasted for about fifteen minutes.

The high priest again questioned the idol: "Did this man offend you?" "Yes." "May he be washed and may we mourn for him and play music?" "No." "May he be buried?" "Yes." "We thank you, Asigu, our great God." The high priest then procured some *sopie*, a form of strong sugar-cane rum, washed his hands with it, and said: "I have not judged you, oh dead! Look from wherever you may be and make yourself ready, for at the break of day you shall be carried away." The dead man answered "Yes."

Before daybreak next morning I heard one of the bossies, or village officials, loudly calling: "Come let us start, for the dead one wishes to go away." After considerable delay the corpse was placed in a dug-out canoe, and the cortège which consisted in this case of about 20 people followed in other canoes. My request to accompany this gruesome little expedition was reluctantly granted. Some five miles from the village the crafts drew into shore, and about a half mile from



(Above) THEY CHANGED WORLDS but not customs! Familiar is the fact that migration was sluggish and relatively insignificant until the movement of men and nations was suddenly galvanized by the Age of Colonization. Familiar also is the case of the negro torn from his timeless African homeland to work the earth of newly discovered continents where inevitably he shed his native culture to adopt in varying degrees, the "civilized" ways of his masters. But startling and perhaps unique is the case of these primitive Bush Negroes who burst the bonds of an elsewhere implacable destiny, reverted to cultural type, and defied history by establishing the tribal life of West Africa in the jungles of Dutch Guiana

(Above) SOUTH AMERICAN woods carved to suit an African's fancy. (Below) Crown Prince of the Aucaners, most inaccessible of the slaves who revolted 200 years ago

(Below) AFTER A SLOW AND DIFFICULT journey up the treacherous Guiana rivers, Morton C. Kahn reaches the cultural "lost world" of the Bush Negroes, where we see him with two upper Aucaner tribesmen at lower right. This was Doctor Kahn's seventh trip of exploration to this general region, where he has conducted important medical and anthropological research





(Above) HOLY OF HOLIES of the Bush Negroes: a crudely-wrought idol strangely lacking the gifted artistry of their wood carving. Though their ancestors fled to the jungle for freedom, they ironically committed themselves to a different but no less real slavery in their allegiance to the old African gods



(Above) IN THESE RUDE HUTS, the Aucaner conceals the physical symbols of age-old voodoo cult. The most sacred idols are publicly exhibited only on ceremonial occasions

(Right) THE AGEEDAH or sacred drum used for calling the spirit of the voodoo god

(Left) SIGNAL DRUM used also to produce intricate rhythms for ceremonial dances. Note the curving designs in low relief by which it is often possible to recognize Bush Negro wood carving.

Beneath the foliage (lower right) is a sort of low curtain of palm fronds. Aucaners believe that passing through this barrier cleanses one of evil spirits



the river's edge we came upon a large deep pit. The body was literally dumped into this pit without lamentation and without the beating of tom-toms. Several old skeletons were to be seen about. No one, not even his wives, was allowed to weep, because this youth had been cursed by Asigu. He had deserved death.

Upon returning to the village, his meagre possessions were brought before the high priest, who selected what he wished. The remainder was turned over to his wives and family. If there is more than one wife, each has a right to a share, but all must go into mourning for an entire year before they are eligible to live with a man again.

Death by witchcraft—ceremony

Sometime thereafter a woman died. The customary ceremonies began, and when all was in readiness the cortège moved through the village and stopped in the center of the clearing. The high priest moved toward the corpse which was upon its bier on the heads of two men, and started to question it.

"Woman, did anything happen to you that you went away so quickly from among us?" The speaker for the dead nodded, the answer being "Yes."

All of a sudden the two men with the corpse on their head started to run. With their burden they attempted to enter a certain hut. The people began to scream. The high priest held up his hand for silence, beckoning the carriers to return to their former place, which they did. Then the priest thus addressed the idol of the god.

"You, oh God, who knows everything, tell us what has happened to this woman, and help us to stop her from entering this house." The high priest kneeled down to pray, and the idol of the god was carried around him three times. Then he arose and



speaking very loudly continued: "But, Mr. God (Massa Gadu) and all other spirits, when a dead person acts so strangely, aren't the people who caused her to die, in the hut into which she tried to enter?" The speaker for the dead nodded "Yes." "Well, tell us what we must do now. Must we cut off the hair of this woman and beat the people who have killed her?" "Yes."

The hair was cut off. This is called Kree-usu.

The high priest again spoke: "The great god calls for vengeance for this woman who has been murdered so innocently by black magic. Thus I go and beat the people who are in that hut."

Someone in the crowd then began shouting: "Let us punish this family for that terrible crime. Make yourselves ready!"

The people dispersed to their huts amid much moaning and murmuring, but it was not until some two hours later that they began to reassemble. The men had greased their bodies, and I found they wore heavy iron fighting bracelets. These slip down over the heel of the hand and are dangerous as brass knuckles. With these bracelets they are able to deliver a terrible fore-hand or back-hand blow. The women were possessed of sticks and cudgels.

Meanwhile the unfortunate family had barricaded themselves in their hut, weeping and wailing and imploring mercy. I certainly felt that someone would be killed. One of the oldest men called in a loud voice: "Open the door. We have come. The Great God asks for vengeance, vengeance, vengeance!" Silence from within the hut. The command was again repeated while those inside cried aloud for mercy, but they naturally did not have the courage to open the door. After the third demand still brought negative results, a length of tree used as a battering ram swiftly cracked in the entrance.

Seven or eight husky Aucaners swarmed into the



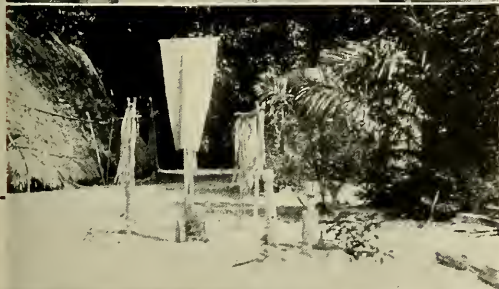
(Above) NIGHT DANCING at the ceremony of Brokko Deh, a time of great merriment and prodigious feasting which, oddly enough, is part of the orthodox Aucaner funeral. Except for the aged, no Aucaner is believed to die a natural death. Witchcraft and divine wrath are the causes



THE DANCE-FEAST to end mourning may last two weeks. When an Aucaner dies, a speaker is appointed for him who tells from which of the two causes he has died. If he says witchcraft, the suspects receive a terrific beating and sometimes are killed

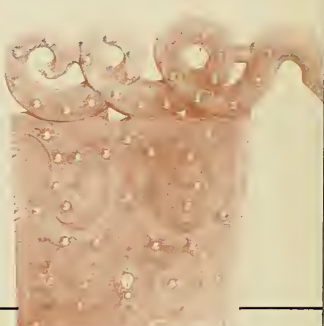


(Left) THE HIGH PRIEST, whose diabolical hair-tufts are appropriate



(Lower left) ANCESTOR SHRINE. To signify the end of mourning, sacred water is scattered here, and later food. The latter ceremonial offering is unceremoniously gobbled up by children

(Right) A ceremonial bench



hut and dragged out the unfortunate inmates still crying and screaming; these were two men and one woman. These poor people were fallen upon and for about five minutes were subjected to a terrific beating. All had bruised eyes and there was considerable blood from cuts and noses. The children of the village added to the din by screaming and crying unbearably.

After a time some began to cry out: "Don't hit him any more." "She might die." "They have had enough," etc. Still others tried to restrain those who were applying the beating. After a while the culprits were released and quickly scrambled back into their hut. It took quite a while for the excitement to subside. Some who had come from other villages embarked in their canoes, participating in boat races and singing war songs as if nothing had happened.

As to the poor people who were beaten they suffered considerable pain, and no one looked after their injuries. They will be considered witches for a while, but this will be forgotten in time. The possibilities for "racketeering" on the part of the high priest in ceremonies of this kind is obvious. Sometimes people have been actually killed.

Such rituals purporting to find the cause of death or the persons guilty of witchcraft have been practiced by the Bush Negroes since the early days of rebellion, more than 200 years ago, and are distinct West African survivals. In many parts of the Dark Continent and also among the Bush Negroes up to relatively recent times, the culprits were almost always put to death; occasionally an entire family was wiped out in this manner.

The ceremony to end mourning

The Brokko Deh or end of the mourning time is celebrated most elaborately and pompously. The ceremony I witnessed lasted about eight days, but the natives told me that if there is a sufficient supply of food it is quite liable not to be completed until two weeks have elapsed.

Before beginning, the best hunters and fishermen were chosen to provide for the occasion, while the women went to the food grounds where they obtained sufficient cassava and upland rice. The fish and game were liberally smoked and huge circular pancakes were prepared from the cassava flour.

The day before the feast began the men of the village embarked in their canoes and paddled up the river in order to obtain firewood. They started on this journey about noon and toward evening returned with vast cargoes of the more combustible types of wood found in the jungle. Several tom-tom players with their drums also accompanied this expedition.

and the entire occasion was one of jocularly and merriment.

Late in the evening I watched the ceremonies begin. The Africanesque Susa and Songai dances were performed to the usual Bush Negro orchestra of drums, rattles, and the resounding boards of hard wood which were beaten with two sticks. I found the rhythm of Bush Negro tympanics most complex. These dances, which began about 10 o'clock, lasted until early morning. Many of the Bush Negroes possessed muzzle-loaders or old percussion-cap shot-guns which were fired all night long as the dances progressed. At such times there is much shouting and screaming, but it impressed me more as a celebration rather than a religious ceremony.

The following morning, amid solemnity and prayer, I saw the sacred water poured at the base of the ancestor shrine which stood near the center of the village. This was a memorial service to the spirits of the dead. A few hours later food was placed at the base of the shrine, but it was quickly grabbed and eaten by the children. Those who had been in mourning were dressed in red, the color which signifies that their mourning is over.

The following evening no dances were held but stories were told recalling the personalities and exploits of the deceased. The Bush Negroes are excellent mimics and on this occasion gave full latitude to their talents in this direction.

On the morning of the third day sugar-cane rum was poured over the floor of the large council house in memory of the departed Gran-mans and Captains. Feasting lasted until the provisions were exhausted. On the last day dancing began about 5 o'clock in the morning. At mid-afternoon, the orchestra went through the village from house to house until it arrived at the home of the high priest. Four turtles and four chickens were then brought into the clearing, and after ceremonial mutterings and incantations the high priest seized a knife, killed the chickens and severely wounded the turtles. The blood from these animals was allowed to drip upon the feet of those who had been in mourning, and on the final evening the wild Papagadu or Voodoo dance was held, which terminated the ceremony of Brokko Deh.

Sweeri

After the idol of the Grangadu Asigu, the thing which causes most fear and reverence in the heart of the Bush Negro is a liquid known as sweeri. This substance must be prepared by the high priest and administered by him in the form of a drink. As far as I could determine it consists of a mixture of various herbs and other substances, suspended and infused in the sopie or sugar-cane rum. Sweeri is sup-

Continued on page 232



(Below) THE BLANK FACE of the Voodoo god tops a bound column of trade-goods calico beneath the sacred palm-thatched "temple"



(Below) A SACRED MOUND of white clay called pembadotee with which the negroes smear themselves and their implements on certain ceremonial occasions



(Above) ASSISTANT "CAMERA MAN" of expedition

(Upper left) A PICTURESQUE METHOD of catching fish: the graceful bow and arrow.

(Photo by Rogalli)

(Left) Less spectacular but often more productive is the wily device of pounding the nekku vine, which yields a toxic juice capable of poisoning all the fish in the river. For all the natural plenty of this new land which fate and his own initiative have given the Bush Negro, this transplanted African's ancestral traditions have saddled him with a dogmatic caste system and a death ritual which brutally mar an otherwise relatively utopian existence

(Left) WOMEN PLANTERS in the tribal farm. Some sugar-cane is grown by the Aucaners, but the strong rum known as "sopie" is procured at the trading post almost 200 miles away. With the latter as solvent a sacred herb drink called "sweeri" is manufactured. This is dispensed by the priests of the topmost clans to all subservient tribesmen for a price. It is regarded as a charm against witchcraft by the "vassals" but not necessarily by the manufacturers, who strive for immunity in other ways

(Below) FETISH with food offerings at base: one of the mute rulers of these "freed" slaves—Abandu, the god of the jungle



RUGGED

BY OLIVE EARLE

← VENUS'S FLY-TRAP (*Dionaea muscipula*)

Myriad species of insects devour plants, but the Venus's Fly-trap is one of the few plants that retaliates, as it does by killing and eating insects. An insect, brushing against the sensitive hairs growing on the surface of the trap, springs the trap and suddenly finds itself imprisoned between the sides of the leaf, which close quickly like a book. The spiny bristles interlock so that any but a significant meal cannot escape. After catching its prey, the Venus's Fly-trap proceeds to digest it by juices secreted by purple glands in the surface of the leaf. At the same time, the leaf bulges with the fly's body, but soon the shapeless mass appears, and in the course of a week the leaf opens again, leaving nothing but the chitinous covering of the insect.

After the exertion the leaf rests, and for many days it can pass over its surface with safety. Two or three leaves seem all that one leaf can undertake, after which it comes stiff, then fades and dies. Rain does not spring the trap; and if an inedible object falls on it, it closes again quickly. The trap is about the size of a thumb-nail and is located at the end of each of the leaves, which grow in rosette form about the flower-stem, which bears small white blossoms. Venus's Fly-trap is found in the bogs of North and South Carolina.

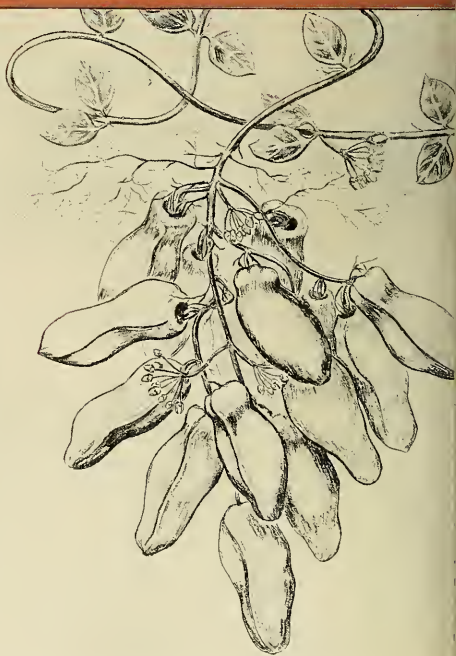


INSECT-EATING PLANT

SELF-POTTING PLANT → (*Dischidia rafflesiana*)

The "Flower-pot Plant," astonishing as it may seem, has forsaken the earth and shaped its leaves into "flower-pots" for its own roots. The small, somewhat fleshy leaves grow in pairs at wide intervals along the branches, and some at the end have developed into these pitcher-like appendages, which are two to five inches in length, greenish in color and purplish inside. The "flower-pots" act as reservoirs to nourish and protect tender young roots, not only with water but often with a deposit of soil said to be brought there by ants, which frequent the interiors for shelter or nest building. As the flower-pots disintegrate, turning yellow, the well-fed roots attach themselves by fibrous filaments to the tree, to assist the other supporting roots growing in haphazard fashion from the stems.

The plant which has developed this fantastic method of carrying on its life without connection with the soil lives in the aerial realm of the Malaysian forests. Other members of this family have developed other means of providing soil for their roots. Some, with disc-shaped leaves, turn the leaf's concave side to the supporting tree and press against the bark. The upper part of the leaf projects, and in the pocket thus formed bits of dead bark, leaves, and dust collect to form a soil into which the plants thrust their roots.



FLOWER-POT PLANT

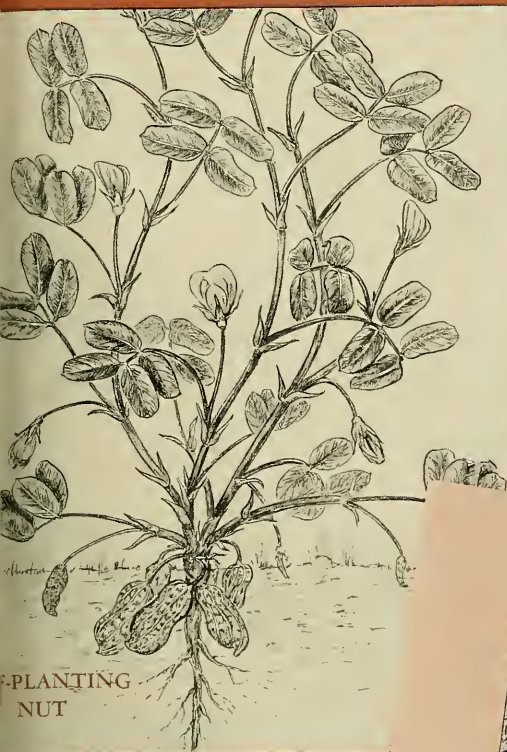
INDIVIDUALISTS

of the Plant World

← PEANUT

(*Arachis hypogaea*)

The well-known peanut breaks the usual rule among nut-bearing plants by producing its fruit underground. As the flower fades after fertilization, its recurving stalk bends toward the earth, and with two or three inches added growth, the seed pods are pushed into the soil. Being an annual, it lives only a single season, and has presumably developed this method as a safety measure to ensure reproduction. Generations of protection under cultivation have not altered this peculiar habit. Once in the earth the fruit develops into the familiar nut whose use ranges from circuses to salads. Upon removal from the ground, the plants with the nuts attached are stacked around a six-foot pole, with the nuts in the center protected by the leaves while curing. The hay from the plant is clover-like and is used as forage; residue from nuts and shells is valuable in animal feed. Thought to have originated in Brazil, where species of it are indigenous, cultivation of the peanut in the Old World began soon after the discovery of South America, but reached no magnitude in the United States until the middle of the last century. A warm climate, free from late spring or early autumn frosts, is needed. The branching plant grows to a height of two feet, with thick, hairy stems and yellow flowers. It belongs to the same family as the bean and the pea, as the name suggests.



PLANTING
NUT

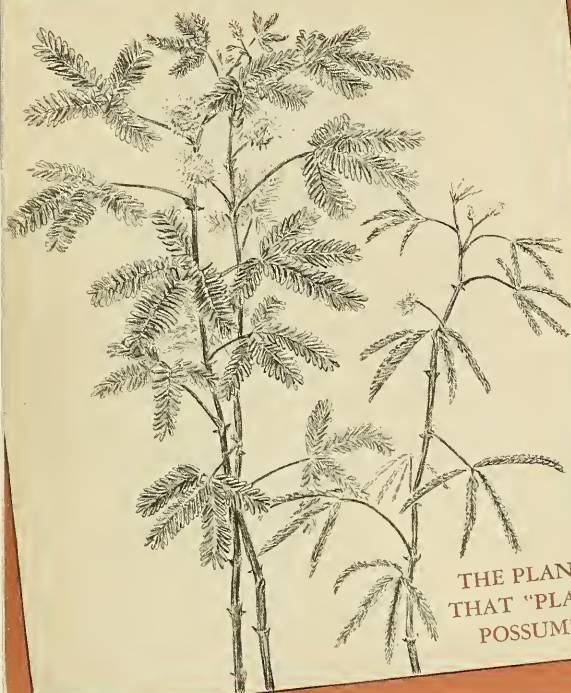
THE CHOCOLATE TREE →

(*Theobroma cacao*)

People in the temperate zone are often astonished at the chocolate tree's peculiar type of growth. The flowers, which produce the edible portion, grow directly from the trunk and even sprout occasionally from the surface at some distance from the tree proper. Blooming in small reddish-pink clusters, several thousand will appear on a tree, but generally only twenty or so develop into pods. The pods are from six to eight inches long with thick, ribbed and warty rinds. In a soft pink pulp which is sweetish but without food value, each pod contains five to ten seeds or nibs, which, after treatment, become the chocolate or cocoa of commerce. As a drink, chocolate was in general use in ancient Central America, and bales of cocoa nibs were used as money by the Mayans. "Food for the gods" is the interpretation of the native name *Theobroma* still used in the scientific name. Montezuma is said to have regaled Cortez with the drink, and its cultivation spread through Spanish travelers to South America and the West Indies. Now many varieties are grown in places where the climate is warm and humid enough. The tree originally grew in forests, shielded from sun and wind, and plantations are usually set in sheltered valleys with the added protection of tall wide-spreading trees. The tree reaches a height of about 20 feet in cultivation, but in a wild state considerably taller.



FRUIT-PRODUCING
TRUNK



THE PLANT
THAT "PLAYS
POSSUM"

← THE SENSITIVE PLANT

(*Mimosa pudica*)

This oddity of the plant kingdom makes its presence known spectacularly to the foot traveler in Brazil by presenting to his backward gaze a trail of wilted green. There on the hot plains, the sensitive mimosa grows wild over wide areas, and the touch of a passing body effects a really startling change. Contact with a single leaflet at the tip of the stalk causes its twin brother opposite also to close up. Their neighbor leaflets feel the movement and likewise draw together. Pair by pair the movement continues right down, until the leaf stalk itself, as though wearied by the activity, feels impelled to droop. Thus in a short time the whole plant appears to languish. In a congenial climate the strange shrub soon recovers.

The same effect is produced if the main stem of the plant is shaken, but the plant apparently adjusts itself to the normal shaking due to the wind.

Many experiments with electricity, chemicals and heat have been tried on the plant in order to see its reactions. Too frequent artificial stimulation makes for less sensitivity, and over-exertion can apparently cause the death of the subject.

At night the sensitive mimosa, like many other plants, including some in colder climates, folds its leaves in sleep; then the leaves become stiff and would rather break off than be forced to assume their daylight position. With the rising of the sun the plant awakens. This shrubby tropical herb is often cultivated in hot houses.

PINEAPPLE →

(*Ananas sativus*)

Considering what a very common fruit the pineapple is throughout the civilized world, it is surprising how many persons have no idea how it grows. Many suppose that it grows in a palm tree like coconuts. Actually it grows close to the ground on a short stalk, and each plant, two to four feet high, produces only one pineapple in the course of its life.

The peculiarity of this plant is that the fruit is not one fruit but many, fused into one. Other plants have united fruits, but in the pineapple the fruits become so firmly joined that they cannot be pulled apart. The diamond-shaped pattern on the outside of the pineapple shows the number of small fruits that were combined to make the large one. The shriveled point sometimes found in the center of each diamond is all that remains of the flower. In some wild varieties each fruitlet remains separate and bears seeds. Under cultivation the seeds do not develop. New plants are sometimes grown by cutting and setting out the crown of leaves, but more often the suckers, which are little shoots sprouting near the base of the stalk, are planted. The finest pineapples are grown under shelters, which act as a sunshade by day and as a blanket at night. Three hundred years ago the pineapple was considered such a rarity that it was presented as a gift to King Charles II of England by returning travelers. South America is its original home, but it is now grown in all tropical countries and has been so improved that a large pineapple may weigh as much as 20 pounds.

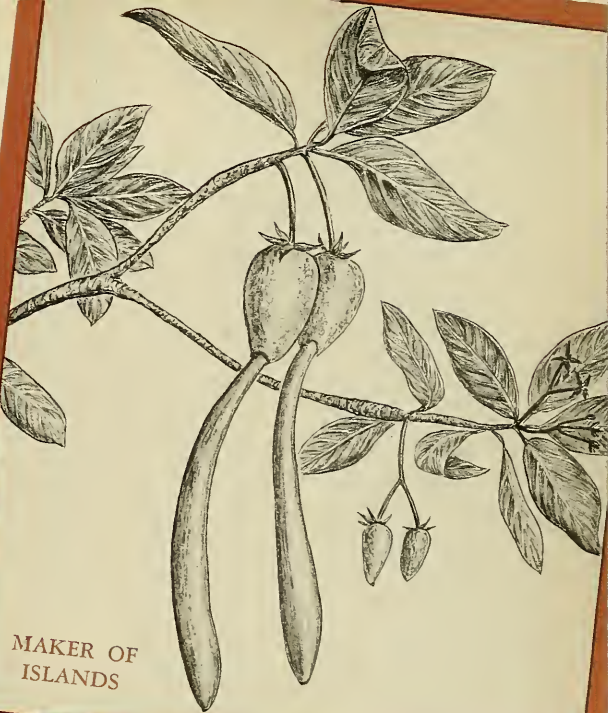


UNITED
FRUIT

MANGROVE →

(*Rhizophora mangle*)

This extraordinary tree, as though in great haste to reproduce itself, has the unique ability to cause its seeds to germinate and send out roots while they are still on the tree. The illustration shows two of the aerial club-like roots descending from the pear-shaped fruits on the growing tree. When about a foot long, the fruit drops into the water, where, if it reaches bottom, it proceeds to grow, and soon another mangrove is added to the thicket. Aerial prop-roots sent down from the lower branches and stem provide extra anchorage, and the grove finally becomes an impenetrable tangle. Because of this habit, the mangrove is a spectacular land builder and is responsible for the formation of the Florida Keys. The mangrove "club" may dive through eighteen inches of water, but it sometimes fails to reach a foothold, and then the tide carries it away in an upright position. When it reaches a spot where the tip touches bottom, it becomes stranded and the lower end of the club at once sends down roots which anchor it. A new stem rises rapidly and reinforces itself with descending roots. Around these roots silt gathers, and a new island has been born. Other mangrove fruits fall round about with their roots already well started; the islet grows rapidly, and it is not long before another generation of trees is adding its quota to the new land. The mangrove is found in all tropical and semi-tropical countries, along the shore-line and in salt marshes at the mouths of rivers. The flowers are yellowish, the leaves evergreen.



← HURRICANE PLANT

(*Monstera deliciosa*)

This strange plant is one of the easiest to know, by reason of the many holes in its leaves, which sometimes save it from destruction in high gales by allowing the winds to pass through without tearing the leaves to shreds. The actual survival value of this peculiarity, however, is difficult to evaluate, for the plants also grow in deep forests where not the slightest breeze stirs. The tough green leaves are truly monstrous, sometimes measuring almost a yard in length and nearly as broad.

The hurricane plant bears delicious fruit (as the latter half of the scientific name implies), but each fruit only ripens little by little, so that the eating of it is necessarily prolonged over a period of several days. The fruit resembles a long, green pine cone about a foot in length, which turns yellowish as it ripens, inch by inch.

The hurricane plant needs a warm climate and flourishes in many tropical countries. Sometimes it is grown as a vine in greenhouses in the United States. It is a most adaptable plant, and will take on the habits of a vine if given a tree to climb, in this event sending out roots with which to clasp the tree. It also uses aerial roots to absorb moisture and gases from the air. If there is no support for it to climb, the *Monstera* is content to remain a spreading, bush-like plant. In this form it bears flowers somewhat more readily than when climbing. The flower is similar in structure to the arum lily.

THE SPIDER AND THE "FLY"



*The 30-million-year-old "trap,"
shown actual size*

By F. H. POUGH

*Assistant Curator, Geology and Mineralogy,
American Museum of Natural History*

HERE is a 30-million-year-old fly-trap which caught the killer as well as its possible victim in its sticky surface—a piece of amber in which are to be seen the preserved forms of a primitive spider of the family *Oonopida*, a family whose present distribution is largely tropical, and a winged bark louse of the family *Psocidae*.

Amber is the petrified sap of a tree, sap like that which we may see forming today on spruce trees, which has been buried with the fossilized forests and which is recovered today for use as a semi-precious gem. The drops of those days were sticky like today's spruce gum, and insects were caught in it then, even as they are today. A later wave of the sap covered over the trapped victims and left them embedded in what was to become this piece of amber after many millions of years of burial.

The insects, like those shown in this remarkable picture, serve as an additional clue to the prehistoric climates and kinds of life of the Oligocene period. The fact that members of the family of the primitive spider shown here are native to tropical countries suggests that the climate along the Baltic Sea was much milder in the Oligocene than it is today. Amber is found in many places, though the largest and most publicized occurrence is that in East Prussia. Recently some specimens have been found in Canada and a number of insects have been identified and described in some of this material. Amber comes also from Sicily and Rumania, though not in large quantities like that of Germany. Some has even been described from Staten Island, near New York City, though very little has come from there.

The insects which are found preserved in amber are our best fossil insects. Much of what we know of their evolution has been learned from a study of such bits of amber as this one, and some of the most valued pieces of amber jewelry are those in which a perfectly preserved insect is well shown. Actually, most of the substance of the animal itself has been reduced to dust, and these solid-looking bodies are practically empty shells, but they retain the form of the insect down to the last detail and even show the original colors and iridescence.

Amber is but one of several related substances used in jewelry. Copal and Kauri gum are similarly used, and often insects are artificially inclosed in these resins, which incidentally lend themselves more readily to falsification than does true amber. Kauri gum is also a natural resin, but it may be quite modern or have been recovered from the floors of ancient forests whose age can be reckoned in historical, not geological intervals. Copal is another somewhat older resinous substance, which has not been preserved and petrified to the extent that true amber has. Bakelite, an artificial substance, is another material which is used as an imitation of amber. Made from formaldehyde, the unpleasant smell emitted when burned by a hot needle quickly reveals its falsity.

The photograph at right is an enlargement of the small piece of amber shown actual size under the title of this page, in which the two specks in the center are the spider and the Psocid. It was made on, and enlarged from a Leica negative by Anton Baumann, of E. Leitz, Inc., in the Department of Geology and Mineralogy laboratories, from a piece of amber belonging to the writer.

(Right) ENLARGED 40 times actual size, this photograph shows in remarkable detail the two insects imprisoned 30 million years ago



IN THE LIFE OF

Drama unfolds in the community when property rights are infringed, revealing marvelous laws which resemble those of human society, and powers of recognition beyond our own

By N. TINBERGEN

I WISH I could show you the glorious scene of Dutch North Sea sand dunes in early spring. You certainly would have to use your legs, it is true, for it requires an hour's bicycle tour and a subsequent hour's walk through the sand, but I am sure you would enjoy it.

The bicycle ride takes us through the meadows and through the awaking bulb-fields. High in the pale blue sky the larks are singing, and brilliantly black-and-white lapwings are hurrying northward.

In the sand dunes the scenery is quite different.



EACH SPRING the skies over Holland's North Sea sand dunes (right) echo with the eerie voices of the herring gulls, as they swirl in cloud-masses, their white breeding plumage gleaming in the sun. Returning from winter quarters along much of northern Europe's coastline, the birds find their mates, glide down to earth on broad wings as above, and prepare summer nests for the hatching of a new generation.

Into these lonely yellow sands came author Tinbergen. His equipment: a small cubical tent, high-powered binoculars, a net, colored bird bands, and an ornithologist's boundless patience. His purpose: to observe the amazingly intricate social life of this flourishing summer colony. His discoveries: that herring gulls have a "language," that they clearly surpass humans in length of vision and probably in their matrimonial fidelity—but that they don't know their own eggs when they see them!

The home life of the herring gull can also be observed along our North Atlantic Coast, where the bird is abundant



HERRING GULL

Pale yellow sandhills, dark valleys covered with birchwoods, irregular hummocks with yellowish green marram grass, and gentle slopes covered with "dune thorn" shrubbery. This is the home, and has been for centuries, of our herring gulls. When we watch the locality on this first warm day in March, we see the arrival of the gulls. In winter they live scattered along the coast, from Heligoland and the Danish-German coast down to northern France. Now they have gathered near the breeding places, have changed their plumage into the brilliantly white breeding dress.

When the tide is rising and they have finished their feeding on the beach, they rise into the air, forming an irregular chaotic flock. Soaring and calling they slowly climb higher and higher while traveling inland, and like a cloud-mass of whirling flakes they arrive above the colony-haunt. Their calls carry miles and miles over the desolate sand hills.



They circle and circle, and we expect them to come down, but they stay high up in the air, and that is all we see of them on this day. After some hours, they leave again and collect on the sea shore.

Returning some days later, we may watch them alight in the dunes before us. An enormous change occurs within the seemingly chaotic cloud; the individual birds scatter all over the colony, and before we realize it they have neatly arranged in pairs, each pair occupying a little dune or hummock. Chaos has changed into organization!

If we spend an hour or so in closely watching the individual pairs, the complexity of this organization becomes more and more obvious. Some pairs fight against other gulls, and it soon appears that the fights are strictly localized; the birds resent the presence of other birds near their resting place only. True border clashes result. They seem to know each other very well, for they never attack their own mates, even in the most entangled scimmages. Sometimes they join the flock, indulging in a wild social flight high in the air; after which, descending again, they alight on the very same spots they occupied before. How do they find their way? How do they recognize each other? How do they communicate without having any "speech"? What is the meaning of their calls, their movements, their fighting? In other words: how is this community organized?

It takes some time and some trouble to answer these questions, but we don't need very elaborate equipment for our study. A small, cubical tent a yard or so on a side is our most important accessory. It is drably colored and has peep-holes in different sides. Good field glasses are valuable, and we will have to use a net or trap to catch some birds for banding; for, as we will see later, our ability to recognize individuals by their natural peculiarities of posture, face expression and the like is much too poor. The gulls recognize individuals at a glance without using our aluminum and colored bands; we humans don't have such splendid powers of discrimination.

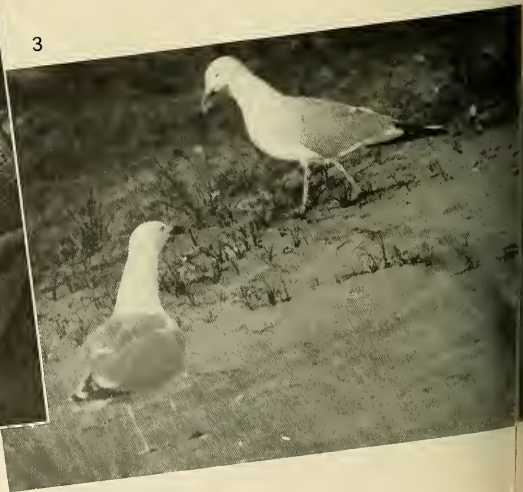
Although I happened to do my watching in Holland, the same can be done in the United States, since the herring gull is abundant on the Atlantic Coast. We do best to start our study by patient watching, keeping two or three pairs under observation and neglecting all other birds. Each pair stands on its post. The birds are dull, and spend their time in preening and sleeping. An instantaneous change, however, occurs in all birds when a strange gull alights in the neighborhood. One bird of each pair stretches its neck, at the same time pointing the head downward, and in this threatening attitude walks to the intruder. The change in the expression of such a threatening bird, brought about by a mere change in posture, is amazing. The intruder seems to think the same way, and takes wing at once. This is first-hand proof of the value of this movement as a kind of "language": the birds "understand" what



1



2



3

APPARENTLY CHAOTIC in flight, the herring gull colony develops the most orderly organization the instant the birds strike ground. Individuals at once pair off with their mates (Figure 1) and seem to know exactly where their particular home is although they have not seen it for a whole winter

ARMED WITH A NET, author Tinbergen caught many of the birds and banded their ankles with distinctively colored "bracelets" as shown in Figure 2. He then watched the behavior of these marked individuals in their group activities. Bands do not bother the gulls and enable field-men to identify the birds from day to day and from season to season

"GET OFF MY LAND." In Figure 3 the belligerent posture of the gull at right is clearly understood by the intruder (left), who took wing shortly after the photo was snapped. Had he stood his ground a fierce scuffle would have ensued. Every herring gull is extremely touchy about its property rights. It will not tolerate even momentary trespassing on its 100 to 300 square-yard domain and will sometimes go so far as to shoo strangers off a neighbor's ground

GESTURES COMBINED WITH CRIES comprises a serviceable herring gull language. In Figure 4 the female is announcing that it's her turn to brood the eggs. And she *means* it. The male accedes, as shown in Figure 5, allows the female (right) to take her place on the nest

A HOME-LOVING MALE GULL (left, Figure 6) stolidly broods his eggs while a foot-loose female struts her courtship "gestures" without avail. Herring gulls are more strictly monogamous than man. Each spring they reunite and fly unerringly to their summer homes, but they probably take their winter vacations separately

WINGED OTHELLO. In Figure 7 the black back of the bird at left marks him as a different species, but his love-making gestures so closely resemble standard herring gull tactics that he can often plight a successful troth. (Lesser black-backed gull)



5



7





(Upper left) AS SOON AS THE HATCHING BEGINS, the parent birds tend to be less tolerant of their human observers



(Above right) THE BIGGER THE BETTER. Herring gulls have very keen eyesight and can distinguish their mates among what appears to humans as merely a distant flock of gulls. But, paradoxically, they have almost no ability to recognize their own eggs. Author Tinbergen substituted a wooden "ostrich" egg, eight times the normal-size egg (right) to find that some individuals actually preferred it! Their efforts to squat on the oversized "decoy" were ludicrous in the extreme. The gull relies almost wholly on his uncanny knowledge of the nest's exact location. Remove the eggs a short distance away and he will persist in brooding the empty nest



THE HERRING GULL IS BORN with an "elementary education." The frightened chick above has understood the danger-cry of its parent and run to the nearest cover, crouching breathlessly. Feeding (left) is also an unlearned process. Parents carry food in their bill, the end of which has a distinct red spot. This serves but one functional purpose—to lead the chick to food. When he grows hungry he signals by pecking at this spot. Offer him a stuffed bird with the red spot shifted from tip to base of bill and he will promptly peck at the base

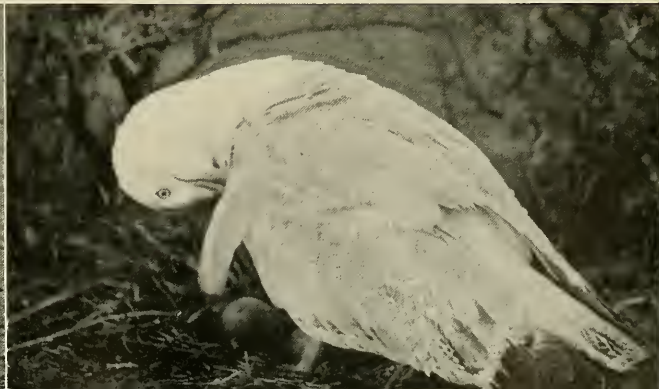
(Right) CHICK PECKING AT RED SPOT to acquire food. Parent birds will feed anybody's offspring up to a certain age, then makes sharp distinctions. But chicks soon learn to distinguish their own parents and unless very hungry won't try to take anything from strangers. This is just as well, because once the chick passes the age limit, strangers are apt to kill it



YOUNG HERRING GULLS (left) grow up to respect the property rights traditional among these birds, and every youngster knows his place. They never wander from certain fixed stations, where they are happy enough with such pastimes as preening their budding plumage, playing and sleeping

(Below left) YOUTHFUL "WHITE WING" at the water's edge. The herring gull preys on the dead and dying animal life washed up by the surf, a task which makes him a useful fellow to have around beaches. The young gull shown has never been taught how to do its foraging; the method is completely inborn

(Below) A PREENING BOUT during incubation. Potentially, hatchlings may live to be wise old birds of 20 years (oldest on record) or more. And though the life expectancy of herring gulls is generally much shorter, bird-banders may have reasonable hope of following the activities of one individual through several years. Colonial birds make excellent long-term study material for amateur ornithologists, who should find this gull particularly rewarding since it usually returns to its birthplace year after year



their colleagues' movements mean! Now it occurs often that an intruder, though he may be scared, does not flee, and then, after prolonged mutual threatening, a fight may result. One bird gets hold of the other, takes its bill, wing, tail or neck in its own bill, and, having a good hold, pulls or shakes it furiously. Feathers may fly, wings may flap, and the struggle may continue for many minutes.

These fights occur only at the borders of the territories of the individual pairs. Watching the same birds day after day we will actually see that every bird only fights in defense of the territory, a piece of ground some 100 to 300 square yards around the post.

Often it is only one bird, usually the male, that does the fighting, while the partner walks around excitedly. Which is the male, which the female? In every pair the male is markedly stronger and bigger. Even a human observer can see this. But further than that we cannot go. It is impossible for us, in most cases, to identify a bird outside its territory. Yet the gulls do so without difficulty. A flying bird, upon returning, alights beside its mate among a flock of other gulls without showing any hesitation. How does it know? Sometimes the voice is the clue. We know this by observations like the following:

A gull is incubating before us, and, not at all concerned about our tent, falls asleep. As long as he takes his nap, "traffic" in the colony goes on, numerous birds flying to and fro, some of them calling. Our bird remains asleep. Suddenly, promptly after the call of another flying bird, he wakes up and calls, and looks at the flying gull; the latter alights, and it appears to be the mate of the sitting bird. Nature made this fine experiment for us.

In other cases, however, we are sure that the partner was recognized in flight without having given any sound. Recognizing a gull in flight at a distant of 30 yards is beyond our abilities, but not beyond those of a herring gull!

When we watch the same part of the colony next year, we find that the same territories and the same posts are occupied again. But is it done by the same birds? Again we don't recognize them! Therefore, we have to band our birds. Catching a gull on its nest seems an easy thing, but it may take hours or even days before we get him. He gets a combination of colored bands and is released. The bands rattle as he flies off. Fortunately, he is not scared too much, and does not desert his eggs. Now the mate must be caught. We wait till she relieves the banded bird in incubation, and our net traps her, too. In this way we mark several pairs. Next year, great surprise! We find the territories occupied,

and, we recognize our banded birds! Such moments of pure joy about a discovery are the highlights of biological research.

Some of these banded pairs returned year after year, and two of our seven pairs did so during four consecutive years. Sometimes, a banded bird moves to another part of the colony, but presumably this occurs only when its mate has died.

These bands may be useful in answering our other questions at the same time. Where do our gulls come from? Where were they born? We have eight colonies at different places on our coast. Are they populated by Dutch-born gulls, and does a bird born in one colony settle to breed in another colony or does it return to its own colony after the four years that elapse before it reaches maturity? Fortunately, many young were banded on former occasions by other field naturalists, and sometimes we caught a bird on its nest that bore a band which betrayed its birthplace. We started a regular hunt for banded birds. Every banded gull was watched, its nest located, and the bird caught when possible. Thus we caught eleven gulls in our colony at Wassenaar, ten of which appeared to be Wassenaar-born. Another colony on the famous bird island of Texel, about 65 miles from Wassenaar, yielded us fifteen banded birds, fourteen of which were Texel-born. This proved that herring gulls as a rule return to the colony where they were born, select a territory and keep that territory during the rest of their lives. The life of a herring gull, by the way, may be very long: the oldest bird known is over 20 years old! Most of them, however, do not live longer than a few years and the greater number do not even reach maturity.

The mates of a pair remain together. Probably they separate in winter, but next spring they find and recognize each other somewhere on the sea shore, before they return to the breeding haunt! We have still more evidence of the remarkable power of discrimination of these birds. A gull not only knows its mate, but also its neighbors. This appears in observations like this one: we once observed a pair that not only chased strangers from their own territory but also from their neighbors territory. Only the neighbors themselves were allowed to stay. Whatever the neighbors did, however they behaved, they were always recognized and never attacked as long as they did not intrude on the first pair's territory.

When the season advances, nests are built and eggs are laid. Everywhere in the colony nests with eggs can be found. The eggs are very variable, and sometimes we find a very abnormally colored clutch. Next time we want to show it to some friends, and

then we may have some trouble in finding it again—to their amusement. Yet the gull never has any trouble in finding and recognizing his nest.

How does he know his own eggs? We will have to arrange some experiments. Our hide is pitched at a distance of some 30 feet from a nest. Before hiding, we remove the eggs and put them a foot from the nest. In the nest itself we put the eggs of a neighbor. The returning bird walks to the nest, settles on the neighbor's eggs and disregards its own clutch. We change conditions, leaving the bird's own clutch outside and removing the strange eggs. Now the bird returns and incubates in the empty nest! Next we destroy the nest. Two artificial nests are made, close to the original nest. In nest A we put the bird's own eggs, in nest B the abnormally colored eggs we found before. The gull returns, tries to sit down on the original nest spot, but hesitates, then steps to nest A, hesitates again, looks to nest B, steps into it and settles down. Suddenly it sees A, rises, walks over to A and sits down. In this way the bird goes to and fro several times, apparently equally stimulated by both clutches.

We extended these experiments and they showed that the color of the eggs did not make any difference at all. Blue and yellow eggs were brooded as greedily as normal eggs. Red eggs, however, though sometimes accepted, were often refused. Sometimes a gull first gave the red eggs some vigorous pecks, and then could not resist their form and brooded them. We also offered large, wooden eggs that had a volume of eight times a normal egg. Some individuals seemed to prefer these "ostrich eggs" to eggs of normal size! They tried to sit on them, but fell down, forward, backward or sideward, again and again! It was difficult for us not to burst into laughter at that sight. The gull apparently was so busy with this highly attractive egg, that it did not notice our desperate struggle for self-control.

After these experiments we knew that a herring gull certainly does not recognize its own eggs but that it knows exactly where to look for them.

The hatching of the eggs brings a marked change over the colony's daily life. Everywhere the little downy chicks appear, and soon after birth they desire food. The old birds have taken care of this by swallowing great quantities of food on their last foraging trip. Strangely enough, the little chicks, which don't know—*cannot* know—anything about this world, do exactly the right thing to get food. They "know" what to do just as a new born baby "knows" how to drink. The chicks walk to the parents, making faint, high sounds, and pick at the red spot of the parent's bill. If you take such a chick away and offer it a stuffed herring gull's head with

the red spot on the base of the bill instead of at the end, the chick pecks at the base.

The real parent bird regurgitates food and takes tiny little parts of it in its bill. In this way the chick gets the food.

The chick "knows" still more. At the sound of the adult's danger-cry it crouches and keeps quiet. We have our difficulties in locating it.

From now on, family-life becomes more complicated. The old birds learn to recognize their own young. In the beginning we could change their young for their neighbors' young; they would feed and brood these strangers equally well. Repeat the same thing after a few days and they will refuse to feed every stranger, though these young may beg and harass them for food. Mostly they even kill strange young outright.

The young, on their part, are learning a great deal, too. They learn to know their territory, and each chick has its fixed hiding place, where it instantly goes when the old birds' danger calls give warning. Also, they have their "shadow rooms," special places where they hide from the sun during noon.

After some days, they know their own parents and do not beg food of strangers that happen to visit the territory. When they are very hungry, however, they may do so occasionally.

I should certainly like to tell you much more about the ways of the herring gulls, but space does not allow this. However, the story so far given will be sufficient to show the numerous relations that exist within this bird city, some based upon remarkable innate capacities to react to other individuals, others evolving from highly complicated learning processes. The birds have connections with territories, with their feeding grounds and nests, with mate, young and neighbor, and certainly with other individuals as well. In numerous ways they influence each other's behavior: they threaten by posture and voice, they alarm each other in case of danger, they even have a red spot on their bills, the only function of which is to guide the feeding behavior of the new born chick.

The herring gull is not the only bird that lives in such a complicated social relationship, nor is social organization confined to colonial birds. Every bird that associates with another bird, mate or young, is connected with its companion by numerous intricate relations. The study of these relations is only at its beginning. Yet it has already revealed striking similarities between human and bird communities, and we may certainly hope that a better understanding of the ways of birds will bring us a better understanding of human nature.



"ONE AFTERNOON
I AMUSED MYSELF
BY WATCHING
A BARRED OWL"

(from *"The Works of Thoreau"*)

"F" FOR THE FROG

(from *"The Alphabet of Birds, Bugs
and Beasts"*)



Seeing Nature
through
THE CAMERA'S EYE

By HENRY B. KANE

END MEN OF SPRING





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Is there in your heart a feeling of love and respect which cries out for adequate expression?

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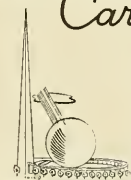
Here is a living tribute to hallowed memories which serves for all time to lift the hearts and elevate the spirits of the community. In the majestic beauty of their music is comfort for the aged, hope for the afflicted, inspiration for all. To the donor they bring the enduring satisfaction of having fulfilled, in a particularly fitting manner, one of life's most sacred obligations.

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AFRICA'S LOST TRIBES IN SOUTH AMERICA

Continued from page 214

posed to protect one from being bewitched and also from the vast number of evil spirits which play such a prominent rôle in the economy of the Aukaner and other tribes. The fear of the substance as well as the beliefs which surround it are such that even a number of persons from the Saramacca tribe on the upper Suriname River leave their homes in order to visit the high priest of the upper Aukaners on the Tapanahoni River for the purpose of obtaining this substance. Such a journey involves days of arduous travel.

A person who drinks the sweeri cannot be bewitched by another, moreover anyone who attempts to cast a spell over one so protected is liable to die. If a protected one dies by accident then he is supposed to be a wissiman (witchman). Interestingly enough, the two aristocratic clans, the Otter and the Missi-Jon, are the ones from which the high priests as well as the kings are chosen, and the sweeri is the property of these clans. It appears

that they do not have to drink it in order to receive protection, which they seek in diverse other manners.

The ancestors of the Missi-Jon and Otter were the first to settle on the upper Tapanahoni River, and for this reason they consider themselves the aristocrats, much as do some of the descendants of the Mayflower Pilgrims or the early Dutch settlers in this country.

Human nature of more sophisticated communities certainly seems to have many counterparts among primitive people. However, it must be realized that while these wild Bush Negroes are possessed of adequate housing and usually an abundant food supply, including miles of jungle and rivers which contain much game and fish, their life is made highly complicated and in many instances actually miserable by the vast number of spirit enemies which lurk in their midst.

It gives me great pleasure to acknowledge the help of my two comrades, Mr. M. A. Melchert and Mr. E. W. Rogalli, both of Paramaribo, Dutch Guiana, who were most cooperative in aiding me to collect and interpret the data contained in this article.

DO NOT MISS

LIZARDS have long been popularly supposed to be among Nature's most inveterate sun bathers, but recent investigations by C. M. Bogert have demonstrated that the ability of some species to survive desert sunlight is limited to only a few minutes. In a coming issue of *NATURAL HISTORY* Mr. Bogert will tell how reptiles regulate their temperature by changing color, and how they have survived in great diversity despite climatic conditions differing adversely from their original environment of 175 million years ago.

KERRY WOOD rose to the front rank of Canadian nature writers as the author of a distinguished narrative *The Geese** which won him an international reputation. Following his absence of more than a year from these pages, *NATURAL HISTORY* is again gratified to present his latest work **BEHIND THE DAM**. This story of a colony of Canadian beaver is told with Mr. Wood's unsurpassed talent for conveying a poignant feeling of the drama of wild-life in its pure state. The author's powers of observation are much too keen, his schooling as a naturalist too thorough, to allow any tawdry "humanization" of his characters. These are real beaver. They pit tooth and claw and their remarkable engineering skill against the manifold dangers which Nature, in all her vast indifference, sets in their path. And in the progress of the tale they become quietly and unconsciously, the symbol of their kind.

R. T. Bird of the museum's Dinosaur Hunters, scarcely dreamed what lay ahead of him when a clue that was little more than a hunch led him into an out-of-the-way section of Texas—evidence of the most gigantic four-legged beast known in Nature. His story, **THUNDER IN HIS FOOTSTEPS** will convey dramatically the romance of modern scientific exploration.

**NATURAL HISTORY*—November, 1937.

Do you know a flat-foot from a toe-walker? Soon in *NATURAL HISTORY* you will see a fascinating key to the identification of **ANIMAL TRACKS**, in which the naturalist Ellsworth Jaeger shows the endless pleasure to be derived from the hobby of deciphering the movements and moods of animals unseen.

Conquering legions have marched under the sign of the eagle and popular myths have credited this bird with such fearful depredations as the robbing of human cradles. You will soon read in *NATURAL HISTORY* the biography of a true eagle—a simple, useful bird, touchingly devoted to the human friends who reared him. His name, traditionally, is **CAESAR**, but it might well have been Ferdinand.

Readers of *NATURAL HISTORY* have already made the acquaintance of a number of extraordinary household pets which Professor Roy L. Abbott has made of some of the smaller animals of the North American wild. His remarkable knack for penetrating the intimate personalities of half-tamed creatures is again demonstrated in the biography of courageous **OLD ZIP COON**, perhaps the most bizarre pet ever to have the run of the Abbott house. The adventures of this likable raccoon will be published in a future issue.

In **A PICTORIAL HISTORY OF A BITTERN'S NEST**, A. Dawes DuBois describes the trials of a "candid camera man" intent on recording the family life of this fascinating member of the heron family. The mother bittern was so camera shy that she actually "growled" at his approach—warning enough from any bird—and when he persisted, forced him to pay for the pictures with his own blood! But Mr. DuBois feels the pictures were worth it and upon their near-future appearance in *NATURAL HISTORY*, we believe that readers will enthusiastically agree.

INFORMATION TEST

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

Score 5 points for each correct answer. Correct answers on page 245

- | | |
|---|---|
| 1. The peanut is curious because
(a) It reproduces by spores
(b) It plants its own seeds by pushing them into the ground
(c) Its nuts all fall on the same day | 11. The red spot at the end of the herring gull's bill
(a) Has no known function
(b) Serves to lead the chick to food
(c) Warns the lesser black-backed gull it is confronted by its mortal enemy |
| 2. "The skunk of the cave world" is an epithet properly applied to
(a) The slimy salamander
(b) The daddy-long-legs
(c) A certain species of blind cave crayfish | 12. The name Vanderbilt, by its literal translation alone, conveys the sense of "blue blood."
True..... False..... |
| 3. The woodpecker never moves down a tree-trunk head foremost.
True..... False..... | 13. Bats can sometimes be knocked unconscious by the mere report of a shotgun.
True..... False..... |
| 4. Herring gulls are more strictly monogamous than man.
True..... False..... | 14. Herring gulls recognize their mates at 30 yards, but cannot distinguish their own egg from one eight times as large.
True..... False..... |
| 5. Deep in the jungles of South America, the Aucas are
(a) A "lost tribe" of African natives
(b) Modern Incas
(c) Descendants of Columbus' sailors | 15. The Florida Keys owe their existence to
(a) The mangrove tree
(b) Coral
(c) The engineering feats of early Indians |
| 6. Cowrie shells are the chief source of pearls.
True..... False..... | 16. "Long Haired Resolute Helmet Number Two" is the literal translation of
(a) Franklin Delano Roosevelt
(b) Joan Crawford
(c) Kaiser Wilhelm II |
| 7. Is there any evidence that children of parents migrating to a new environment will grow up measurably different physically?
Yes..... No..... | 17. Mother bats sometimes carry their young in flight.
True..... False..... |
| 8. Pineapples grow on trees.
True..... False..... | 18. The herring gull sometimes mates with a bird of a different species.
True..... False..... |
| 9. Venus's Fly-Trap is
(a) Another name for the trap-door spider
(b) An extraordinarily large mouthed frog
(c) A plant that traps and devours insects | 19. The Flower-pot Plant
(a) Produces gourds which are sold widely as flower pots
(b) Will exterminate any other known plant if it gains access to a window box
(c) Shapes its leaves into "flower pots" for its own roots |
| 10. The fact that bats bring forth living young make them a unique species of bird.
True..... False..... | 20. If you have a name like King, Prince, or Duke, your ancestors were doubtless members of the feudal aristocracy.
True..... False..... |



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YOUR NAME PLEASE

By "BROWN STRANGER IN THE BARLEY FIELD"
(formerly Donald Barton)

I REMEMBER an Indian story in one of our early school readers. The story was about a Redskin chief called Rain-in-the-Face, which we thought an enormously funny name. I can remember going home from the school with another little boy, and giggling all the way over this name which we had been forced to stuff fists in our mouths to keep from laughing about in the classroom. When we had wearied of the name itself we substituted various offensive and childishly bizarre substances for "Rain" and giggled at them in turn. Altogether we had a pretty uproarious time with Rain-in-the-Face.

Some time later a German boy came to our school. We had been prepared for his coming by a brief lecture on the brotherhood of all nations which, of course, made us expect the worst. But he surprised us all, particularly with his excellent command of English. True, it was quite a little different from the way we spoke it, but it was also quite a little better. One day I was asking him about vague German names and words I'd picked up here and there.

"What does *von* mean, like in von Hindenburg?"

"Von means 'of,'" he said.

"And what does the Hindenburg part mean?"

"Why," he said, "it doesn't mean anything. Hindenburg is just a name."

That seemed a reasonable answer, and when I spoke of it to my father it seemed reasonable to him, too. Although I remember he did explain that *von* was the same to Germans as the "O" of O'Neil is to the Irish and the "Mc" of McNab to the Scotch.

"English speaking people," my father continued, "put 'son' on the end of names, like Jackson, instead of something on the front. Jackson means son of Jack and in the same way *von* Hindenburg means of Hindenburg, or son of Hindenburg."

Thus it was in the misguided days of my childhood.

Now that I have grown to be something remotely kin to a philologist, the idea of a man called Rain-in-the-Face no longer over-stimulates my risibility. Rather it makes me envious. For, if the reader will glance at the by-line atop this page he will see an analysis of the name my father chose to call me. Add to this, one brother's (not inappropriate) name of "House-wolf" and another's (as yet inapplicable) "Bent-nosed wanderer," and you have three very good reasons why I have no license to laugh at Rain-in-the-Face, as well as supporting data for the old saw that a history of European civilization from the primitive to the present, lies hidden in the names of your friends and relatives.

Parents choose ancient European names like Randolph (House-wolf) and Wade

(*Fadus* (L.)=Wander), Cameron (Bent-nose) as innocently as they misinform you about von Hindenburg. Both Father and my German schoolmate were right about the "von"—and for that matter they were also right about Hindenburg being just a name like Barton. But Barton means barley field and "Hindy" (as we would surely have called him were he an American instead of Prussian folk hero) was not the son of a long-forgotten ancestor named Hindenburg but rather the son of a family that in all likelihood originally came from a mountain populated by many deer (*hinden*=deer; *burg* or *berg*=mountain).

Such names as Barton and Hindenburg belong in the scholarly classification of local or residence names; which simply means that the originator of my line lived in a barley field, Hindenburg's, by a deer-mountain, and yours—well, we'll come to that presently. Suffice it to say here that residence names and indeed all surnames are the product of a comparatively late stage of civilization. A nomadic hunter seldom, if ever, stayed in one place long enough for the place to become definitely characteristic of him. Hence Rain-in-the-Face, Sitting Bull and all the other "Nature Names" betray the Indian's pre-nomadic culture.

First Names

Of course nearly all of what we call our Christian names come from a pre-Christian period. This fact becomes most interesting in connection with Saint's names which remain so popular even in the present-day United States that one authority estimates nearly a quarter of the total American males are called John, William, James, Charles, or George, and that out of every four women there is certain to be either a Mary, Ann, Margaret, Elizabeth or Catherine among them. Saint's names all, most of them antedate both the Christian religion and its founder. What happened was that the early Church made saints of its converts at such a clip that a great number of previously heathen names were canonized and suddenly put in circulation, where they acquired strong Christian associations. The latter phenomenon is responsible for some of the lofty ex-post-facto meanings found in popular "What-to-name-your-baby" pamphlets. For example, Mary, probably the commonest of all feminine Christian names, is usually translated as "sympathetic." The reference here is plainly the Holy Mother. Actually, Mary comes of an old Hebrew descriptive name which brands its bearer as "bitter." On the other hand, these pamphlets frequently interpret Winifred as "friend of peace," which is flattering enough if you like the Anglo-Saxon choice (win=friend, fred=peace). But I venture most girls would prefer the much less abstract and, to my poetaster's thinking, lovelier, "white wave" (Celtic). Fur-

thermore, since Winifred, like many of our given names, emerged from the primitive European wilderness, "friend of peace" does seem a rather grandiose concept for a horn-helmeted tribesman to have applied to his infant daughter.

Paul, a common masculine saint name, unquestionably is bestowed with the early Christian philosopher in mind, although it traces directly to the Latin *paulus* (small) or, as we would say "a shrimp." An admiration for the classics may prompt some doting parents to tag Daughter, Portia after Shakespeare's serene and noble female attorney. This may prove something of a burden if her schoolmates discover that Portia derives from *porcus* (L.) or "sow." The same would be true of Ophelia, "snake."

Doubtless quite a few male readers share with me the name of Donald. Very likely, most of you have looked it up in the dictionary and preened yourself on its more vainglorious, and therefore, much more common definition, "haughty chieftain." Personally, I always felt myself spiritually infused with the attributes of a sort of conglomerate Stevenson and Scott hero until someone felled me with the large number of authorities who translated the Celtic into "brown stranger." This was, of course, quite a blow. As was pointed out in these pages last month* primitive men often take or receive names such as "Strong Eagle" in the hope of acquiring that bird's essential qualities of speed, strength, and vision. There is little doubt that as a group, we still possess a tincture of belief or superstition that our name may in some measure affect our destiny. At any rate, I had at least a chemical trace of that feeling about "haughty chieftain" until "brown stranger" came along. All Duncans, Douglases, and Douglasses please note—for you appear to be in the same boat. How this "brown stranger" business may affect our destinies, none can pretend to know, but it certainly destroys a beautiful picture of our past. Instead of proud chiefs marshaling our kilted clansmen, we seem to have been, temporarily at least, outcasts of some sort, despised by surrounding fair-headed tribes for our swarthy (dun-colored) skins. The phrase "Black Douglas" at once comes to mind in this connection.

Simply to keep in the Scottish key, mention ought here be made of the strange case of the MacGregors. During the interminable Anglo-Scottish border feuds of the 17th Century, this clan became a particularly excruciating thorn in the English epidermis. Apparently every time a royal army was sent against the MacGregors, its battalions invariably returned in rather dreadful shape, and no one quite knew what to do about it. The idea, of course,

*If that IS in a Name, March NATURAL HISTORY, page 174. A discussion of the Name as a concept of primitive societies.

was to eliminate the MacG's. But how? At length someone hit upon what would seem a curiously modern solution—i.e., legislate them out of existence. But readers of last month's tale of the African savage—who so hopefully shouted "Lion is not there" (when it obviously was, but he didn't want it to be)—will perceive little more than an extensive elaboration of this same principle when King James' parliament unanimously passed a law abolishing forever the name of MacGregor. There were, however, one or two teeth in the law and a few MacGregors obediently changed their awesome badge of clan to the mild-sounding Johnston.

This happened, of course, quite some time after the use of surnames had become general, although even at that date the British Isles were separated from outright primitivism only by a span of little more than a score of generations. Thus, the complexities of naming had multiplied at a relatively fast rate.

In the old days, rugged, long-bearded hunter-warriors, both in Britain and on the Continent handed down typically primitive names which are identical with their words for various weapons and animals, as Gerald "firm spear," Gertrude, "spear maiden," Oscar, a "bounding spear," and Roger, "spear of fame." Among the animal names, Arnold is probably a synthesis of Arwald (eagle-power) and Arnulf (eagle-wolf). Arthur (Earnthor) is Eagle of Thor. We find also, Osborn, "divine bear," Everard "wild boar," and Bernard "resolute bear." The suffix "dolph" usually means wolf. Thus the author of *Mein Kampf* has come by a first name meaning "noble wolf," the latter half of which would seem singularly appropriate if the legendary rapacity of the wolf is suggested. But our primitive ancestors thought very highly of the wolf and admired him sufficiently to take his name.

Surnames

The number of Smiths, like Mark Twain's weather, is something people complain of, but never do much about. What brought the plague upon us, however, was in part the great boom in the "smith business" during the Middle Ages. Reared on romances of that period, we usually think of this "iron era" as a sort of timeless though colorful pageant consisting of a group of heavily boilexplated individuals knocking each other off horses to the hearty applause of ladies wearing tall dunce caps. But behind the costumes and backdrops lurked a vast army of less blithesome humans—the artisans of the day, those who manufactured all the armor and, what's more, kept it in good repair. Only the foolhardy knight would think of undertaking a dangerous tournament before he'd had his chassis thoroughly checked over. The smith, in frequency of occurrence and approximate social position, was the filling station mechanic of his day. But he was less specialized. Not only armor, but the prosaic plough and horseshoe as well as iron collars and bracelets for the identification of serfs and bondsmen, were fashioned at his forge. The popularity of this profession produced a prodigious number



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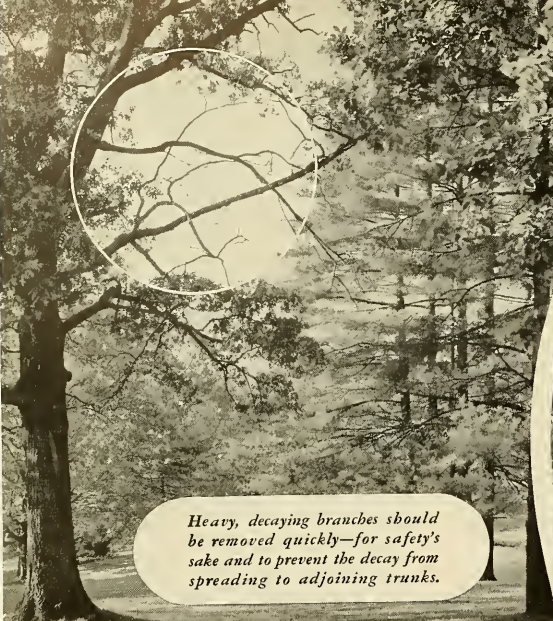
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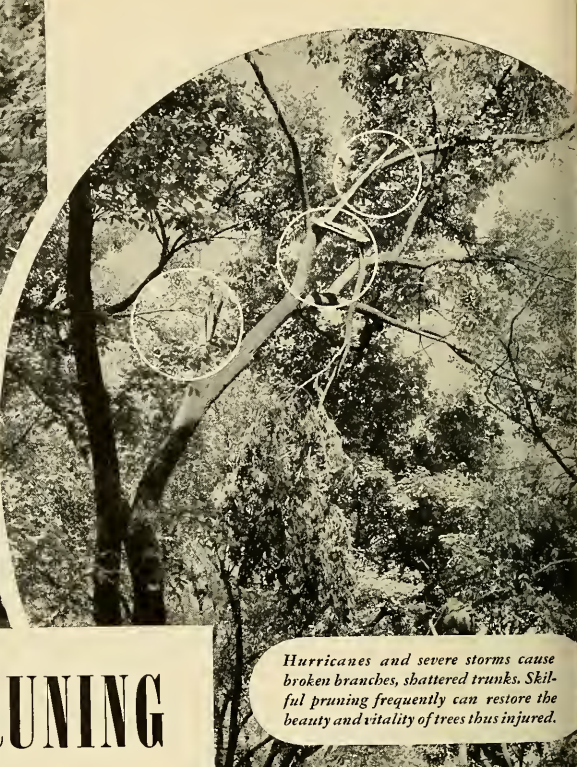
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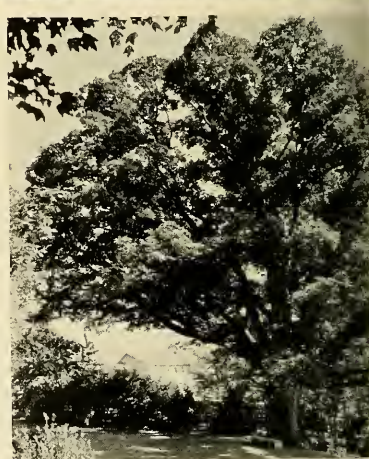
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of John-the-Smiths who, of course, eventually became plain John Smith. However, since one in every 88 contemporary Americans is a Smith, it is a most uncritical view of the progenitive capacities of these honest Britons to suppose that they sired all their namesakes here and in the mother realm. They didn't. Immigrants with names like Glafkos Pappatheodorokomoundoronicoloupculous understandably took refuge in "Smith" shortly after landing on these shores.

The medieval armorer, who handled much of the creative side of the smith business, probably gave his name to some of the modern Armours. Chaucer, who "covered" moyen age Britain with endearing wit and charm, derived his name from Chausserie, meaning hosiery. Then there were numerous Taylors, Bakers, Skinners, Brewers and Fletchers (meaning "arrow-maker"). Curiously enough, another term for arrow was a slang word, "flo." From this and not from that which blooms in the spring came the modern surnames of Flower and Flowers. Often these names were not so much received as taken. It was considered stylish in those days to have a second name—therefore the prerogative of the nobles. As a matter of fact, our word "surname" stems significantly from the phrase "Sir name."

Traditionally, Jones has always run Smith a close second in frequency of occurrence, although Johnson by far outstrips it in the United States. Not associated with any trade, Jones belong to that group of names known as metonymics (mother names), which means that in medieval times when marital relations were often lax, illegitimate children often resorted to the name of their female parent.

Jones comes from Joan and really means Joan's son. This does not necessarily throw a bar sinister across the entire Jones escutcheon, for so much caprice entered into the adoption of surnames when they first became required by law, that three brothers might often have different ones—the first, say, taking his from their father, the second from the mother, and the third simply from something that struck his fancy.

Roger Babson, the celebrated economist, owes his name to an ancestress named Barbara—the diminutive Babs yielding the name Babson. Jennings is a metonymic (Jenny) and the valorous General Custer of Custer's-last-stand fame appears to have received his name originally from a girl named Constance which in Chaucer's time was spelt Custance and eventually reduced to Custer.

Doomesday Book

Use of the English surname can be dated most conveniently from the "immigration" of a large number of belligerent Frenchmen under the leadership of William the Conqueror who took over the country and proceeded to split it up among them. The famous Doomesday Book, the first English census, resulted from the desire of William and his henchmen to secure a record of the population in order to discover who were the land holders and also to estimate the potential tax yield. Accordingly, a flock of underlings, ward heelers of their day, who

had learned a little penmanship in the monasteries, travelled the length and breadth of the land recording their own interpretation of the nickname, trade name or landmark which the bewildered peasantry stammered out in a desperate effort to fulfill this—to them—incomprehensible need for personal identification. Nor is it any wonder that with clerks largely French and peasants largely illiterate, these names are spelled six ways from Sunday. Names of rank, names of games, names having to do with dress, cooking or church officials all found their way into the Doomesday Book. Here are some names based on positions in the feudal system of government alone: Burgess, Sheriff, Canon, Clark, Chamberlain, Deacon, Chaplin, Steward, Woodrow (the latter from Woodreeve, an official whose duties included guarding the noble's woods from marauding peasants).

Another, and in fact earlier, adventure of William the Conqueror's in nomenclature was the Roll of Honor. This was a record of those Frenchmen who fell in battle during the conquest of England, and to have their name correspond to any therein entitles an English family to a kind of super-Mayflower claim. This Roll of Honor was kept in an Abbey for several centuries until both record and Abbey were destroyed as a result of Henry VIII's bolt from the Roman Church. Previously the not altogether scrupulous historian Leland had copied the names from the list, so that after the destruction of the original, his was the only remaining record. It appears, however, that the savant was amenable to a little palm-greasing by the social climbers of that era and that the document is interlarded with spurious names that were never in the original. The exact number of these interlopers is known only to God and Leland, but it seems reasonably sure that the name Bassett was one of them. The probable "legitimate" names include Alinecourt, D'Arcy, D'Aubigny (modern Dabney), Banister, Bohun (modern Boone), de Bure (modern Bowers), de Brionne (modern Brian, Bryan, Bryant), de Ferrars (modern Ferris, Ferrar), Grenville, Harcourt, Lascels and Lascelles (modern Scays), Melville, de Perci (modern Percy), St. Clair (modern Sinclair), de Vesey, de Vere, de Warene. But the motives of Bassett and others who bought space in Leland's "social register" seem to spring eternal; at least they reappear in modern family-tree hounds. Then there are those who pique themselves secretly or otherwise on names that appear to descend from the upper crust of feudal society. People with names like Duke, Earl, Abbot, Bishop, King, etc., are accustomed to think of themselves as descendants of individuals who actually occupied these positions in the feudal hierarchy. But if there be any humble Sowdens present, let them be assured that they are quite as aristocratic in line of descent as their condescending neighbors. For Sowden or Souden is a corruption of, and therefore, simply another word for, Sultan. And Sultan, however strange a name it may seem for some "Shropshire lad" of the Middle Ages, is nevertheless as redolent of Yorkshire pudding as Tommy Atkins.

Here's the rub. Dukes, Kings, Princes, Earls, Sultans and many another titular name are all make-believe—simply paper moons. They were the roles played by actors in the miracle plays, which became the fountain-head of entertainment and, broadly speaking, of education during the moyen age.

After their separation from the Church, these plays were staged by theatrical guild members each of whom acted the same part over and over again. The ingenious illiterates who thronged around the movable "pageant" (stage) probably had even more enthusiasm and credulity for the performance than little Johnnie for the current episode of Heigh-O Silver. Accordingly, the man and the part became one in their eyes and it was not long before honest, ale-drinking Roger who always played one of the three wise men (sages), became Roger le Sage. Thus the present day Mr. Sage, watering his suburban lawn, is unfortunately not heir presumptive to the wisdom of some hoary medieval soothsayer. At best, he might simply inherit the skill to play a part in the local church's Christmas pageant. Our Mr. Goode and various combinations like messers Goodman and Goodwin probably spring from an ancestor who trod the boards in the exalted role of God. The original John Prince had no royal blood nor did William Bishop ever wear other than a stage-prop mitre. But there is one curious thing about these surviving miracle play names. They are almost all favorable! And why not? Who of us cares to perpetuate the fact that our ancestor was a villain, even on the stage. What has become of the descendants of Hugh de Deth (who played the part of Death in the miracle plays)? The name was long ago abandoned. But "Le Demon" by the neat trick of dropping the "de" has passed his name on in the guise of a citrus fruit (Lemon). Yet a few have persisted almost intact. Rareities like Paynor trace to the "Painer" (tormentor or devil) and at least one of the common variety, Best, has survived, no doubt through the fatuous assumption that it was a superlative. In sober truth, "the Beast"—a "regular" in the stage Hades—seems the more likely derivation. Best, nevertheless, remains an excellent name for a department store, and Macy also appears to thrive in this capacity although its probable source is the French "malchic" (bad dog).

Sometimes names arrived at in this way have a cruel sting, a few perhaps deservedly so, while others are quite complimentary. In post-Norman England, this very fundamental method of naming had a tremendous vogue. The recorded results range from Walter Alipunch (all paunch or stomach), Kate Katsmouth, and John Blackinthemouth (likely a blunt commentary on dental problems of the times), through the many verbal "activity" names, favorable and not so favorable. Of the former, Maude Makejoy, a highly popular 13th century entertainer who danced before a Prince of Wales in one of the earliest command performances, shows that this naming system is not always derogatory. Thus whenever favorable traits have been commemorated in the

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name, it usually survives. Although there are not likely to be many Makejoys left, Lovejoy, vouchsafing as it does a sunny disposition, is prevalent enough. However, "activity" names were all too often unfavorable. Drinkedregges, Losewit, Spilwryn, Poorfish, Lapwater, Ralph Sparewater (apparently a victim of B. O. whose friends didn't hesitate to "tell him"), and that paragon of politicians, William Handeshakere, all signified family "traditions" few people thought worth preserving.

Although they have by and large disappeared from contemporary lists, these verb names are profusely inscribed in the various census records of the Middle and even Elizabethan ages. How closely they are allied in thought with the curious old doctrine of humors is hard to say, but at any rate from Ben Jonson with *Everyman in His Humour* to the latest play (1938) from the pen of Bernard Shaw* wherein a police commissioner is named Sir Broadfoot Basham, the English drama has preserved this traditional nicknaming device. Program leaflets of Sheridan's plays would often succinctly limn his characters before ever the curtain rose; the names Sir Benjamin Backbite, Lady Sneerwell, etc., scarcely giving much cause to doubt their villainy. Though this avowedly crude method of literary characterization or rather caricaturing is apt to irritate the sophisticated modern, actual names in Pepys' diary of the same period show that names of this type were once just as native to London as Huck Finn or Ethan Frome is to the American scene. In evidence whereof, the diary gives up the following curiosities: Eatwell, Lovelady, Fullalove, Sweetlove and Shakelady. By his time, however, the astonishing and delightful caprice in the selection of surnames had spent its force, and the greater part of the names mentioned in the diary could be found in modern directories.

Fat, Fat the Water Rat

In the nicknames of your boyhood gang—Skinny, Fat, Shrimp, and others less common—lies an ever modern instance of the seemingly inherent human capacity for spotting one another's weakness or peculiarity and emphasizing that mark of distinction. Nicknames in general often result from the sociological fact that the usefulness of a name for a given locality diminishes in proportion to the frequency of its occurrence. The most famous illustration of this seeming truth is the tiny English seaport of Buckie where there are 25 George Cowies. In order to make some distinction among them, their neighbors unconsciously fell back on the old and tried method of nicknaming. Accordingly there are a "Neep," a "Snuffers," a "Toothie," etc. But surely many readers will know of some small and comparatively isolated town where substantially the same thing has happened. A friend of the writer's once lived in a district where there were a dozen families named Covington in the space of ten miles. Here members of each family are "pigeon-holed" by their father's colorful nickname. Thus one child is "Walkin' Billy Coving-

ton's little girl," another "Lyn' Walter's," a third, "Chicken Robert's."

Another type that has become increasingly rare in modern times is the old biblical name. The Puritan ascendancy in England was characterized by a raid on Old Testament names like Bezalel, Abijah, etc. Quickly exhausting this grim-sounding treasury, the "round heads" fell greedily upon such abstracts as Prudence, Mercy and Charity for women, and hortatory names like Lament and Faint-not for men. The latter variety reached its climax when the famous brothers Barebones (itself originally a nickname) were christened respectively Praise-God Barebones and the incredible If-Christ-Had-Not-Died-For-You-You-Had-Been-Damned Barebones. His friends, by the way, cheerfully called him Damned Barebones.

In the Public Eye

It is no accident that "bright lights," "limelight," and other similar expressions for fame stem from the argot of the theater. Every trouper dreams of fame not in the abstract but in the real sense of having his name spelled out in electric light bulbs, and he knows that a large part of his success will be determined by how his name will look and sound under those glaring circumstances. This is, of course, one reason why actors and actresses so often change their names. Euphony naturally becomes their guide in choosing the new one, yet a little caution with regard to its original meaning might at least protect them from the esoteric cackling of the learned word-mongers.

Nothing said here is capable of dimming—and is certainly not intended to dim—so constant and enduring a beacon in the Hollywood firmament as Miss Joan Crawford, of whom the writer has long been a devout admirer. But it becomes difficult to hold the tongue as the translation of her "nom de cinema" unfolds. It was imperative, of course, that she adopt some name other than her own. For Lucille Le Sueur (her birth name), which any French dictionary will quickly reduce to "shining sweat," is scarcely a glamorous label.

On the other hand, no self-respecting "glamor girl" would ever select the combination of "Joan Crawford" if her public had any idea it could be traced back to something like "kitchen wench from the cow pond." Though now commonly eulogized as "Gift of the Lord," in Shakespeare's time the name Joan had become synonymous with kitchen maid, as our "Rastus" with the stock American negro; while "craw" is probably a corruption of "crodh," Celtic for "cow." Ford, of course, is any shallow stream bed.

Shirley Temple, whose name has come to stand for perfection of little girl grace and charm, might find it advisable to eschew all inquiry into the history of her surname. The source is ecclesiastical to be sure, but not in the usual sense. Apparently, there were once a staggering number of illegitimate children left at the doors of priests' homes in the London Temple. And the worthy prelates, overburdened with the dual task of providing the last as well as the baptismal name, decided on "Temple" as a blanket sur-

*Bernard Shaw—Resolute Bear in the Woods.

name. This priestly residence thus became the nominal father of all the foundlings. Also suspect are names of days in the week, for it was common erewhile to name foundlings for the day on which they were found. At first glance, Billy Sunday seems most appropriate for a preacher, but on second thought, it has its drawbacks.

The late nationally famous journalist Arthur Brisbane owes his surname to the medieval predilection for torture. As punishment for what we would consider relatively minor offenses, prisoners were then commonly "broken upon the wheel." Since "Bris" comes from the French verb *briser* (to break) and "bane" probably is a dialect word for "bone," it is reasonable to surmise that one of Brisbane's early ancestors may have been invested with the office of breaking people's bones across the spokes of a large wheel.

Politically famous names are perennially fascinating. Lloyd George is a "gray farmer." Clemenceau (clemency) for the Tiger of France produces a contradiction in terms, whereas Poincaré—the name of a characteristically mild statesman—means "square fist." Kaiser Wilhelm II breaks down into the curious catalogue-like item of "Long Haired, Resolute Helmet Number Two" while one might well wonder upon what meat the mighty Julius Caesar fed that he should grow so great with a name meaning "Downy-bearded Long-hair."

Modern American aristocracy has its piquant curiosities. The Biddles of today were the Beadles (extremely petty feudal officials) of yesterday. Vanderbilt—a name which more than any other has made "Van" the keynote of social exaltation—means simply "from the heap." Perhaps oddest of all is the case of the Belmont family which has produced leading figures in all of its various countries of residence. The name, of course, has the Romance Language meaning of "beautiful mountain" but when a certain Belmont left Spain for Holland during the 16th century, he signified his intention of adopting the new country by translating his name to Schonenberg (Dutch for beautiful mountain). It was a change from which the family appeared never to have recovered for according to the genealogist Gottheil: "From that time on the family was known indifferently by one or the other name, at times even by both."

Sea Change

Translations seem to occur whenever people come to live in a foreign country. The famous Napoleon Bonaparte owes his family name to just such a process: Bonaparte being the Corsican translation of "Kalomeris" which name his forebears had brought with them from Greece. A great deal of translating and quasi-translating (like Mohr to Moor) has taken place in the United States where the historically unprecedented waves of immigration and the resultant "melting pot" necessitated rapid adjustment on a wide scale. The endless number of Cohens among the Jewish Americans is largely due to a curiously modern mistreatment of the German Jews. About 150 years ago, surnames were relatively uncommon among these people, and when an order

was put through requiring the adoption of a family name, the job of recording or supplying these names was given to minor political officials. The latter proceeded to charge fees in return for bestowing favorable appellatives. Those who could not meet their demands received such definite handicaps as Kanalgeruch (canal stink) and Scheissbund. The latter name afterwards cost a wealthy Jewish merchant half his fortune when he simply wished to insert a "w" in Scheiss (dung) in order to give the name some semblance of respectability. But when the Eastern Jews began to immigrate in great numbers to America, they took this opportunity to rid themselves of obnoxious names—many of them quite naturally resorting to Cohen, meaning "rabbi."

But what changes names most, according to Howard F. Barker,* is the abrasion of common speech. In the New World, many names suffered a sea change which reduced them to more easily pronounceable syllables. Thus General John J. Pershing's Pennsylvania German forebears were Pfoersching, Herbert Hoover's ancestors (also Pennsylvanian) were Hubers, and John D. Rockefeller who started his career as a whiskey salesman, came from a family of Roggenfelders (rye-fielders). Sometimes the changes are less easy to follow. Mansson, for instance, became Lindbergh. The Czech Otraska disintegrated into O'Tracy. And a Mr. Kabotchnik had a lawsuit with the Boston Cabots because he wanted to take their name—and won it. Samuel ("include-me-out") Goldwyn was born Gelbfisch or "yellow fish."

To create truly American names in a frontier environment was something of a problem. There was once a politician who signed himself K. N. Bill. The initials stood for Kansas Nebraska and he had a sister whose name was Missouri Compromise. There were allegedly a number of babies christened so during the Oregon boundary fracas. Trailing Arbutus Vines was foisted on one girl by botanically minded parents, and the same variety must have been responsible for the given name of a lady professor at the University of California—Eschschlotzia, from the scientific name of the California poppy, *Eschschlotzia californica*. Strange first names will result, like nicknames, in every inbred community where the surnames are nearly all identical. Thus a tombstone in one hill-billy township reads: "Henry Ritter Ema Ritter Dema Ritter Sweet Potatoe Creamatartar Caroline Bostick, daughter of Bob and Suckey Catlen." Compare this with the unpretentiousness of a girl named simply "Vest." She was so called because at the age of one week her father had wrapped her in his vest and proudly carried her on an exhibition tour of the neighborhood. This method of naming recalls that found among primitive tribes where appellations are often selected from something in the environment peculiarly associated with the birth or infancy of the child. Thus two negro babies whose birth occurred during a flood were christened Highwater and Overflow; and another William McKinley Louisiana-Levee-Bust Smith.

*Research Associate, American Council of Learned Societies.

Continued on page 248

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BLUE STAR

----- by Kunigunde Duncan
Told from the life of Corabelle
Fellows

The Caxton Printers, Ltd.
Caldwell, Idaho, \$2.50

B LUE STAR was the Indian name of Miss Fellows, who in the 80's volunteered to teach in an Indian school, was sent out to the Rigg's Mission in Springfield, South Dakota, to be trained for the service. However, more than a fourth of the book comprises a sketchy adolescent autobiography of Miss Fellows. After a period of practice teaching at the Rigg's Mission, she was sent to lonelier posts on the reservation and finally to Cheyenne River reservation, South Dakota. She taught Indian children, crusaded against gambling and informed against white "bootleggers." Her chief adventures were with Indian men who sought to abduct her, difficulties she invited by disregarding the advice given her by both Indian and white friends. Finally she fell in love with a mixed-blood Indian, married and settled down to live on a farm. Here the autobiography ends. The reader will enjoy this narrative of adventure and get here and there the feel of the atmosphere surrounding the Mission Indian School of the time.

CLARK WISSLER.

PERRI

----- by Felix Salten
Translated by Barrows Mussey
Drawings by Ludwig Heinrich Jungnickel

Bobbs-Merrill, \$2.50

A JUVENILE book, but the grown-up boys and girls who enjoyed *Bambi* by the same author will find the same fascination here. Only those who have outgrown *Wind in the Willows* can afford to pass it by. This is the story of Perri, a little girl European red squirrel, and her friend, Porro, a little boy squirrel, and Annerle, a three-year-old human child. The reader receives many intimate glimpses of other children of the woods, including a brief glimpse of *Bambi* himself.

Felix Salten, the author, is a dependable naturalist, but, what is much more rare, he writes with the imaginative pen of a Barrie, a Kipling, or a Kenneth Grahame.

CLYDE FISHER.

MIGRATION AND ENVIRONMENT

----- by Harry L. Shapiro
Oxford University Press, New York, \$7.50

I T has long been popularly supposed that groups of mankind changed in physique fairly readily to fit their particular environments. There is, however, no satisfactory proof that this is so, and scientific studies of man have taken it for granted that the Ethiopian cannot change his skin excepting through many thousands of years of slow evolution.

In this important book Doctor Shapiro, Associate Curator of Anthropology at the American Museum, has approached the question with the help of precise measurement and statistical analysis, and has found proof that a change in environment can indeed definitely change a peo-

ple's physique, though not by a startling amount. He found his opportunity for study in the large numbers of Japanese who went to Hawaii 30 years ago to furnish plantation labor and who have since raised a generation of children there. This group of Japanese has thus subjected itself to two important processes, the first being the migration of the adults and the second the raising of the next generation in a new environment. Doctor Shapiro compared the immigrants and their Hawaiian-born children with each other and with their own relatives who had remained in Japan, and discovered differences which, to an anthropologist, are considerable. The immigrants are proportioned somewhat differently from the Japanese, and the Hawaiian-born children are larger than their parents. Doctor Shapiro makes careful statistical allowances for differences in average age, in occupation, and in the part of Japan whence the migrants came, and finds that none of these causes can be responsible for his results. He concludes that the immigrants differ from the Japanese generally because they were "selected" by some unknown, unconscious factor, and that the children reared in Hawaii differ purely because of the environment. More precise explanations are not possible yet, but these facts alone are very significant for human evolution. He warns, however, that such changes as he discovered are probably limited in extent, and do not mean that the Japanese in Hawaii will evolve toward the native Hawaiian type.

The book is necessarily of a technical and statistical nature, but in one section Doctor Shapiro has set forth the whole problem and his results in a well-rounded way and in terms which can be understood by anyone.

W. W. HOWELLS.

SEVEN SEAS ON A SHOESTRING

----- by Dwight Long
Harper and Brothers, \$3.00

T HIS is the odyssey of a young man, Dwight Long, who sailed west from Seattle in September, 1934, in a 32-foot ketch, to Hawaii, Tahiti, through the islands of New Zealand, Australia, New Guinea, where he describes Mr. Archbold's plane lying at her moorings the day before she sank, in the summer of 1936. Thence he sailed his *Idle Hour* to Singapore (where he met the Martin



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Johnsons), Ceylon, and through the Red Sea and Mediterranean to London. The narrative is not without its human tragedy. A Tahitian boy, the ideal friend and shipmate, who joined the ketch at Bora Bora, took ill and died in Ceylon. The *Idle Hour* was laid up over a winter in England, and later, after an adventure with Franco's men when anchored in a sheltered spot on the Spanish coast, he sailed her across the Atlantic to New York, only to have her break adrift and be wrecked at Port Washington on Long Island Sound in the hurricane of 1938 while he was giving a radio broadcast in the city.

This is indeed an "excitement packed story" as one reads on the jacket of the book. Its incidents are fully dramatized, and any careful naturalist will hesitate to quote the first-hand observation of a giant komodo lizard slaughtering a young boar, however tempted to do so. Neither would one recommend its pages off-hand for detailed information on weather, currents or handling a small boat at sea. Possibly it was not all so happy-go-lucky as it sounds. But it is certainly a readable yarn, with real achievement behind it.

J. T. N.

CHARCOT OF THE ANTARCTIC

by Marie Oulie

E. P. Dutton and Company, \$3.50

M. LIE. OULIE, by a simple narration of events, has described a career which needs no recourse to artistic license to be made dramatic. She does not depend on her own recollections and impressions as a friend of Charcot's to give a picture of him, but has woven her story from various sources and episodes.

As Jean Charcot inherited fame from his father, Dr. Jean-Martin Charcot, she devotes considerable space to his family background. The early training he received in medicine and surgery was against his own inclination, so it was not until after his father's death that he was able to do what he had long dreamed of. A series of summer cruises in command of his own boats to Scotland, the Faeroes and Iceland gave him valuable training and confidence. Thus at a time when international interest in Polar exploration was reviving he was able to induce French participation. The two expeditions which he organized and led to the Antarctic are described rather fully, making the book a convenient source for students of Polar research.

It is an enjoyable book, though it is to be regretted that popular misconceptions are, occasionally, repeated when life in the Polar regions is portrayed. It might be profitable for the author to read Stefanansson and to check on the actual number of hours of daylight and darkness in different latitudes, and one asks why temperatures between 30° and 40° below zero should be any more remarkable in the Arctic than in New York State or elsewhere? To finish the fault-finding quickly, her figure for the length of time that the Eskimos have been extinct in northeast Greenland is twice the truth.



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The story reaches its climax with the tragic wreck of the auxiliary bark *Pourquoi Pas* in 1936 on the Iceland coast. Charcot and all but one of his companions perished, and with them went the records of the expedition's work in Greenland. The events which followed show the esteem in which he was held by his countrymen and those who knew him. Not the least of his contributions was the inspiration and encouragement he gave to young people interested in exploration.

JUNIUS BIRD.

PLAINS INDIAN PAINTING: A DESCRIPTION OF AN ABO- RIGINAL AMERICAN ART

----- by John Canfield Ewers

Stanford University Press, Calif., \$4.50

THIS handsome book should be found in the collection of every reader of books about Indians. The author was first trained in art, then while a graduate student in anthropology at Yale University made an exhaustive study of painting as formerly practiced by the Plains Indians. He is now Field Curator, Museum Division, United States National Park Service.

This is no ordinary picture book, for the author searched the museums of the world for the oldest and best examples of Plains Indian painting. He scanned books of travel for information as to colors, brushes, time spent in painting, differences in the art of men and women, etc. Perhaps the most original contribution in this book is the analysis of the Indian's technique in painting and designing. The pleasing geometrical compositions of the women include a real masterpiece—a painted buffalo robe shown in a fine color plate. The men drew pictures of horses with their riders; and artists will be interested in their varying techniques. There are tribal styles for these and, within their limits, individual variants. The author has become so familiar with these tribal differences that he can identify the tribal origin of buffalo robes and painted skins found in museum collections. The section dealing with perspective, action and composition will enlighten even the layman. Horses are first drawn in outline, then filler colors are added. The tail is always shown, the mane rarely; the necks are elongated but when horses are shown in rows the effect is pleasing. Profile drawings are the rule and most of the horses face the painter's left. The author designates the tribes of the Siouan Family as the most skillful in drawing horses.

The drawings representing men are usually in profile; action is well handled, as illustrated in dancing figures; the body is often unduly elongated as is the neck of the horse, but this is so handled as to emphasize action and posture.

Several of the classical paintings illustrated in the book are from the American Museum of Natural History Collections, which were exhaustively studied by the author.

CLARK WISSLER.

TO PERSIA FOR FLOWERS

----- by Alice Fullerton

Oxford University Press, \$3.00

OFFICIALLY backed by the British Natural History Museum, Mrs. Fullerton and her friend started for a section in northern Persia near Tehran, to collect such seeds, bulbs and plants as might be useful for planting or for botanical records. This book is their record of the journey.

Crossing Russia had its decided ups and downs, getting over the narrow, slippery roads of the Elburz Mountains provided nerve-racking thrills, but growing used to the two-room home with its cracked mud walls, bird-infested, leaky, flat straw roof, held up by green poplar poles, a door that would not shut, window frames without glass, no stove and bitter cold weather—had its real discomforts; yet none of these obstacles seemed to dampen their ardor for investigation. The broken paned and curtainless windows opened onto a court where natives of Suddanabad came to observe these, their first, British neighbors who were to become their beloved friends.

Suddanabad was used as headquarters and for many months Mrs. Fullerton divided her time between kindly ministrations to the sick and afflicted and the collecting of plant materials. Her simple, but very realistic descriptions of crops, food, clothing, ceremonials, industries and homes of these people, whose customs seem strange and primitive, make one forget that this adventure was primarily a botanical one. We are told that Persia is the native home of the lilacs, many forms of roses, irises, tulips, salvias and gladiolas. Among the five hundred species collected were numerous relatives of the former and other familiar garden flowers such as: a bright pink salvia, *Salvia hydrangea*, a satin-pink morning glory, *Convolvulus stachydoifolius*, a jade-green

iris, *Iris Sisyrinchium* and a mauve gladiola.

The twenty-four illustrations contain only three of flowers, the others are of Persian scenes and natives.

This book will be of interest not only to gardeners, but also to those who enjoy intimate glimpses into the lives of other peoples.

FARIDA A. WILEY.

COMMON EDIBLE AND POISONOUS MUSHROOMS OF SOUTHEASTERN MICHIGAN

----- by Alexander H. Smith

Cranbrook Institute of Science,
Bulletin No. 14

Paper 50 cts., cloth \$1.00

THIS is an excellent handbook for the identification of the common mushrooms of the area indicated, by the curator of fungi at the University of Michigan. As the author states in the introduction, "This bulletin has been designed for beginners to use in the field and at home rather than in a botanical laboratory." Simple workable keys, which omit microscopic characters, are included. These, together with fine illustrations from photographs, make identification easy and certain for some forty of the commonest species.

The booklet also contains hints on when and where to find mushrooms, and directions for cooking them. CLYDE FISHER.

THE BIRTH AND DEVELOPMENT OF THE GEOLOGICAL SCIENCES

----- by Frank Dawson

The Williams & Wilkins Company,
Baltimore, \$5.00

THE eminent author of this useful and important work combines with his notable scholarship the rare gift of lucid and vivid writing. This combination has produced a book which will be welcomed not only by the world of science, which has long suffered from its lack, but by the general reader who will find here fascinating literature in a field that is but little known.

Dean Adams has brought to his task a knowledge of the literature of his subject, both classical and modern, which can only be described as "encyclopedic," and his quotations in the text are so well chosen that one gets the "feel" of a description, such as that quoted from Pliny the Younger, which pictures the first recorded eruption of Vesuvius.

The Chapter on the Conception of the Universe in the Middle Ages is particularly well done and its sub-heading "The Ptolemaic conception of the Universe," "The powers, influences and virtues attributed to the heavens," "The doctrine of the Macrocosmos and the Microcosmos," and "The doctrine of 'Signatures' and 'Correspondences,'" open up a new field of thought for most of us.

The Chapters on "The Generation of Stones" and "Medieval Mineralogy" contain much that is quaint and little known. It is, however, when the author

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treats such subjects as "Earthquakes and the Character of the Interior of the Earth" that one becomes aware of the depth to which he has penetrated into the writings to which he has access, and to realize that a full bibliography of the Birth and Development of the Geological Sciences would run to many hundreds of titles.

Throughout, the book is illustrated with well chosen half tons (many of them portraits) and text figures. H. P. W.

INDEX OF NORTH AMERICAN FERNS

----- Compiled and Edited
by Maurice Broun

Published by the compiler, Orleans, Mass.

THIS compact, little volume of a bit more than 200 pages is a catalogue of the Ferns and Fern Allies of North America north of Mexico, including all known forms, varieties, and hybrids. References to the original descriptions are given, and also the habitats and ranges. The manuscript was carefully read by Mr. Charles A. Weatherby, Senior Curator, Gray Herbarium, who wrote the foreword. Most of the records of habitats and ranges were furnished by Dr. Edgar T. Wherry of the University of Pennsylvania.

CLYDE FISHER.

LIVING THINGS: HOW TO KNOW THEM

----- by H. E. Jaques

Published by the Author, Mt. Pleasant, Iowa, \$1.00

THIS little book printed by photographic offset process is unique in its format. It consists chiefly of keys, with the keys to the plants printed on green paper, and the keys to the animals on orange paper. The keys to the phyla, classes, and more important orders are given, although genera and species could not be included in a book of this character covering so large a scope. This, of course, curtails its usefulness. But the average student will find much of value in it, provided he supplements his identification with a detailed key.

In the study of general classification and relationships the book is excellent. There is an amazing amount of vitality in the keys, which unlock for us the treasures of the living world, and then indelibly lock them in our minds. This is accomplished by lucid descriptions and superior illustrations. Delightfully humorous "cartoons" are interspersed throughout the book. Printed on white paper, contrasting with the green and orange, there is a general consideration of the classification of living things, a list of about one hundred suggestions for projects in nature study, an explanation of how to use the keys, a phylogenetic list of the classes and orders, and a very complete index and illustrated glossary, although the print in this section of the book has been reduced so as to make the reading difficult.

This is the second book in the Pictured-

Key Nature Series. The first "How to Know the Insects" was published in 1938, and the third "How to Know the Trees" is now in preparation. J. R. S.

A GUIDE TO THE SNAKES OF UGANDA

- by Captain Charles R. S. Pitman

The Uganda Society (Kampalla, Uganda) 30/-

THE author's modesty in calling this book a "guide" is exceeded only by the painstaking care he has used in compiling its 362 pages of text, pages filled with general information as well as with interesting facts pertaining only to African snakes. Actually this is the most pretentious book on African herpetology since John Anderson's volume on the Reptiles and Amphibians of Egypt appeared in 1898.

In addition to the text there are 18 pages of line drawings, 2 maps, 2 diagrams and 23 pages of excellent colored plates that depict 95 species of African snakes. It is safe to say that these colored plates surpass anything hitherto published, both in accuracy as well as in beauty. The edition is limited to 500 copies, many of which will enter the libraries of naturalists who find delight in superb illustrations. C. M. BOGERT.

THE SPIRIT OF INDIA

----- by W. J. Grant

Scribners, \$3.75

THE aim of this book is to give the reader a general idea of the political, economic and religious situation in present-day India. The author, without penetrating too deeply into the various aspects shows the underlying differences in the spiritual aims and consequent sense of values between East and West.

Mr. Grant's descriptions of the various sections of this vast country with its teeming population made up of many races and religions, and its age-old caste system which necessarily implied industrial and economic restrictions, give some idea of the tremendous obstacles which stand in the way of India's acceptance of Western ideals of progress and civilization. His explanation of the "spirit" of India and her philosophy or "Weltanschauung," if one is permitted to use that much-abused word, helps one to understand India's attitude toward England and England's ideas of industrialization and education.

It is to be regretted that in his chapter on Religion he has omitted Buddhism. For, though a dying religion in India, Buddhism contributed much to its culture, art and literature; and, no mention is made of the great Hindu epics, the Mahabharata and the Ramayana, whose ethical teachings are so much a part of the spirit of the people.

Even if one does not agree with many of the views expressed by the author, there can be no doubt of the fact that Mr. Grant is a lover of India and sees her problems through sympathetic eyes.

The book is profusely and beautifully illustrated.

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LETTERS

Continued from page 187

7. Insects have never been used for food in the United States.
True..... False.....
8. A "fire-plough" was used by primitive peoples as an aid in the cultivation of crops.
True..... False.....
9. During hibernation the woodchuck's heart-beat remains the same as in summer.
True..... False.....
10. "Fellow" was one of the dogs bred in Switzerland to be used as guides for the blind.
True..... False.....

ANSWERS

1. *False.* See page 69. While a profession in natural sciences requires a gift and long training, nature hobbies are open to every one.
2. *False.* See page 73. The parrot is grey and abounds in the region.
3. *False.* See page 80. The Mangbetus of Africa are splendidly proportioned, often sleek and feline.
4. *True.* See page 80.
5. *False.* See page 85. It would be a shame and a distinct loss from a health standpoint to stop eating blueberries.
6. *True.* See page 86.
7. *False.* See page 88. The American Indians ate honey ants. In the Nevada-California region caterpillars were eaten.
8. *False.* See page 106. The "fire-plough" is one of the simplest and earliest devices used for fire-making.
9. *False.* See page 115. The heart beats slowly and feebly during hibernation.
10. *False.* See pages 117 and 123. "Fellow" was bred in America.

* * *

February 27, 1939

SIRS:

Enroute to Florida, yesterday about fifteen miles south of Raleigh, N. C., we again met the cattalo—the same one we photographed west of St. Louis in April of last year. The beast is still in fine condition.

CLYDE FISHER.

SPRING COMES TO THE ROBIN NEST, a Nature photograph by Joseph Hug, Milwaukee, Wisconsin.



SIRS:

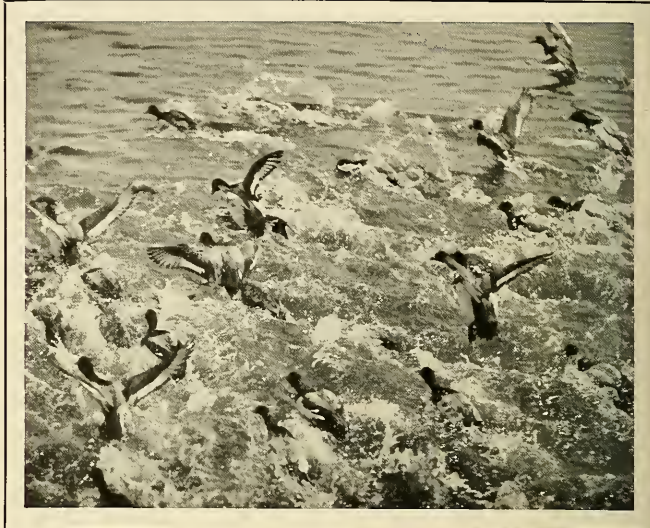
This unusual photograph of a raft of Lesser Scaup Ducks rising from Florida waters was taken by a student of Mrs. Gladys Gordon Fry who sends it to the Museum's Department of Education. Bird observation opens as wide a field to the camera artist as to the natural scientist, and there are many participants of both types in the organized study groups.

Reflecting a widening interest in conservation, the Spring Bird Walks in Central Park under Mrs. Fry's leadership and

sponsored by this Department will begin April 18th. The plans for this year's series include early morning walks leaving from the main entrance of Roosevelt Memorial at 6:30 on Tuesdays and Fridays; 10 o'clock tours starting April 21; and a course of four lectures preparatory to the field work given by Mrs. Fry at 10 o'clock on April 18, 25, May 2 and 9.

CHARLES RUSSELL.

Curator, Education Department,
American Museum of Natural History.



Above photo by Helen Thompson Farrell



CATTALO: Offspring of a domestic cow and a buffalo bull, enroute across the continent. Eight years old, this magnificent, burly beast weighs 2300 pounds, is jet black in color. Jumbo will lift his forefoot on request to show his specially designed shoe

NOTICE

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

SIRS:

An explanation of a distinction to be observed among dinosaur tracks is occasioned by two photographs published with a letter from John Stewart MacClary in the February NATURAL HISTORY. Mr. MacClary, who lives in Pueblo, Colorado, is largely responsible for bringing these footprints, located in the Canyon of the Purgatoire, to the attention of science. The writer had the pleasure of discussing them with Mr. MacClary and examining them last fall.

Two sets of tracks are recorded side by side in these rocks. The three-toed prints, shown below in the photograph originally published, apparently were made by one of the iguanodont dinosaurs, a plant-feeding, water-wading biped quite common along certain shorelines during Cretaceous



Above photo by Louis S. Snyder

times. Through no oversight on Mr. MacClary's part, the other tracks were not reproduced with his letter. These are shown in the second photograph and constitute the ones referred to as mystery footprints.

And they are indeed surrounded by mystery. What large dinosaur could have left these roughly circular, 26-inch prints behind him, in such a mechanical succession! It is difficult to associate them with the usual trail of any heavy quadruped. We had first considered them possible sauropod tracks, but the vague character of the prints, the lack of identifying toes or claws, and the manner in which they fail to correspond as a trail, to the very definite sauropod trails in Texas, made for hesitancy in so classifying them.

The subject dealing with trails of other large dinosaurs will be covered by the writer in an early issue.

ROLAND T. BIRD.

Department of Vertebrate Paleontology,
American Museum.

SEVENTY-TWO YEARS AGO THIS MONTH

DEAR MR. DAVISON:

The enclosed letter which was among my husband's papers was written, as you will see, to his father by Dr. Albert S. Bickmore, who dreamed of and worked for a Natural History Museum for New York, long before the present Museum was in being. I think that you will agree

with me that this letter should belong to the Museum. . . .

As you know, Professor Bickmore's name is dear to those interested in the Museum. . . . * Very sincerely yours,

MRS. MORNAY

(HELEN HOFA WILLIAMS.)

Englewood, N. J.

* * *

Rev. William R. Williams, D.D.,
27 Grove St., New York,
United States of America.

MY DEAR SIR:

You will remember on reading the signature to these pages that I had the pleasure of calling at your residence in Grove St. on the 1st of Jan., 1865, and having the privilege of listening to your kind advice in regard to promoting the building of a Museum on the Central Park. I was then about to commence a long journey through the East Indian Archipelago, and you kindly said you should be happy to hear I had met with the success I was anticipating, and I therefore take the liberty to write you this short note and mention the route I have taken.

I arrived at Batavia on the first of the following May, and forwarded to the Governor General my letters of introduction. He forthwith honored me with a general order to all his officials requesting them to aid me in every way in their power. From Batavia I proceeded along the north coast of Java to Surabaya; thence to Macassar in Celebes, thence southward through Sapy Strait and along the south coast of Flores to Coupang in Timor; thence along the west coast of Timor to Delly and northward to the Banda Islands and the Spice Is. Having collected the shells I came to seek I journeyed to and fro with the Governor of those islands in his splendid steam yacht, which carried me to Bouru and Ternate, thence I crossed to the northern end of Celebes—the most beautiful country I have ever seen. Coasting down the eastern shores of Celebes I returned to Macassar and Batavia and went to Padang in Sumatra. There the Governor took me into his palace and supplied me with his own servants and houses. From Padang I went northward some 250 miles, till I had passed far into a land only inhabited by cannibals, and then turned toward the sea and returned to Padang. After another journey into the interior I came down to Bencosten and crossed the whole island to Banka and continued on to Singapore and Cochin China. Reaching Hongkong I made a journey of 1200 miles from Canton through the central parts of China to Tungting Lake and Hankow. Later I have visited Peking and even Corea, also the coast of China, and now have reached this port on my way to the mouth of the Amoor River, to improve a very generous offer of His Imperial Government at St. Petersburg to take a *free pass throughout the Russian Empire*. Spending the coming summer and autumn in Siberia and Central Asia, I expect to reach Moscow in October and hope to be again in New York before 1868.

*Albert Smith Bickmore (1839-1914) originated and crystallized the conception of the American Museum of Natural History in 1868 and the school service system of education in 1880.

Continued on page 248

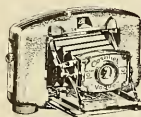


Photo by R. T. Bird

Answers to Questions on Page 233

- (b) It plants its own seeds by pushing them into the ground. See page 217
- (b) The daddy-long-legs. See page 204
- True. See page 206
- True. See page 222
- (a) A "lost tribe" of African natives. See page 209
- False. Cowrie shells are believed widely throughout Africa to be possessed of magical properties. See page 210
- Yes. The children of Japanese immigrants in Hawaii differ physically from their parents. See page 240
- False. The pineapple grows close to the ground on a short stalk. See page 218
- (c) A plant that traps and devours insects. See page 216
- False. They are not birds at all, but mammals. See page 194
- (b) Serves to lead the chick to food. See page 229
- False. The name Vanderbilt means literally "from the heap." See page 239
- True. See page 191
- True. See page 228 and 229
- (a) The mangrove tree. See page 219
- (c) Kaiser Wilhelm II. See page 239
- True. See page 194
- True. The love-making gestures of the lesser black-backed gull so closely resemble those of the herring gull that they may occasionally form mixed pairs. See page 225
- (c) Shapes its leaves into "flower pots" for its own roots. See page 216
- False. See page 237

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Lenses for Your Camera

By CHARLES H. COLES

Chief Photographer, American Museum of Natural History

SOONER or later, most parts of your camera will wear out, but that piece of glass called the photographic objective carries on without any appreciable decline in activity as the years roll on. The case of the camera will become battered and worn, the shutter will stick and miss fire, the bellows will crack and leak light, but the lens still continues to function almost as well as it ever did.

Inasmuch as you can expect a long life from your lens, it may be interesting to look at some of these products of the lens-maker's art from the standpoint of general performance.

Simple lenses

The lenses of the cheapest types of cameras are of very simple construction. Their makers sacrifice speed to attain reasonable definition. However, better definition is possible even with this type lens, as box camera owners learn to their surprise when they discover the diaphragm plates by which they may alter the size of their aperture. Even without making this discovery, they can still obtain pleasing results, for at the larger apertures, the simple lenses produce negatives that are pleasantly soft in outline. Portraits and even landscapes are artistically shrouded in a flattering haze devoid of sharp lines and hard edges.

One of the principal defects of the simple lenses, you ex-box camera fans may remember, showed up discouragingly when you tried to photograph a building. The sides of the edifice looked anything but straight in the picture. Such a picture is said to have caused a little alarm in an office building when someone passed around a picture of the Chrysler Tower he had taken from the window.

"Why, the building is about to collapse!" they cried, but a glance out of the window reassured them that no danger was imminent.

The rectilinear lens design overcame the bulging tendencies of the simple lens and also increased the sharpness of the image to a great extent. An R.R. lens when stopped down to f.16 produces images of fine definition within an angle of about 20 to 30 degrees.

Anastigmatic lenses

The invention of this lens design in 1896 led the way to the manufacture of lenses of high speed and critical definition such as we use today on the better cameras. The simple combination of three lenses with air spaces, designed by Taylor of England, was soon followed by the Tessar design of Rudolph in Germany. Both arrangements are used extensively on present-day cameras.

The triplet design appears most often under some name that indicates its construction of three elements: Triotar, Trioplan, Trionar, and others. Its slightly

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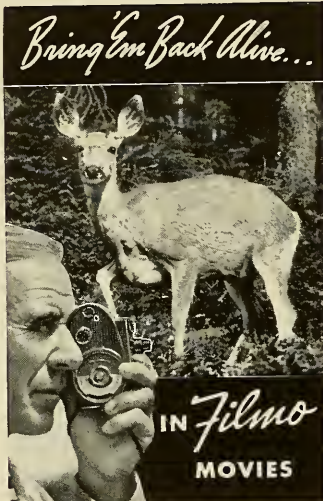
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lower cost makes it a favorite on the middle price range cameras. Although it is made in speeds as high as f.2.9, it is usually confined to lenses of f.3.5 or slower. Its lack of good definition at the edges of the field is about its only drawback. The angle of good definition extends through about 25 degrees, which is usually insufficient for still cameras which normally operate through an angle of 45 degrees. For motion picture cameras and long focus still cameras where the angle to be covered rarely exceeds 20 degrees, the triplet lens is everything that could be desired. The images are brilliant, the elements are easily cleaned, and neither time nor weather affects the transmission of light.

The Tessar lens design was an adaptation of the triplet lens which improved the marginal definition of the latter. The Tessar proved so successful that it has been copied by almost every other lens maker since its original patents expired. Originally designed as an f.4.5 lens, modern Tessars have been increased in aperture to f.2.8. To improve it further the focus of the infra-red has been brought into virtual coincidence with the visible light image so that no special adjustment is needed any longer for long-distance infra-red photography.

Minor improvements continue to be made in the Tessar construction. One of the drawbacks of this lens design was the sharp curvature of the front lens. This has been corrected in some of the later constructions. The softness of the glass of the front element in the Tessar has exposed it to tarnish by the atmosphere and scratching by contact with dust. This defect has been reduced by the Bausch & Lomb Optical Company in their Raytar lens, whose front element is a much harder glass than is usually found in anastigmat lenses.

The advent of the candid camera increased the demand for lenses of higher and higher speed. The small size of the negatives used in the miniature camera made the design of an f.1.5 possible. In the case of motion picture lenses where a still smaller picture size is required than for a miniature camera, lenses of f.1.3 made their appearance.

These new high-speed lenses are built up of a large number of lens elements, sometimes as many as eight pieces going into the complete objective. By cementing some of these together, several of the reflecting air-glass surfaces are removed and the tendency of the lens to flare is thereby reduced.

Because of the large amount of glass exposed, rapid lenses require the use of a lens hood to reduce the amount of stray light that strikes the front element. In the case of motion picture lenses, their small size makes it easy to place a large and efficient lens hood over them, but in the larger cameras, a hood of proper depth is awkward to carry and use. A collapsible type of hood is to be recommended.

Care of lenses

To give your lens the care that it deserves, you should keep in mind a few simple rules:

1. First dust the lens with a brush.
2. Wipe gently with lens tissue.

LENSES FOR YOUR CAMERA



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"Close Formation" by Arthur E. Nelson

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3. Breathe on lens and swab with tissue.
4. Never touch the glass surface with your finger. Some perspiration is corrosive.
5. Keep a cap on the lens when not in use, to reduce atmospheric attack.
6. Put a filter on when there is danger of salt water or rain striking the lens.

YOUR NAME PLEASE

Continued from page 239

Negroes, of course, are noted for their imaginative naming. Only a negro mother could have named her son Pism C Jackson after the Hundredth Psalm, i.e. Psalm C; while negro daughters (and, rarely, white) sometimes are saddled with such difficult, medically tinged names as Euretha, Latrina, Gonadia and Placenta.

The Vanishing American

It seems pertinent at this point to inquire after our friend Rain-in-the-Face. How did he and all the other aboriginal Americans fare in the naming and re-naming bee which was a natural consequence of the relatively sudden admixture of so many language groups in the New World? The question is probably best answered by a glance at the names of students listed in various Indian schools. A few phonetically spelled old tribal names like Wauskakamik survive although usually playing surname to a spurious John or James. Literally translated affairs like Standingdeer and Black-bear are found in the same company. (Accent the first syllables and see how they might pass unchallenged in any English drawing room). But for the most part the roll call in an Indian school-room would sound prosaic enough. Brown, Stevens, Jones, Walker and even occasional immigrant names like Lundquist and Petoskey comprise the rank and file.

Nevertheless on some reservations the tribal names linger on. Mr. H. L. Davis in an enlightening communication published in Mencken's *The American Language* states:

"The Indian Bureau for some years made an effort to retain the Indians' names in their original languages, translations into English only being sanctioned when the native version was too long or too unpronounceable to admit of fast handling. However . . . translation has been pretty generally adopted everywhere. Appellations such as *Dirty Face* and *Big Baby* are received with the utmost solemnity by the Cheyennes, the Sioux have *Bull Head* and *Stink Tail*, I have heard of a chief on the Northwest Coast who answered with the utmost simplicity and frankness to *Unable-to-Fornicate* (or words to that effect), and I once knew a Siletz who insisted with firm complacency that his name, no matter what anybody thought it, was *Holy Catfish*.

"Native names in the native language have generally been retained among the Navajo and to a considerable extent among the White Mountain Apache. It is a kind of half-and-half business, for the Indian Bureau requires the patronymic to apply to all heirs of a man's body, which by itself upsets the whole Indian name-system wherever it is applied. Indians in a free state don't use patrony-

mics at all. Among the White Mountain Apache the problem is attacked more sensibly; the Indians are permitted to take what names they please, and for registration purposes are given reference-letters and numbers, like automobiles.

"The Paiute Indians of the Great Basin get round the patronymic requirement by keeping their native names only for religious and ceremonial purposes, and adopting for business use the surname of some white family. This will eventually result, of course, in the native names disappearing entirely, as it has done among the Cherokee and such tribes of the Eastern United States, and as doubtless it did among the negroes of the South in the early stages of slave-importation."

The curious irony in all of this is that as he surrenders the natural and seemly names of his rapidly disappearing traditions, the Red Man will adopt those of animals in the long-vanished European wilderness. He will be known by the words for Viking weapons and by the kitchen utensils of London taverns where Shakespeare drank his ale. He will proudly flaunt the name of the stockiest of stock characters in a medieval miracle play or take pride in what was once the ludicrous nickname of some plodding Yorkshire peasant. He will, in short, be known by the names that we prize so dearly—our own.

LETTERS

Continued from page 245

I shall offer to give all the collections I have made or may make as a nucleus for the proposed Museum, not that I may be connected with it in any capacity, but only to have the pleasure of starting such a good cause and perhaps be allowed to suggest on what principles I hope it will be carried out. The collections mentioned will be all I shall then possess or am likely to possess, but I freely give all I have in this world and only hope others will offer enough to make a proper beginning.

I trust you will be happy to lend your influence in its favor, and hope you will mention it, as occasion may offer, to such gentlemen whom you know as may take pleasure in lending it their aid. If you know Gov. Hamilton Fish I hope you will mention it to him if it should chance to be quite convenient.

I am one of those who believe that science and religion instead of being antagonistic should work together, and if a Museum is formed in New York I trust it will always manifest the most kindly feeling toward Christianity while it illustrates the surpassing goodness and wisdom of the Deity as manifested in his works.

While at Swatow lately, I had the pleasure of meeting two of our good Baptist Missionaries. They see much cause for encouragement, and generally I find that the cause of Christ is prospering abundantly in these heathen lands.

Hoping also to have the benefit of your good advice in the future, I have the honor to be Most respectfully yours,

April 15, 1867, ALBERT S. BICKMORE,
Yokohama, Japan.

LETTERS

DEAR MR. BARTON:

Your item concerning names in *NATURAL HISTORY* interests me, and reminds me of a professor who used to say, "Boys, don't trace your family tree back too far. You may find someone hanging on it."

There are a couple of items, however, which may be clarified; and I hope you will not resent this note.

Cohen is not rabbi. Cohen is from a semetic root KHN which means "to stand," and came to mean "Priest" because he stands to officiate. "Rabbi" is from RBN, or rabban, and is "teacher." RBN in use is chiefly post-exilic. Rabbi actually means "my teacher," the final "i" indicating first person possessive in Hebrew. "Rabboni" is more endearing.

You have Samuel as "include me out."* The root SML is for "hearing." El is the ancient semetic name for God, probably older than JHVH, especially in its plural form "elohim." So Samuel actually means "heard of God."

(REV.) W. R. SIEGART.

St. Matthew's Lutheran Church
Reading, Penna.

* * *

DEAR MR. BARTON:

Your discourse on "names" in the April *NATURAL HISTORY* is very interesting and very entertaining.

Concerning your inference that the melancholy name of Death has long been abandoned, I should like to add this note. Still living in the Valley of Rossendale, Lancashire, England, is one man by the name of James Death, usually known as Jimmy Death. My informant is my Mother. I point this out as evidence of man's temerity in retaining such a name when it might be expected to have been dropped generations ago along with the many similar ones you cite. From all accounts the man is a very decent citizen.

OLIVER H. STANSFIELD, M.D.

Worcester, Mass.

* * *

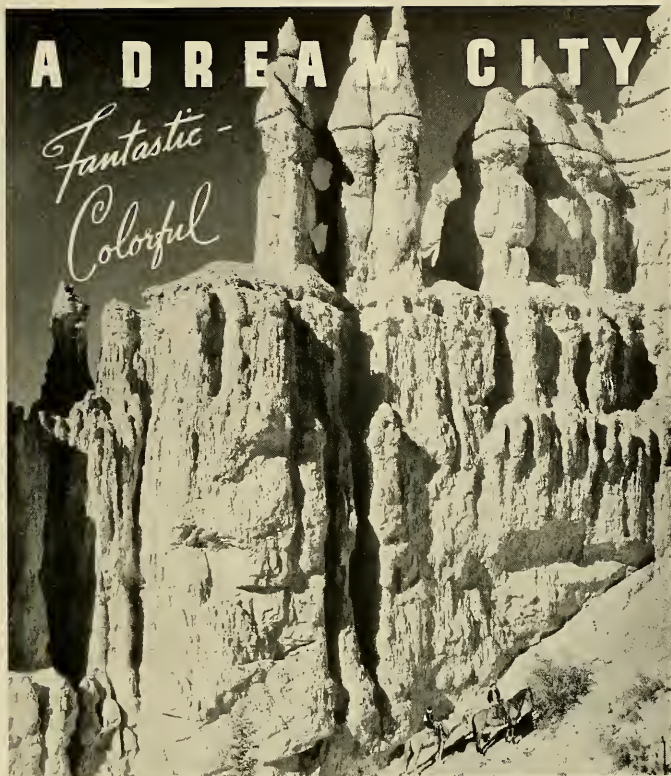
DEAR DR. CURRAN:

Concerning your article "On Eating Insects," in the February *NATURAL HISTORY*: yes, our older Indians in the Yosemite region still eat insects—our Miwoks not so much as our Paiutes who have come over the Sierras from Mono Lake. I have tried to secure some samples of insect food for you from the local Indians, but they seem to be entirely out. I believe it will be possible this summer to secure a supply for you from the Indians at Mono Lake.

Koochabbie (variously spelled) is still harvested yearly on the shores of Mono Lake, and the larvae of the Pandora Moth (called *Tikkule*) are gathered under Jeffrey Pines every two years. They are roasted in trenches and stored in baskets. Soup is made from them. Old women like to roast a dozen of them on a sharp stick twisted in the fingers over hot coals.

I have eaten both of these foods and

* The typographical arrangement of Samuel ("include-me-out") Goldwyn may have led others to suppose that the parenthetical phrase was a translation of the name. Actually it is a phrase attributed to Samuel Goldwyn as typical of his linguistic monkeyshines.



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prefer the former. They taste like shrimps. A few years ago our old Indian, Tabu-ce, gathered a supply of yellow-jacket larvae and roasted them for us in her *chamah-you* basket, using live coals, just as she would roast pine nuts. We have had them on display ever since. The Miwok word for them is *me-ling-i*. Enjoyed your article.

C. A. HARWELL,
Park Naturalist.

Yosemite National Park
California

SIRS:

. . . May I take this opportunity to express my appreciation and enjoyment in your fine publication? The articles are always well written and very readable and well illustrated.

JULIA SMEAD.

The Colorado Museum of Natural History
Denver, Colorado

SIRS:

. . . I want to congratulate you on the very high standard of the articles and illustrations which have been appearing in recent numbers of NATURAL HISTORY MAGAZINE. I am particularly interested in the valuable educational way in which you dramatize important facts by clever drawings and succinct descriptions. Your handling of the various breeds of dogs is a masterpiece. I wish that it might be copied in enlarged form and placed in the domestic animal room of some of our larger museums.

HAROLD J. COOLIDGE, JR., *Chairman,*
Pan American Committee,
International Wild Life Protection.
Cambridge, Mass.

SIRS:

. . . I do not regret the \$3.00 I have spent to become a member—the magazine alone will be worth more than that. All of the articles are instructive and well written. The ones that interest me most are "The Story of Glass," "The Twilight of the Aztec Civilization," "The Story of Fire," "Biography of a Whistlepig," "Modern Treasure Islands" and "Old Mister High-Power."

BILL PESTER.

Indio, California.

SIRS:

I wish to write this short letter of appreciation and encouragement concerning the March number of NATURAL HISTORY because of the very worthwhile articles on conservation of wild life and resources. If only more thousands of comparatively unaware and careless people could see such a publication frequently, the waste and even all-time ruin, allowed to continue, might be checked much more, even though some greed will always exist. I am very pleased to read more and more such accurate but not cold accounts written recently in several periodicals. Print more of it!

GEORGE B. ROSSBACH.

Dudley Herbarium
Stanford University, Calif.

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Address Esther W. Eno, School Registrar
Buffalo Society of Natural Sciences
Buffalo, New York



These intimate nature studies in the life of our common gray squirrel show how the photographic hobby can augment the pursuit of Nature throughout the year, even within the confines of a large city. The pictures were all taken in Prospect Park, Brooklyn, by Frank Smith. Two types of nests are shown: one in a hollow tree, the other high on a limb. The little fellow digging frantically in the snow in the center picture is searching for nuts buried before the storm. No quest for "a needle in a haystack" is this, for a keen sense enables the squirrel to recover most of the food hidden, even after snow has blanketed the region.

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

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The Magazine of the American Museum of Natural History

FREDERICK TRUBEE DAVISON, President

ROY CHAPMAN ANDREWS, Sc.D., Director

VOLUME XLIII—No. 5

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MAY, 1939

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THUNDER IN



HIS FOOTSTEPS

By ROLAND T. BIRD

*Department of Vertebrate Paleontology
The American Museum of Natural History*

The ghost of the most gigantic animal that ever walked the earth is conjured to life when a lone fossil hunter tracks down the first true footprints left by this stupendous creature, and thrills to the romance of a great discovery

THERE had been snow on the window of Jack Hill's store when I looked in, so I wasn't certain if the things were real or not. Even at that, I had been a great deal more than startled. I walked on past the store window, on down the street facing the whirling cloud of flakes that were northern New Mexico's first taste of winter, trying to think, trying to find in my mind and in my category of fossil track experience, a niche for these strange objects. It might not do to go back and enter the store appearing too excited over them. Owners of fossils picked up in the rough sometimes are quite ready to place exorbitant value on them, and I'd never met Jack Hill. I stole past the window once more in the casual manner of a man disinterested and glanced in. Yes, they apparently were real enough. Real as rock could be . . . in that Indian trader's store in Gallup!

I took a last look and resolutely reached for the doorknob. After all, I only wished to see these odd prints at closer range, analyse them more carefully, and identify them if possible. It seemed too good to believe any living creature had made prints like that to turn up here unnoticed and unsung in a trader's store. Still you never can tell about such things. Anyway I turned the doorknob and squeezed into a large room in which it seemed half the Indians in West Gallup had gathered to escape the vileness of the weather.

A busy clerk nodded assurance when I told him I only wished to examine the strange objects in the window. I made my way past a group of dusky squaws with their bundles on the floor, to the window. My fingers sought the stones, turning them to better light. For a moment I had them to myself—the strangest things of their kind I had ever seen. On the surface of each was played the near-likeness

of a human foot, perfect in every detail. But each imprint was 15 inches long! Then a big Hopi moved closer, grunting in my ear, laughing. "Zuni tracks," he said. Out of the corner of my eye I could see the clerk smile: "Do you know of anything, have you ever seen anything, that looked like that before?"

No known animal

I had to admit I hadn't. Furthermore, I could conceive of no animal that might have made them. It was ridiculous to think they were human footprints. They were too large and bear-like; and yet they weren't like the largest prehistoric bear I could think of, the great Pleistocene cave bear, for the toes were not typical. I felt a keen sense of regret when I told the clerk: "I'm afraid your Jack Hill has found himself a pair of fake footprints."

It really seemed too bad for both of us. I was finishing a field trip that hadn't been very productive of fossils for the last two months. True, there had been a couple of rare, rather incomplete dinosaur skeletons collected earlier in the season in Montana—thanks to the assistance of my good friend George Shea of Billings. But here it was almost the end of the season, with almost no hopes for new prospects. If these things had only presented something more tangible to go on. . . .

I was explaining this to the clerk when I learned Jack Hill had some other tracks from the same locality in Lupten. When I heard they were dinosaur tracks in exactly the same type of stone, from apparently an identical stratigraphic level, my thoroughly revived curiosity could scarcely be retained. This put things in an entirely new light. Even the possibility of such an association seemed incredible. Could I have been mistaken in my first conclusions? I couldn't believe anything until I'd seen what Hill had in his other store, so that night I drove to Lupten.

The entire affair now presented one of the strangest problems in all my fossil hunting experience. The dinosaur footprints were found as represented and, like the "mystery tracks," they were fine specimens—too fine. I had every reason to suspect the

(Left) "THUNDER LIZARD", a sauropod dinosaur approximating the one which left his footprints in Texas mud 120 million years ago. He bulked the equivalent of four or five 6-ton elephants. Man would have reached only to his knee

Drawing by George F. Mason

entire lot had been fashioned by some stone artist, but how they had been so neatly done, how a man could have duplicated the dinosaur tracks at least, without an intimate knowledge of something genuine, there was no means of telling. The latter were typical of some large three-toed carnivore, and all the friction pads showing in the impressions were correct in every detail. Although Jack Hill hadn't been in town, it was learned both types came from Glen Rose, Texas. A conflicting multitude of questions at once arose: If the dinosaur tracks *were* genuine, could the strange prints be those of some hitherto unknown reptile? If they were all copied



MAN, beast, or hammer and chisel? Although of questionable origin, these mysterious, 15-inch, man-like tracks led to the region where the gigantic sauro-pod left his trail

after genuine prints, would there be any chance of finding such if I went to Glen Rose? If a basis could be established for the dinosaur tracks, what might be learned about the others?

To plan on collecting any known type of fossil, the prospector must take into consideration the age in which that particular type came into existence, must be certain that rocks of that age are exposed in a locality where they are said to be evident; yet under all circumstances he must also be ready to gamble on finding still others *in situ* when he arrives. These tracks presented even the extra gamble of being fakes, but, oddly enough, when I consulted a geologic map, I had a hunch something might be there. Glen Rose was in a region where one might reasonably expect to find actual dinosaur tracks, if not the others. Its surroundings were lower Cre-

taceous in age—rock exposures roughly 120,000,000 years old—very definitely of the Age of Reptiles. It all seemed too fantastic to put much stock in, but such was the foundation for what might be described as a “mystery hunch.” With still other unexpected things ahead, it proved to be a lucky one.

So Glen Rose became my destination. I arrived with the hunch still strong and healthy, though was relieved to think it hadn't cost me many extra miles. I didn't want to feel too encouraged, but the fact also remained this was a region never worked by the American Museum before.

The town and its surroundings were a pleasant surprise. The wooded region up the Paluxy River looked as if it might furnish many favorable campsites. Good drinking water—often as much the concern of fossil hunters as a place to camp—promised to be abundant, for Glen Rose, as a little health resort, had many fine mineral wells close by. Roads were above the average, and the rock exposures I soon expected to be working were right at hand.

Three-toed surprise

I drove around in the old Buick that has been our expedition mainstay for more years than her disposition shows, drawing these deductions and acquainting myself with other details. When I circled the country courthouse square a little later, my eyes caught sight of something that made me want to shout for joy. There, inserted in a bit of masonry not far from the door, was a large, three-toed dinosaur footprint. Its surface had been turned away from me, and I'd thought for an instant it was the usual fossilized log or stump one sometimes finds exhibited in places where fossils abound. But as I swung the Buick in to the curb it presented in all its outlines a faithful picture of such a track.

It was a beauty, and there was no doubt that it was genuine. It was all of twenty inches of footprint perfection, made by a three-toed carnivore in mud which had faithfully preserved every minute detail. The satisfaction of seeing it was worth my extra miles; it clarified the worst half of an embarrassing problem, and gave promise of other things. A slab of such prints alone would be a fine addition to any museum collection.

Even so, they were things long taken for granted in the community. I inquired around and soon learned they occurred in numbers in the rock ledges along the river bed for several miles upstream—the river sheering its way through Cretaceous rocks, bringing them to light as it cut along. One close glance at that civic symbol in front of the courthouse had convinced me that the dinosaur tracks in

Lupten had been false; that originals from which they had been copied were here—the next thought concerned the others. I hadn't been able to locate the man from whom Jack Hill bought them, so set out to deal with what the rocks themselves might have to offer. I knew the best way to do this was to get in touch with someone familiar with the river, so I drove upstream and sought James Ryals, whose farm was described as bordering the track ledges conveniently.

I felt a little sorry for the man. He expressed disgust at the very mention of tracks. I learned he'd had his difficulties with them; he occasionally chiseled specimens from the bed of the river to sell, but the financial returns were hardly worth the labor in-

my surprise he said, "Oh, you mean the *man tracks*. Why sure, there used to be a whole trail of them up above the fourth crossing, before the river washed them out."

My surprise was partly overcome by Ryals' casual reference to them as human footprints. I smiled. No man had ever existed in the Age of Reptiles. But here apparently was the answer to the other half of that baffling track mystery. Maybe Ryals would know of more of them. Often a simple question can save you much random prospecting. My interest was hard to conceal when I asked: "Can you show me one?"

Ryals intended to cut some cedar posts that afternoon and was reluctant to leave, but I finally prevailed on him to walk to the river with me. We didn't have far to go to find a few dinosaur tracks and were soon peering at several under water and river silt—those at least were evident. Then we came to a place where we had to cross over to reach a track ledge beyond. Finally after jumping from stone to stone we stopped at a shallow hole with a muddy bottom. Ryals sloshed a shovel back and forth and then stood back while the current washed the surface clean. I watched closely as the outline of a foot took form, something about 15 inches long with a curious elongated heel.

A mystery print

What I saw was discouraging in one sense, enlightening in another. Apparently it had been made by some hitherto unknown dinosaur or reptile. The original mud had been very soft at this point, and the rock had preserved faithfully this element of softness, but the track lacked definition on which to base conclusions. There was only the one, and though my eyes itched to see a good one, the overlying ledge covered any possible next print. Ryals said he knew of no others exposed at present.

We turned our attention to other things. The three-toed prints occurred in numbers along the ledges, often at the water's edge and under river silt. Some were the most perfect I had ever seen. A unique situation, however, had accounted for this. The limey matrix had originally been firm, viscous mud, ideal for impressions; and the softer shales that represented the muds that filled them later, had disintegrated freely without marring the tracks. However, due to the wear of the Paluxy River, good trails, in a series, were difficult to locate. They'll have to be in a place well protected by mud, I thought, as Ryals rambled on, telling of still other trails that had been thus torn away or destroyed by this water action. Then we came to a heavy gravel bar, curving around a bend. "Too bad," he said,



A BODY some 60 feet long was supported on these huge thigh bones: skeletal remains in Wyoming of an animal similar to the one that left its 12-foot stride in Texas rocks

volved. One such specimen lay in the yard. I could hardly wait to inquire about the mystery tracks, and at a favorable moment broached this doubtful subject. I hardly knew what to expect, but much to

TRACKING DOWN DINOSAURS. More stirring to many than their actual skeletons are the footprints they left revealing their movements and habits. At right is seen R. T. Bird of Barnum Brown's dinosaur corps on a lone hunt for footprints in Texas, planned to be installed in the American Museum's new Jurassic Hall, just opened. Though dinosaurs were abundant in their heyday, they left footprints only where they stepped in mud which eventually hardened to form rock

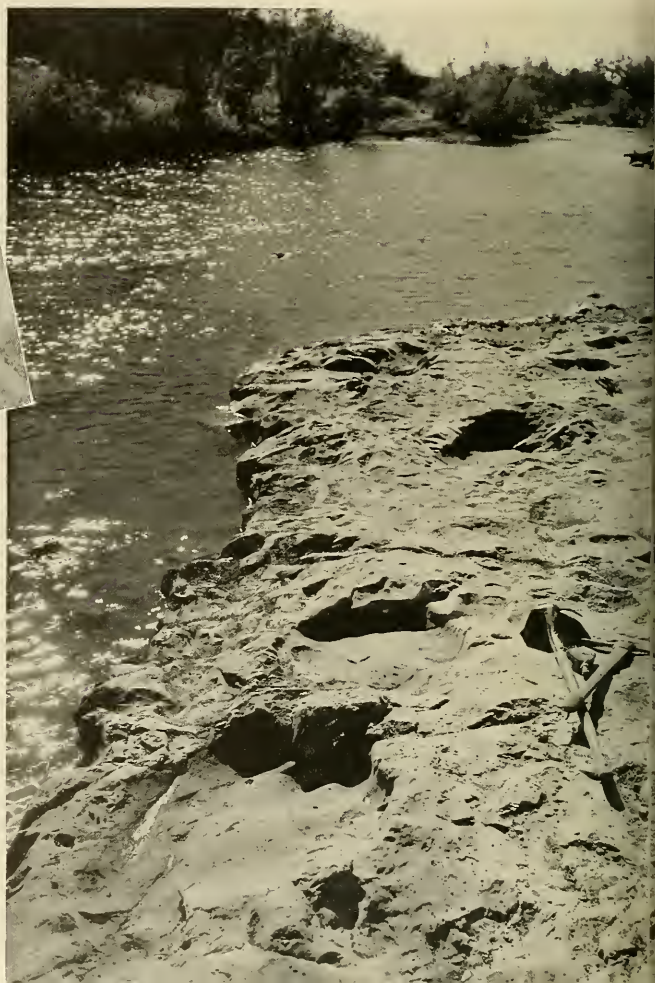


THE PALUXY RIVER (*above*) recently eroded sediments exposing the ancient mudflat on which the dinosaurs left their footprints, long since turned to stone. The three-toed prints shown in lefthand photograph were made by a fair-sized two-legged dinosaur which fed on other animals and was presumably on the hunt when he passed this way. He towered about thirteen feet high and was a dynamic machine for the pursuit and capture of prey, which he tore to shreds in his powerful jaws and hind feet



*All photos by
R. T. Bird*

(*Right*) WHERE THE GROUND "THUNDERED" to the tread of one of the most gigantic four-footed animals the world has ever known: footprints of a prehistoric titan resembling the familiar Brontosaurus, whose name appropriately means "Thunder Lizard." These prints were associated with the three-toed prints and are the only definite ones of their kind ever to be disclosed. With an enormously long neck and tail, the creature must have measured 60 feet or more in length and stood 15 feet high at the hips. The row of prints shown are all rights, the first left print appearing just above the center of the picture



MORE THAN A YARD from toe to heel and almost large enough for a bathtub: a footprint which sets a record for size. It clearly retains the marks of the four toes which the animal is known to have possessed on its hind feet, as proved by skeletal remains

THE ANIMAL WALKED TOWARD the camera in the photograph below, which shows the main track ledge in the distance as a point projecting into the river. Careful observation will disclose the tracks approaching the lower right corner as a double row of potholes under several inches of mud and water



(Right) TICKLING THE TOES of a sauropod for the first time. This cast, made by pouring plaster of Paris into one of the gigantic footprints, shows what the bottom of the creature's right hind foot looked like. Projections at left represent the toes and claws. Its length is 38 inches as R. T. Bird measures it

THUNDER IN HIS FOOTSTEPS



looking down at a mass of stones and boulders. "There used to be some fine things under that stuff; I wish you could have seen them."

Biggest of all

Then he described sauropod footprints. This was startling information, for the group of dinosaurs known as sauropods contains the most gigantic four-footed animals known of any age. I questioned him at length, hesitating to believe the man. Tracks of the largest beasts in Nature! In this type of rock, where tracks were preserved so faithfully, it sounded too good to be true. A sudden desire to dig into the gravel bar almost overcame my better judgment. That indeed, would be a strike I'd little dreamed of—the discovery of these largest of all footprints. But the heavy gravel bar was several feet in depth, and there was no assurance such prints might still remain underneath. The turbulent Paluxy often plays strange tricks with its bottom at periods of high water, when ledges rip away like cardboard. As it had been a long time since Ryals had seen these tracks, I felt it best to conserve my enthusiasm for other things. We moved on, and I temporarily dismissed the subject, but it was a thought to keep in mind.

For the next few days I prospected up and down the river in the old Buick, talking with people and learning of tracks and trails they'd known of, and investigated other possibilities. I became so accustomed to the mention of "man tracks," that I found I'd adopted the term myself in conversation, though additional specimens of that reptilian footprint with the curious elongated heel were to be found nowhere except in the memories of those who recalled that famous "fourth crossing trail." As for further information on the sauropod tracks, I encountered only one other man besides Ryals who had ever known of them. This was Ernest Adams, Glen Rose archeologist, who knew the region perhaps as thoroughly as any man. He passed the remark that there was more than one undescribed footprint along the old river which he knew had never been reported—among the lot, those of this heavy quadruped. "I think you'll find them," he said.

Still, as I look back on it, I remember I hadn't been overly excited. All the previously discovered sauropod tracks were vague, not too definable things. None had ever turned a theory, and the possibility of finding such seemed remote. I only knew of two cases, and one of these I'd visited earlier in the season. They were an odd series of 26-inch circular prints, but when one attempted to analyze the trail it failed to jibe as sauropod. The Meyers and I, and several other friends of John MacClary, had spent

an exciting half day investigating these tracks southwest of Pueblo, Colorado. I was interested, hopeful, but not excited.

There seemed to be only the three-toed tracks left to work with, so I planned to find the best ones. I wanted to locate a prospective slab for the American Museum. It would have to be done systematically, starting in at the beginning, and uncovering all places where I knew from experience the tracks existed. To take out such a slab would have to be a consideration for the future, but I wanted definite assurance that one was here.

I started above the "second crossing," worked that area carefully, and then came upstream a mile above the "third." Tracks had been waterworn and scattering below, but up here prospects were better. Then one morning, little dreaming what lay in store for the day, I finished cleaning off two of the best trails as yet encountered. They had been made by two large carnivores walking close together—creatures with seven-foot strides that would have towered thirteen feet or more in height, probably weighing several thousand pounds each. It was quite evident the mud they walked on had had a firm base, as neither animal sank more deeply than three inches.

The lucky strike

Around noon I had finished everything but digging the prospector's usual "three-feet-beyond-your-specimen-just-for-luck," when I spotted a large pothole filled with silt that didn't seem to be anything, but which was right there inviting an investigation. When I dug into it and threw back a few shovelfuls for a look-see, my heart nearly jumped out of my mouth. There, right at my very feet, was a depression totally unlike any I had ever seen before, but one I instantly surmised must be a sauropod footprint. The thing was still partially filled with river silt, and I hardly dared believe it could be, yet its general contours matched perfectly my preconceptions of such a track. It had the shape of a gigantic lizard's foot, might almost have served to take a bath in, and had been impressed deeply in the surface. Now I recalled Ryals' mention of such tracks under the heavy gravel bar. "Good old Ryals," I said to myself, "the man must have been right at that!"

It was like uncovering a place where one of the pillars of Hercules might have stood. My emotions could not have been more stirred over a find of dinosaur eggs. It seemed like an hour, but it must have been less than a minute before my shovel grated bottom, and with a little careful sweeping out the thing was clean enough to be defined. Something

about it had seemed almost too easy. Here I had been working diligently all that morning, without suspecting a thing like this was near me; and yet here it was, a sauropod footprint. The river gurgled past me, laughing, as I studied the four deep claw-scratches, the huge one on the inner toe; the typical upward curve of the reptilian heel, and other detail. The print was that of a right hind foot.

Giant stride

For the next few moments I did the things which any track hunter would have done under the circumstances. I stood up and glanced around the track ledge, wondering where such a gigantic foot had been placed at the end of the next step. The entire ledge on that side was littered with silt thrown from the other trail. The last rise in the river had swept in quantities of mud and this had thoroughly covered this other trail. I figured in a straight line the way the toes were pointed, and shoveled out a likely place. But nothing was there—just solid ledge. Then I ran my shovel along until it hit the rim of another depression.

It was all of twelve feet away from the other. Heavens, had the fellow stepped that far! I threw about a wheelbarrow load of dirt out of it, trying to orient my conceptions of such an animal. I looked up, half expecting to see a mountain of animal above me. But here it was again, the impression of another right hind foot, like a fossil hunter's pot of gold at the end of a rainbow.

Then a left print so badly waterworn that I hadn't suspected it as being a track, over by the river's edge. Each of these three prints was over a yard in length, by nearly two-thirds of a yard across. All were four-clawed, and as such, could be definitely classified as hind feet. So fascinated that I didn't think to pull off my shoes, I sloshed around in shallow water just beyond, to locate where both rights and lefts continued. While so engaged I noted still other sauropod tracks in deeper water. Evidently more than one of these fellows had been wandering around there once.

I came back to the dry ledge, satisfied at last. I'd learned where to search for the forefeet by this time—always a little in advance of the rear ones. They were more shallow and hadn't showed up as readily, but were none the less interesting. Such tracks indicated the foot had been heavily padded with flesh in life, and there was just a trace of the single claw on the inner digit. This was a day of days! Even my beloved chief, Barnum Brown, would have been not a little thrilled at this. I thought of him, then on an aerial survey, up in Canada. I was

sorry he wasn't here. Well, the trail would remain for other times to come.

Can you visualize the great bulk of such a creature that had walked there? He must have approximated the big brontosaurus whose huge skeleton now dominates the New Jurassic Hall in the American Museum. When you come into that hall, and look up into that great mechanical mass of articulated bones above you, even then it is difficult to picture such a beast in life. Sixty-seven feet of lengthy neck, backbone and tail; four pillar-like legs with hips alone fifteen feet above the base; shoulders according, and a massive basket for a middle. . . .

Still such a creature once floated a vast body most of the time in lakes and lagoons where favorable plant food abounded. Here a similar sauropod had apparently been moving over a shallow mud flat.

Even if I hadn't tried, I couldn't have helped imagining the big fellow was moving along there, time and time again, as I finished cleaning up that trail. At the end of an hour I walked back and sought a high place on the river bank where I could look along it. I wanted now to piece the complete story together around these tracks as the evidence seemed to show it happened; I wanted to catch the detail of a strange and spectacular sight: that of this greatest of all four-footed animals in motion. The smaller, flesh eating dinosaurs had come along there first, for I found a sauropod footprint impressed on one of theirs. It was evident they were terrestrial animals; hence this rock ledge, then a mudbar, must have been exposed close to some shoreline, or at best only covered by shallow water. As previously mentioned, these carnivores were large, yet the mud was firm enough to hold them.

Thundering ghost

With these thoughts in mind the great dinosaur moved again for me. He was out there on the shallow mudflat coming in from deeper water, progressing in the manner of a heavy quadruped, moving slowly, leisurely, without concern. Beyond were other sauropods, but he, in the foreground, was the central figure, with the sunlight glistening on his moist skin like the glint of a wet alligator crawling on a bank to dry. It glistened on his tiny head and along the great snakelike neck that held it. It followed across his massive shoulders as he moved, and flashed on the ripple of the muscles; it danced over the great broad back and ponderous hips and thighs, to linger on the water after the passage of a lengthy tail. He would have bulked the equivalent of four or five, six-ton, African elephants combined. The heavy mudflats must have trembled under him. You might have felt the thudding jar of every step as he

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OLD ZIP COON—*A giant of his kind, he followed his master on hunting trips and could lick his weight in dogs, but he proved one of the most rambunctious pets that ever had the run of a naturalist's house*

By ROY L. ABBOTT

*Professor of Biology,
Iowa State Teachers College*

IT WAS my good fortune to grow up in a "coon country," which country was a place of mud flats and huge basswoods and elms, with the high grounds above the surrounding bluffs thick with melon patches and cornfields. It was a veritable haven for coons, and at the heels of a yowling pair of hounds I have followed for miles during many a thick, drizzly night stumbling blindly through water and over logs and brush, eventually to come up with one of these pointed-nosed, black-masked fellows sitting humped and imperturbable in the top of some tall tree.

Yet as often as I met him I always felt a thrill of admiration as I saw his eyes shining valiantly down at me, for no coon that I have met was ever a quitter against any odds. I have seen him shaken from a treetop into the very center of a pack of waiting dogs, and in spite of his heavy fall put up a fierce fight for his life. More than once, too, I have seen him stand half-covered by the icy waters of a creek and fend off four or five mongrels, gripping them with his strong hands, slashing them cruelly with swift teeth, and ducking and half-drowning them as they waded out to the attack.

King of coons

But of all the coons I have met, I never met one before or since like Old Zip, a pet I kept for two years. For one thing, he was almost king among all coons for size. He weighed 25 pounds, and that when lean and in fighting-trim, and there was not a dog in our neighborhood who could. . . . But let me first tell how I found him.

Before I met Old Zip, as far back as I could remember there had been a tradition of him or rather his prototype in our community. Among us country boys at the little consolidated school where hunting and fishing were as much talked as history and mathematics, "Old Zip Coon" as we called this mythical coon-of-all-coons was a familiar topic of conversation. We had all seen him or, perhaps more accurately, at least his tracks. He was, of course, a giant in size, his tracks

in the mud of this or that creek were like those of a young bear. We saw nothing incongruous in the fact that he was reported as being seen in widely different localities at about the same time, and we violently resented the implication that there might be several big coons scattered about the country. To us there was only one "Old Zip Coon." Hadn't I, myself, been one of the fortunate few that had actually seen him?

Through the morning mists

I had been unable to find one of our cows the night before, and was out early next morning searching for her in the creek bottoms when my good luck occurred. It was damp under foot, and I was pretty quiet as I came up to the creek bank hoping I might catch a glimpse of a flock of wood ducks. I stuck my head through a clump of dogwood, and then, miracle of miracles, there in the shallows, the vapors from the water curling around him, stood an enormous coon probing into the mud with one paw while his eyes searched the shore. I think my gasp of surprise must have caused him to turn my way, then with a sort of injured expression as he saw me he at once waded straight into the creek, swam the last few yards and vanished among the bushes on the opposite bank.

I forgot all about the lost cow and dashed frantically home to spread the news and beg father to assist me in capturing the prize I had sighted, but he only smiled and said:

"You wouldn't want to catch him now, would you sonny? Furs are not prime in late March, you know, and if you want a coon for a pet, get him young—old ones are sullen and bad-tempered. I know for I've tried 'em. Go back after the cow, and keep an eye on that big basswood along the creek there. You might have a surprise in a month or two."

And I did. I fairly haunted that part of the creek, for it just happened there was a good "bullhead hole" right under the great basswood to which he referred, and one evening about the first of June the thing happened. I was sitting quietly waiting for a bite when suddenly there was a scratching sound as of toenails on the bark above me, and then something landed with a great splash right in the middle of the creek.

I had seen squirrels slip from a branch and fall plump into the water but this was the first time I had ever known a coon to be so careless, for that is what it was—there was no mistaking that pointed head which came bobbing up and that fluffy ringed tail floating out behind as the little fellow swam bravely straight toward me. He was so bent on getting out of the water I believe he never saw me until I clapped a wet gunny sack containing half a dozen bullheads over him and carried him home in triumph, hardly stopping for more than a glance at the old mother coon who came inquisitively headfirst half-way down the tree in response to his cries. I would investigate her and the rest of her brood later.

Of course, I named him Old Zip, for there was never any doubt in my mind that this husky baby coon was any other than the son of "Old Zip Coon" himself. He must have been still nursing when I captured him, for it was no trouble to get him to drink from a bottle following those first few hours which it took him to make up his mind I wasn't going to hurt him. After a few blundering trials he quickly learned to grab the bottle rather ill-manneredly from my fingers, and holding it between his strong hands he would suck and gurgle away at it never ceasing until half a pint of milk had entered and swollen his little belly. Then he would drop the bottle carelessly, lick his paws, and crawl into a corner for a nap, never forgetting, however, to curl his bushy tail across his face.

Gourmand

By late November he was nearly grown, and no wonder, for with the exception of a pet woodchuck I once kept,* Old Zip could eat more per ounce of his weight than any animal I ever saw. And he ate a far greater variety than the woodchuck. In fact I never found many things that he wouldn't eat. He could outdo the woodchuck even in eating cornbread and molasses, and in addition seemingly had a limitless capacity for chocolates, honey, plum-pudding, and custard pie. I have often wondered, in fact, how an animal so unused to these delicacies in the wild state could acquire such a taste for them. Indeed I shouldn't say "acquire" for Zip and every other pet coon I have seen seemed to be born with such tastes for sweets.

But in addition to sweets, Old Zip had also a strong liking for meat. Coons have been accused of killing chickens, in fact, have been caught in hen houses with plenty of dead chickens about as proof of their crimes, but although surrounded, so to speak, by chickens, Old Zip never injured one. I have seen him

pick up a young chicken and inspect it minutely, pushing his sharp nose over all parts of its anatomy, yet offering it no harm. I have seen him do the same thing with a very young pup, even thrusting his nose into its ear and sniffing deeply as if determined to find out its meaning.

Fisherman

It was fun to take Old Zip hunting. We lived near the woods, and he would follow me closely through the trees humping awkwardly along like a young bear, never failing to climb up and run along the trunk of every fallen tree in our path, but always best satisfied when I would stop near a creek where he could fish. Coons can swim strongly when necessary, but they cannot dive and catch fish like a mink or an otter. Yet they love the water, and Old Zip was never so happy as when wading in mud or shallow water and probing for crayfishes or frogs.

So far as I could tell he used his eyes but little in his fishing. Of course he saw frogs lunge into the water, and sometimes made quick passes at them, but for the most part he merely thrust his paws under the water and probed into the mud with his amazingly sensitive fingers, his eyes all the while gleaming apparently absent-mindedly through his black, burglar's mask as if frogs were the last thing in the world to concern him. But there must have been close connection between fingers and brain, for every now and then his arms would stiffen in a quick clutch and he would go waddling to the bank to devour some luckless frog—usually growling low as he feasted.

Now and then he washed his food before eating it, but this is certainly not an invariable habit of coons as some report. Old Zip, of course, washed his food sometimes according to good coon etiquette, for that's where he gets his common name of "wash-bear" among the Germans, and for which the Latins also called him "lotor," the washer. But he never bothered to wash candy, and for that matter other things when he was hungry.

Old Zip had good eyes, but I am inclined to believe from long observation of him and others of his kind, that his chief sense was that of touch—that sense residing chiefly in two places, his fingers and his nose. Never have I seen any animal's fingers, not even excepting a monkey's, that seemed to have quite the astonishing delicacy of touch that Old Zip's had. They would explore any object—a bit of glassware, a flower, a bunch of keys—every part touched by a searching finger before Old Zip was satisfied, and all this, too, usually without looking at the object, unless his nose also was used as a probe.

Those delicate fingers were powerful, too. I have had Old Zip clutch me with them in an amazingly

* "Biography of a Whistlepig," by Roy L. Abbott, *NATURAL HISTORY*, February, 1939.

strong grip, and one writer recently describes a coon battling with his arch enemy, the fisher, and killing this fierce opponent by choking him to death. I suspect that if the author of that interesting tale had known all the facts he would have discovered the coon doing some terrible slashing also with his forty fine teeth as he gripped his enemy with his hands.

Explorer

One of Old Zip's peculiarities always amused me. He seemed to have a strong desire when handling something to bring both hands together around it or through it until they touched. He would thrust one hand deeply into a jug, for example and then seemingly try to touch the hand on the inside by the other through the wall of the jug. If a coon can show surprise, Old Zip always showed it on such occasions, struggling vainly to bring his two hands together. Noticing this peculiar behavior, I gave him a short piece of gas pipe to examine and he at once fitted it upon his two hands like a muff. It was screamingly funny to watch his antics when I put a mouse in the pipe; I think his fingers could barely touch the mouse, which managed to stay just out of danger in the middle. Finally giving up trying to reach the mouse with his paws he eventually thrust his long nose in one end of the pipe, gave a loud snuffle, and the foolish mouse ran squarely into his waiting hand at the other. He was almost as fond of mice as of frogs, and showed surprising agility in catching them.

When I first captured Old Zip, I had two dogs, one a big Shepherd, and the other a half-grown mongrel. The Shepherd would have nothing to do with the coon at any time, always moving aside with vast and stiff-legged dignity when Old Zip approached him. The mongrel on the other hand accepted the coon at once, the two often rolling over and over together and nipping playfully at each other with all signs of enjoyment.

One day when Old Zip was a year old and well grown, a neighbor's dog came into the barnyard and sailed into the coon with a savage rush that scared me. I happened to have a pitchfork in my hand and quickly started to my pet's defense, but I at once saw he didn't need my assistance. As the dog charged in for the kill, Old Zip flung himself backward against a straw stack, and met the fierce lunge with a coolness and skill that left me open-mouthed. His legs and arms seemed to entwine the dog, and his jaws flashed and cut like saws. When the Collie finally shook himself loose he had had more than enough of it.

Of course, I gleefully advertised Old Zip's fighting prowess, and it wasn't long before he had to meet all sorts of dogs, my one stipulation being that dog

and coon should be about the same size. John Burroughs says that "a coon is probably the most courageous creature among our familiar wild animals. . . and will always whip a dog of its own size and weight." I don't know about the "most courageous" quality, for I have seen woodchucks die like Spartans, and a lone muskrat stand his ground in the center of a circle of boys and fend them off by making short rushes first at one and then another, until he finally broke through the wall of his enemies. But I do believe with Burroughs that for cool defiance of danger, an almost contemptuous indifference to great odds, the coon stands by himself. In facing a foe, Old Zip never seemed to lose his head; every move that he made counted for something. I suppose that sooner or later we would have found a dog that would have been too much for him, if father hadn't put a sudden stop to the contests. I was secretly glad of this for, cool though he was in battle, constant brawling didn't seem to be good for Old Zip's disposition, and I noticed that he showed a tendency to snap at me now and then when I handled him.

Pantry thief

Old Zip was allowed the run of the house for a while, but we soon had to stop that, for he was the worst pest that ever entered a room. He had an insatiable curiosity to handle and examine objects and it was practically impossible to keep things out of his reach. He could open a door almost as easily as I could, and when that door happened to lead to the pantry, as it did one day when mother was outdoors—well, that was the last straw. He had evidently tasted everything, even going so far as to uncork bottles, and the pantry was a wreck. So was mother's patience, and from then on Old Zip spent his time outside of the house, and most of his daylight hours involved no greater activity than lying sprawled either back or belly up in the sun on a wide limb of a dead maple. Like my pet woodchuck, he loved to soak up the sunshine, especially when the jays neglected to pester him.

Old Zip spent his first winter in the haymow of our barn. During the coldest spells, he borrowed deep into a hen's nest in the hay, but at no time did he actually hibernate like a woodchuck or a ground squirrel. He was out and lively as ever by the last of February, and showed a disposition to wander off into the woods.

I believe the sex-urge was moving in him at this time, for coons mate in February, and so I tied him up for a while at night. It was now, too, that I first heard his song or love-call, or "whicker," or whatever it may be dubbed—a long-drawn, quavering squall

somewhat like the voice of a screech owl but much louder. Old Zip would never make his song while I was watching him, but I have heard it skittering forth from many a coon in the deep woods at night—a wild, unforgettable cry!

It was during this season that I penned him for a week with a she-coon belonging to a neighboring farmer boy. Some two months later the boy gleefully announced that the female had produced six "coon-lets" and, of course, I went over to see them, taking Old Zip along with me. Coons are thought to be monogamous, but not a great deal is known of the part the father plays in the family life, and Old Zip certainly showed no particular affection for his progeny. While my friend held the mother, savage and snarling at the end of a leash, Old Zip, seemingly entirely unmindful of the she-coon's threats, calmly picked up two or three of his babies, examined them minutely, then dropped them like sticks and ambled carelessly away. I believe he never knew in any sense that they were his, and I wondered what sort of brawl there would have been had the mother coon been free while he examined her brood.

During Old Zip's second year, I paid less and less

attention to him—the novelty of a pet coon had worn off somewhat—and I knew that he was spending most of his nights in the woods, returning, however, to sleep out the days in the security of the barnyard. One night, in fact, he sought safety in the barnyard from a pack of coon-dogs, who made the night so horribly vocal I had to drive them off with a club. But I saw him even less after that, and I believe he spent his second winter holed-up in a hollow basswood back of the barn. He appeared for a meal two or three times in March and then disappeared altogether—probably too much engrossed with family affairs to pay any further attention to his human friends who, after all, had forced themselves upon him.

It has been forty years since I last saw Old Zip, and the life of a coon even when lived to the full is probably only fifteen or twenty years at most. But remembering what a splendid creature he was, so full of the raw vigor of woods and waters, I have no doubt that even today, some members of his family tree still fish for frogs in the very creek where I first saw his father, and that they cease food-hunting long enough now and then to send out their long, weird cry under the stars.

DO NOT MISS

CLIMBING NYAMLAGIRA, in which Martin Birnbaum, tireless globe-trotter and intrepid student of primitive as well as civilized art, recounts the thrilling ascent of Africa's famous volcano. Writing of the mountain country that Akeley loved best, Mr. Birnbaum describes the monstrous beauty of this majestic peak and the tameless forces that rule the blazing pandemonium of the primal world.

The story of the rose, its place in the poetry, architecture and folklore of many nations, is told with simple clarity and charm in Harriet Geithmann's **QUEEN OF FLOWERS**.

Do you know a flat-foot from a toe-walker? Soon in **NATURAL HISTORY** you will see a fascinating key to the identification of **ANIMAL TRACKS**, in which the naturalist Ellsworth Jaeger shows the endless pleasure to be derived from the hobby of deciphering the movements and moods of animals unseen.

MODERN ESKIMO ART, in which the astonishingly beautiful ivory carvings of the far north take shape under nimble brown fingers schooled in a centuries-old tradition. Much has been written of the Eskimo as huntsman and primitive economist. Here he is presented as an artist, and a plea is made for the prominent inclusion of his work in the great world of true art.

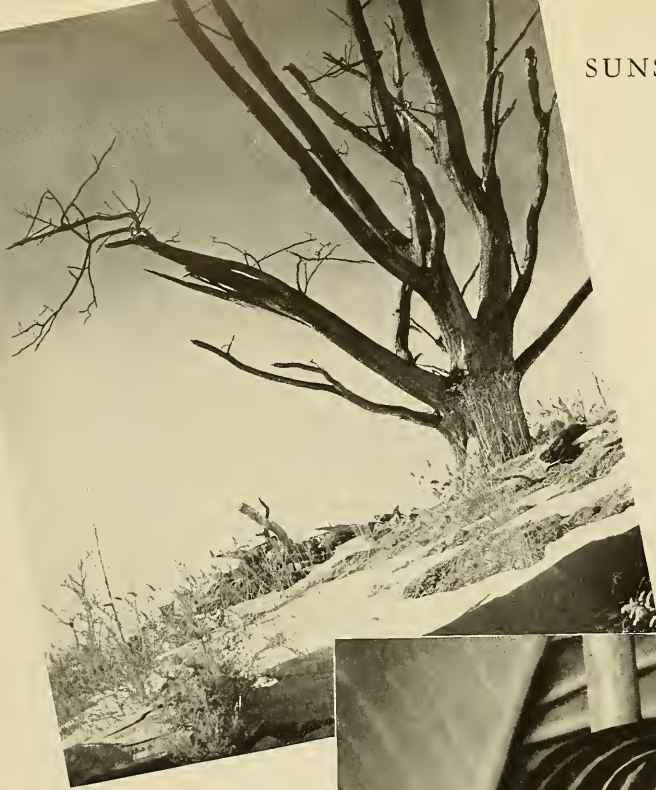
THE HUMAN BOT FLY by the author of *On Eating Insects*, wherein Doctor Curran reverses the procedure of his previous article to examine the fantastic case of in-

sects not only eating, but living inside men. When the bot fly captures its mosquito and carefully lays eggs on its back, does it *know* the mosquito will shed those eggs near its sting-wound on man or monkey? And what happened to those pioneer scientists who let the bot fly larvae thrive in their muscle tissue? These are only a few of the questions discussed in Doctor Curran's amazing article.

LIZARDS have long been popularly supposed to be among Nature's most inveterate sun bathers, but recent investigations by C. M. Bogert have demonstrated that the ability of some species to survive desert sunlight is limited to only a few minutes. In a coming issue of **NATURAL HISTORY** Mr. Bogert will tell how reptiles regulate their temperature by changing color, and how they have survived in great diversity despite climatic conditions differing adversely from their original environment of 175 million years ago.

In **A PICTORIAL HISTORY OF A BITTERN'S NEST**, A. Daves DuBois describes the trials of a "candid camera man" intent on recording the family life of this fascinating member of the heron family. The mother bittern was so camera shy that she actually "growled" at his approach—warning enough from any bird—and when he persisted, forced him to pay for the pictures with his own blood! But Mr. DuBois feels the pictures were worth it and upon their near-future appearance in **NATURAL HISTORY**, we believe that readers will enthusiastically agree.

SUNSET SENTINEL



JACK-IN-THE-PULPIT





A PEEK INTO THE WORLD OUTSIDE Young White-footed Mice

Seeing Nature *through* THE CAMERA'S EYE

By HENRY B. KANE

STRAY

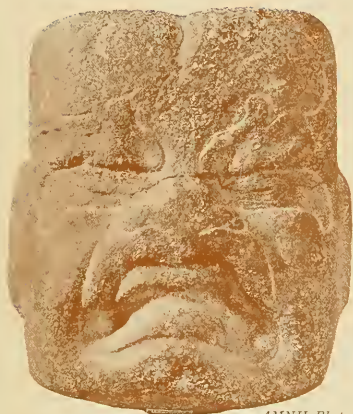
Young Meadow Mouse

THE CAMERA'S EYE



BY THEIR ARTS

You Shall Know Them



AMNH Photo

1. TIGER-FACED deity mask
(Olmec) from Central Vera Cruz

By GEORGE C. VAILLANT

*Associate Curator, Anthropology,
American Museum of Natural History*

ART is a common denominator in all types of human culture. The greatest artistic achievements are still made by hand, so that the element of machinery, which so distinguishes modern Western Civilization no more affects the production of our modern arts, except perhaps architecture, than it does those of earlier eras. However, the social background of our modern art is very different from that of earlier and less complex tribes and nations. Whereas these simpler groups produced their arts in terms of craftsmanship, in our Western Civilization we confine such creative impulses to a small proportion of the population, whom, as "artists," we maintain as a special part of our social and economic structure.

Our attitude to our own artists is also affected by the extreme complication of our social organization. Simpler tribal communities often maintained skilled craftsmen by virtue of their artistic production, even as we do our own people with superior talents. On the other hand the universal primitive dependence on hand-work makes the cleavage between especial talent and ordinary skill seem less profound than in our modern communities.

The tendency of our artists and designers to draw inspiration from the arts of other peoples in other climes and other times may be due in part to this communal poverty in artistic expression and in part to the specialization implicit in a highly skilled profession. The fact that our modern use of the word "Art" has added to the term special shades of meaning not to be found in most languages may be also symptomatic of this general movement away from group participation in the creation of art forms.

Yet, if we moderns do not produce communal arts, we do show a wide interest in the achievements of

Whether it be fear of the supernatural typified in the eerie carvings of Polynesia, the gaudy ritual of fantastic New Guinea masks, the astonishingly modern impressionism wrought on an African elephant tusk, or the subtle naturalism of clay sculpture in ancient Mexico—each primitive art tells the essential story of the community that produced it

other peoples, who have not lost their manual skill through complete dependence on machine production. Representative of this interest on our part is the art museum, an element of popular instruction and gratification, only recently introduced into our social economy. Here we may see sculpture, painting, and other works of art carefully selected according to our own ideal of beauty and the historical development of this ideal.

The art museums carefully distinguish the more modern works as to their creators, but they can only designate the period and place of origin of the earlier masterpieces. Moreover, this anonymous art of the past often has a religious or utilitarian purpose, whereas the most recent identified works seemed designed for purely aesthetic ends. The relationship of the ancient religious arts to our modern aestheticism can be readily seen, and from the point of view of appreciation or intrinsic worth, the past does not have to bow to the present.

The majority of the art museums, for reasons of public taste, space, and finance, direct their exhibits with a view to their relationship to our present culture. There is a very obvious tendency to broaden the historical and comparative base of our modern art. Examples of Egyptian, Chinese and Cambodian art enhance and expand the view of aesthetic achievements of mankind. Yet there are many important and interesting schools of artistic expression that cannot be included in the museums primarily formed to show art.

These developments, however, are not inaccessible. They are collected and exhibited in anthropological museums, whose purpose is to show the Natural History of Man and whose exhibits are frequently combined with those of Natural Science, as in the American Museum of Natural History. Since anthropology occupies itself with the biological, social and technical



Photo by Hess



AUSTRALIA

2. (Left) Not a Southern Bushman, Pacific Islander, but New Guinea artist's concept of a supernatural being. The (to us) repellent effect should be overlooked in favor of the skillful carving and the insight it gives us into the people's awe of powers of Nature.

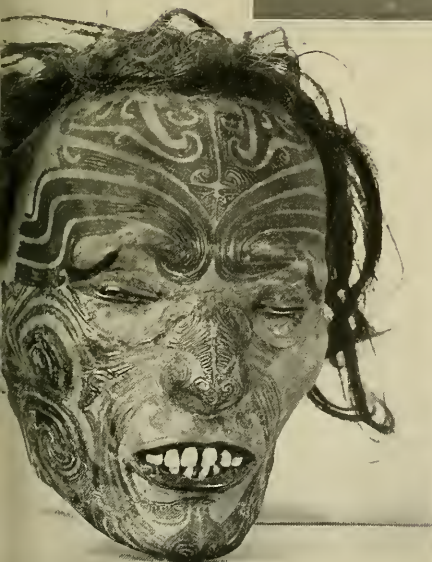
PACIFIC OCEAN

EASTER ISLAND

All maps by
Levett Bradley



AMNH Photo
by Kirschnur



3. THE CLOSE ASSOCIATION between community attitude and the shape and matter of community art is shown in the examples above, left and right. Beneath the painted clay face (*top*) is a human skull used by the New Guinea artist as a manikin. Note weakness of chin due to discarding skull's lower jaw. Even more lugubrious is the Maori head-hunter's art (*left*). Here is the ultimate in "naturalism." This human head solemnly and ingeniously preserved had the elaborate color design "chiseled" rather than tattooed into the skin during life. Both forms betray a realistic interest in *The Head* as against the bird-beaked figment of an Easter Islander's fancy (*right*) which suggests imaginative mysteries. All these forms are distinctly alien to the western mind

AMNH Photo by
Kirschnur



Photo by Hess

processes by which man has been able to live in every part of the globe, the art of man appears as an aspect of his general evolution, not as a subject in itself. By a sort of informal consent these collections stop with the dawn of civilization, whereupon the art museum takes up its phase of the story and the museums of science and industry or history display the other phases of cultural evolution.

It is obvious that this cleavage is artificial. There is much material of anthropological importance in a major art museum and many fine examples of art in a museum exhibiting the natural history of man. Yet, the difference in manner of display and emphasis tends to divide the two types of museums as well as the interests of their visitors. To reconcile this apparent divergence the American Museum of Natural History has set up an exhibition to stress the notable achievements of peoples whose arts were not tributary to the main stream of European civilization, and consequently are not represented in museums illustrating the art history of our culture.

Skill in depicting the human form and in suggesting its spiritual essence is an important index to the artistic achievement of mankind. Even as man originally created his gods in his own image and endowed them with his own attributes magnified and intensified, so in making images to revere and to symbolize, man tried to reproduce the human form. Thus in these outlying zones of human culture, sculpture becomes an excellent means for comparing the native arts with our own highly defined artistic conceptions. The formulae of presentation, the ultimate synthesis of the physical type, the hauntingly intangible reflections of the group psychology, all lead us into fascinating fields of contemplation. A study of pure design, if more directly comparable, is too cold to challenge the imagination as does sculpture. This point will become more clear when we consider the tribal carvings we have selected as illustrative of the high development of arts outside of our own tradition.

Easter Island

Isolated in the limitless expanses of the Pacific, Easter Island is the source of an important sculpture in wood and stone. The wood-carving combines three features, a religious purpose, a naturalistic presentation and a firmly established style. The figures represent either old men or elusive beings with heads of birds. They seem to be designed as portable idols, since they do not stand without support, and disclose the delicacy of detail and subtle gradation of surface planes requisite to an object designed for handling. In contrast to the wood-carving, the massive heads and torsos, made from huge blocks of lava rang-

ing up to 30 feet tall, appear rude and uncouth, but symbolize, nonetheless, the power of the supernatural so dominant in primitive life.

We cannot recapture the precise attitude of mind of these carvers in wood and stone, since forcible removal of the population in 1862 destroyed the native culture. However, technically and stylistically Easter Island art fits into the general pattern of Polynesian sculpture. If the forms are perhaps ancient in concept, they are not of any tremendous antiquity. However, contemplation of these carvings from our own emotional and intellectual plane discloses an eerie quality, fitting to the religious art of a people isolated in the midst of a limitless sea.

New Guinea

In contrast to the austerity of Easter Island sculpture, the art of New Guinea discloses a barbaric panoply of ritual. Intricate design, bright colors, fantastic masks, complexly stylized idols, create a rich pageant to absorb the tribal interest. Ceremonies for initiates, ceremonies for uninitiates, ceremonies bought, and ceremonies sold, involved a mass participation in plastic and decorative expression, productive of an astounding array of highly decorated paraphernalia. While individual examples or even a large number of specimens, hastily seen, might well induce the effect of an exuberant lack of restraint, closer study reveals an adherence to stylistic canons and to forms of presentation, that indicate a long tradition of expression. In its broadest aspects this wood-carver's art radiates through the Melanesian islands, each of which has its distinctive tribal styles. Its past may extend even to the early culture of the Asiatic coast.

Such art as this is difficult to harmonize with our west European canons, but in a decorative sense, one could easily conceive how the very intricacy of a New Guinea carving would relieve the rigorously mathematical lines of our most modern interior decoration. Although we may reject these styles as bombastic and outside of our tradition, Melanesian art is a distinctive, expressive, and calculated result of centuries of practice under a well-defined, if un verbalized, æsthetic.

Utilization of Natural Forms

The direct principle of reproducing natural forms seems stifled in the midst of this rampant Negroid development of design. Yet the treatment of human skulls discloses a plastic sense that stands out from the rest of the art. The skulls were covered with clay, which was then carefully modeled with an accuracy suggestive of actual portraiture. The ultimate end may have been magical or ritualistic, but the result is a noteworthy sculpture. All too often, the skillful

building up of the features is lost through the application of paint, which, although reproducing the appearance of a living subject, nonetheless obscures the essential excellence of the modeling.

In contrast to this plastic art, based upon head-hunting, is the Maori custom of carving and dyeing beautiful designs upon their faces during life. After death the heads of notables were smoked and carefully preserved. The process brings out the design and shows how exquisitely the elements of the pattern were gauged to conform with the position of the features of each face.

Both of these methods of using the human head as a background for artistic expression far surpass a third variation found in the Amazon drainage of Ecuador and Peru. Here the head of a victim is skinned and the hide reduced by heating and drying. Manipulation of the skin retains the main contours of the face and the adornment of the head with colored feathers and insect wings discloses an interest in ornament. Yet the total result is crabbed and wizened, hardly to be compared with the superb techniques of the Pacific Islands.

West African Art

The art of Africa evokes from us moderns a more direct response than do these styles from the Pacific. African sculpture seems to express the lusty emotions of the Negro, and conforms to the sensory appeal of our European tradition. Perhaps because of its greater familiarity to us, perhaps because of its emotional content, African art does not have that strangeness of presentation and function that blocks our approach to many of these distant arts of obscure peoples. While all Negro carving has a generic resemblance from the point of view of Europe, familiarity with the subject will disclose many tribal and regional styles. In all of Africa, the west coast has produced the most exciting developments, the bronze art of the Benin region and the ivory sculpture of the Mangbetu people.

The Benin bronzes fulfilled the needs of church and state as did the medieval art of Europe. This strikingly rich fruition of Negro genius has a bold realism, fitting in those west coast kingdoms, where killing, cannibalism, polygamy, drunkenness, and, above all, pomp prevailed. The casting of the bronzes by the lost-wax process may have been introduced by Europeans, but the expression and the styles have no hint of influences alien to the Negro. The heavy pride to be seen in photographs of west coast kings is transposed to these bronzes and the accentuation of the wide, low, thick features reveals the artists' understanding of the way to visualize the essential character of the tribal psychology. As befits a national art,

there is an inherent monumental quality indicative, not of the individual artist, but of the æsthetic influencing the whole tribe. The production of this tribal art was a craft, not an embodiment of an individual's perception, and we notice in the arts of the Middle Ages, although the traits stressed are less full-blooded than the African, the same obliteration of individual reaction in a great mass expression.

The Mangbetu ivory treasure is probably the last coördinated output of a West African kingdom. The firm hand of colonial administration plus the drying up of the ivory supply combine to extinguish the full development of a national art. The social background for the creation of this ivory sculpture was much the same as in Benin, but the gleaming white of the medium employed gives a less lowering effect than the blackened bronze of Benin. Elongated forms, controlled by the shape of the elephant tusks, have a gracefulness lacking in the bronzes. Ivory also provides a natural surface for drawing so that the graphic arts are represented in a lively and expressive manner, although less grounded in the traditional forms of the sculpture. In this Mangbetu art, craftsmen, working in a tradition, served religion and the coast and created a closely coördinated artistic expression that permeated a wide variety of forms. Even as the arts of the Middle Ages, this African æsthetic reveals unity but not repetitiousness in its richly varied application.

Occasionally, the element of pure realism breaks the bonds of custom and exquisite forms result. Two superb clay heads from the Yoruba country will rank with great portrait heads of any civilization. African art, because of its vitality, will stand high in the scale of tribal and national arts. Our familiarity with the racial types involved and our comprehension of Negro emotional values bridge the gap between African presentation and our own. Therefore, African art makes an excellent point of departure for the understanding of arts wherein a distinctive set of racial and emotional factors are involved.

New World Art

The art of the American Indians passes through the full range of artistic evolution. All stages are represented from the highly sophisticated products of highly ritualized civilizations to the crude linear patterns of people almost on the threshold of human living techniques. Yet this rich and complex field for observing not only the fulfillment but also the formation of artistic expression, is virtually unknown to the world of art. Three factors have been instrumental in barring a popular esteem for our aboriginal continental art: it is exhibited in the custody of an-



5. (Below) BENIN BRONZE is the alliterative catalogue name for this collector's piece and indicates the traditional medium of the Benin tribe of West Africa. With this alloy they fulfilled the needs of church and state much as did the art of medieval Europe. Students comparing the two also point out that both forms show the strict subordination of individual expression to that of the group, a quality our modern art has all but lost

AMNH Photo
by Kirschner



4. (Left) AFRICAN ART, with its many ardent devotees among us moderns is generally more appealing to our emotional temperament than the work of any other primitives. Somewhat paralleling our feelings about African as opposed to oriental music, it seems lustrier, earthier, more stimulating than other more decorative arts. Down center of page are two items in a Mangbetu chief's royal treasury. Both are beautifully incised ivory pieces curiously possessing the abstraction of form sought in much modern sculpture. Upper figure is girdled with a kind of pictorial frieze, while the graceful taper of the lower one is controlled by the tusk's shape

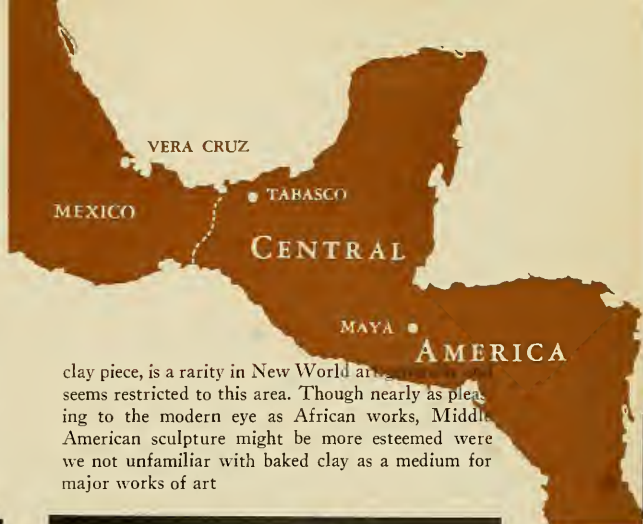
Photos by Hess

6. (Below) SOMEWHAT MORE ELABORATE is this Congo-made head, a striking ornament attached to no more exalted a base than an ordinary clay pot. Notice the skillful execution of the features. This together with the care expended to work up a metallic surface seems a prodigal waste of talent to us, accustomed as we are to machine-produced utensils



AMNH
Photo
by
Kirschner





7. (Above) AN ABORIGINAL "CHERUB"; typifying the highly humanized Totonac art of what is now the state of Vera Cruz (Mexico). Relics of pre-conquest days in this region often show a whimsical likeness to Chinese art, doubtless enhanced by the depiction of the Mongoloid features so common in American Indians. Humor, like that so clearly defined in this

clay piece, is a rarity in New World art. It seems restricted to this area. Though nearly as pleasing to the modern eye as African works, Middle American sculpture might be more esteemed were we not unfamiliar with baked clay as a medium for major works of art



AMNH Photos by Kirschner

8. (Above) TWO MAYA MASTERPIECES which once looked down from the walls of a sacred temple. The symbolism of an established tribal ritual looms large in the one at left with its grotesque features, but the excellence of the naturalism in the other has the appeal of a great world art



9. (Left) THIS GOD'S MASK from the Tabasco region displays an unusually sophisticated style as well as the expected religious stylization so prevalent in art designed for community expression. Plaster masks presented in this same way adorned the walls of the earliest Maya building yet discovered by archeologists

Photo by Hess

thropology; much of the subject matter is highly ritualistic; we lack an emotional understanding of the Indian character and, therefore, his art, so that the subject matter of his aesthetic seems cold and abstract.

Our western civilization has as a goal the comprehension and the subjugation of nature. In our modern art, we see efforts to recapture and transmit a person, a mood, a truth, or an attitude. The Indian tried rather to establish a magical relationship with nature, wherein, although recognizing the superiority of natural forces, he could constrain or induce them to act in his favor. This attitude persisted even in the highest Indian civilization where magic was transformed into a complex ritual and the tribal surplus was converted to the maintenance of the religion. The service which art has always rendered religion was not neglected in Mexico, but it progressed along the lines of symbolism and ritualistic detail. Thus in content and in presentation, Middle American art is antagonistic to our method of contemplating the universe. However, it is possible to select out elements of Middle American art which can be appreciated intelligently against our own background.

Maya Art

The ceremonial art of the Maya-speaking peoples stands supreme among these ritualistic developments. Every line, every contour, every minor symbol bespeaks tradition and method. Yet the Maya gods were often human personifications of natural forces and in representing them Maya craftsmen reproduced their ideal of beauty. At Copan, in Honduras, during the middle centuries of the first millennium after Christ, a remarkable sculpture in the round was dedicated to this end. The deformed forehead, large nose, astigmatic eye were stressed as important indications of beauty. As would be the case in depicting a fattish people, the contours of the face and body were stressed, rather than the anatomy, and the polishing, pecking, and grinding processes necessary in working stone without metal tools would accentuate the sculptors' interest in surfaces. The Copan stoneworkers succeeded in producing figures which have an aloof repose, fittingly recording the power incarnate in nature. Moreover, these figures were meant to be seen from below and the faces of these gods look down dispassionately upon their worshippers.

The Art of Vera Cruz

An abundance of fine sculpture comes from central Vera Cruz in Mexico and it is easily assimilated in terms of our western aesthetics, for Totonac and Olmec art gives a tantalizing suggestion of Chinese

forms, an impression heightened by the skillful reproduction of the Mongoloid features, commonly found in our Indian population. The Totonacs and the Olmecs not only worked in stones ranging in hardness up to jade, but also utilized baked clay as a medium for expression. The latter substance, so subtle and so easy to manipulate, seems to have been neglected by most Old World civilizations as a material for major work of art. Yet its extensive use in Middle America as a medium for major plastic expression may be a result of the absence of the sharp-edged metal tools, essential for wood-carving. In fact, our aversion to this material in our own art causes us to discount some of the most important Middle American art.

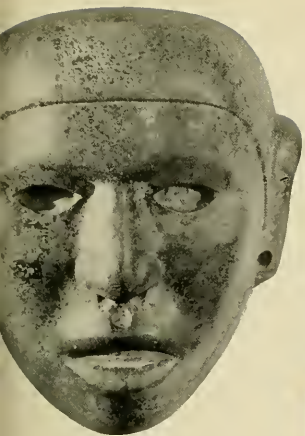
The variety which the Olmec and the Totonac attained in their clay sculpture extends to differentiations of physical type, distinction between ordinary and supernatural beings, and even to distinguishing facial expression, and definitely reveals the presence of versatile and sensitive craftsmen. Yet these workers also could combine the abstract designs of a stone ceremonial yoke with an elegantly chiseled profile of purest realism. They could create the chuckling merriment of a laughing head in clay and reproduce a warrior's stern features in porphyry. Another group of clay sculptures recalls the fatigued sophistication of the Ptolemaic art of Egypt.

Arts like these are comparable on direct terms to the great national expressions of the Old World. The jades from southern Mexico rival in sheer intrinsic values of color and design the long-admired jade art of China. Yet there is no doubt of the independent evolution of these two arts.

Aztec Art

The Aztecs are the best known to us of the Middle American peoples. The Spanish conquerors, military and ecclesiastical, studied them carefully, for they represented the full tide of Indian culture at the coming of the whites. Aztec art exemplifies the ceremonial representation of Middle America, enhanced by the balance and rhythm of the profound sense of design, almost universal to Indian art. Yet, given a reason, Aztec craftsmen could reproduce, with singular charm, goddesses who had for them the connotation of youth and spring. The validity of Middle American presentation is amply attested by the works of Diego Rivera, who was the first of his countrymen to thrust away the canons of European bodily proportion in order to portray the anatomical and spiritual qualities of the Mexican Indian.

The peoples of western Mexico never attained the high degree of civilization reached by their eastern



10. (Left) FOR SHEER CRAFTSMANSHIP this porphyry mask from Central Vera Cruz is unexcelled by any single art work in the American Museum's vast Middle American collections. Comparison with the Maya heads on page 273 discloses a latent strength in this piece, borne out by the ruggedness of the modern Mexican Indians in contrast to the gentle softness of the present-day Maya. Indian history before the Conquest bears out the mute testimony of the art styles



11. (Right) CORN GODDESS OF THE AZTECS carved in basalt. The idea of ripe maidenhood suggested by growing corn is one of the many poetic conceptions which primitive people have applied to their staple food-plants



AMNH Photos

12. (Left) LARGE CLAY FIGURE unearthed from an ancient grave in western Mexico. Despite this association with the after world, the comparatively naturalistic treatment of face and body denies that its creators were enslaved by ritual. But one glance at the fantastic Zapotec sculpture at right reveals the work of a people given to the intense ceremonials of a Middle American theocracy. Resembling the many-armed gods of Tibet, this piece does not require experts to point out how the requirements of the local religion had narrowed the range of artistic expression



13. (*Below*) MORE PRECIOUS THAN GOLD from every standpoint was the native American jade from which this beautifully carved ceremonial axe-head was created. The face is that of a deity widely worshipped under various names, who was conceived as having the face of a jaguar or

ocelot (large leopard-like feline). Below at right is the head of a Vera Cruz idol wrought in baked clay, a medium favored for the subtlety it permitted these early artists who lacked effective metal tools



AMNH Photo



Photo by Hess

and southern neighbors. Their art, expressed chiefly in clay, is intended to represent but not to symbolize. Both people and animals are represented doing things, although not in violent movement. This passiveness, a sort of monumental inaction, runs through Mexican Indian art, and the modern visitor notices that same lack of violent emotional expression in the present native population. At first oppressive, the effect becomes soothing and calming, counterbalancing the violence of thought and deed in our western world. Equally characteristic of the old Mexico and the new, is a sly, quiet humor which peeps out of the rigors of ceremonial expression even as it bubbles quietly among the modern Indians repelled so far from their once proud state.

North American Art

The North American Indians seldom reached the great heights of ritualistic expression attained in the Central American civilizations. While the builders of the mounds in the middle western and southeastern United States show evidence of considerable artistic ability, for sheer exuberance in design and sculpture the carving art of the Indians of the Northwest Coast stands supreme. Wood was the great medium, and it is tantalizing to think of how little we would know of this art had it not flourished in the latter half of the nineteenth century. Not only do these tribes

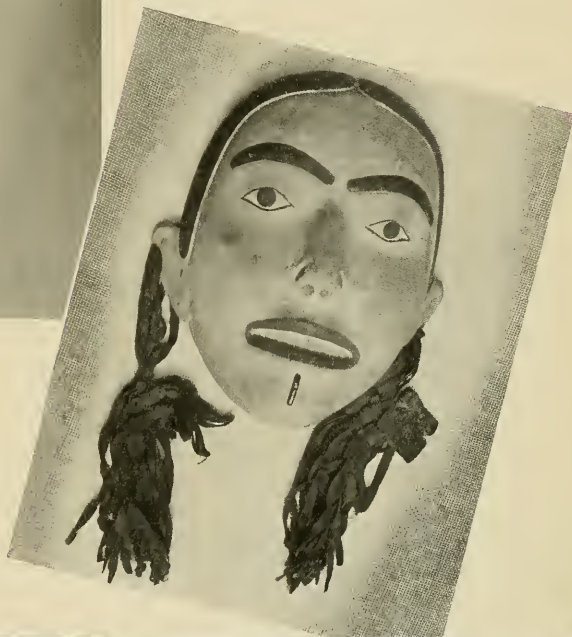
show the innate Indian ability to use conventional representations in exquisitely designed combinations, but also they produced in their masks, especially, a naturalistic sculpture of startling power, ranging from the sympathetic depiction of a young girl to a medicine man portrayed in the depths of a trance. The bulk of material indicates a tremendous conversion of technical talents to the service of art.

In viewing primitive art, one sees the work of the skilled craftsmen of many nations, tribes and communities. There is a unity to each of these communal expressions of man's search for harmony and beauty. An individual who cannot afford the great masterpieces of the western world may find great content in collecting these minor works of art in accordance with the dictates of his own æsthetic conventions. Another, weary of words, of theory, of propaganda, may find a peace in the feeling of common endeavor which these arts produce, without the accompaniment of torrents of verbalized learning. Despite the individualization of western art, in practice one can pick out the schools, the culture groups, just as among these anonymous arts of forgotten people. If this exhibition means nothing else, it shows that art is a people's common heritage, a field in which all may participate. Let us not let our tendency to specialize and to delegate turn us away from fruitful, active interests for the sake of a sterile admiration of technical superiority.



14. THE MOST ADVANCED art developed by the North American Indians was the work of the tribes occupying the coasts of British Columbia and southern Alaska. At left is a horrendous monster of mythological significance to its Kwakiutl makers, which contrasts with the lovely Haida girl's face below. The modeling of this mask so vividly recalls a living person that portraiture is suggested

All photos by Konrad Cramer under a grant from the Rockefeller Foundation to the Museum



15. (Below) THIS KWAKIUTL MASK is intended to show two separate personages. The open wings close to represent another embodiment of the same spirit. Vivid coloring plays an important role in characterizing the mythological being. The colors are used symbolically rather than to enhance the æsthetic values. (Below right) No example from the Northwest Coast in the Museum's collection can touch this Tlingit helmet for sheer power. It depicts the warped features of a paralyzed old man revealing an irritable contempt instead of mawkish self-pity



THE INGENIOUS ESKIMO—*Engineer without degree and manufacturer without materials, this brown-skinned magician builds an edible sledge, makes windows without glass, and induces his animal enemy to commit suicide, while rejoicing in the title of "The man who can make the most out of nothing"*

By EDWARD WEYER

Editor, NATURAL HISTORY

"GOD'S FROZEN PEOPLE"—so runs a witticism about the Eskimos. Applicable, though not so completely as many think, to the barren northern wastes in which they live, it is far from the mark when one considers their clever ingenuity, an ingenuity at which I never ceased to wonder during several years spent in studying Eskimos, both in Alaska and in far-away North Greenland.

Take the Eskimo's most annoying enemy, the wolf. At all times it preys on the caribou or wild reindeer which the Eskimo needs for his own food supply. Sometimes, too, it kills children, and is a ferocious animal when enraged. Because of its sharp eyesight and keen intelligence, it is extremely difficult to approach in hunting. Yet the Eskimo kills the wolf with nothing more formidable than a piece of flexible whalebone such as was part of the corset of every woman in years gone by.

Spring bait

He sharpens the strip of whalebone at both ends and doubles it back, tying it with sinew thread. Then he covers this with a lump of fat, allows it to freeze, and throws the thing out where the wolf will get it. Now the Eskimo's work is over. The wolf swallows the frozen dainty in one gulp. Presently the warmth of his stomach and his digestive juices go to work. The sharp whalebone springs open, piercing the wolf internally and killing it.

The Eskimo hunts the seal to provide not only food and clothing, but light and heat. Here again is a vigilant animal. It basks at the very edge of open water, sliding off and disappearing in a split second. White men find it difficult to approach within 150 feet. But an Eskimo, inching along on his belly and waging a battle of wits every second of the way, fools his prey with seal-like movements and with an implement that has claws attached to imitate the sound a seal makes when scratching the ice. An expert Eskimo can crawl close enough to grab a flipper with

one hand and drive his knife home with the other.

When the Eskimo gets a walrus weighing more than a ton on the end of a harpoon line, he is faced with a major engineering problem: how to get it from the water up onto the ice. Mechanical contrivances belong to a world in whose development the Eskimo has had no part. No implement devised by him has had a wheel in it. Yet this does not prevent him from improvising a block-and-tackle that works without a pulley. He cuts holes in the hide of the walrus, and a U-shaped hole in the ice some distance from the water's edge. Through these holes he threads a slippery rawhide line, once over and once again. He doesn't know the mechanical theory of the double pulley that he thus employs; but he does know that if he hauls at one end of this line the walrus will be dragged slowly out of the water and onto the ice.

When he takes to the water the Eskimo sits in a one-man boat of seal hide stretched over a light framework fashioned from driftwood or sapling. In making his craft he has continued the skin across the top, so that the boat is completely decked over except for the hole into which he sticks his legs; and now he has tied his waterproof jacket securely around the hole. Thus the boat virtually is made part of his body and he becomes a water animal. When an overwhelming roller curls down upon him he voluntarily capsizes, receiving the blow on the bottom of his kayak and righting himself when the deluge is past.

Men against the sea

Though he rejoices in the impossible, even the Eskimo must have thought twice before settling on barren King Island, in Bering Sea. Marooned there, the Eskimo seemingly would face starvation, for precipitous cliffs and a raging surf cut him off from the seal and walrus in the sea below.

But the Eskimo always finds a way, and even on this bleak rock he has established a flourishing village from which he puts to sea in his frail kayak and in his larger boat, the umiak, even in the most forbidding weather. We think of the catapult method

for launching airplanes as a last word in our streamlined age, but the Eskimo has used this principle for generations. On the land the paddler sits in his kayak while companions on either side lift him, boat and all. Swinging him like a pendulum, they let fly at a given signal, and the fisherman and his boat are thrown clear of the breaking waves.

Our Eskimo's inventive accomplishments are the more remarkable when we realize the sparsity of his population. All the Eskimos in the world could be seated in the Yankee Stadium without filling half the seats. Further, these people are scattered east and west over a distance 800 miles greater than that from New York to San Francisco and north and south over a distance greater than that from Maine to Florida. No technical school, no library, no scientific institute has stood at his elbow to help him solve his problems. What he knows he has learned himself, in the school of experience.

As example, let us consider Okluk, who is planning a visit to his cousins' camp three days to the north. It is almost time for the yearly festival, and the singing and dancing will make him feel young again. But he has no sledge, and the journey is impossible without one.

There is not enough driftwood to build a sledge and Okluk, like most of his people, lives beyond the timber line. But if the Arctic cold has prevented him from having many of the important things in the world, it has taught him much. When you have not trees but have cold weather, use the cold weather.

Okluk soaks broad strips of walrus hide in water and rolls them up with salmon inside, laid lengthwise. Then he sets the bundle outside to freeze solid. Soon he has enough solid pieces to lash together to make a walrus-skin sledge. This will carry him, and his baggage, as long as cold weather lasts.

A mind for small comforts

But he loads almost nothing onto his sledge, though he will pass no settlement on the way. He takes fresh straw for his boots; he knows, though many a white man hasn't believed it and has suffered frozen toes as a consequence, that the straw in the boots should be changed daily if it is to continue to insulate against the cold. He takes food for his dogs, but little for himself. He includes some seal oil to light and heat the overnight huts that he may build. And that is all. Yet as he urges his dogs forward he contemplates a trip that will be pleasant in every way.

At night in short order he builds a snow house, in which he is soon too warm for comfort. He takes off most of his clothing, but continues to perspire though

nothing separates him from 40 degrees below zero except a shell of snow. The source of this heat is his seal-oil lamp, whose long, low wick of moss gives a flame eight inches or more in length, which sends its cheerful glow through a window of clear ice onto the windy world of ice and snow.

Since Okluk possesses no matches, he produces a light for his lamp by friction. He spins rapidly a piece of dried wood, one of whose ends is in a socket held in his teeth while the other, or business end, turns in a socket pressed against the ground and in which there is a cotton-like substance for tinder.

Why does his snow house not melt? Okluk has never studied thermostatics, and can't count above six; but he knows that though the air in his hut is warm, the intense cold outside will neutralize this and keep the walls from melting.

Breakfast single-handed

Okluk has no gun or bow-and-arrow, yet he would like to breakfast on one of the birds flying about in the early morning. He enlarges the ventilating hole of his snow hut. Now he sprinkles bits of meat about the opening. As he sits below it he looks more like a philosopher than a hunter. But a flutter of wings brings him to life. Several birds are flying low over the bait. One swoops down to snatch a morsel. Okluk snatches first and has it by the legs. Quickly he pulls it down through the opening and has fowl for breakfast.

Okluk's trail crosses wolf tracks, and the next night he hears them howling. He doesn't like wolves. But how can he kill a wolf without a gun or trap? He hasn't even brought his whalebone along.

He smears his knife with blood and buries it in the snow with only the blade protruding. From the door of his hut he sees the wolf approaching, drawn to the blade by the scent. The wolf licks the blade, cutting his tongue. Excited by the taste and smell, he gourmandizes, literally whetting his own appetite. Okluk sees him drop from weakness, bleeding to death while gorged with his own life-blood. Okluk has a fine pelt to take to the festival.

There is one thing that bothers Okluk as he tries to sleep. His hut is warm and dry, his belly is full of meat, his heart beats with the pleasure of meeting old friends. But Okluk is not alone in his furs. He cannot sleep when he has to scratch so much of the time. Ignorant of the prodigious thought given to this problem by armies and nations, he methodically unpacks a strip of bear fur with a string tied to each end. This he threads down under his clothing. When he pulls it out the unwelcome guests are found to have

Continued on page 297

The modern coelacanth, brought up from South African waters on December 22, 1938



1939 A. D.

RECENT

TERTIARY

Previously believed to have been extinct for 60 million years, this antiquated fish from the Age of Dinosaurs is discovered to have lived in the ocean down to the present day. Of all living creatures it shows the earliest evolutionary stage in the development of the human hand and foot

60,000,000 B. C.



CRETACEOUS

The 60-million-year-old fossil that came to life; Macropoma, the ancestor of the living coelacanth, which was well known to science from its fossil remains but was supposed to have left no descendants. Note close resemblance between ancestor and offspring

A FOSSIL COMES TO LIFE

By EDWIN H. COLBERT

*Assistant Curator, Palaeontology,
American Museum of Natural History*

One of the most important zoological discoveries of the present century gives us a glimpse at the closest living relative of our fish-like ancestors

ON THE TWENTY-SECOND of last December a trawler dredging in shallow waters off the tip of South Africa brought up in its net a large threshing, biting fish which, because of its size and its unusual appearance, at once attracted the animated and rather cautious attention of the fishing crew. Looking at their curious find with speculative wonder, the fishermen hardly realized their inadvertent discovery of this fish was no less important than if some heat-plagued explorer, fighting his way through an unknown tropical jungle, had suddenly come face to face with a live dinosaur.

This fish was big—over five feet in length, with a weight of 127 pounds; and it was vicious, and, above all, it was quite unlike anything the fishermen had ever seen before. So they took it into East London when they returned to port and presented it as a rather noisome gift to the local Museum. Of course, by the time the fish reached the Museum in East London it was very much defunct, so that the curator, Miss Courtenay-Latimer, had a weighty problem on her hands as to how to preserve such a large zoological specimen with limited facilities.

She sent a communication post-haste to Dr. J. L. B. Smith, a leading South African authority on fishes, asking him to come to see the new animal as soon as possible. But before Doctor Smith could reach East London, the fish was becoming decidedly odoriferous, so Miss Latimer had it skinned, had the skin mounted, saved the skull and disposed of the body.

When Doctor Smith saw the skin, he recognized at once that one of the greatest zoological discoveries of the present century lay before him. For what he saw was a living member of a great group of fishes which hitherto had been thought to have become extinct some 60 million years ago. Not only that, this fish belonged to a special group or subclass of the very ancient fishes which included the direct ancestors of all the amphibians, reptiles, birds and mammals. In other words, here was the great-grandchild, to the nth generation, of the brother of our own forebears.

NATURAL HISTORY, MAY, 1939

The modern coelacanth, *Latimeria chalumnae*, the closest living relative of our fish-like ancestors.
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PRESENT PERIOD
 Began 10,000
 years ago

CHIEF SUB-CLASSES
 OF MODERN FISHES



TRIASSIC PERIOD
 Began 60
 million years ago

CRETACEOUS PERIOD
 Began 120
 million years ago

PALEOGENIC PERIOD
 Began 155
 million years ago

CRETACEOUS PERIOD
 Began 200
 million years ago

TRIASSIC PERIOD
 Began 225
 million years ago

PERMIAN CARBONIFEROUS PERIOD
 Began 245
 million years ago

PERMIAN CARBONIFEROUS PERIOD
 Began 275
 million years ago

TRIASSIC PERIOD
 Began 340
 million years ago

TRIASSIC PERIOD
 Began 375
 million years ago

SHARKS

ARMORED FISHES (e.g. garpike)

BONY FISHES (e.g. salmon)



MACROPOMA

Mammals

Australian Lungfish (*Ceratodus*), which like the coelacanth was supposed to have long been extinct, until its discovery in 1869

Reptiles

CERATODUS

Amphibians



Eusthenopteron, a joint ancestor whose fish descendants, the coelacanths, retained the lobed fins, while its land-dwelling descendants developed hands and feet

To many people, fishes are fishes and pretty much alike. So that the finding of a specimen so unusual as this new fish from South Africa will not catch the public imagination as much as would a more spectacular and perhaps a more familiar discovery—even of much lesser importance. Yet to those acquainted with fishes, this new find is one of the events of a lifetime—and justly so. For it is a living *coelacanth* fish (pronounced seé-la-kanth), the likes of which were supposed to have passed from an earthly existence at the time the dinosaurs became extinct.

What are the coelacanth fishes? These are fishes quite distinct from the “ordinary” bony fishes and sharks with which most of us are acquainted. They belong to a separate group or subclass known as the *Crossopterygia*, or lobe-finned fish, which passed the heyday of their evolutionary history many millions of years ago. The crossopts are distinguished, in short, by a deep body and skull, the skull having a steep “humped” forehead, by two dorsal fins (in contrast with the single dorsal fin of typical fishes), by lobed paired fins, in which the bones show the same positions and relationships as do the bones in the legs and feet of land-living vertebrates, including man himself, and are quite different in structure from the fins of ordinary fish. The coelacanth is also distinguished by a tail having the long axis or backbone running to its tip, by a reduced gill cover or operculum, and by large, heavy scales, the surfaces of which are rugose and covered with enamel. In the extinct coelacanths there was a calcified or partially ossified air-bladder or lung.

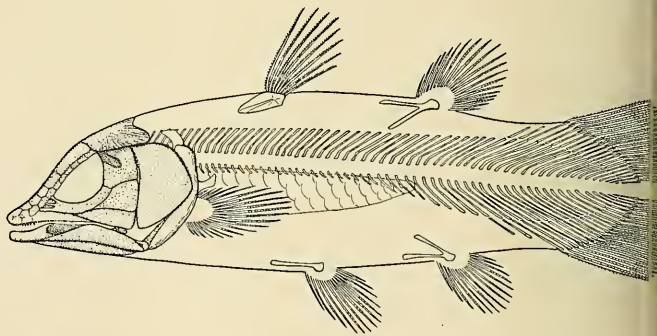
It is unfortunate that the body of this new fish could not be saved, because certain problems as to its internal anatomy, such as the presence of the large lung-like air-bladder, must remain unknown until an-

other specimen can be procured. Meanwhile a false impression should be corrected regarding its capacity for storing oil. A report gained wide acceptance that the fish oozed oil until 20 gallons had escaped, a quantity which would weigh more than the fish itself. The fish exuded 20 ounces of oil, not 20 gallons.

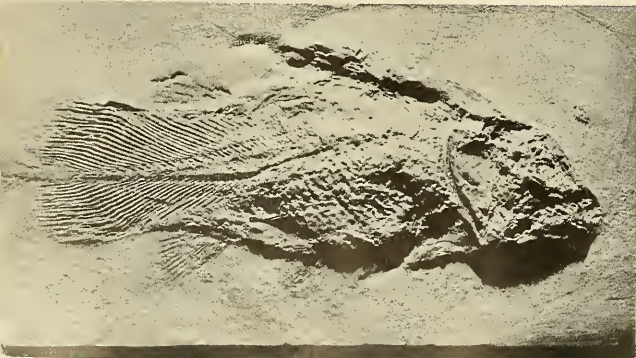
Until this discovery in South Africa upset all our man-made definitions, the span of the coelacanths on earth was thought to have ended with the Mesozoic Era, the time during which dinosaurs ruled the land. Yet even at that far distant period in earth history they were already the long-persistent survivors of much earlier ancestors, for their crossopterygian relatives lived far back in Devonian times, some 300 million years ago—long before the dinosaurs began, before there were any such things as land-living vertebrates. And it was these Devonian crossopterygians with their lobed fins, so prophetic of the limbs of later vertebrates, that were the direct ancestors not only of their little-changed descendants, the coelacanths, but also of the first amphibians, which were the first vertebrates to venture out of the water for a new life on the land. They in turn were the ancestors of the reptiles, birds and finally the mammals, including man. So it is that by looking at this living coelacanth we can see approximately what the ancient crossopterygians of 300 million years ago might have looked like, and we are thus enabled by the discovery of this living “flash-back” to get some idea as to how our own fish ancestors appeared in flesh and blood.

Until the living coelacanth was discovered, all the coelacanth fish and all the ancient crossopterygians (in which the coelacanth group is included) were known only from fossil forms; hence any restorations of these fishes as they might have appeared in life

(Right) A NOTED SCIENTIST'S restoration of a primitive type of fish that was supposed to have become extinct 60 million years ago: Sir Arthur Smith Woodward's *Macropoma*, the fossil that came to life. Note how closely this restoration duplicates the living coelacanth, just discovered, on preceding page



AMNH Photo by Coles



IF THE ANCIENT FOSSIL COELACANTH at left (*Undina*) could come to life, the living coelacanth might well swim toward it with all the signs of recognition it would exhibit for its own species. It cannot be said, of course, that the two could interbreed, but the living coelacanth possesses in its germ plasm, hereditary factors supposed to have long since vanished from the earth, controlling among many other things the flipper-like lobed fin which was the predecessor of the mammalian hand and foot.

were based on remains of their bodies preserved in the rocks for 60 million years or more. Now that a "living fossil" has swum into our ken, so to speak, it is possible to see how nearly right were the scientific studies on the fossil specimens. Surprisingly enough, we see that the living fish is just what we thought it should be—in other words, the restorations based on fossils are now corroborated. Two of the reconstructed fossil coelacanths in particular, forms known as *Macropoma* and *Undina*, are closely approximated by the living fish. In the accompanying illustrations you can note the truly remarkable similarity between *Macropoma* as restored and the modern fish as it appears without benefit of human fallibilities and opinions. "Shall these bones speak?" Perhaps not, but the men who studied the bones spoke and drew pictures too, and now that the fossil has come to life it shows that the words and the pictures were essentially correct.

To get back to the main story of the discovery of this fish—when Doctor Smith saw what a magnificent thing he had he promptly sent word to London, where, of course, there were not a few lifted eyebrows, for the dyed-in-the-wool scientist is sometimes a skeptical individual, especially when confronted with anything so astonishing as a resurrected crossopterygian fish. But Doctor Smith wrote a brief description wherein he gave a name to the new form, *Latimeria chalumnae* (in honor of Miss Latimer, who first recognized that this was an unusual specimen) and sent this to London with pictures of the fish. Then things began to happen.

There was a meeting of the Linnaean Society at Burlington House, at which some of the foremost experts on recent and fossil fishes were present. An examination of the pictures and of the description

convinced these men—Sir Arthur Smith Woodward, formerly the head of the Department of Geology at the British Museum and one of the great authorities on fossil fishes, Professor D.M.S. Watson of University College, London, an outstanding worker on primitive land vertebrates and their immediate ancestors, Dr. E. I. White, in charge of fossil fishes at the British Museum, and Mr. J. R. Norman, in charge of recent fishes at the same institution. Their blessing was given to the discovery, the description was published, and soon it became a zoological sensation throughout the world, to be discussed and studied in classrooms and laboratories from New York to New Zealand.

Now there comes this question: Why wasn't *Latimeria*, the new coelacanth crossopterygian, discovered long before this? Several answers are possible. In the first place, it is quite possible that this fish has been caught before by fishing trawlers but was thrown back by incurious or indifferent men as "another catfish." That it may have come to the attention of men before is made probable by the statement of one resident of East London, who claims he saw one of these animals cast up on the beach some five years ago, but before he could get help to pull it in, it was washed away by the tide. Perhaps this is a deep-sea form that only on rare occasions wanders into shallow water where it will fall prey to the sweeping net of the trawler. Or what is more probable, it may be that *Latimeria* lives among the rocks and crannies of the ocean floor, so that even in shallow water it is ordinarily below the range of the net.

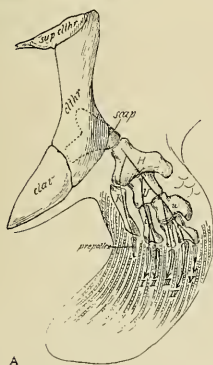
Whatever may be the explanation, it is a safe guess that there is going to be some intensive fishing and some excited fishermen off the South African coast during the next few years.

FROM FIN TO FOOT

(After William K. Gregory of the American Museum of Natural History)

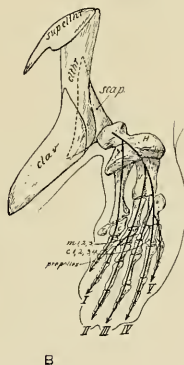
FISH

A lobe fin of approximately 300 million years ago. (Essentially *Eusthenopteron*)



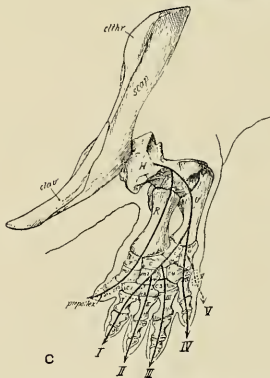
INTERMEDIATE

(hypothetical)



AMPHIBIAN

A primitive foot of some 200 million years ago. (*Eryops*)



THE FIN of the living coelacanth is believed to resemble the ancient type shown in the first drawing above, possessed in essential characteristics by the ancient fish *Eusthenopteron* of about 300 million years ago. This series of three drawings, based on the data and conclusions of several well-known scientists, shows the probable evolution of the am-

phibian foot, on the direct evolutionary line to all the great animals that walk the earth today. But long after the passably good foot C was evolved 200 million years ago, the coelacanths clung to their backward form, so that today the living fish has something of the out-moded appearance of one of the first horseless carriages on a four-lane highway

FROM EGG TO

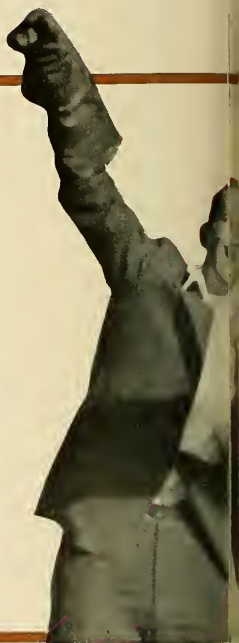
By
LEWIS AND
MARIAN WALKER



(Left) THE BIRD that grew too tame for his own good: Caesar at one week of age, when human friends first saw him and noticed an infected eye which needed treatment. When Caesar learned to trust man, the crucial question was how to save him from becoming gunfodder



CAESAR WAS BORN in a section of California where bullets riddle "No Hunting" signs and Golden Eagles are a thinning species. During the preceding 20 years, only one pair of eaglets from the lofty nest at left learned to fly. But Caesar's infancy was watched over by Marian and Lewis Walker from the box-like tree-top blind, and the authors often climbed the sycamore to observe Caesar at close range when the parent birds were off hunting. Twelve rabbits and eleven ground squirrels were found to have been delivered to the pure white baby on one occasion. Eagles are valuable to man because they keep down harmful rodents



"COMMON" is the word used in referring to the numerical status of Golden Eagles in San Diego County, California. This is misleading. For although Golden Eagles are plentiful here compared to some other parts of the United States, they are nevertheless becoming all too rare. The reason is not hard to find. For years we have climbed steep mountains and scaled sheer cliffs in search of an occupied eyrie suitable for observation. Nests were found—yes, quite a few. But so were empty shotgun shells! Theoretically eagles are protected by law in this state, but practically they are protected only as long as they keep out of range.

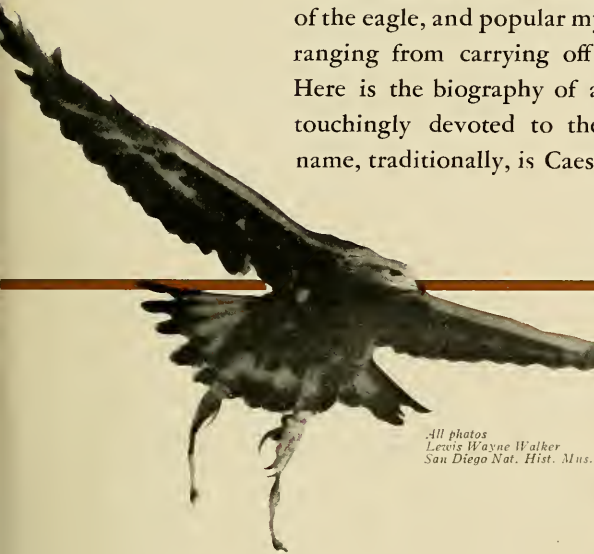
In December of last year, we heard of an exception to the last rule. A bare quarter of a mile from the home of a rancher raising turkeys, chickens, pigs and general ranch stock, an eagle had a nest situated in a spreading sycamore, 50 feet above the ground.

The pile of sticks comprising the nest had been accumulating over many years. All in all it was in an ideal location. We made arrangements to be notified if the eagles evidenced a desire to inhabit this tree nest and then delved into a little of their past history—a history of frustration.

For years previous to 1918, a pair of eagles occasionally resided in a tree 300 feet from the present site. A wet year, however, uprooted their home and dropped it to the ground. The following season they started to build in the sycamore where our observations were presently to be made. Each year the nest became more imposing, and now, being 5 feet deep by 6 feet wide, it can plainly be seen from a road a half mile away. Eggs were laid. Some years they were collected, some years they hatched; but between 1918 and 1938 only one pair of young learned to use their wings. This was in 1924. During these years the

EAGLEHOOD

Conquering legions ancient and modern have marched under the sign of the eagle, and popular myths have ever told of fearful depredations ranging from carrying off whole sheep to robbing human cradles. Here is the biography of a true eagle—a simple useful bird of prey touchingly devoted to the human friends who reared him. His name, traditionally, is Caesar but it might well have been Ferdinand



All photos
Lewis Wayne Walker
San Diego Nat. Hist. Mus.

(Right) CALLING ON AN EAGLET. Clambering up for one stealthy visit, Mr. Walker found that Mother Eagle was at home. Heart in mouth, he stared at baleful yellow eyes and wickedly curved beak less than two feet away, but the mother bird did no harm. Having won the young bird's trust, the Walkers were obliged to adopt him for his own protection. As he grew older, "airing" required a range available only at a nearby air-field. Here Caesar cruised about, free but supervised, and learned to return promptly to master's wrist



rancher tried his best to give them protection. A placard tacked on the tree trunk did not help in the least. "NO HUNTING" and "NO TRESPASSING" signs were riddled with bullets. On one occasion the rancher constructed a tremendous nest-like structure on a tree closer to his home in the hope that the eagles would take it over, better enabling him to watch over their well-being. Thus far they have spurned his offers.

At one time an adult was found dead. This, the rancher believed, would mark the termination of eagles nesting in the locality, but the following year, the remaining mate returned with another. Together they reigned over the same domain.

Notification reached us in December that sticks were once again being carried. During the first week in January the eggs were laid. Two in number and unlike most eagle eggs, which are blotched, these were

an immaculate white. After a conference it was decided for the sake of safety to begin observations only at the termination of the 43-day incubation period.

Time passed rather slowly. Locks were kept on the ranch gates to give the incubating parents as much seclusion as possible. During this vigil the male seemed to do most of the hunting and visited the nest with almost clock-like regularity three times daily. At about 7 o'clock in the morning he would drop in with a ground squirrel or rabbit, only to leave again immediately. At 11:30 or 12 o'clock he would relieve his mate and incubate until about 4 in the afternoon. The female would then take the shift throughout the night.

Approximately a week after the time for the young to hatch, the tree was ascended to see how things were progressing. One lone eaglet, "Caesar" as he was later to be called, was lying face down with an

added egg nearby. Surrounding the pure white baby was a bountiful supply of food—12 rabbits, from tiny cottontails to husky adult jacks, and 11 ground squirrels. When we know that rabbits and ground squirrels destroy over 10% of the annual agricultural crops raised in the West, it is plain to see why eagles justly belong to the protected species.

On that first visit a tiny infection was noticed on the right upper eyelid of the eaglet. At the time it seemed minor, but within ten days the infection gained headway and eventually closed the eye completely. Then, for the first time in avian history the infected eye of a wild eagle was given daily treatments high in a sycamore. We figured that if medicants such as argyrol and epsom salts solution were beneficial for humans they would also benefit an eagle, and in time they cleared up the infection. During all these ministrations Caesar never attempted to fight. Occasionally when the cut of a scalpel or the application of hot epsom salt solution brought a sharp twinge of pain, he would jerk his head away, but the talons which even at an early age could inflict damage were never used.

Mother eagle at home

One memorable day the head of the adult female was seen above the nest. As we walked toward the tree other things drew our attention. When one of us started the perilous climb we firmly believed that the parent eagle had taken her departure while we were looking elsewhere.

Arriving below the nest, I grasped a supporting branch and chinned myself into position to see what type of food was in the eaglet's larder. There, less than two feet from my face, was the curved beak of the old female! The black pupils of her eyes expanded and contracted in rapid succession. In fact, they seemed to keep time to the tingles on my scalp. Yellow eyes glared at me as the golden-tipped crown feathers rose to a crest. The lemon cored beak half opened as though mocking my jaw. Then, majestically and unhurried, she turned her back, opened her wings and dropped off the far side of the nest in a glide which bore her out of sight. She moved not a moment too soon. Muscles which at first were tight and tense relaxed, and somewhat shakily I pulled myself to the side of the baby.

On this visit there were 2 rabbits, 3 ground squirrels and, surprisingly, 2 gophers lying in the nest. The small size of the latter and the fact that they are almost entirely nocturnal makes their method of capture quite a mystery. These gophers were the only small rodent remains ever to be found in the eyrie.

At the age of about 6 weeks Caesar commenced really to exercise. With awkward flaps, he would

dance first on one foot, then on the other. Unfortunately, however, most of his calisthenics were carried on with his face hidden from camera view by the stout limb which shows so plainly in the photos. In fact, it almost seemed that the birds were camera shy and used this branch as a shield. The only time both adults were observed at the nest simultaneously the female kept her head and shoulders completely hidden behind this obstruction.

Caesar's keen eye

We were usually warned of the coming visit of an adult by the peculiar chicken-like "chee-op, chee-op" call of Caesar. He would recognize a parent in flight at a distance so great that human identification could not be positive even with aid of field glasses. That legendary "eagle eye" had developed early, though once in a great while it would fail him temporarily when low-flying buzzards put in a sudden appearance from behind the main trunk of the tree. These buzzards, incidentally, did not appear to deserve the reputation for sharp eyes with which many have credited them. Some naturalists insist that buzzards locate their carrion food by vision alone, while others maintain that it is a keen sense of smell. Observations made while in the blind at the eagle nest tend to prove the latter to be correct. On numerous occasions they were seen to circle lazily about, and as long as they remained on the windward side of the eyrie they were unperturbed. Let one of their soaring circles carry them to the lee side, however, and the flight changed to a direct course straight to the pile of sticks which always held many a half-eaten meal. This happened so many times that it could not have been mere coincidence. As soon as they arrived in a position where they could see Caesar, they would veer away and continue their aimless circling.

Caesar's father had rather a unique method of delivering prey to the nest. Heralded by Caesar's "chee-oping," he would zoom down in a glide which made his large wing feathers swish as they cut the air. Coming in below the nest-level, he would put on the brakes by rising abruptly. His feet would swing forward and the claws release their grasp on whatever he was carrying, such as rabbit or squirrel. This would then travel in an arc and drop in the nest's center while he landed on the edge. It all seemed so perfect that there was no waste motion. In contrast to this well rehearsed act, the female would land laboriously and drag with a hopping motion any donation she was bringing her eaglet.

At the age of nine weeks Caesar "looked like an eagle." Almost all of the white down had been covered with feathers. He went through his exercises with a wilful purpose and his wings, which had lost

that insecure, infantile wobble, would lift him straight off the nest to a height of two or three feet. On one occasion when up quite high, flapping wildly, I distinctly saw him glance at his home below. He was much too high for his peace of mind, and with a clamp-like action five feet of wings shut tight to his sides and he dropped to the nest in a heap.

The oft rumored enforced starvation of the young by the parents to induce the breaking of home ties was not at all in evidence at this eyrie. Caesar commenced to see the world in slow stages while there were still about a half dozen edible carcasses in the nest. He progressed from branch to branch, from tree to tree, then on tiring wings down to the ground. When we left him that evening we did not expect to see him again, so bid him "adios" and "happy landings."

Dangerously tame

Several days later while driving by the ranch, we were stopped by the owner and asked if we would care for Caesar. We answered in the affirmative, mentally picturing every calamity which might have befallen the parents. He soon reassured us that all was well with Caesar's family, but expressed his concern in this way: "That bird is too tame for his own good. Humans have always been his good friends—a daily sight at the nest. As long as he stays on my ranch, I'll do my best to protect him, but he is bound to wander—just more gunfodder, and we will never see him again."

Half a mile from the nest tree he was found on a dead stump, silhouetted against the sky. We walked up to him and tried to scare him down. He looked at us a bare 20 feet away, full of curiosity, but would not fly until overbalanced by our continued shaking of the trunk. He glided perhaps a quarter of a mile and landed in an open field. Again we approached and ended by stroking his back and head. He was far too tame to remain wild. So we brought him home.

It was no time before Caesar could be taken for "airings." He would fly about a little and then return to alight on a gloved hand, friendly and trustful. Presently we started free but supervised, protected flights to build strong muscles. Our aim was to simulate natural development as much as possible, in the hope that some day when he learned to catch ground squirrels and rabbits, still his daily food though humanly provided, we could take him deep into Lower California, and there release him far from human habitation where eagles are more than mere targets.

About five months passed. Plans, so plausible at the outset, had to be cast aside as unworkable. How can

a tame, trusting bird be made wild and shy over night? That was the problem to solve before letting Caesar shift for himself. Every meal, every bath, in fact, every little attention, had for months been a human responsibility. Caesar expected them and if they were not forthcoming he would fly to the nearest human. How long would he last in a land of hunters?

Two or three times a week he was taken for long flights out on an almost deserted aviation field. At first, he seemed afraid to rise and play on the wind currents and instead stayed close to the ground with wing tips just grazing the grass tops. As muscles grew stronger and tougher, his flights lengthened from a few hundred feet to several hundred yards. Occasionally in passing over a shrub he would zoom into the air a score of feet.

One windy day a tumbleweed bounced over the ground and Caesar was off in full chase. After this sign of a desire to pursue a moving object, we tried him out on rats. Their sharp teeth inflicted many tiny wounds until he became deft enough to grab where the grabbing was safe. After rats we tried ground squirrels and rabbits, and finally full grown opossums. These latter animals can really bite, but Caesar was always just one jump ahead. In grasping a running possum he would usually fasten one foot on the hindquarters, which would make the possum stop to turn and bite. Before the mouth could close, however, the other set of talons were brought into use, pinioning the mammal's head to the side of his body.

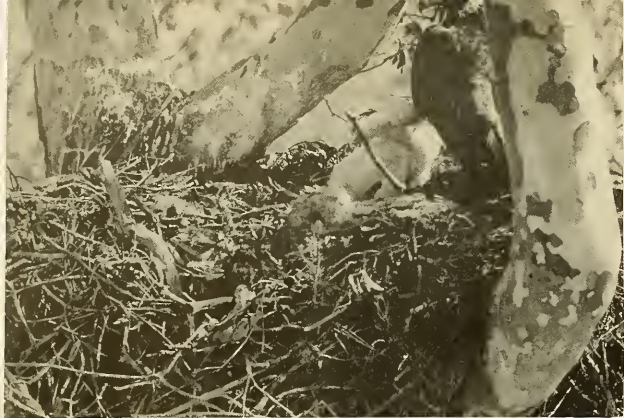
Caesar's hunting technique

Previous to our ownership of Caesar, we presumed that the sharp claws of the eagle pierced the skin of the prey and so caused death. This seems to be generally accepted. In truth, however, especially as far as possums are concerned, a muscular pressure of the feet brings about an unconscious state in a very few seconds. The solar plexus punch of boxing and the bear hug of present-day wrestling might be likened to the eagle's grip in its effect.

If Caesar was made to release his grip on a possum, within a minute or so of its capture his prey would slowly come back to consciousness and would seem none the worse for the ordeal. Rabbits, squirrels and rats seemed to be killed outright by the very power of the pressure.

Caesar never tried to carry his food, which was disappointing to a certain extent. We had hoped to get a general idea of an eagle's lifting power. To obtain such data, we finally put weights in socks and tied them to his feet. He was then cast from a building 15 feet high into the face of a ten-mile wind.

Continued on page 302



(Left) SHADING THE NOT-YET-SO-MIGHTY CAESAR from the sun—part of a mother eagle's duties. Though male Golden Eagles are the smaller bird, her husband did most of the hunting and was more skillful at delivering prey. Thrice daily he swooped down to release his "catch" bomb-like into the nest. In contrast, his mate landed first, dragging her offering to the larder with an awkward hopping motion

(Right) CAESAR FOCUSES his "eagle eye" on the camera. The young bird early showed the traditionally keen sight of his kind. Unconsciously he warned human visitors of the parent bird's approach when the flying speck could not be positively identified even with binoculars. Yet, had not the Walkers intervened, Caesar might have become blind. Their treatment of his infected eye marked the first occasion in avian history when a nesting wild eagle received daily medical visits. Caesar endured medication and minor surgery without ever using his even then formidable talons



(Below left) "CHEE-OP!" which is good "eaglese" for "When do we eat?" Here Caesar has lost his baby fuzz, sprouted real Golden Eagle feathers, and is about ready to fly. The supposition that parent birds use enforced starvation to make the youngster take to his wings did not apply to

Caesar. The mother and father of this lucky bird were ever on the alert to satisfy his hungry cry. Caesar commenced to see the world in slow stages when there were still about a half dozen edible carcasses in the nest. Eagles should be protected, for they help preserve the balance of Nature



(Right) UNDER THE CRITICAL EYE of his hard-working father (left), the gawky Caesar tears out a "beaksome" morsel of fresh-caught jack-rabbit. From six weeks of age on, Caesar indulged in various calisthenics, like that shown below, preparatory to his first flight

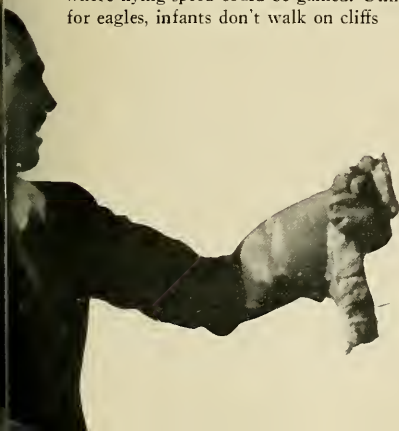


CAESAR'S FIRST TAKE OFF was an awkward flopping attempt that lifted him a few feet above the nest. He once discovered he was up higher than usual and, fearfully clapping five feet of wings to his sides, thudded back into the nest. But Caesar learned to fly with the best; and, once formally adopted by

the Walkers, lent himself to interesting observations as a hunter of small mammals. From these experiments they learned that eagles customarily squeeze their prey to unconsciousness or death without bloodshed. Possums slowly came back to life



(Below) OTHER EXPERIMENTS disproved the newspaper stories of eagles carrying off human babies. Tying various weights to Caesar's ankles, they tested his lifting power under controlled conditions. Conclusion: a wild eagle in perfect condition could not carry away an 8 pound baby unless from the edge of a cliff where flying speed could be gained. Unhappily for eagles, infants don't walk on cliffs



BEHIND THE DAM—*While the wilderness vanishes for man, this pair of young beavers pit tooth and claw and their remarkable engineering skill against the manifold dangers which Nature, in all her vast indifference, sets in their path. A poignant drama of the wild, symbolizing the life story of one of our most beloved animals*

By KERRY WOOD

THIRTY beavers were in the group that hurried down the spring ravine, all striving to keep covered in the trickle of water that was jammed and crisscrossed with blackened logs, some still smouldering. The forest fire had completely destroyed the greenery around the tiny mountain lake, and it was this loss that forced the animals to leave their home waters. The burning of the spruce trees did not greatly matter, and they could have cleared the lake of its hissing, ash-covered debris, while their stick-built houses, with mud coverings cracked and peeled by the fire's heat, would repair easily, but it was all to no avail without the poplars, food trees* that beavers of their type find essential to life. So, at the coming of dark, the thirty animals had silently left their ruined homes and swum across the lake to the outlet stream, where they followed single file behind an old leader and hurried toward a haven that he knew.

It was the first time a broad-backed young male beaver had left the confines of the Alberta mountain valley. He was newly of age in beaver maturity, a large, solid animal of forty pounds' weight and a long yard in length from nose to tail tip. Travel would have sent him afar on exploration this year even under normal conditions. Now, of course, he shared the common anxiety of the band, forced to this hurried exodus from a well-loved home, and he sensed there was great danger attending the flight.

But the fire that made them abandon the lake had also routed other animals from the region. For three miles they traveled down the desolate ravine without encountering sign of an enemy, then the valley made a sharp turn and as suddenly the air came clean to their nostrils as they left the burnt area behind. Promptly the night was full of menacing shapes and sounds, and they scented the big mountain lions and heard the warning wail of a

coyote. By this time the trickle of creek had been augmented by springs, giving it something of size, and the beavers could hurry faster in the deeper waters.

Only at the noisy shallows were they exposed, and at one of these a tawny shape flashed from the shore and sent a momentary panic among them. But it was only a mule deer putting water between itself and its back trail, the harmless animal pausing a moment to stare at the swimming band. A short time later the creek swelled to a wide, placid stream without a current, and the leading beaver suddenly slapped the flat of his tail on the water to produce a resounding, shot-like noise. Usually this is the beaver danger signal, but this time the old leader made the sound because of pleasurable excitement. Next moment the animals heard a similar report from farther down the stream, and when they rounded the bend they were in sight of a beaver pond and knew their hazardous journey was ended.

They were welcomed by the creek families, for sociability is a dominant characteristic of beavers and inter-colony visits a regular practice.

Beaver city

Young Broadback had never seen beaver-built dams and canals before. At his home-lake there had been no need of dams to ensure a sufficient water level, and food had grown plentifully at the lake's shoreline and the animals did not have to range far for supplies. It was different with the colonies on the creek; there were many family groups settled along the half mile of stream comprising their domain, and most of the original bank growths of poplar had been cut and used and now they had to travel some distance inland to find food trees. To make such trips safely the animals had dug a series of canals tangent to the creek and reaching out to virgin poplar stands. The canals were over a yard wide with an average depth of twenty inches of water, the longest channel stretching over a hundred feet inland from the creek. The earth taken from

*i.e. aspens. The two common cottonwoods of Alberta are known as "poplars" and "Balm of Gilead."

the ditches was piled neatly on the banks, and the canals were almost as straight as if they had been lined out by surveyors. Small barriers maintained water levels in them, while six or eight high-piled dams blocked the main stream at strategic intervals to provide a good head of water at all times. The colony houses were large, each about 30 feet in diameter and 10 feet high in outside measurement, with space enough inside to house six or eight beavers. In addition to the stick-houses, a number of families lived in bank dens reached by under-water tunnels and having additional tunnels leading inland from the den-rooms and with small outside openings, providing air. Brush was piled on top of such openings, to prevent enemies entering the tunnels and reaching the beaver-rooms.

Wanderlust

When the first novelty of exploring the new surroundings had passed Broadback became restless. It was obvious that the animals of the lake colonies had decided to join forces with the beavers established on the creek. Already some new stick-houses were being built to accommodate the newcomers, disused bank dens being pressed into service for others. Larger food supplies were needed for the doubled community and canals were extended further inland to permit the harvesting of more trees, while another dam was under construction to give the animals more water area. But Broadback could not feel settled; the wanderlust was waking in him.

On an evening in June the instinct demanded obedience. He left the lodge before the other occupants were stirring, diving into one of the exit tunnels and coming to the surface out in the center of the oval pond. Broadback took a swift glance around. A pair of blue-winged teal, sleek-feathered and beautiful, were poised on the shore-line; a yellow and black swallowtail butterfly was hovering above the white clusters of chokecherry blossom; roses shone on the eastern banks, catching color from the red sunset, and from the spruce-lined ravines the fluted notes of thrushes spiralled earthward.

For an instant Broadback was still, his head, back, and tail lying flat on the water. Then, satisfied that no enemies were near, his webbed hind-feet surged powerfully and sent him swiftly forward. He went to the nearest dam, rose dripping from the waters and waddled over the top; he slid down the muddy runway to the pond, swam quickly to the second blockade, and again crossed to the lower stream. One beaver was in sight in this pond, a golden-checked young female sitting on the top of the largest of the creek band's houses. She greeted him with a

soft mewling sound, but Broadback paid her no heed, even when she dived into the waters and swam out to him. She crossed the dam with him and followed closely as he sped over the last remaining pond and climbed clear of the final barrier. The waters were shallow and swift below this dam, for the stream was beyond the sphere of the beavers, and down the center of the noisy brook hurried Broadback and Golden-cheek.

Mile after mile they traveled at a feverish, reckless speed dictated by strong instinct. Normally beavers move slowly and with caution when traveling, taking time to explore the interests of new territory and always alert for dangers; but when the wanderlust first grips the young beaver, wariness is forgotten and, by day or night, on land and water, they obey the summons with almost frantic eagerness. Old woodsmen call this the "scatter-time," when virile young animals roam far from home colonies and thus keep the beaver folk free of the inbreeding that would seem to be a danger of their closely knit community form of life.

Lynx

Broadback and Golden-cheek spent all that night traveling the miles of creek winding from the colony ponds down to the big river. It was a long journey, and dangerous. At one point where they had to leave the stream to skirt a tumultuous waterfall, a lynx sprang from the shadows as the two beavers waddled across the exposed gravel-bars. Together they faced the enemy, rearing on haunches and poised ready for fight, and seeing this the wild cat slowed its rush and hesitated to a stop, yellow eyes glowering on them. For a moment the tension lasted, then the beavers took advantage of the foe's indecision and retreated back to the water. Another time a great horned owl swooped out of the night and drove keen talons into Broadback's fur. The owl had underestimated the size of its intended victim, but before it could clear its claws and flap to safety, the beaver had whirled and seized the bird. Teeth penetrated the soft matting of feathers and closed on flesh; the great wings threshed convulsively a moment before relaxing in the rigidity of death.

In the yellow morning they swam into the wide estuary where the creek's brown waters mingled with the glacial flow of the mountain river. On a silt island they found a tangled heap of driftwood and dug a way into the heart of the matted pile and there curled, nose to tail, to sleep away the daylight.

It was a lazy holiday month, July, and Broadback and Golden-cheek roamed afar. The first urgency of their wanderlust had passed and they were content to journey slowly, taking time to investi-

THE BEAVER

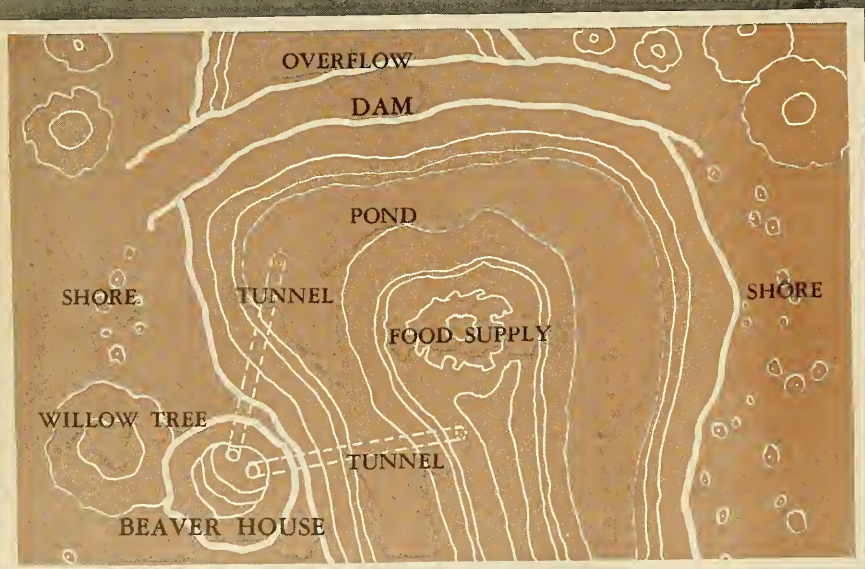
Nature's number one engineer in

Hut six feet high and twelve feet wide, built at water's edge

Thinner section of roof where heat melts snow and permits ventilation

Mud layer five inches thick, which freezes solid

GROUND PLAN OF BEAVER DAM AND HOUSE

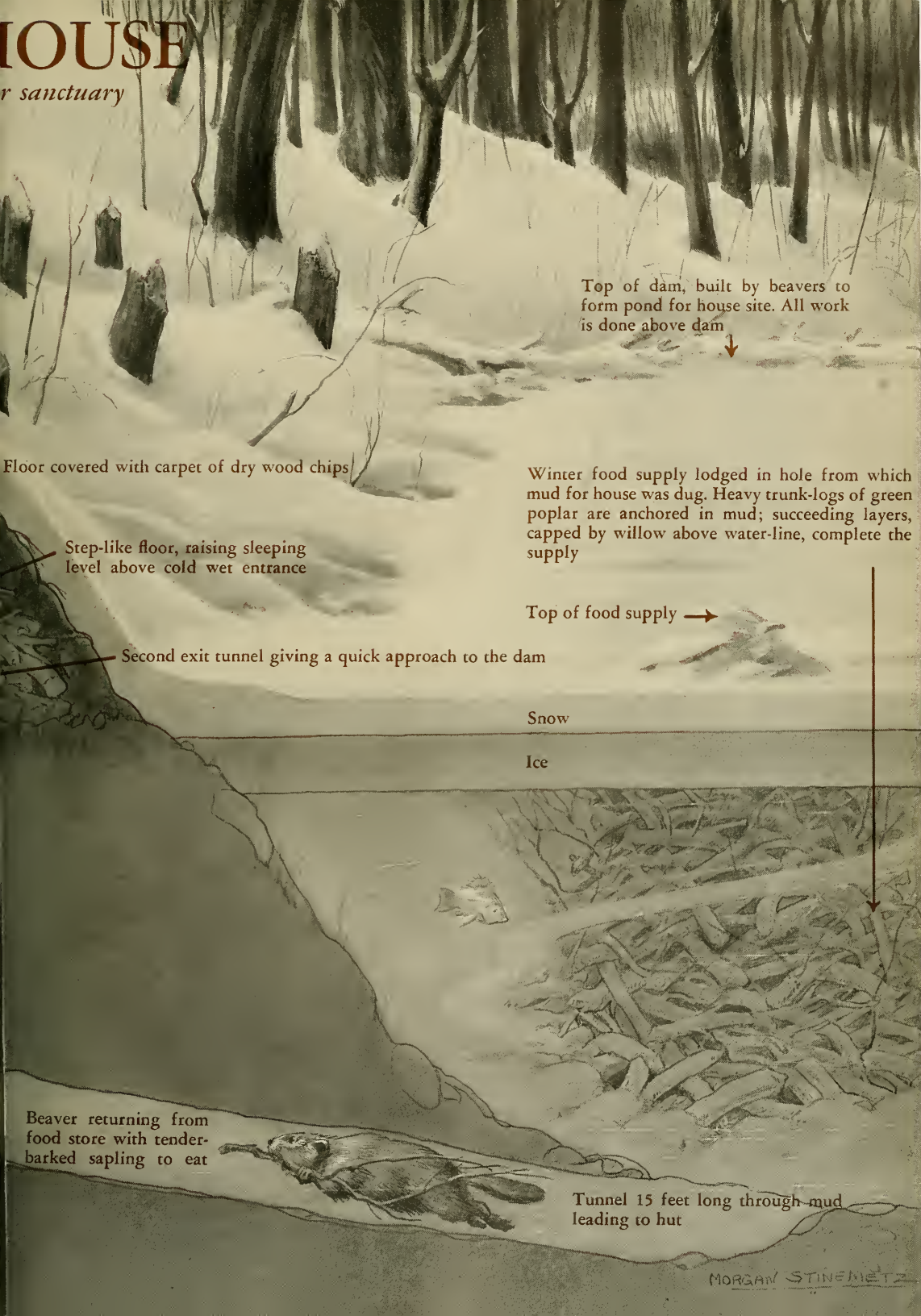


Drawn For NATURAL HISTORY MAGAZINE MAY, 1939

by MORGAN STINEMETZ

HOUSE

r sanctuary



Top of dam, built by beavers to form pond for house site. All work is done above dam



Floor covered with carpet of dry wood chips

Step-like floor, raising sleeping level above cold wet entrance

Second exit tunnel giving a quick approach to the dam

Winter food supply lodged in hole from which mud for house was dug. Heavy trunk-logs of green poplar are anchored in mud; succeeding layers, capped by willow above water-line, complete the supply

Top of food supply →

Snow

Ice

Beaver returning from food store with tender-barked sapling to eat

Tunnel 15 feet long through mud leading to hut

MORGAN STINEMETZ

gate the tributary creeks and rills that helped swell the size of the big river. Food was abundant everywhere, and to vary the diet of poplar bark they ate water grasses, dug out juicy roots of stream-side plants, sampled the low-growing berries, and enjoyed many varieties of mushrooms, favorite fare with them. For shelters there were any number of bank holes handy, some of them dug by beavers in past years. When holes could not be found they took cover under drift-piles and log jams. It was a time of ease, of comfortable living.

Home site

This aimless life seemed to lose its attractions when August was half gone. Summer was in its final bloom and instinct was stirring again, whispering of the winter to come and of preparations needed. The next creek encountered was an irresistible magnet to them; they set out to explore the small stream as though with a definite purpose in view. They traveled slowly, inspecting the region with a thoroughness not in evidence before. Where the banks were low and heavily wooded the two animals would frequently leave the water and go cautiously inland a hundred yards or more, seeming to study the extent of the cottonwood groves. At one part of the creek they found evidence of old beaver colonies, marked by chiselled stumps and by crumbling bank holes and tunnels—there is hardly a stream in all North America, save where alligators were plentiful, that was not at one time the scene of beaver activity.

All the way to the creek's swampy source they journeyed, then down from the open slough lands to the treed valleys again. Sultry August was ending and in the low lands, where the first frosts had visited, the leaves of the dogwood shrub were richly purple. Autumn had come and restlessness increased in the two beavers, putting an uneasy fever on them. Presently they reached a slow-running stretch of water where they had lingered on their way up the stream, and here they ended their wanderings. It was Broadback who made the decision to settle down, for he started to build a dam.

The location selected for the barrier was at the foot of a deep stretch of water. On a gravel bar there the two animals had eaten their evening meal of poplar bark, and when he had finished Broadback dragged his partly peeled stick to the neck of the pool and laid it on the shoreline, jamming it into the soft mud. Then he rolled a few large stones from the bank, using his hand-like paws on the rocks and pushing his chest against them to shift them across the mud. Some pieces of driftwood were next added to the accumulation, then more stones were rolled onto the little pile, anchoring some of the

dry and buoyant sticks. Golden-cheek, giving out a guttural grunt, quit her feeding and fetched the sapling she had been stripping and shoved it alongside the collection at the water side, pressing it into the muddy bottom lengthwise with the stream's flow. Then she waddled ashore with Broadback and was soon helping him hunt for materials.

When the available supply of building sticks had been collected from the banks, Broadback went inland to the edge of the tree growths and set about cutting a poplar. The timber fell half in the water and Golden-cheek, who had been adding stones and mud to the dam structure, immediately joined him at the task of trimming the tree. First the branches were chewed off and carried one by one to the dam and poked into place, each addition requiring a little fussing to anchor it securely. Then the main trunk of the tree was divided into short lengths and the heavy, low-riding logs floated down the stream and pushed into the heap, most of the large sticks being laid lengthwise with the water flow for easier handling and cemented into place by forcing them into the soft bottom of the stream or piling mud on top. They carried the mud in their front paws, clasping the load against the breast.

The dam busied them for a week, the two animals working on it nightly until a solid barrier had been built across the stream from bank to bank and piled a foot above the original water level. To the human eye it looked a haphazard jumble of sticks and stones and mud, but it was staunchly built and well suited to its purpose. The water in the pond began to rise and as it did so the two beavers increased the size of the dam, extending the ends and raising its height until the depth of the pond above the barrier suited their needs.

A moated castle

Golden-cheek began the next chore. She started carrying sapling sticks to the shore a few yards above the dam, piling the wood around the gnarled roots of a giant willow that grew close to the pond's edge on the higher bank. Broadback paid little attention at first, but when the young female's plan took form as she made trip after trip with the sticks he became interested and joined her at the work. Again they made use of whatever wood they could find handy to their building work, cutting trees as soon as convenient supplies had been exhausted. As the hours passed, the sticks mounted into a tightly packed heap measuring, four nights later, two yards high and spreading ten or twelve feet in diameter at the base.

When the size of the stick-pile seemed sufficient, the animals went out to the center of the pond in

front of the heap and dived to the bottom to start digging an entrance tunnel. They could stay underwater two and three minutes at a time quite comfortably, working steadily at the digging until their lungs were empty and forced them to the surface for air. They took turns at the digging once the tunnel was started, one resting on the surface acting as lookout while the other worked. There was nearly two yards of water above the entrance hole, and they tunneled bankwards straight toward the heap of sticks piled around the old willow. Mud from the hole was scattered out behind the digger into the pond waters and much of this flowed, as silt, down to the dam and helped cement that structure into a more water-tight barrier.

The finished passage measured some fifteen feet from its entrance on the pond floor to its opening among the roots of the big willows. How they managed to judge the distance so accurately, digging from the pond entrance and charting the tunnel's course so that the upper opening came directly under the stick-heap, was a small marvel of engineering that can be witnessed in every beaver pond.

Where the tunnel ended under the stick-pile Broadback and Golden-cheek started chiselling away some of the saplings. They chewed off the stick ends neatly, cutting clear a roughly circular room large enough to house the two of them comfortably. The head room was scanty, thus leaving a thick jumble of sticks as roof over them, while the floor level was just a few inches above the water of the tunnel opening. On the floor itself, final touch of construction, was spread a thick carpet of the chips chiselled from the stick ends. This is a cleanly material that sheds water quickly, keeping the lodge dry and neat.

Against winter's cold

First snow came, foretaste of winter. The night sky was faintly luminous, lighted by the falling flakes. Above the range of sight were the flight lanes of the birds, in busy use during the snowfall. The shrill whistlings of the wild swans floated down and now and then sounded a deep, militant rhythm of Canada Geese. A band of northern greenheads, fat and noisy, rocketed into the pond to punctuate their migration. A bittern came too, a solemn, stately wader with a raucous voice. Long-billed snipe, beautiful in velvet browns, whirled around the marshy spring beds where the snows melted quickly and provided feeding grounds for the jacks. Even the stream itself became a migration avenue as shoals of fish, small Rocky Mountain whitefish and the coarse Dolly Varden char, hurried to reach the river and find holes where they could winter.

The storm was quickly over and the skies clear again, but it had given warning of winter's approach that even the glorious magic of Indian summer could not dispel. Broadback and Golden-cheek set about giving the outer walls of their lodge a thick, even coating of mud. They could carry a surprising amount of mud in their paws, holding them spread apart and utilizing the forearms as holders too, a large, loose wad of mud clutched against the chest. They shoved it around the base of the stick-house at first, hardly leaving the water to place it, but when the base had received a generous five-inch coating they pushed farther up the sides until finally they had to waddle upright on their hind legs as they carried the mud to the higher parts of the house.

Storeroom

This mud was taken from the bottom of the creek not far from the house, and when the whole lodge had received a thick plastering, with only a small area on the top of the stick-pile left bare to provide ventilation for the room underneath, the reason for taking the mud from one part of the creek bottom was revealed. The deep hole thus formed was to be used for a storage site, wherein they would pile their winter's supply of food trees.

Now they set about cutting trees, raiding the bottom lands where the poplars were close to the creek and easy to harvest. When cutting a tree, Broadback sat up on his hind legs with his tail flat on the ground behind him and acting as a prop for the body weight. He faced the trunk, his front paws resting on the tree to steady his stance, and once the cutting was started the animal rarely changed his stand until the work was completed, except in the case of a very large trunk that required deep cuts on all sides.

The yellow rodent teeth were well specialized for this, being long, curved wood chisels with a hard-wearing enamel in the front and a softer substance behind that wore quickly away to leave a sharply sloped cutting edge. They first bit out a high cut on the tree, then made another incision a short distance under the first, and finally seized and jerked out the fragment of wood left between the two vertical cuts. Both beavers preferred to work on the smaller trees, probably because they could be cut easier and, too, the barks of the younger trees were better for food. It took either one of them about an hour's time to cut down a tree measuring five or six inches through at the base, while a half-inch green branch could be severed quickly with one or two bites.

As for the knack of felling their timber in any given direction, it seemed that most of their trees

tumbled toward the water, making it more convenient to harvest the wood. Probably this was because of the beavers' habit of sitting on the creek side of the trunk when cutting, the creek side always being the safe side for an aquatic animal, and therefore the main, deep cut was made from that position and timber, when falling, usually follows the direction of the deepest trunk cut.

A nice judgment was needed to know when the cut was finished. The sapling would start shivering when the teeth had reached the heart of the tree, the trembling becoming more violent as the work progressed from then on. At last would sound a faint cracking, warning that the job was nearly done, and a few quick bites produced a louder crack and started the tree rocking. Broadback would then drop to all fours and scurry as quickly as possible toward the water, thumping his heavy, muscled tail on the ground as he ran and giving the waters a resounding slap with the flat of it when he reached the creek.

This peculiar tail thudding and water slapping was warning to other beavers within hearing that a tree was falling, and Golden-cheek would stop whatever she had been doing and join Broadback in the pond. If the timber was crashing into the stream itself, they dived under the surface until the commotion ended. Always, after the fall of a tree, they stayed in the pond a few minutes testing the air for scent of enemies who might have been attracted by the noise. When it seemed safe they went slowly, watchfully ashore and both would set to work on the tree, trimming off the branches and cutting the main trunk into conveniently handled lengths. They could push or drag a log weighing 60 pounds overland, and once in the water a 100-pound stick was easily managed by one beaver.

Stocking the larder

Into the food hole first went the heavy trunk-logs, the sections arranged in a rough circle on the pond bottom. Green poplars are easily sunk, and a little pressure forced the weighty logs to the bottom where they were rammed into the mud and secured. The succeeding layers followed this pattern, ends of sticks being jammed under the anchored stuff as the pile rose above the mud. Twenty poplars were cut for the winter's food supply, and the hole gradually piled high. As a capping layer a number of willows were floated to the pile and shoved on the top; willow does not sink so readily as poplar, and western beavers habitually use it as the top wood on the food pile.

All this took time, and October was well along

when the food hole was filled. The leaves had fallen and the woods looked nakedly barren. Migrant birds had long since flown south, leaving the chickadees, the jays, and the woodpeckers in lonely possession of the woods.

In the grip of winter

Frosts became more severe in November, laying hoary hands on all the countryside. The mud on the walls of their stick house froze into an iron-hard armor, strong protection against the outer world. Another storm swept the land and after the snow-fall the weather turned bitterly cold. In a night's time ice formed on all the surface of their pond, and as the cold intensified the ice thickened inch by inch and started a new season for the beavers: five months of life under the impenetrable walls of winter.

The habit of work was still strong on them and at first they spent the force of their energies at digging. They needed a number of bank holes at intervals along the creek to be used as breathing holes or for shelters when they foraged some distance from the lodge. The entrance holes were deep under water, the same as for the stick house, and the animals tunneled sharply upward above the water line and rounded out small rooms under the high banks. In a few cases they dug tunnels along the banks connecting some of the breathing rooms, but such digging had to be abandoned soon because the frosts of winter penetrated deeper and hardened the soil against their paws. As a final digging chore they excavated a second entrance to the stick house, the hole opening downstream from the first and giving them a quick approach to the dam.

Thus passed the first period of the new season. The drive of their ambitions slackened and the pair relaxed into the restful routine of winter life.

Above the three-foot thickness of their house walls a different kind of winter raged on the land. Hunger stalked the white valleys, crept through the shadows of the snow-piled spruces, and howled across the barrens of the heights. Lynx haunted the forests, coyotes and foxes wandered the lowlands, and packs of wolves ranged near and far, desperate for victims. Nimble-footed martens were in the trees, and lithe mink and weasel followed the creek lanes in quest of small game. Swift goshawks policed the upper air by day, while black-taloned horned owls ranged silently over the wintry wastes at night.

Snug in the warmth of their house, Broadback and Golden-cheek were secure from all the worries of want and barricaded safely against the killers. Often a foraging coyote found their house roof and savored the warm smell of the occupants, and often, driven by a lean stomach, the wolf-dog wasted time

at digging, trying to penetrate the concrete-like walls. Once a strong-clawed cougar tried to gain entrance, and failed. For food, the beavers had only to dive into the water tunnel and swim a few yards, then wrest a branch from their hoard. They could cut it into small lengths and negotiate the tunnel, returning to the warm house to eat the bark at leisure; or, if privacy was wanted, the feast could be enjoyed in one of the bank rooms. When poplar bark palled on the appetite they dug out the roots of willows and searched the pond bottom for water-preserved leaves. Cold did not bother them; there was a thick layer of fat under their thick fur that made the low temperatures of the water easily endured. It was a comfortable life, won by hard industry and keen intelligence.

In late winter the young female became the mate of Broadback, a union that would probably last as long as both lived.

One March day the two animals heard water trickling on top of the ice. Excitement grew in them as, with the swiftly passing days, the trickle swelled in volume and became a surface stream. Here and there the ice wore thin, letting in more light. Near the dam the barrier finally cracked, and Broadback quickly enlarged the break and the pair swam clear and saw the outside world again.

Winter staged a final storm, then the real thaw set in. Ice broke from bank moorings and raced down the stream, floating on the brown snow waters. A jam formed in the beaver pond, the ice floes held back by the dam. The waters rose and the jam tore loose, carrying part of the barrier with it. No mat-

ter: there was an abundance of water in the stream now, for the full roar of the spring flood dinned through the valleys. The beavers disported on the riotous torrent, awake to the season's magic.

As April ended, the floods subsided and Broadback and Golden-cheek repaired the dam. It was a glad-some time, all the air spiced with the fragrant flow of sap and the awakening fertility of earth.

Then came the day when Golden-cheek turned suddenly surly in the house, uttering guttural chatterings and pushing with her front paws at Broadback, urging him toward the exit tunnels. When he demurred, she pushed harder and chattered angrily. Broadback dived into the tunnel and quit the house, leaving the female alone.

It was broad daylight outside and the sun was high overhead, hardly a sensible time for a hard-working beaver to be stirring. As he sat on the bank a short distance from the house, Broadback's ears caught a strange, new sound. This was a high-pitched squealing, and it seemed to originate inside the lodge. The young male knew that it did not come from Golden-cheek herself; and as the volume of the sounds increased, curiosity sent him diving into the pond to re-enter the house and investigate. Golden-cheek had just given birth to four fuzzy beaver-kittens.

Three weeks later the young ones were taken out of the lodge for their first visit to the outside world. Broadback was hard at work building a new dam that would create another pond. Their domain needed more territory: they had founded a colony.

THE INGENIOUS ESKIMO

Continued from page 279

gone into the bear skin because of its thick fur, and he has relief from the only disturbing circumstance in his philosophical, ingenious life.

The next day the sun comes out bright, making the snow so dazzling that Okluk will soon be snow-blind and quite unable to pick his way to shelter. While we are imagining the awful death that awaits him, he is getting out his shatter-proof goggles and putting them on. He has never seen a piece of smoked glass, but his eye-shades of walrus ivory or wood,

with fine slits in place of lenses, serve the purpose just as well.

Now he keeps glancing at the sun, the clouds. Is it growing warmer? This might indeed be unfortunate, for Okluk's sledge is getting soft. But his weather sense tells him that he will make his destination, and he does, though none too soon. His sledge will not be of much more use this season, but no matter. After giving himself over to the joys of friendly reunion, Okluk uses his sledge for food. He feeds the thawed walrus skin to his dogs, and stuffs himself on the salmon that was rolled up inside.

ODYSSEY OF A BIRD ARTIST

The rise of Francis Lee Jaques from farm boy to his present eminence in the highly difficult art of bird portraiture suggests the passing of a type and the problems of the Nature painter in an increasingly industrialized continent

ONE morning in the year 1924, Dr. Frank M. Chapman, Curator of the Museum's Department of Birds, sat at his desk contemplating an oil painting of a flock of Black Ducks. For a time he stared at the canvas, then finally he

—and that in this case he thought it was well worth Doctor Murphy's time to come up to his office and look at the man's work.

Doctor Murphy knew that his Curator-in-Chief, while always graciously encouraging to young artists, was too

lay on the Curator's desk, fringed by the edges of its rumpled wrapper.

"There it is," Doctor Chapman said. "I have had this before me for some time now, and I can't say what others may think, but to me it's wonderful."

Such unqualified praise from a man who is probably the most distinguished ornithological figure of his time was so unexpected that it could mean only one thing: the first major recognition of a great talent—a talent destined shortly to be obtained for the American Museum's program of public instruction through the medium of decorative faunal habitat exhibits. Indeed, a few weeks later, Francis Lee Jaques was at work on the first of 26 habitat group backgrounds. Within a decade he had advanced from the status of an unknown middle western artist, electrician, and taxidermist to an enviable position in the select vanguard of American bird painters. In the winter of 1938, *Life Magazine* in the course of its commendable campaign to bring before its 2 million-odd readers the color work of the world's leading artists, chose Mr. Jaques' paintings to represent his field. But by the time this honor came his way, he had already gained widespread critical esteem for his remarkable and in some cases unprecedented ability to portray the *living* bird in its natural environment—an ability signaling the departure of modern bird artists from the technique which produced the ill-disguised mortuary appearance of most 19th century bird portraits. The astonishing rapidity of Mr. Jaques' rise to this exalted position in a field so bestrewn with technical pitfalls and esoteric difficulties prompts an inquiry into his background; an attempt to resurrect the environmental factors which shaped his talent; to trace, though dimly, the mysterious growth of the artist's mind and sensibilities.

Although he was born in Illinois the early boyhood of Francis Lee Jaques is a story of farm life in central Kansas, of a lad living in and with the American soil and as familiar with its teen-



raised his eyes slowly, arose, and walked out of his office and down the hall to the desk of his colleague, Dr. Robert Cushman Murphy. He told Doctor Murphy that he had that morning been enjoined to glance at the paintings of an unknown bird artist—an opportunity that was frequently his

exacting in his demands to be easily impressed. And because of this he knew that he was about to see a piece of bird portraiture that was distinctly out of the ordinary. He was not disappointed. On entering Doctor Chapman's office the two scientists walked over to the Black Duck canvas which

ing wildlife as are contemporary urban youngsters with tall buildings, imitation machine guns, and the ticker windows of movie palaces. Around the fireside his father would tell young Jaques personal reminiscences of hunting trips—trips that went back even to the days when buffalo herds still pounded across the verdant prairies of the pre-Dust-Bowl West. Come autumn, when crops were in, he would take his young son after fox squirrels in the woods of the river bottoms or they would crouch together near the prairie ponds, guns leveled above the wind-bowed reeds at the wedge-shaped flight of the water fowl then abundant in that region. In the spring, while young Jaques trudged behind a plow, grackles, killdeer plover, redwing black-birds and many other varieties fluttered in winged clouds at his heels, quick to peck at sinuous worms in the fresh-turned earth. Here were birds; not seen through the lenses of powerful binoculars in some city-bound park, but birds living, eating, fighting, within arm's length of the boy whose brush was later to fix them out of time and space in just such vital activities. These experiences, this tactile closeness to birds in wholly natural surroundings, stimulated the boy to entertain himself during the long radio-less farm evenings by taking pencil and sketching what he had seen birds do that day. And though this simple medium permitted only experiments in form and shading, his sensitive mind was recording the patterns and plumage he had so minutely observed; the color of the feathers and their arrangement which his searching fingers had explored. Filled with a longing to broaden his gift, to work in media which would enable him to create birds as he had seen them—in the life—he subscribed for a correspondence course in drawing. But lessons in art R. F. D. seemed to fall far short of his expectations and he did not stick at them for long—a fact curiously in tune with the relative lack of formal training which characterized his entire development. To this day he often wonders what the orthodox discipline of a standard art course would have done for him. But there is no doubt he considers—and there is a great deal to bear him out—that the stimulating impressions of his youthful outdoor life were far more important.

Don't take for granted that the burgeoning artist had any time for desultory dalliance with his muse, however. He had to see to it that his off-hour activity yielded a maximum

return, for at 14, he was hard at work on his grandfather's farm earning the opulent wage of 25¢ a day. It was at this point in his career that the Jaques family decided there were greener fields to the north, and one morning they packed up their movables and set off, picturesquely enough in a covered wagon, bound for the hills of Minnesota. As the boy walked along beside the horses or rode in the lumbering wagon, he was able to see what we today might call a slow motion view of an appreciable section of the United States. Making the same trip on the concrete highways of 1939, a contemporary youth could absorb little of the

prenticeship to Nature terminated by settlement in Minnesota. The scene had changed, but in the county of Aitkin on the banks of the historic Mississippi, the young man was thrust into intimate association with the varied ecology of a great timber country. Whereas Kansas had given him a contact with the frontier in part colored by family remembrances, he now saw a tangible record of Minnesota's pioneer phase in the broad swaths of stump-land—black-dotted mementoes of a tremendous logging boom, whose dimensions had dwindled by the time of his arrival but which was by no means spent. Here, young Jaques ex-



pastoral surroundings from the window of a speeding automobile. This factor, Mr. Jaques feels, cannot be emphasized too strongly in any attempt to analyse the environmental background of his achievements.

Nor was the quite undeliberated ap-

changed plow for axe and followed the pine tree trail. Wintering in what was still largely a wilderness, he would step from his logger's hut into the thick of a wildlife even more luxuriant than the plains had offered. And it was the stimulus of this experience that

led to his establishment of a taxidermist's shop, which he conducted for 10 years, infinitely bettering his understanding of bird flight by a study of their wing structure and gaining also a valuable knowledge of deer, moose, and smaller mammals.

On one of his occasional holidays in the City of Duluth, the young artist chanced to meet a celebrated painter who not only influenced his technique but was to be his guide and, in a very informal respect, his master from that time through his early days at the Museum. This was Clarence C. Rosenkranz, until recently a member of the widely known artist staff of the American Museum and now in charge of background paintings at the Philadelphia Academy of Science. Under his tutelage, Jaques acquired a modest proficiency in water colors, oils and other standard media and was presently resolved to try selling his work in the open market. As is so often the case, he met with a number of sharp rebuffs, one of which he laughingly remembers was a brief but very pointed note from a half puzzled, half irritated, magazine editor which read, "We don't know what to do about your work. Please don't send us any more."

The difficulty was that even at this date, Jaques was striving with every device at his command and possibly some that he had not yet quite mastered, to capture the essence of a living creature on canvas. His imagination and the daring motion of his line came as a shock to appraisers long accustomed to flat colored prints of dead ducks, their heads limply dangling, or blustering field pieces depicting luckless fowl the instant they were blown luridly to smithereens.

At long last he finally sold a sketch to a furrier for use in a small advertising campaign. Shortly thereafter he sold or rather traded some of his work to such publications as *Field & Stream* and *Outdoor Life*. The verb "traded" is used advisedly, for these magazines were then in the habit of paying for their illustrations in due bills drawn on various firearm and hunting equipment manufacturers who advertised in their pages. Mr. Jaques is still the proud possessor of a sixteen dollar shotgun—remuneration for his first acceptance. But you can't eat shotguns and in a rather discouraged mood, he cast about for some more or less regular source of ready cash.

It is one of the more engaging aspects of his career that a born painter

of wildlife should turn in this critical hour to the greatest emblem of the Power Age—the railroad. The fact that Duluth is a railroad center undoubtedly had much to do with determining this choice, but there is a modicum of irony in picturing Jaques as a fireman on a giant locomotive, the invention which perhaps more than any other enabled man to encroach so suddenly and so violently upon the domain of wildlife that the depletion or outright extermination of many species inevitably resulted.

An idealist's conception of the Nature artist would have him munching crusts in a garret rather than demeaning himself by so much as the merest contact with one of these cinder-belching agents of destruction. But there was nothing of the poseur, nothing of the paradigm about Jaques. When he stood watching a long line of freight cars looming black through the strangely lighted dusk of a snowy evening, he saw that Beauty had but changed her garb. He sought and found work with a railroad company, glorying in the throttle-wide bumbling of locomotives as the headlight picked out mile on mile of gleaming, gracefully curving track.

He might easily at this juncture have turned his talent exclusively to the profitable specialty of industrial art. As a matter of fact he did to a certain extent and—so complete is his naturalist's adjustment to the Age of Power—still does.

Perhaps bringing out even more sharply this curious dichotomy in his makeup is the fact that Jaques enrolled for a course in the theory and practice of electrical installation, from which he was graduated *summa cum laude*.

With the entrance of the United States into the First World War, he decided to try his hand at soldiering, spending 6 months overseas in the Army's Coast Artillery. And after the Armistice, the still-booming merchant marine briefly claimed his services. Despite these vagaries, the remarkable opportunity which taxidermy had given him to handle and dissect nearly all the birds and mammals native to Minnesota was yet to pay him dividends. In his shop he had learned more and more of the intricacies of sub-human anatomy—the delicate feather patterns of the avifauna and rippling mammalian musculature—all of which not only sharpened his painter's eye and stimulated the accuracy of his imagery, but prepared him as though by some providential plan for the tasks

he was later to be assigned at the Museum.

Nor was his electrical background at all extraneous. He was able to implement his knowledge in this craft to quickly gain an understanding of his new art medium, the habitat group, a form almost entirely restricted to museums, and one which depends to a considerable degree upon electrical lighting for its effects. This last factor often proves a shibboleth to young artists whose skill in the older, traditional media of canvas and mural is unquestioned. Their frustration is in many cases the result of an inability to grasp the stringent limitations placed upon the use of shadows by diffused lighting rather than a losing struggle with abstruse problems of, say, ornithology. The latter discipline held astonishingly few terrors for Jaques when he came to the Museum in 1924. He knew birds so thoroughly that he was never forced to apply himself to a laborious study of the taxonomic collections within the Museum, or to patient hours of observation in the field. He had, of course, to do a certain amount of both, but his intuitive mind was so thoroughly equipped by his youthful experiences that he could easily avoid tussling with a scientific nomenclature which, by the way, he regards as a mere necessary evil. On his own testimony, he hardly ever remembers names anyway, and this applies to people as well as the graeco-latin classifications of birds. As to the axiom that no bird painter can master his art without frequent recourse to field glasses and long hikes with local bird identifiers, Jaques smiles and shrugs. "I haven't got much time to go out identifying birds," he says, "it takes me every minute I can spare to draw them."

But Mr. Jaques, as one of his friends says, is a master disclaimer. The fact is, he has observed birds over half the globe, from the Arctic to Chile, and from the South Seas to the Alps, using every available moment during his several Museum expeditions in bird observations. And on private vacations Mrs. Jaques and he have covered most of the United States and Canada.

Conquest of the medium of habitat groups was, however, only half the battle. Partly from pride and partly from an inner compulsion that had been with him throughout life, Jaques had to devote himself unflinchingly to the improvement of bird art by the example of his work. This branch, like

painting in general, is subject to an evolutionary process which modifies the achievements of the past to suit the discoveries and increasingly adroit techniques of the present. It has been developed slowly by a number of extraordinarily gifted and patient practitioners since the days of Audubon, all of whom have felt the impact of much new ornithological data and the revelations of the high-speed camera. For by stopping the motion of birds in flight, photographers have taught both artist and scientist much about the methods and distinctive peculiarities of birds on the wing. Yet all too often painters have rashly seized upon these stopped-motion pictures, which although they yield admirable lessons in bird flight, frequently distort the image as it actually appears to the relatively low-speed human eye, and, therefore, from the anthropomorphic standpoint (and painting is inherently anthropomorphic) distort the ultimate "truth."

Mr. Jaques has become an outstanding portrayor of the flying bird, not by any slavish attempt to duplicate the camera eye but by the careful selection of the many avian traits to which bird photography has given him access. A flushed covey of game birds can be shown up as an excessively awkward composite on sensitive film. But to the hunter's eye, it is an esthetic phenomenon rich in wing pattern, distinctive in color and formation. And it is from this "man's-eye view" that Jaques paints his bird whether the creature be flying, courting or calmly afloat upon the waves. If there is one characteristic which separates his work and that of any truly great modern bird painter from portraits of an inferior order, it is the successful creation of an individual in every bird that takes shape upon his canvas. The capture of this quality is paramount—life, zest, color authenticity and all the rest of it are natural byproducts.

It was once said of bird art that there is very little accuracy in the decorative prints and little decoration in the accurate ones. Thus, much of the history of this genre is taken up with the feud between the artist and the scientist. There is supposed to be an indissoluble conflict between these two spheres of interest which may be summed up in the aphorism that the painter wants a picture and the ornithologist wants a map. Scientists like Dr. Robert Cushman Murphy freely admit that illustrations such as

those found in the standard technical works represent an often painfully arrived at compromise between the esthetic and the diagrammatic approach. True art in which the selection of detail has been determined by its own special criteria is seldom useful to the average ornithologist. Science expects the artist to help by clarifying problems of identification, to fix individual characteristics more firmly in its collective mind.

One would imagine that the rather over-celebrated "artistic temperament" would suffer grievously under such restrictions. Not so Jaques. Almost instinctively, he seeks to instill accuracy into everything he touches. He believes that the scientist and the *good* artist are much closer together on this point than legend has placed them. While he can keep his head admirably in the presence of the most *outré* concoctions of the super-modernists, his only admonition, and indeed his chief touchstone, is that "good drawing will never hurt anything." And to Jaques, good drawing and absolutely faithful rendition are synonymous. His one quarrel with science came about when he was asked to make all the birds in a certain picture to scale. His ornithological mentor saw nothing untoward in this request since he was naturally interested in making exact measurements. But Jaques soon convinced him that to draw birds to scale within a landscape where the delicate adjustment of perspective is all-important, would produce so unearthly a result that simply in the interests of "truth" the scientist should forbear.

Despite his fame as a Museum artist and the demands which the acquiring of this fame have made on his time, Mr. Jaques has not completely abandoned his former vocations. He is one of the country's more indefatigable amateur railroaders. When the mood prompts him, furniture is pushed aside in his New York apartment to make way for "miles" of shining rails, curved at just the right arc, glittering uphill and down, and doing all the things which he so enjoyed seeing actual tracks do in his days of professional railroading. Over these tracks purr model engines and coaches designed and in part manufactured by Jaques himself. Don't get the idea that these are the kind of toy trains Junior loves to speed up so fast that they topple buzzing off the track at every turn. Mr. Jaques' model trains are the products of careful experiments in the relation of raw power to train weight

and wheel traction. They are constructed to put on as realistic a performance as possible and although he is strictly an amateur, Mr. Jaques uses his models in working out his own designs for the trains of the future. Streamlining, incidentally, is a motif which he considers all right for electric and Diesel engines, although not altogether satisfactory even there; but to streamline the good old huff-puffing steam locomotive wounds his sensibilities. He feels that the two ideas are simply incompatible.

As an outdoor passion, Jaques recommends riding on narrow-gauge railroads. The narrow-gauge road like the locomotive is, he suspects, on the way out. But to him they both represent "real railroading," and he wants to get all the fun he can out of them before they become things of the past. Mr. Jaques selects trains and allied subjects for many of his off-time paintings and likes to read magazines exclusively edited for railroad people. One of his train paintings was presented last Christmas to the president of one of the leading railroads.

But Jaques is at bottom an *afficionado* of Nature painting with a heavy accent on birds. Critics uninterested in avian life have praised the extraordinary beauty and power of such land and seascapes as the background for Dr. Roy Waldo Miner's Coral Reef group in the Museum's Hall of Ocean Life, and the Hawaiian and Pacific Sea Bird groups in the Whitney Bird Hall. Others have grown unreservedly enthusiastic over the lovely quality of his illustrative sketches for books.

Canoe Country, in which he supplemented Mrs. Jaques' text by a series of remarkable pen-and-inks depicting mammals, birds and camping scenes in the Minnesota woods has nearly sold out an edition of 5,000 copies and another book on the marshes of Louisiana, *The Geese Fly High*, is in process. One of the sketches shown in these pages is from *Canoe Country* and the other from *The Geese Fly High* which will be brought out next fall by the University of Minnesota Press.

But, as Mr. Jaques himself says, there are many excellent landscape painters, a goodly number of top-notch industrial artists and book illustrators, some fine all-around Nature painters, and yet precious few really finished bird men. Asked if he would hazard a guess as to why this is so, Mr. Jaques explained that the bird was perhaps the most difficult of all subjects. Painted alone, most birds beset the

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THUNDER IN HIS FOOTSTEPS

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came along, leaving this great trail behind—just as the name *Brontosaurus* implies. . . . “A Thunder Lizard.”

I spent the rest of the afternoon photographing the trail and taking accurate measurements. A sense of both elation and futility marred my dreams that night. It was out of the question to remove even one of these washtub tracks—that would have to be a consideration for the future. In the end I had to be content with a pair of plaster casts. If anything should happen to the originals, they would constitute a record.

As to the mysterious stone artist, I never located such a man, nor did I try very hard to do so; I was satisfied. I really felt as if I owed the man a lot. The strange quest he started terminated in a manner far beyond anything I had expected. If the idea of tracing down originals had not occurred to me, then this story never would have been written. All the prints in Jack Hill's had been well done—too well done, the only reason to suspect them. The one single “mystery print” that Ryals showed me checked with the descriptions of at least a dozen

people, in regard to the others once seen there. How often I wished I could have seen them too! To me they are still as indefinite as the creature that made them. I think more will turn up another day, but that is, again, another hunch.

As for the sauropod tracks, their story is but half told. I have hesitated to deal with technical details in a narrative of this nature. Many interesting things are still to be learned about them, but that, like removing a trail-slab, is a fitting story for the future. This—just a tale of prospecting—has been offered for the value it alone may hold.

Incidentally, the big tracks were still there by the Paluxy River when I last saw them. It will be a hard, strenuous, not to mention expensive, job to take a series of them out. An ideal place to exhibit such a slab has already presented itself to Dr. Brown. There is ample room on the base of the Museum's *Brontosaurus*, just under the mounting of his tail. So mounted it will appear as if this big fellow had just stepped out of them. In the river bed they will be soon worn away and lost forever. What could be more fitting than the place described? Like *Brontosaurus*, he, too, this Texas sauropod . . . had once moved forth against the world with thunder in his footsteps.

FROM EGG TO EAGLEHOOD

Continued from page 287

Measurements were made of the distances covered with different loads.

The average distance made while carrying two pounds was 162 yards, although he could have continued for miles, circling and dipping back and forth. We finally called him to the ground. On the next flight we doubled the load. This strained him quite a bit and forced him to use his wings and forget about pleasurable glides. On these he averaged about 61 yards. On the next series of flights, carrying eight pounds, he averaged just twelve yards, and they were covered only by wildly flapping wings and straining muscles to avert a sudden ground collision.

These tests were rather revealing considering the recurrent news dispatches. . . .

BOY DROPS TO GROUND AFTER FIGHT-
ING OFF GOLDEN EAGLE
FATHER KILLS FIFTY-POUND EAGLE AS
IT CARRIES OFF CHILD

They make good reading, but the surprising thing is, they are believed!

From our experiences with Caesar, we doubt very much if a wild eagle in *perfect condition* can lift eight pounds off the ground. A female (the larger sex) might be able to carry such a load if flying speed could be obtained by dropping off a cliff. Unfortunately for eagles, however, eight-pound babies don't walk on cliff tops!

The longer we had Caesar, the more convinced we were that complete freedom for him would end disastrously. His tame and trusting nature would be his undoing. He seemed happy in captivity—a captivity which gave him hours of complete though protected freedom. He was much too grand to become a hunter's trophy.

Came a letter from the Peregrine Club of the University of Pennsylvania. These American pioneers of an ancient sport had heard of our bird and wanted him. A whole club of falconers could give him the necessary exercise, correct food and attention. Hence we agreed to part with Caesar and terminate a ten-months' friendship which ran from egg to eaglehood,—a friendship we will never forget.

Recent Museum Publications

NOVITATES

- No. 1001. Two New Fishes from Lake Victoria. By J. T. Nichols and F. R. LaMonte.
1002. Taxonomic Studies of Ephemera. I: Description of New North American Species. By Herman T. Spieth.
1003. Taxonomic Studies on the Hydras on North America. V. Description of *Hydra cauliculata*, N. Sp., with Notes on Other Species, Especially *Hydra littoralis*. By Libbie H. Hyman.
1004. North American Rhabdocoela and Alloecocoela. II. Rediscovery of *Hydroilimax grisea* Haldeman. By Libbie H. Hyman.
1005. North American Rhabdocoela and Alloecocoela. III. *Mesotoma arctica*, N. Sp., from Northern Canada. By Libbie H. Hyman.
1006. Birds Collected During the Whitney South Sea Expedition. XXXIV. Notes on New Guinea Birds. IV. By Ernst Mayr.
1007. Birds Collected During the Whitney South Sea Expedition. XL. Notes on New Guinea Birds. V. By Ernst Mayr.
1008. New Species of Mallophaga from *Afropavo congensis* Chapin. By Theresa Clay.
1009. Records and Descriptions of African Syrphidae.—I (Diptera). By C. H. Curran.
1010. Records and Descriptions of African Syrphidae.—II (Diptera). By C. H. Curran.
1011. New Species of Rotifera from the Collection of The American Museum of Natural History. By Frank J. Myers.
1012. *Cooperia totadentata*, a Remarkable Rhinoceros from the Eocene of Mongolia. By Horace Elmer Wood, 2nd.
1013. A New Genus and Five New Species of Neotropical Hesperidiidae (Lepidoptera-Rhopalocera). By E. L. Bell.
1014. Notes on Carangin Fishes. IV.—On *Caranx crysos* (Mitchill). By J. T. Nichols.
1015. Fossil Plants from the Upper Cretaceous Aguja Formation of Texas. By Erling Dorf.
1016. A New Race of *Garallaria excelsa* from Venezuela. By E. T. Gilliard.
1017. On *Spermotodus pustulosus* Cope, a Coelacanth from the "Permian" of Texas. By T. Stanley Westoll.

BULLETIN

Volume LXXVI Art. 1—The Social Behavior of the Jewel Fish, *Hemichromis bimaculatus* Gill. By G. K. Noble and Brian Curtis.

ANTHROPOLOGICAL PAPERS

Volume XXXVI Part IV—Archaeology in Central Alaska. By Froelich G. Rainey.

INFORMATION TEST

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

Score 5 points for each correct answer. Correct answers on page 306

- | | |
|--|--|
| <p>1. Coons always wash their food before eating.
True..... False.....</p> | <p>10. The most famous fish of 1939 was previously supposed to have died at the time of
(a) The three-toed horse
(b) The dinosaurs
(c) The first man</p> |
| <p>2. The old woodsmen's term "scatter time" refers to
(a) The wanderlust impulse that drives young beavers away from the home colony
(b) The wolf pack's habit of surrounding a lone Eskimo on all sides
(c) The eagle parent's practice of starving the young out of the nest when their wings are strong enough</p> | <p>11. Eagles squeeze their prey to death or unconsciousness without bloodshed.
True..... False.....</p> |
| <p>3. It is possible for genuine human footprints to be found in Cretaceous rocks, roughly 120 million years old.
True..... False.....</p> | <p>12. The Eskimo kills a wolf with a weapon no more formidable than the whalebone which women formerly wore in their corsets.
True..... False.....</p> |
| <p>4. The coelacanth fish oozed 20 gallons of oil
True..... False.....</p> | <p>13. Beavers use only the branches of trees to construct their dams, the trunks being too heavy for them to handle.
True..... False.....</p> |
| <p>5. A young eagle will never leave its nest until the parents deliberately starve it out.
True..... False.....</p> | <p>14. The reason that human footprints are never found in association with dinosaur tracks is that early man refused to live on the same continent with the dreadful creatures.
True..... False.....</p> |
| <p>6. The Eskimo induces the wolf to "commit suicide" by
(a) Driving the animal into a frenzy of despair
(b) Appealing to the wolf's taste for its own blood
(c) Luring it to the edge of a high cliff off which it never fails to leap</p> | <p>15. A Golden Eagle in the pink of condition cannot lift even an 8-pound baby from the ground.
True..... False.....</p> |
| <p>7. Like woodchucks, coons hibernate during the winter.
True..... False.....</p> | <p>16. Edible sleds are the exclusive products of confectioners and never got anybody anywhere.
True..... False.....</p> |
| <p>8. Beavers subsist on only one food—the bark of trees.
True..... False.....</p> | <p>17. In spite of their ferocious appearance, no dinosaurs were flesh-eaters.
True..... False.....</p> |
| <p>9. The largest animals that ever walked the earth left tracks that are
(a) Two-toed
(b) Three-toed
(c) Four-footed</p> | <p>18. Nature has compensated the Eskimo for his aversion to bathing by making it impossible for any vermin to live in the Arctic.
True..... False.....</p> |
| | <p>19. Desert Pack Rats defend themselves against coyotes with cactus thorns.
True..... False.....</p> |
| | <p>20. Though scattered over a territory 800 miles broader than the distance between New York and San Francisco, all the Eskimos in the world could sit in the Yankee Stadium without filling half the seats.
True..... False.....</p> |

YOUR NEW BOOKS

BIRD-MAN'S ANTHOLOGY • DESERTS IN TEXT AND PICTURE
THE WATCHER AT THE NEST • HANDBOOK OF NATURE
STUDY • POISONOUS PLANTS • A BOOK OF WILD FLOWERS

A GATHERING OF BIRDS - - - by Donald Culross Peattie

Dodd, Mead and Company, \$3.00

THIS anthology of the best ornithological prose is edited by an author of whom we have become accustomed to expect freshness and originality and have not yet been disappointed. Bird-lovers who have read widely in the vast literature of ornithology might be tempted to avoid an ordinary anthology as repetitious but they will find in this one not only some almost unknown passages of power and charm by forgotten authors, but also an arrangement and presentation that give to old favorites new life and meaning.

The number of authors selected—nineteen—has been limited not so much by space considerations as by the plan of providing biographical sketches, of giving each enough space to show characteristic style and develop a subject, and of presenting them in such order that the whole book has the balance, the light and shade, of a program of music intended to satisfy a variety of moods. Mr. Peattie has further insisted that each selection must measure up as science as well as literature, a dual standard that gives dual satisfaction to the reader. It is appropriate here also to refer to the attractively decorative woodcuts contributed by Edward Shenton, a full title page to each author and an end-piece to each selection.

What a varied gallery it is! Here are the immortals, Gilbert White, Audubon, Wilson, Thoreau, and Hudson, represented by well-chosen excerpts; others like Richard Jefferies and P. H. Gosse whose claims we are in more danger of forgetting; and some almost forgotten, like Peter Kalm, Thomas Nuttall, and John Muir. We are reminded by selections from Alfred Russell Wallace and Elliott Coues that men prominent in nineteenth century science and exploration have left also their contributions to literature. To choose representatives from contemporary authors is probably a thankless task but it has been well done in selections from William Beebe, Frank M. Chapman, Gustav Eckstein, Cherry Kearton, and Robert Cushman Murphy. That two of these five should be members of the staff of its Department of Birds reflects well-deserved honor on the American Museum of Natural History.

It is not the place of a reviewer of an anthology to anticipate readers' pleasure by comment on the selections themselves, but it may be permissible to remark that

Mr. Peattie's own prose in the linking biographical essays has a graceful conformity with that of the best of his authors.

R. A. FALLA.

DESERTS

- - - - - by Gale Pickwell

Whitlsey House, \$3.50

AS an introductory handbook dealing with the deserts of the American Southwest this work should achieve considerable popularity. Unquestionably its 64 full-page photographs provide highly useful as well as artistic means of acquainting the reader with deserts. However, the text amounts to little more than an assemblage of glorified captions for the pictures. For the traveler with a casual interest this is perhaps desirable. The reader should realize that he is getting only the highlights,

but getting them in a rather satisfactory manner.

Increasing interest in the American deserts has resulted in the assemblage of a considerable amount of information pertaining to our understanding of them and their inhabitants, most of which the author has failed to review. Happily, however, the book includes a bibliography, although it is brief and it omits one of the most useful works, Buxton's *Animal Life in Deserts*.

Regardless of these, as well as other criticisms that can be made, the book represents an admirable pictorial description of the Southwestern deserts, with enough fundamental concepts explained to attract further study. The splendid photographs will warrant expenditure of the small amount of money necessary to place this book in the library of any desert enthusiast.

C. M. BOGERT.

THE WATCHER AT THE NEST

- - - - - by Margaret Morse Nice

The Macmillan Company, \$2.00

FOR a number of years, Mrs. Nice has been making ornithological history by her detailed, careful observations of the life history of the Song Sparrow. From time to time she has published the various results of her studies in the pages of *The Auk*, *The Wilson Bulletin*, *Bird Lore*, the *Journal für Ornithologie*, and the *Transactions of the Linnaean Society of New York* where they have aroused enormous interest in this phase of bird study as well as in the particular subject of her investigations.

The first half of the present volume summarizes in a popular way a great deal of the information contained in the more formal reports, especially those parts that are likely to appeal to the general reader. The story is told in a running account of progressive observations over a period of eight years in the limited area of a backyard and its surrounding fields at Columbus, Ohio. By means of numbered and colored bands on the legs of her subjects, Mrs. Nice was able to assure herself of the individual identity of the various Song Sparrows that nested from year to year in this zone of observation and hence to determine many interesting things that would have been mere matters of speculation if based on unrelated studies. A wealth of detail on the life of the Song Sparrow as an individual is thus presented beginning with the

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arrival of the first males in the spring and the establishment of their territories and continuing through the arrival of the females, the courtship and selection of mates, the building of the nest, incubation of the eggs, the feeding of the young, the building of the second nest and the rearing of the second brood, and on to the departure of the birds in the fall with all the varied activities that make up the birds' existence. The record is a monument to the patience and persistence of a keen observer and careful historian. To that reader who has not been fortunate enough to see Mrs. Nice's more formal reports, this abridged account should be an eye-opener as to the possibilities of study that lie before a student of birds without the necessity of his traveling beyond his own doorstep.

The latter half of the book contains a series of chapters on the Cowbird, Magnolia Warbler, Black-throated Green Warbler, Ovenbird, Bell's Vireo, Mourning Dove, Yellow-crowned Night Heron, Bobwhite, and "Spring in Oklahoma." Although they do not pretend to give the same wealth of attention as is devoted to the Song Sparrow, they show the same keen powers of observation and present a surprising amount of information on their various subjects. Roger Tory Peterson has supplied a group of attractive illustrations in black and white to supplement the already enlivened pages of the volume.

J. T. Z.

POISONOUS PLANTS OF THE UNITED STATES

- - by Walter Conrad Muenscher

The Macmillan Company, \$3.50

THE author is Professor of Botany in the New York State College of Agriculture at Cornell University. In the same series he has written the volume on weeds, which appeared in 1935.

All the vascular plants in the United States that are known to cause poisoning when eaten, by contact, or by mechanical injury, to man or animals, are included—about 400 species in all. All of these are flowering plants except one fern and a few species of scouring-rushes. Fungi and other lower plants are not included.

The poisonous plants are described with a statement of range and habitat. An aid in identification are copious illustrations from excellent drawings. In each species the poisonous principle is discussed, as well as conditions of poisoning, symptoms and treatment. Altogether the volume is a carefully prepared, attractive, and useful handbook.

CLYDE FISHER.

HANDBOOK OF NATURE-STUDY

- - - by Anna Botsford Comstock

Comstock Publishing Company,
Ithaca, N. Y., \$4.00

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during *Handbook* is a fitting memorial to her life of unceasing endeavor to share with others her own deep love and understanding of the out-of-doors. Practical and useful in scope, suggestive and imaginative in text and style, this extraordinarily complete, large volume should be an essential part of the equipment of every school nature room, camp bookshelf, museum reading room and naturalist's library.

In many respects this is a new book. The list of Cornell University Professors who have collaborated in the complete revision of this edition, is as long as are the names impressive. Mrs. Comstock's genius shines through, nevertheless. The original flavor has been successfully retained wherein is concerned the author's rare ability to interpret Nature for the benefit of teacher and pupil alike. Two hundred and thirty-two carefully planned lessons, for the instructor's use, are strategically placed throughout the general, informative text. A valuable annotated bibliography has been added. . . . The format is attractive, the type satisfactory and the numerous illustrations, many of them new, are well reproduced upon good paper.

WILLIAM H. CARR.

A BOOK OF WILD FLOWERS

- - - - - by Margaret McKenny

The Macmillan Company, \$2.00

MARGARET MCKENNY'S *A Book of Wild Flowers* arrived fresh from the press on a cold March morning which held no promise that spring would ever come. One glance at the cover, a delicate citron green, dominated by richly colored Harbells, Sweet Flag, and Day Lilies, conjured thrills of summer warmth to dispel the outer cold. The first illustration, a Skunk Cabbage, brought a sharp realization that "even if it has a strong smell, we like the Skunk Cabbage. When it pricks through the mud, we know that spring is near."

From there on one follows the flowers in about the order one finds them in the eastern woodlands, Arbutus, Hepatica, Marsh Marigold, etc., into the flowers of late spring and summer, thence to the late summer and autumn flowers. The text is concise, simple and poetic without being sentimental as the following excerpt describing the Bloodroot shows: "Like a white frill the petals of the Bloodroot fit around its heart of gold. The flower bud is covered with a thin green coat. When the coat falls off the bud looks like a pearl."

The beautiful illustrations have been made by Edith F. Johnston, first in watercolor from the flowers and then on lithograph plates, a delicate and detailed process which the artist has done with painstaking skill.

Not only children will cherish the book for its gay colors and simple text but many an amateur nature lover will slip it into his pocket for rambles in the woods and meadows. Even the seed pods have been drawn on each page opposite the colored flower and a complete botanical index included.

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"BIRDIE" BOWERS OF THE ANTARCTIC

-----by George Seaver

John Murray, London, 10s. 6d.

THIS book completes our knowledge of the heroic group under Scott's leadership, that died on the Great Ice Barrier in 1912. Henry Bowers was then twenty-eight, the youngest and, in his own estimation, the least important member of the party. Mr. Seaver's biography is the first individual record of a remarkable character, who equaled the others in achievement and cheerful endurance to the end.

He was the only son of a sea captain, famed as a navigator and mercantile pioneer in the East, from whom he inherited the passion for a sailor's life and the marked abilities shown in his own career. At twenty-four he was in temporary command of SS. *Bhamo*, one of the Irrawaddy Flotilla. As the crown of his desires, came Scott's offer of a place in the *Terra Nova*.

He joined the Expedition, hoping only for service on board, and was overjoyed when he was chosen for the landing-party; and later, with Wilson and Cherry-Garrard, for the Winter journey. His physical and mental powers soon won Scott's complete confidence; and his integrity, humour and unselfishness made him a favorite with all.

Bowers' weekly letters to his family are the basis of this book; characteristic letters that reflect his undaunted spirit, his keen enjoyment of Antarctic life—its hardship and stress and continual risks—all set down in his vigorous, warm-hearted way. He had answered an irresistible call, and started on his last journey "with a joyful heart that nothing on earth could take away."

MURIEL KENT.

UNCAS AND THE MOHEGAN-PEQUOT

-----by Arthur L. Peale

Meador Publishing Co., Boston, Mass., \$2.00

THIS volume reviews the early history of Connecticut in which the most conspicuous Indian personality is Uncas, Chief of the Mohegan. The name Uncas holds a prominent place in fiction, but the real Uncas was a great Indian who, like Keokuk, Corn Planter, Washake and Tammany, understood the futility of armed resistance to white men and so preferred peaceful methods of adjustment.

The book opens with a brief history of the white man in New England, beginning with the somewhat mythical Norsemen, followed by the facts of Dutch and English explorations. Then comes an account of the Pequot wars. The strong tribes in New England were the Mohegan, Pequot and Narragansett, occupying eastern Connecticut, Rhode Island and adjacent parts of Massachusetts. Because these tribes dominated in New England, an Indian war of extermination was inevitable. The first colonists found the Mohegan and the Pequot at war with each other. In 1637 Uncas steps into history as the leader of a large Mohegan force assisting the English in an attack upon the Pequot. The people of Uncas profited

somewhat by aiding the English to exterminate the other New England tribes, but in the end they were crushed in turn by economic and political conquest. Uncas, however, respected and loved by the colonists, lived in peace until his death in 1682. Thus in this book he is the center of interest or the climax to the narrative.

The second part of the book presents a series of short narratives comprising a few sample myths of the old Indians, stories of adventurous whites and Indians such as make up the lore of the frontier, and abstracts of legends accounting for a number of place names in Connecticut, as Sachem's Head, Eliot's Rock, Devil's Den, etc.

Finally, the reader will find useful information as to the localities of monuments and other memorials to Uncas and his descendants. So the volume deals in part with tales of adventure and myth, but these are not presented as romance or literature, but as historical information. It is a pleasing volume and though making no claim to having discovered new sources of information, has assembled data so scattered that even a skilled historian would find the task time-consuming.

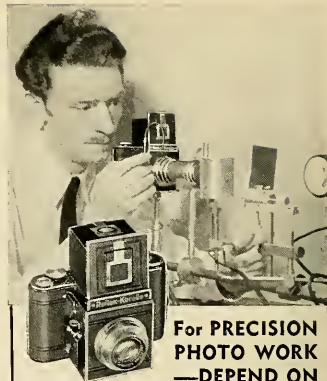
CLARK WISLER.

CORRECTION—Through an oversight the last name of Dr. Frank Dawson Adams was omitted in reference to his book "The Birth and Development of the Geological Sciences" in the April *NATURAL HISTORY*.

Answers to Questions on

Page 303

1. False. See page 263
2. (a) The wanderlust impulse that drives young beavers away from the home colony. See page 291
3. False. See pages 256-257
4. False. The coclecanth oozed 20 oz. of oil, not 20 gals. as earlier reported. See page 282
5. False. See page 287
6. (b) Appealing to the wolf's taste for its own blood. See page 279
7. False. See page 264
8. False. They also eat berries, mushrooms, and roots of plants. See page 294
9. (c) Four-footed. See page 261
10. (b) The dinosaur. See page 282
11. True. See page 287
12. True. See page 278
13. False. A 40 pound beaver can manipulate a 60 pound log on land and one weighing 100 pounds in the water. See page 296
14. False. See page 257
15. True. See page 302
16. False. The Eskimo makes a sledge that is both edible and an efficient vehicle. See page 297
17. False. See page 261
18. False. See page 279
19. True. See page 308
20. True. See page 279



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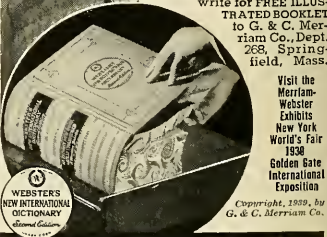
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Big Ones Out of Little Ones

By CHARLES H. COLES

Chief Photographer of the
American Museum of Natural History

"DO you make life-size enlargements of pictures?" the old gentleman asked the clerk behind the counter of the camera store.

"Certainly," said the clerk. "We specialize in such work. Do you have a negative of the picture?"

"Yes. Here it is. It is a picture of a whale," was the startling reply.

The old gentleman probably appreciated the improvement that a picture undergoes when it is enlarged from a small snapshot negative to a picture that can be seen easily without eye-strain. The whole subject of enlarging is such an interesting and important phase of camera work that every amateur should look into doing this work himself. It is during the process of enlargement that the full possibilities of the negative are revealed. Besides those artistic effects that are difficult to produce by contact printing alone, there are several solid scientific reasons why every negative should be enlarged.

Let's take a little scientific excursion into the geometry of looking at a scene. One eye is all we'll be able to use if we want to make our deductions applicable to the camera afterward. Into our eye come rays of light from every part of the scene. Now let's imagine that we're looking through a window pane at the house across the way. We draw a line on the glass over every line that we see in the scene. If we're careful we'll have made a two-dimensional representation of the house on the plane of the glass, accurate in proportion and perspective. This is what your eye has seen and this is what your photograph should duplicate.

Reaching for our camera, we place the lens at the point at which we held our eye when we made the drawing and take a picture of the house across the way. The picture is developed and a contact print made. However, since the size of the house in the print will be much smaller than our glass drawing, the photograph can never look natural. To achieve the desired effect of naturalness we must enlarge the negative until the picture is the same size as our glass drawing. The perspective of the picture will then be visually correct when the photograph is held the same distance from our eye as the drawing when we made it. Please note that no mention was made of what camera or focal length lens to use. Any lens will do for this experiment.

Let's assume that when we made the sketch the window pane was at normal viewing distance from our eye; that is, about 12 inches. A picture taken with a camera that had a six-inch focal length lens would have to be enlarged twice to have the enlargement match the drawing on the glass. A picture taken with a Contax or Leica with a two-inch lens would have to be enlarged six times to make the picture of the house the same size as the sketch. When these enlargements match the drawing in size, the pictures will look right if they are held a foot from our eye.

All these experiments lead us to the following rule: to make a picture in normal perspective, enlarge the negative by the number of times the focal length of the camera lens can be divided into the distance from which you want to view the finished picture. It is surprising how much better some of your pictures will look after they have been enlarged to the degree required to correct their perspective.

Types of enlargers

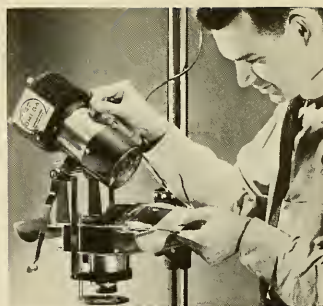
So much for the theoretical end of enlarging. Now let us see what is available to make these enlargements. There are two general types of enlargers, classified according to their optical systems.

The first type, and generally the more popular, is the diffuse light system, wherein a negative is illuminated by light that has passed through a diffusing medium such as milky white glass (called opal glass). In these enlargers an electric light bulb is enclosed in a lamp housing to prevent the light from leaking out into the darkroom. The light from the lamp passes down through the bottom of the lamp-house, through a sheet of opal glass and thence through the negative. Below the negative is the enlarging lens that throws the image of the negative downward onto the easel on which the sensitive paper is placed.

The other type of enlarger employs a pair of lenses in place of the opal glass to illuminate the negative. These lenses are called "condensers" because they concentrate the light on the negative. This type of optical system has the advantage of a great deal more illumination than the diffuse system. The condenser enlarger also produces more contrast but at the same time more grain than the other type. The definition is supposed to be superior with the condensers but since the enlarging lens, and not the condenser, has the responsibility of producing sharp pictures it is difficult to see why one enlarger should be sharper than another when the projection lenses are of similar quality. The condenser enlarger has one conspicuous fault about which very little is said. Unless the lamp is carefully adjusted in the lamp-house, the illumination of the negative is very likely to be uneven. There is only one correct lamp position for each degree of enlargement with any particular enlarging lens. For each change in enlargement or change in the lens on the enlarger, the lamp must be readjusted. By using a frosted bulb or an opal glass bulb, these changes will be minimized, but it is well to check the easel illumination often to make sure it is uniform over the area to be used.

Negative carriers

Enlargers hold the negative in various ways while they are being enlarged. Some press the negative between sheets of optical glass. Others hold the film between plates of metal out of which rectangular areas have been cut slightly smaller than the size of the picture. Still others split the difference by pressing one side against glass and the other side against a metal aperture plate.



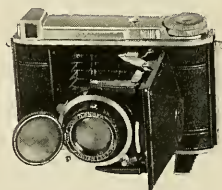
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By the use of two glass plates, the negative can be held optically flat while it is being enlarged. Certain difficulties arise, however, from this arrangement. Dust has a way of being attracted to glass, particularly after it has been rubbed to clean it and thereby has developed a charge of static electricity. After the negative has been clamped, there is no way to remove that last little speck of lint from its surface with a brush unless the glasses are separated—and then more dust enters.

Then, again, the glass becomes scratched with use and these scratches show in the print as white lines that present trouble in retouching. Finally, if the exposure has been too long and the negative becomes too warm, the glass will permit no expansion and so the negative will be ruined by buckling. There's still another trouble with glass. Newton's Rings, those funny little circles that show up especially with a recently developed film, are attributable directly to imperfect contact of the negative with glass.

So if you've kept your negatives very flat and are not making enormous enlargements, the non-glass negative holders will save retouching all those little white spots on the prints formed by dust on the negative during enlarging. For maximum definition, however, glass does a better job of holding a negative flat.

Note: If you must keep your negatives in a roll (but it is not to be advised), keep them rolled with the emulsion side out. They'll lie much flatter in the enlarger.

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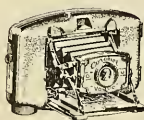
ODYSSEY OF A BIRD ARTIST

Continued from page 301

artist with nettlesome problems of texture. For, under natural light, the feather pattern is apt to confuse the shape while the shadowing confuses the feather pattern. Moreover, there is nothing in the bill to show whether a bird is turned full face or one quarter away. Painted in a composition, the bird normally occupies so small a space that it is well-nigh impossible to portray him in proper size relation to his setting and still retain all the specific details. Thus, it is Jaques' special ability to solve these problems in an esthetically appropriate and moving way which has come to be recognized as his own unique touch. And the full exploitation of this ability is manifestly his ultimate mission in the world of art. True, he loves to paint landscapes, seascapes, turbid industrial scenes, even prosaic electrical appliances—almost anything except the human figure (his treatment of the latter has never satisfied him). "In fact," he says, "I could use up a dozen lifetimes and still have plenty of things left over I'd like to paint." But the farm boy grown up—the man whose adolescent perceptions were played upon by an abundance of forces which a changing, mechanized American may never again bring to bear on its youth—has clearly done more than sufficient for one lifetime by his prodigious enlargement of the scope and beauty of bird art.

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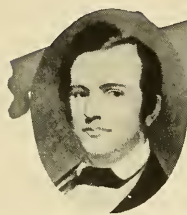
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THE TALL TRUTH

ROAD-BUILDING RATS

Against attack by coyotes and other natural enemies, desert pack rats show an interesting "military" development in the fortification of their nests with piled-up cactus, somewhat as barbed wire is used in warfare. Anyone familiar with the cholla cactus of the Southwest knows how painful its spines are, sharper than any needle and pointing in nearly every direction like the star-mace of the medieval knights. But strangely enough, the pack rat can walk upon the cactus plants with impunity and frequently climbs them to get the fruit. This is possible apparently because the body weight is light in proportion to the foot surface.

Stranger still, however, is the rats' trick of paving little roadways, often over 50 yards in length, with these spine clusters. Passing to and fro on these runways, the rats are relatively safe from the coyotes, who hardly dare pounce upon them.

JOHN ERIC HILL

NATURAL HISTORY, MAY, 1939

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Stefansson: Lost Greenland Colony • Story of Glas

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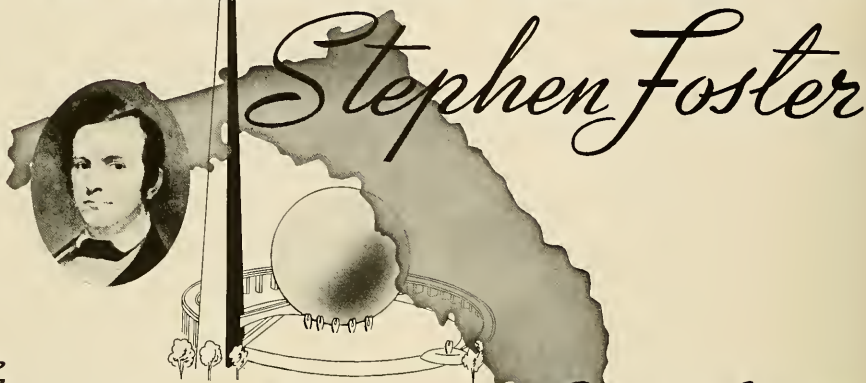
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