OFFICIAL GUIDE
TO THE
American Museum
of
Natural History

General Museum Information

Admission. Admission is on a pay-what-you-wish basis, but visitors must pay something. Admission for Museum members is free. The Museum is open every day except Christmas and Thanksgiving.

Hayden Planetarium. Admission to the Planetarium is separate from the Museum. For Planetarium information call (212) 873-8828; Laser Shows 724-8700; Sky Reporter 873-0404.

Food Express. The Museum's fast-food service is located in the basement. Box lunches are not permitted.

American Museum Restaurant. For leisurely dining in a greenhouse setting, the American Museum Restaurant is located in the basement.

Naturemax Theater. New York City's largest movie screen, four stories high. For prices and showtimes call (212) 496-0900; box office is located in the 77th Street foyer.

Membership. Enjoy the Museum throughout the year and receive an array of attractive benefits, including *Natural History* magazine. Your membership will help support one of the world's great scientific and educational institutions. Stop at our membership desks in the Roosevelt Rotunda or the 77th Street foyer, or call (212) 873-1327.

Museum Shop and **Junior Shops.** Extensive selection of books, unusual reproductions and gifts, rocks, minerals, jewelry, wall hangings, international clothing, posters and notecards. The Junior Shops feature natural history items for the young, from telescopes and books to dinosaur kits.

Special Events. Pick up a free copy of *Rotunda* at any information desk to find out about special events. You also may want to visit: the *Alexander M. White Natural Science Center*, which introduces young people to the natural science of New York City; the *Frederick H. Leonhardt People Center*, which presents music, dance, and lecture-demonstrations of cultures from around the world (weekends only); and the *Discovery Room*, which has hands-on activities for children (weekends only). The *Museum Highlights Tours* are free tours of selected Museum exhibits. Check at any information desk for daily schedules of these events.

Coat Checking. Inquire at information desks.

Parking. Limited parking for a fee available on the 81st Street side of the Museum.

Museum telephone numbers: General information (212) 873-4225; Offices (212) 873-1300; *Natural History* magazine subscriptions (800) 247-5470.

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WRITTEN BY GEORG ZAPPLER

American Museum of Natural History
Central Park West at 79th Street, New York, NY 10024

Robert G. Goelet, President Thomas D. Nicholson, Director

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Contents

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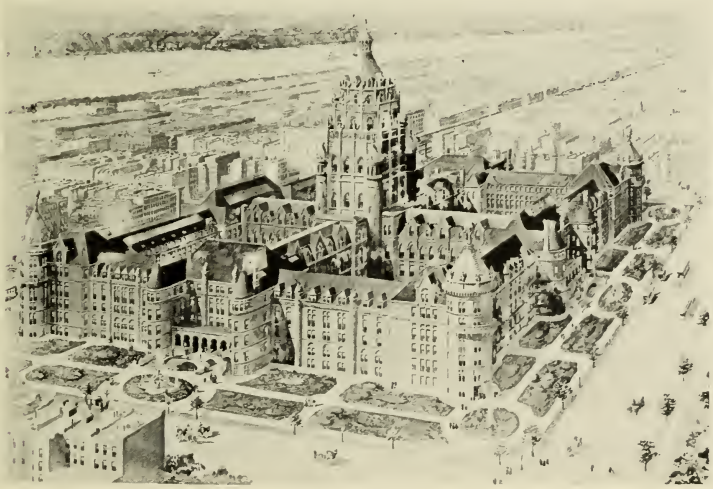
Introduction to the Museum

The American Museum of Natural History, a complex of large granite buildings topped by towers overlooking the west side of Central Park, has spread its marvels before an appreciative audience for over a century. Its stored treasures work their magic on millions of visitors every year and are studied by resident and visiting scientists and scholars from all over the world. A monument to humanity and nature, the Museum instructs, it inspires, and it provides a solid basis for the understanding of our planet and its diverse inhabitants.

Museum's founding

The Museum was founded in 1869 by Albert S. Bickmore as an institution for advancing the study and teaching of the natural sciences. Bickmore vowed that he would "work for nothing else by day and dream of nothing else by night." He inspired a group of



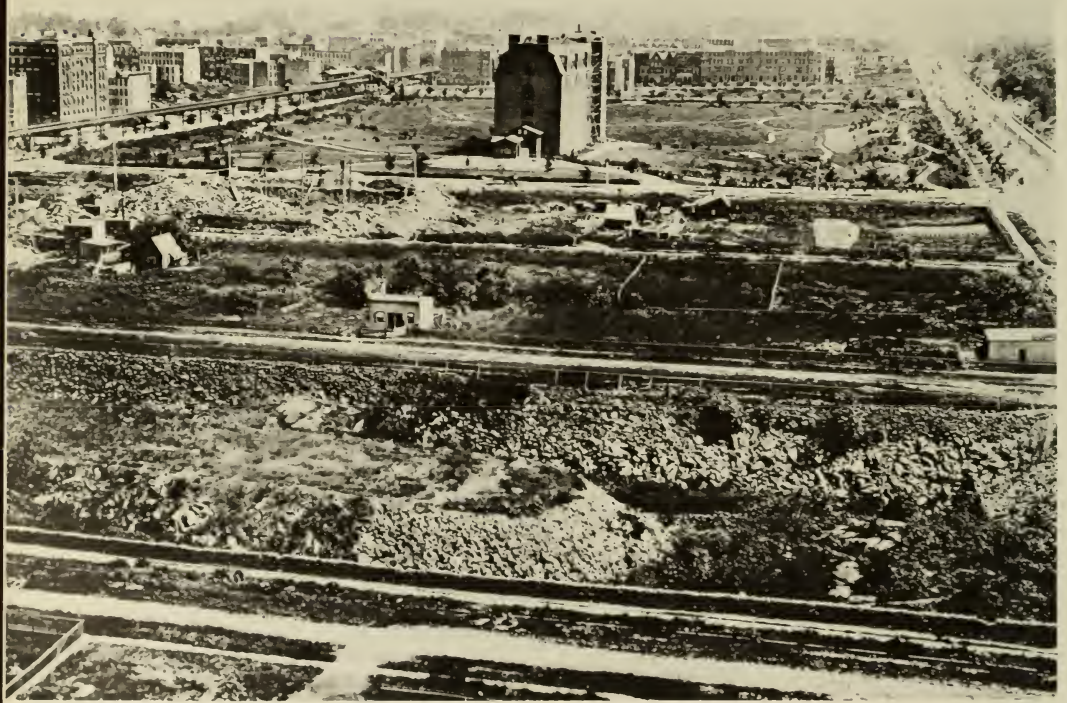
The Museum's original design, shown in this 19th-century illustration, included a central tower named "Hall of the Heavens." The plan was partially completed.

History

prominent New Yorkers and city fathers, including Theodore Roosevelt, Sr., and J.P. Morgan, to underwrite a natural history museum for New York City. It was not intended to be a local or regional institution. The vision of the Museum founders was to establish in New York City, with the partnership of the city, a great center for the scholarship and teaching of the natural sciences and anthropology.

The earliest collections of the future museum were housed in a small Wall Street office building. They were soon moved to the Arsenal building in Central Park (now part of the zoo). Calvert Vaux, one of the designers of Central Park, planned the present Museum on what was then mostly swampy farmland interspersed with herds of goats and a few inhabited shanties. The first unit of the new Museum was started in June, 1874, with Ulysses S. Grant laying the cornerstone. It was completed on December 22, 1877. Other buildings, notably the south façade, a Romanesque Revival landmark, went up during the remainder of the nineteenth century, and several major additions were made in the 1920s and 1930s, including the Theodore Roosevelt Memorial on Central Park West and the Hayden Planetarium.

Today the American Museum of Natural History, comprising thirty-eight major exhibition halls, a planetarium, a highly es-



The first Museum building, visible here, was erected between 1874 and 1877. This view was taken from the roof of the Dakota apartment building on 72nd Street, looking north.

The Museum has sent over 1,000 expeditions to remote corners of the earth. Here Roy Chapman Andrews's famous Central Asiatic Expedition, bound for Outer Mongolia, assembles at the Great Wall of China in the 1920s.

teemed research library, and a large education department, in addition to research laboratories and storage space for collections, is one of the largest museums in the world. It is a private institution, staffed by some two hundred scientists and technical assistants, as well as four hundred other employees. The Museum receives substantial support from a number of major sources. It is particularly grateful to the City of New York, which owns the Museum buildings and provides funds for their operation and maintenance, and to the New York State Council on the Arts, National Science Foundation, National Endowment for the Arts, National Endowment for the Humanities, Institute for Museum Services, 300 corporations, 60 private foundations, 460,000 members, and numerous individual contributors.

Collections

The casual visitor to the Museum is confronted with a dazzling array of exhibits. From dinosaurs to sparkling gems, from Northwest Coast Indian totem poles to Hawaiian feathered cloaks, from a herd of elephants to delicate glass models of microscopic life forms, vista after vista of nature's treasures and humanity's achievements fill the maze of halls. Like an iceberg, the Museum displays only a fraction of its true dimensions. Deep in sections marked Not Open to the Public rest the bulk of the Museum's collections—some 35 million specimens accumulated over the decades on scientific expeditions or through gifts, exchanges, and purchases. All of these objects are carefully preserved and labeled, yet they are not by any means dead storage: they are the lifeblood of the research work conducted at the Museum and by the worldwide scientific community. The collections research activities are under the charge of a number of scientific departments, each of which has a staff whose responsibilities include inhouse and field research, exhibit planning, and the care of collections.

Division	*Area of Concern*
Astronomy–Hayden Planetarium	The universe, galaxies, stars and planets, solar systems.
Mineral Sciences	Rocks, minerals, gems, and meteorites, their formation and composition.
Invertebrates	Animals without backbones—both living and fossil—and their interrelationships with earth history.
Entomology	Living insects and spiders—also invertebrates, but so numerous, diverse, and unusual that they are separately classified and studied.
Vertebrate Paleontology	Fossil backboned animals—the evolution and relationships of fishes, amphibians, reptiles, birds, and mammals.
Ichthyology	Living fishes—the biology, relationships, and distribution of the finned, backboned animals.
Herpetology	Living amphibians and reptiles—the biology, relationships, and distribution of the coldblooded, terrestrial, or partly terrestrial vertebrates (frogs and salamanders, turtles, crocodilians, lizards, and snakes).
Ornithology	Living birds—the biology, relationships, and distribution of feathered vertebrates.
Mammalogy	Living mammals—the biology, relationships, and distribution of the furry, milk-suckling vertebrates.
Anthropology	*Homo sapiens*—physical makeup, evolution, and cultural development, past and present.

(Opposite) The Central Asiatic Expedition of the 1920s made headline news when it discovered the first dinosaur eggs in Outer Mongolia. Here expedition leader Andrews inspects a nest with an "even dozen."

A wanderer through the Museum's departments sees a great variety of research activities. In one lab, a technician chips away at the rocky matrix surrounding a fossil skull so that paleontologists

Scientific research

will be able to study it. In another area, a herpetologist is breeding parthenogenetic lizards—animals that exist naturally in all-female populations and reproduce without males. In the mammal department, a specialist on bats is mapping the distribution of certain species in South America; in the bird department, an ornithologist is listening to calls of a rare species of Mexican flycatcher that have been taped in the field; in the mineralogy section, the structure of gold is being scrutinized under an electron microscope for aspects of its unusual crystal forms. In the anthropology department, an ancient Inca city is being mapped by an archaeologist with the help of sophisticated computer analysis of some two million pottery fragments, while someone else reviews field studies on the economic role of children in Nigerian society.

These are examples of the diverse scientific efforts taking place at the Museum; much work is also performed in the field. Expeditions to the far corners of the globe are a long tradition. Although in the early days these were usually conducted for collecting purposes, today their aim is essentially project-oriented observation and research. The Museum also maintains or is affiliated with field stations located in distinctive ecological areas in Arizona, Florida, and on an island in Long Island Sound, where scientists from all over the world carry out their research.

A caravan of 125 camels, loaded with provisions for the Central Asiatic Expedition, winds its way through the wastes of the Gobi Desert.

How Exhibits Are Made

The Museum's large exhibition department, with a staff of 35, includes exhibit designers, artists, sculptors, preparators, graphic designers, audio-visual experts, and others who help create the many exhibits in the Museum.

The Museum that the visitor sees is a tribute to the skills of the exhibit designer and preparator. The enormous variety of exhibits include lifelike habitat groups of animals from the world's jungles, forests, deserts, and plains, dinosaur skeletons of awesome dimensions, a giant whale seemingly suspended in space, a two-ton piece of jade, gem-encrusted brocades from the markets of the Far East, Indian woodcarvings and painted buffalo robes, delicate gold ornaments, colossal heads from pre-Columbian America, and fine bronzes and carved masks from Africa. In addition to the more slowly changing permanent halls, an ongoing program of temporary, special exhibitions makes the Museum a vital and dynamic showcase.

Modern museum exhibits are a far cry from yesteryear's dusty shelves lined with collections of stuffed birds, shells, minerals, and other objects. Today, a new exhibition begins with a collection and an idea.

In recent years the Museum's special exhibitions have included collections of Colombian and Peruvian artifacts, a selection of household objects from the buried city of Pompeii, a dynamic presentation on volcanoes, and even an exhibition about the way exhibitions are made.

Designing an exhibit

A curator and designer work together to select specimens and develop the "story line" and presentation of the subject of the exhibition. In addition to the basic technique of displaying artifacts and specimens from the Museum's collection, the designer-curator team explores many other possible means of communication: photographs, scale models, video and film shows, fiber-optic maps and diagrams, and sound effects. The journey from concept to finished hall is a long one, and it involves a whole complex of exhibit

A crucial step in the creation of a realistic habitat group is the background painting. (Above) This hand-colored glass slide shows Museum artists at work in Africa in the 1920s, sketching for the Akeley Hall of African Mammals. The scenery visible in this photograph is depicted in a habitat group in the hall. Can you find it? (Opposite, above) An artist making watercolor sketches in the field for the Hall of North American Mammals. (Below) The completed group.

preparation skills—from fieldwork and taxidermy to artifact restoration, industrial design, and audio-visual design. Today's museumgoer encounters a sophisticated presentation that represents the combined labor of curators, designers, painters, artists, technicians, carpenters, craftsmen, electricians, and writers.

Many of the Museum's fine exhibits, including most of its habitat groups, were built before the advent of many of these sophisticated techniques. The story of how the habitat groups were created is a fascinating one. Planning the natural scene that would be shown, in sketches and a story line, was the first step. Next, preparators made a field trip to the selected location during the season that had been chosen for the setting; they went as far as Africa, the Arctic tundra, and the tip of South America. A complete pictorial record of the site was assembled with drawings, paintings, and photographs. Samples of plant life were collected for later preservation and reproduction. Soil, rock, bark, and other materials that could be used as found, or as models for casts, were labeled and packed. Preparators sometimes sent back whole trees or slabs of bark in numbered sections. The animals that would form the group were taken too, if they were not already present in the Museum's collection.

Back at the Museum, a designer and curator worked together to

prepare a small-scale model of the group. This enabled them to determine the best positioning of foreground animals, plants, and various other features in relation to the curved, painted background.

Technicians preserved the grasses, mosses, branches, and trunks of trees with chemical treatments and restored their colors with oil paints. Other plant material, such as leaves, fresh fruits, and flowers, was duplicated in a medium like wax or cellulose acetate from molds made either in the field or in the lab. The ground would usually be composed of the original soil and smaller rocks, together with realistic imitations of the larger elements, such as boulders, made of plaster or fiberglass.

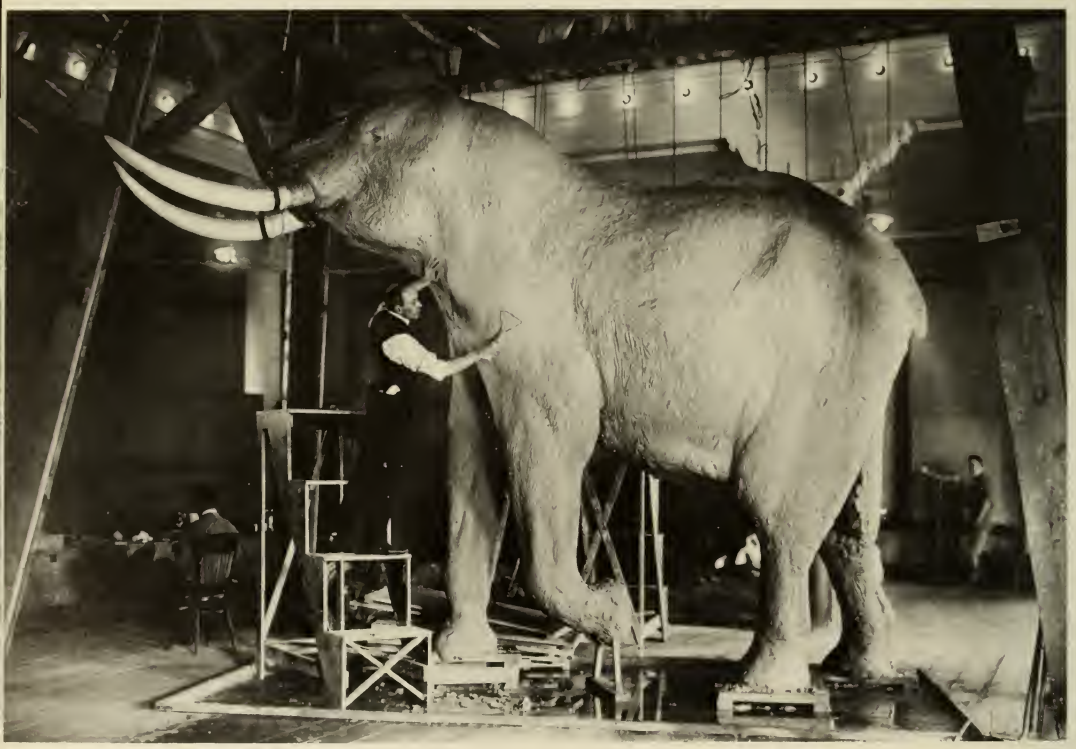
While all this was going on, a master artist would be preparing a background for the scene from field sketches and photographs. The scenery was painted on a hemispherical, double-curved surface. Because there were no corners, the artist was able to create more of an illusion of depth and perspective than would have been possible on a flat surface.

A critical part of habitat group preparation was the tying-in of background to foreground material. This was accomplished in various ways, one of which was to complete part of the three-dimensional foreground material on the painted background. For

example, the rear portion of a fiberglass boulder might be completed in paint to merge the two mediums as perfectly as possible, producing an illusion of continuity and depth.

The mounted animals were sometimes installed last, sometimes first, depending on their position and scale. Birds and small mammals were re-created by sewing their skins over artificial bodies made of excelsior. The larger animals were mounted on manikins, using the Akeley sculpture method, named after its inventor, Carl Akeley. The desired pose was achieved by reinforcing the animal skeleton with wood and wire; prominent veins, tendons, muscles, and flesh were then sculpted in clay over this framework until the animal appeared to have everything but its skin. A plaster mold was made of the clay figure and a hollow manikin cast from the mold. The animal's original skin would then be fitted carefully over the manikin. The result was a mount on which the contours of the body, from ribs to rippling muscles, stood out exactly as they would on a living animal. Final touches, which contributed even further to the realism of the scene, might include "saliva" or a half-eaten leaf in an animal's mouth. The arrangement of lighting to duplicate natural light and realistic shadows was a final and critical element in the creation of a realistic habitat scene. The result is a "window" on the natural world at another time and place.

Carl Akeley, a Museum sculptor and collector, revolutionized the art of taxidermy. Here he works on one of the elephants in the famous Elephant Group in the Akeley Hall of African Mammals.



Earth History and Invertebrate Life

Two Museum departments, with 12 curators and over 40 scientific associates, are in charge of the invertebrates. They are responsible for scientific research and the care of 16 million insects and 8.5 million other invertebrate specimens.
As with the other scientific departments, the collections are studied by an international community of scientists.

The world of invertebrates, the animals without backbones, is vast: of the more than one million different kinds of animals known, over nine-tenths are invertebrates. They include unicellular and multicellular microscopic animals, jellyfishes, worms, mollusks, crustaceans, insects, and spiders.

The Museum has studied invertebrates ever since its founding. Its first large acquisition of invertebrates, obtained in 1873, was a collection of fossils amassed by Professor James Hall of Albany. Invertebrate paleontology—the study of invertebrate fossils and their relationships to earth history—has held a significant place in the Museum's diversified research program ever since. Invertebrate fossils are displayed in the John Lindsley Hall of Earth History, an area devoted to the many factors that have shaped and continue to shape planet Earth.

Formation of the earth

According to current geological theory, the earth was created about 4.5 billion years ago when a large cloud of diffuse gas contracted and coalesced into the sun and planets. The earth is believed to have melted sometime during its first 500 million years, at which time the heavy elements such as iron sank to the core, while lighter elements such as silicon rose to the surface—a process known as differentiation. Geologists believe that the earth has a dense, molten inner core, surrounded by a mantle. Floating on the plastic upper layers of the mantle is the crust, which is carried along on the churning circulation of the mantle's materials. We now know that continents and ocean basins are anything but stable, forming a continually shifting pattern of plates on the earth's surface. Continents collide, thrusting up mountain chains, which will be worn down by the action of water and wind. Rivers cut great canyons through plateaus; sheets of ice crawl from the north

and south to shrink away again. Although these changes happen over long periods of time, earthquakes and volcanoes are dramatic, instant reminders of the restless nature of our planet.

Life's beginnings

Life probably began in water (some think it began in wet clay or atmospheric clouds), perhaps as long ago as 4 billion years. Recently scientists have found the fossil remains of a simple, one-celled creature that inhabited a shallow sea about 3.5 billion years ago. The fossil record is very sketchy until the Cambrian period, about 600 million years ago. At that time many life forms had developed hard parts, which enormously increased their chances of being preserved. These fossils are all marine and include early representatives of all the major divisions of the animal kingdom except the vertebrates.

Life did not take hold on land until the Silurian period (about 400 million years ago), during which plants first appeared, followed soon after by spiders, scorpions, and insects. The first animals with backbones, the jawless fishes, had developed earlier (475 million years ago). A group of later fishes gave rise to amphibians, which colonized the land.

Hall of Earth History

The John Lindsley Hall of Earth History contains many early marine forms and their later descendants, including trilobites (distant relatives of crustaceans and insects); spiraled mollusks called

(Below) The Hall of Earth History depicts early life. This diorama shows the sea floor about 350 million years ago during the Devonian period, from around Buffalo, New York. Visible are trilobites, nautiloids, corals, and crinoids. (Opposite) The sea floor today, from the Pearl Diver diorama in the Hall of Ocean Life.

ammonoids that are related to squids and octopuses; and brachiopods, or lampshells, which originally existed in staggering profusion but are now reduced to a few lingering species.

On view are not only the actual fossils but also a series of colorful reconstructions of sea-floor communities, which provide the visitor with a time-capsule glimpse of the crawling and swimming invertebrate world of millions of years ago.

Living invertebrates

Invertebrates living today include the mollusks, many of which form shells around themselves. The scientific study of shells is called conchology. The Museum acquired an unusually fine collection of some 50,000 shells representing 10,000 species as early as 1874, together with a rare conchological library that was to form the nucleus of the Museum's present natural history library. Over the decades, the shell collection has grown tremendously and now numbers more than two million specimens. The story of shells and

Trilobites were among the most diverse and abundant form of life during the Cambrian period, and their fossil remains such as the one shown here, are useful in geological and evolutionary studies. They are related to such modern arthropods as scorpions and crustaceans.

humanity's involvement with them is illustrated by some of the Museum's finest specimens in an unusual hall, Mollusks and Mankind.

Hall of Mollusks and Mankind

Entomology is the branch of natural history concerned with insects and their relatives, including spiders, mites, and centipedes. Insects alone number about 900,000 species—almost 90 percent of all known kinds of animals. A special Museum department studies a formidable collection of over fourteen million specimens accumulated through field expeditions, gifts, purchases, and exchanges. Insects appear in various exhibits and habitat groups throughout the Museum, which illustrate their importance as links in the food chain, as pests, and as pollinators of plants.

Insects

Modern invertebrates are exhibited mainly in the Hall of the Biology of Invertebrates. One of the hall's central cases contains a series of colored-glass models of microscopic organisms and other invertebrates. These hand-blown models were created by the late master-craftsman Hermann O. Mueller. Among these are replicas of single-celled, amoebalike forms called radiolarians. In real life these organisms are enclosed in complex, lacework structures. The delicate, shimmering blown-glass replicas are enlarged up to 1,000 times. There are also models of microscopic freshwater forms called rotifers, marine coral animals, gaudy sea anemones, and jellyfish with trailing, stinging tentacles. Be sure not to miss the giant squid suspended from the ceiling.

Hall of the Biology of Invertebrates

The nearby Hall of Ocean Life contains a diorama called the Bahamian Coral Reef Group. Reef corals are tiny animals, related to jellyfishes, that secrete a limy framework around themselves. The diorama is the result of twelve years work by the late Dr. Waldo Miner and his associates. The immense coral formation in the diorama, which weighs forty tons, was once part of a fantastic undersea forest three fathoms below a clear tropical ocean in the Bahamas. The coral was cut from the center of the reef, hauled to the beach, bleached, packed carefully in a bedding of sponge, and shipped to New York. Back at the Museum, welders and technicians constructed a six-ton steel framework to support the coral. The living outer layer of coral animals could not be preserved, but it was exactingly re-created in wax. To ensure the accuracy of the exhibit, underwater color photos and films had been made of the parent reef. In addition, Museum artists, with diving helmets, had lowered themselves into the water so they could paint color notes on specially prepared canvas stretched over glass. The end result staggers the imagination. Visitors find themselves seventeen feet below the ocean's surface, facing a reef in all its splendor of color and form, teeming with reef fishes, seastars, anemones, sea cucumbers, and other forms of invertebrate life.

Hall of Ocean Life

Bahamian Coral Reef Group

Dinosaurs and Other Fossil Vertebrates

A 10-story building on Museum grounds houses part of the Museum's 330,000 fossil vertebrate specimens, studied by 5 curators and 13 associates, who also conduct extensive field research. The Museum has the largest dinosaur collection and the largest fossil mammal collection in the world.

The idea that our world was once populated by outsized, strange-looking reptiles is startling. Perhaps this is one reason why dinosaurs have fascinated humanity ever since the first group of bones of these "terrible lizards" was labeled in 1841.

Dinosaurs, and along with them all fossilized forms of vertebrate life—those animals, including fish and humans, that have a segmented backbone—are part of the Museum's collections in vertebrate paleontology.

Fossil collections

The study of fossils at the Museum began under the leadership of Henry Fairfield Osborn, a world-renowned anatomist and paleontologist who was also the Museum's fourth president. Vast collections of vertebrate fossils now fill four exhibition halls; a separate building and additional basement space are devoted to the storage of some 330,000 study specimens. These fossils have been excavated on every continent—from the Arctic tundra of Canada to areas near the South Pole—but the majority of specimens hail from North America, especially the rich fossil beds of the western U.S. and Canada. A great and important part of the collection was gathered during the late nineteenth century by an early paleontologist named Edward Drinker Cope. Most of the Museum's outstanding accomplishments in this field, however, are due to the numerous expeditions undertaken by members of the department's staff over the decades. The most famous of these, the Central Asiatic Expeditions to Mongolia (1922–30), unearthed some of the Museum's most spectacular treasures—among them, dozens of fossil eggs that belonged to a small horned dinosaur known as *Protoceratops*.

Expeditions

Many expeditions to the western United States were mounted by millionaire Childs Frick, an enthusiastic fossil collector and

These giant sloths, which once lived on the pampas of Argentina, are similar to giant sloth fossils found in North America. The diorama shows them rearing up to browse on leaves, using their powerful, stubby tail as a brace.

philanthropist. He donated his collection of fossil mammals—the finest in the world—to the Museum. The Frick Collection and other fossil mammals are now stored and studied in the Childs Frick Wing of the Museum.

The Museum's exhibit halls tell the story of vertebrate life from its very beginning to the advent of human beings. The Fossil Fish Alcove displays the first vertebrates—the fishes—which date back about 450 million years.

Hall of Early Dinosaurs

In the Hall of Early Dinosaurs are fossils and reconstructions of the early, lumbering amphibians and their descendants, the first reptiles. The transition to land was complete with the arrival of the reptiles, since they could reproduce by laying self-contained eggs on dry land, with food and water enclosed in a shell. The earliest fossil reptile egg ever found, a 250-million-year-old lump of rock, is not very dramatic compared with the dinosaur skeletons on view.

This early, hand-colored lantern slide shows Museum scientists digging up a dinosaur skeleton. Most skeletons on display were chipped by hand out of their rocky matrix, an enormously time-consuming and expensive job.

Early reptiles

Its implications, however, are enormous. It is the hallmark of the vertebrates' conquest of the land, a relic of the momentous step that opened up our planet to the reptiles, birds, and mammals, including ourselves.

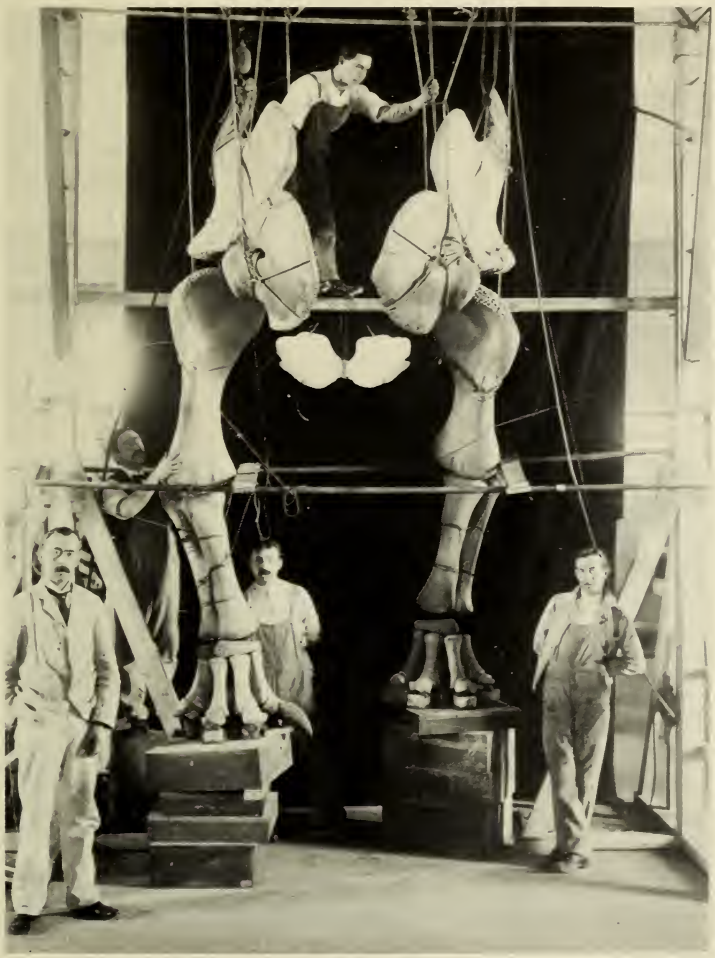
Among the reptiles a visitor encounters here are the thecodonts, the ancestors of the dinosaurs, along with early crocodilians and the group of reptiles, called pelycosaurs, that evolved into *Therapsids* and later into mammals. Some of these creatures had "sails" on their backs, perhaps to regulate their body temperature. Also shown are the earliest dinosaurs of the late Triassic (about 200 million years ago), as well as their later forms, which were to dominate the world's fauna for millions of years to come.

The Hall is dominated by the skeletons of three of the most sensational actors on the world stage some 170 million years ago: the huge plant-eating dinosaur, *Apatosaurus* (formerly called *Brontosaurus*), the plated *Stegosaurus*, and the predaceous meat eater, *Allosaurus*. A silent drama in stone is presented with two of these giants: superimposed on the footprints of an apatosaur trampling through mud are the three-toed fossil tracks of an allosaur, in deadly pursuit.

Hall of Late Dinosaurs

The next hall, devoted to the late dinosaurs, recounts the final and most spectacular chapter of the dinosaur story. A central island features three late Cretaceous dinosaurs: *Tyrannosaurus*, the largest carnivorous animal ever to live on land; *Triceratops*, the huge, rhinoceroslike horned dinosaur; and a pair of duck-billed dinosaurs.

The duckbills came in an array of crested and uncrested varieties, and the mouths of these presumably herbivorous dinosaurs were lined by a veritable pavement of lozenge-shaped, crushing



Dinosaur skeletons are usually shipped to the Museum still partially encased in rock matrix and wrapped in burlap soaked with plaster. At the Museum, technicians remove the rest of the rock and sort and label the pieces of fossil bone. (Left) This is what a dinosaur skeleton looks like before it is pieced together and mounted. (Below) Technicians mount one of the Museum's great skeletons around the turn of the century.

Dinosaur mummy

teeth. One duckbill was preserved in its death pose as a mummy, with parts of its skin and soft anatomy petrified in stone.

The horned dinosaurs were also diversified, as is demonstrated by a series of their variously horned skulls. The visitor can also see fleet, ostrichlike dinosaurs, the six-inch thick skulls of "dome-headed" dinosaurs, and an exhibit of flying reptiles featuring a giant *Pteranodon* with a wingspread of twenty-five feet. Also shown are the armored dinosaurs, built like walking tanks, encased in knobby skin and wielding powerful, clublike tails. A group of primitive horned dinosaurs with their eggs and hatching young, found in the Gobi Desert of Mongolia, evokes a picture of the earth's dramatic changes: the Gobi was once a fertile area.

Leaving behind the dinosaurs, whose mass extinction at the end of the Cretaceous period is still a mystery, we enter the next era of earth history, which was dominated by another group: the warm-blooded, milk-suckling vertebrates called mammals.

Hall of Early Mammals

In the Hall of Early Mammals we see their beginnings as inconspicuous shrewlike and opossumlike animals. These rather insignificant-looking animals later developed into wolflike carnivores and diverse hoofed mammals that proliferated in the Northern Hemisphere, Africa, and especially South America. Marsupials diversified from the early opossumlike forms into many species, both in South America and in Australia, where some became gigantic in size. An alcove devoted to another peculiar South American group of mammals, the edentates, features the ponderous skeletons of ground sloths and a giant, armadillo-like creature called the glyptodont.

Hall of Late Mammals

The final fossil hall, the Hall of Late Mammals, is concerned with some of the mammals more familiar to us. Marching through the middle in single file is what looks at first like a herd of elephants. These are the impressively tusked skeletons of extinct forms called mastodons and mammoths. The four mounted giants represent 10 million years of elephant history, as well as innumerable hours of excavation, preparation, and exacting scientific reconstruction. The famous horse series, also in this hall, shows the striking changes that have taken place in horse anatomy from the sheep-sized *Eohippus* (now called *Hyracotherium*) to the modern genus *Equus*—the horses, zebras, and asses of today. Also on exhibit are primitive giant pigs; graceful, tiny fossil camels; the now-extinct titanotheres with their massive, double-pronged horns; giant Irish deer; and a diversity of early rhinoceroses. Among the carnivores are wolves, cave bears, and saber-toothed cats.

Some of these creatures were hunted by early man, whose fossil history is given space in another part of the Museum, the Biology of Man Hall.

Fishes

There are one million fish specimens in the Museum. Modern storage has been constructed to accommodate these important collections and make them available to the international scientific community. The department has 3 Museum curators and 16 research and field associates.

Today's fishes continue a successful 500-million year dominion over the waters of the earth. There are approximately 25,000 known species of fishes, making them equal in diversity to all other backboned animals—four-footed, crawling, and winged—combined.

Hall of Ocean Life

From giant sharks to tiny gobies, from streamlined mackerels to electric eels that can stun a human being, a vast range of fishes is displayed along the mezzanine overlooking the Hall of Ocean Life.

The ultimate tribute to the finned fish form is paid by that supreme example of mammalian aquatic adaptation, the blue whale. A ninety-four-foot replica of this warmblooded behemoth dives down from the ceiling of the hall into the central open space below. The biological message is clear: to be successful in the water,

Tiger sharks pursue a sea turtle in a diorama in the Hall of Ocean Life. The tiger shark can reach a length of 18 feet or more and has been known to attack humans.

you can't improve on being streamlined like a fish, even if you are a mammal.

Study of fishes

The Museum's fish collection began in 1886. Ichthyologists on the Museum's staff are concerned with the study of all biological aspects of fishes: classification; structural features and how they work; geographic distribution; and, ultimately, the whole question of how fishes have met the peculiar demands of their watery environment. This approach is reflected in the Biology of Fishes Hall.

Biology of fishes

Fishes have adapted to some of the most extreme environments on the earth. Some live in water below the freezing point of fish blood, protected by a kind of antifreeze. They live in caves in total darkness, in torrential streams, in brine four times saltier than the sea, in acid and alkaline water, in hot springs, and under great pressure in the deepest parts of the ocean.

Fish adaptation

The fish skeleton supports a streamlined form that is beautifully adapted to moving through water. The spine is made of numerous vertebrae that provide firm yet flexible support for the musculature whose undulations drive the fish forward. Paired horizontal fins give lift and maneuverability, vertical fins serve for stability, and tail fins furnish extra thrust. A fish body can be squat or elongated, flat or round, with fins high or low on the body. These anatomical features contribute to different modes of swimming and feeding, depending on a fish's environment and needs. The techniques of swimming, self-defense, mating, feeding, schooling, breathing, seeing, hearing, tasting, and smelling, as practiced by fishes, are explored here in various and often surprising exhibits.

Sleeping habits

Most of us, for example, have probably not given too much thought to the sleeping habits of fishes. Some inhabitants of coral reefs sleep through the night in a protective mucous envelope secreted by their skin glands. A model of a green-and-orange parrot fish, inside what looks like a crinkled plastic Baggie, illustrates this unusual adaptation. Some fishes simply hide in crevasses or burrows on the bottom of the sea to sleep. Others, such as deep-sea tunas and mackerels, are insomniacs that need to swim continually in order to aerate their gills; they get along on little catnaps throughout the day. With fishes, as with everything, there are exceptions to the rules. Some fishes walk and skip on land more than they swim, and the climbing perch (which, just to confuse things further, is not a climber but a walker) can travel at the rapid clip of ten feet per minute. Many deep-water fishes have evolved their own sources of light—a particularly vivid example of adaptation.

Though we now require masks, wetsuits, and tanks to enjoy the underwater realm, we should remember that human beings, like all the land vertebrates, can trace their ancestry back to a group of early fishes.

Amphibians and Reptiles

Three curators and 10 research associates study the 230,000 specimens in the herpetology collections, as well as conducting field research in many parts of the globe.

In ancient Greek, *herpo* meant "to creep," and the branch of animal study that includes both reptiles and amphibians is called herpetology. The science of herpetology, however, covers a broader range of animals than just those that creep. Among amphibians, only the salamanders really crawl, while frogs and toads go in more for hopping; as for reptiles, snakes are the only true creepers.

A group of Komodo dragons, the world's largest living lizard, in the Hall of Reptiles and Amphibians. They are shown feeding on a boar.

Although they belong to two distinct classes of vertebrates, amphibians and reptiles share certain characteristics. Both groups are coldblooded, or ectothermic, which means that they are dependent on the outside environment for the regulation of their body temperature. All snakes are legless, but most species of amphibians and reptiles have limbs that are slung out sideways from the body, giving them a side-to-side, waddling movement.

The two classes are distinct in their reproductive habits and physical features. Amphibians depend on water or a moist environment for laying jelly-enclosed eggs that in most cases hatch as free-living, aquatic larvae before developing into small, four-legged adults. Reptiles have developed a shelled egg, containing its own supply of food and water, that is laid on dry land and from which fully formed young hatch. Some reptiles even give birth to live young.

The interest that the crawling beasts of the earth, especially snakes, have always inspired in human beings has resulted in a tour de force of architectural design and informative displays in the Hall of Reptiles and Amphibians.

Hall of Reptiles and Amphibians

The floating exhibit cases, arranged in two rows, emphasize amphibians on one side and reptiles on the other. Reviewed here are the relationships, life histories, habits, behavior, faculties, and various adaptations of the coldblooded vertebrates. Their economic importance and bearing on human activities are also explored; if snake bite and its treatment interest you, you may learn something practical here.

Komodo dragons

Some of the hall's exhibit islands contain full-sized habitat groups that depict a few of the more spectacular reptiles in typical settings and activities. In one case a group of ten-foot Komodo dragons tears apart a boar on a remote Indonesian island; these specimens were among the very first known to science and were captured during a Museum expedition in the 1920s. Nearby, a twenty-five-foot reticulated python prepares to pounce on a preening jungle fowl amid lush tropical vegetation; two gigantic leatherback sea turtles lay eggs on a beach.

Unusual adaptations

Amphibians and reptiles include some of the most unusual creatures, from our point of view, in the animal kingdom. We learn that many amphibians have poisonous skin, a fact well-known to South American Indians who use the secretions of poison-dart frogs to make deadly blowgun-dart poison. One kind of salamander is over five feet long and has an even larger relative, now extinct, whose fossil was once thought to be the remains of a sinner drowned in Noah's flood. Some frogs parachute, using the spread webs between their toes to break their fall. Reptilian adaptations are equally fascinating. Some pythons incubate their egg

A replica of a snake peers out from a bed of leaves in the Hall of Reptiles and Amphibians. Many of the replicas in the hall were cast from specimens in the Museum's extensive collections and later hand-painted to achieve a startling degree of realism.

clutches by coiling around them. Some male turtles tickle their partners' cheeks before mating. Rattlesnakes perform a so-called dance that is actually the tightly intertwined wrestling of two males presumably competing for a territory and the females it contains. To detect prey, pit vipers have a special sixth sense: a pair of temperature-sensitive organs enable them to pick up body heat and aim a deadly strike. One lizard species can run across narrow stretches of water on its hind legs.

Three guardian figures lend a ceremonial touch to the approach and exit of this fascinating hall. Greetings are extended by a giant Galápagos tortoise, supreme symbol of reptilian longevity. On leaving, two twelve-foot kin of the dinosaurs—an alligator to the left and an American crocodile to the right—confer a toothy, gaping goodbye.

Birds

The largest collection of birds in existence (one million specimens) is housed in storage rooms throughout the Museum. Four ornithology curators and 17 scientific colleagues study these birds.

First birds

Some 150 million years ago—long before humans appeared on the scene—the first birds stretched their wings and took to the air. We know this because when one early ancestor of the modern birds died on a muddy seashore, the mud turned into limestone and fixed forever an impression of its skeleton, with the attached wing and tail feathers.

Archaeopteryx

Feathers, though, do not necessarily imply flight. Some scientists think that this ancient bird, *Archaeopteryx*, could flap from branch to branch and glide a respectable distance, once launched. Others, however, believe it was a flightless runner that flapped its wings to stun and capture insects. This debate remains unresolved; but whatever its particular powers of flight, *Archaeopteryx*'s descendants were able to make the air their kingdom, and today they are represented among fauna by some 9,000 species of birds.

Hall of the Biology of Birds

The Hall of the Biology of Birds shows how far *Archaeopteryx* has developed into a wide diversity of descendants. Like all living things, birds may be grouped to show their relationships. Appearance and behavior are the main keys. The swift and skillful hunters are separated from the singing birds, wading herons from soaring albatrosses, fruit-eating parrots from water bottom-feeding ducks and grazing geese. Jogging emus are obviously more closely related to pedestrian cassowaries than to buzzing hummingbirds, but there are, as in most groupings, not so obvious relationships. Birds of paradise, it turns out, are the resplendent cousins of drab starlings; puffins, plovers, and gulls are closely related. Every bone and muscle, every feather and organ of a bird is geared to flight; these and other avian adaptations are illustrated in the exhibits in this hall. The bird skeleton reveals its reptilian heritage—with striking modifications. Many of a bird's bones are hollow, which

Bird skeleton

Birds appear in many Museum habitat groups. This group, actually in the Hall of African Mammals, shows two ostriches of the Kindong valley in Kenya. The largest of living birds, ostriches can reach 8 feet in height. The black-and-white male roars almost like a lion.

increases the lift during flight. The keel of the breastbone is greatly enlarged for the attachment of the powerful muscles that drive the wings. The skeleton of the wing is well suited to its dual functions of propulsion and life. The bones of the "hand" (the end part of the wing) are fused into a solid unit that supports the rotating, up-and-down movement of the wing in flight, while the "arm" (the part of the wing closer to the bird) serves mainly for lift. The string of vertebrae found in the typical reptilian tail has disappeared; instead, a solid nubbin of bone forms a base from which the tail feathers spread out. The skull has an enlarged braincase that can accommodate a bigger cerebellum, the part of the brain that controls balance and coordination.

Bird behavior

The easy visibility of birds, as well as their active nature, makes them ideal subjects for the study of behavior. Bird behavior generally involves more learned activity than that of the reptiles. Nonetheless, some aspects of courtship, nestbuilding, and migratory behavior are built in and appear automatically at the appropriate time. Migrating birds, for example, make astonishingly long journeys between their nesting areas and wintering grounds. Some individuals return to identical nesting sites year after year across thousands of miles. We do not fully understand the mechanisms that guide such behavior. We do know, however, that birds use many navigational clues, including the angle of the sun in the sky, the configuration of the stars, and perhaps even the earth's magnetic field. Familiar visual landmarks can also guide some birds flying on clear nights, at low altitudes, or during the day.

Study of birds

Ornithology, the study of birds, has had a long history at the Museum. The collections, which have been in the making ever since the Museum began, now contain about one million speci-

mens and represent 96 percent of all known species. Purchases, gifts, and field expeditions all contributed to a collection that is today one of the largest scientific resources in the world for research on the biology and relationships of birds.

The offices, laboratories, and storage rooms of the bird collections are housed in their own wing of the Museum, a joint gift of Harry Payne Whitney and the City of New York. Two floors of this eight-story building, which dates from the 1930s, are taken up by exhibit space—the Hall of the Biology of Birds and the Hall of Oceanic Birds. Two other major halls of the Museum are also devoted especially to birds, and birds are included in exhibits throughout the Museum.

Hall of Oceanic Birds

Three of the bird halls feature dioramas. In the Hall of Oceanic Birds they represent the bird life of the far-flung islands of the Pacific. Overhead are the truly oceanic birds, such as the albatrosses, which spend most of their lives riding the air currents that flow along the open seas.

Many unusual species have developed on the isolated specks of land that dot and rim the Pacific. Hawaii has its honeycreepers, New Zealand its flightless rails, kiwis, and the recently extinct giant moas. Birds of paradise, so spectacular they were once thought to have fallen from the heavens, adorn the lush forests of New

The common loon can be found nesting along the shores of lakes in the northeastern U.S. and Canada. This habitat group shows a family of common loons on the shores of Lake Umbagog in New Hampshire.

The peregrine falcon, the swiftest of all birds of prey, once inhabited large areas of the eastern U.S. This scene in the Hall of North American Birds shows a falcon eyrie perched on the Palisades overlooking the Hudson River. The female is returning with a pigeon for her chicks.

Guinea. The cold southern polar seas and adjacent barren shores are the territory of the penguins—flightless birds whose modified wings beat under water instead of in the air.

Hall of North American Birds

Large continental areas also have a characteristic bird life. Our own continent is featured in the Hall of North American Birds, a landmark in Museum exhibition technique. It was designed by Frank M. Chapman, the first head of the Ornithology Department, whose *Handbook of Birds of Eastern North America* was the original bible for generations of bird watchers. Chapman collected most of the material for the hall, which was built by the Museum's Exhibition Department. Its completion in 1912 marked the first time that an entire hall had been devoted to dioramas. It was refurbished and reopened with very few changes in 1964, the one-hundredth anniversary of Chapman's birth.

Among the native species in one part of North America, the Florida Everglades, are wood storks, limpkins, and the long-necked anhingas. Coastal areas are rich in bird life; an Atlantic salt marsh is dotted with skimmers, terns, rails, and geese, while more southerly shores are the habitat of pelicans, boobies, and frigate birds. Among forest species is the wild turkey, Ben Franklin's choice for our national bird. Our numerous waterfowl once included the now-extinct Labrador duck.

Hall of Birds of the World

Although some bird species cross the boundaries of oceans and mountains and a few are found worldwide, each area of the world has its indigenous birds. The Birds of the World Hall shows some major faunal areas and their characteristic birds. Its purpose is to give visitors an idea of the diversity of birds and an appreciation of their graceful presence and importance in every corner of the globe.

Mammals

The 4 curators of mammals and 10 scientific associates conduct extensive studies in the Museum and in the field. The collection of 250,000 specimens—ranging from whales to voles—is stored in various parts of the Museum.

A prominent form of vertebrate life on our planet, mammals occupy many of the exhibit areas of the Museum. Although they comprise only 3,900 living species (compared with 900,000 species of insects, for example), mammals fill many of the world's major ecological niches. Curators and assistants in mammalogy have scientific responsibility for the Museum's displays and research dealing with the biology and classification of mammalian species—those backboned animals that suckle their young with milk, are warmblooded, and generally have hair.

Mammal collections

The Museum's mammal collections go back to the days when they had to be quartered in the Arsenal building in Central Park. The research collection now numbers close to 250,000 specimens, making it the second largest assemblage in the United States, in constant demand by researchers from all over the world.

Hall of African Mammals

The Akeley Hall of African Mammals is named after Carl Akeley, who conceived of, designed, and collected for the hall. Akeley's innovative techniques (described earlier in the exhibition section) combined with an artistic sensibility to bring the mounting of large mammals to an almost magical level of realism. Akeley's goal was to preserve the wild mammal life of Africa—which even in his day was fast disappearing—for future generations.

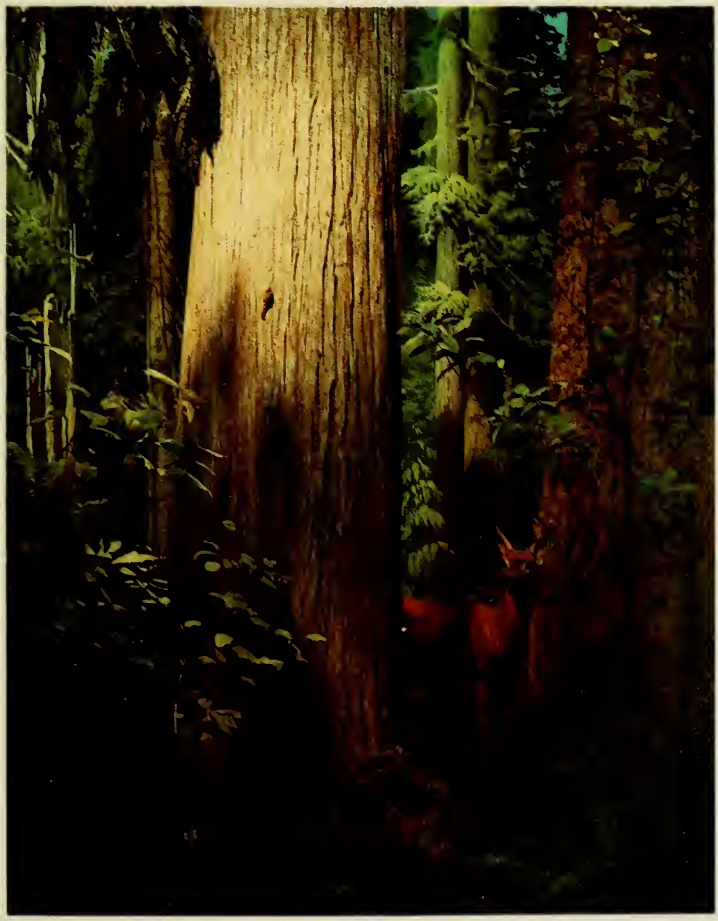
The famous herd of African elephants dominates the center of the hall. These colossal creatures are posed in a state of alarm. A great bull elephant tests the air with extended trunk, while the young huddle close to their mothers' flanks. A smaller bull, toward the rear, has wheeled about to protect the herd against possible attack from behind.

Vistas of African wildlife in natural settings surround the pachyderms. All the habitats in the Akeley Hall were developed

from photographs and artists' sketches of actual locations in Africa. Frozen in time are antelopes of every description with spiked, rapierlike, spiraled, and lyre-shaped horns; giraffes, all legs and neck but somehow elegant; the dangerous and unpredictable African buffalo; a family of lions; and a group of mountain gorillas. The third-floor gallery not only affords a bird's-eye view of the elephants below but also presents a different set of habitat groups.

Hall of Asiatic Mammals

Like Africa, southern Asia has distinct species of mammals, which are featured in the Vernay-Faunthrope Hall of South Asiatic Mammals. The conflict between expanding human populations and animal life has been going on longer in Asia than in Africa, and many of the larger south Asiatic mammals are very close to extinction. Among the species threatened are the tiger, the Indian and Sumatran rhinos, the Asiatic lion (about 200 survive in a small area in India), the Asiatic leopard, and several kinds of deer



Many of the habitat groups in the Hall of North American Forests exhibit mammals. This diorama depicts the Olympic Rain Forest near Quinault, Washington, in mid-June. A mule deer is visible in the shade of western red cedars and hemlocks. This is the only true rain forest in the continental U.S., receiving up to 20 feet of rain per year in some areas.

and antelope. Decorated in typical East Indian motifs, the hall displays these rapidly disappearing mammals in India, Burma, and Thailand, in their natural habitats.

Hall of Primates

Primates, one of the many subdivisions of the mammals, include monkeys, apes, and humans. In the Hall of Primates, an informative arrangement of skeletons, artwork, and mounted specimens provides an overview of the primate order. Visitors may be surprised to learn that bush babies and lemurs belong to the same order as ourselves.

As mammals moved into a variety of ecological niches after the demise of the dinosaurs, some backboned, warmblooded, hairy, suckling, sea-going species developed. Some of these aquatic mammals, such as the whales and porpoises, live entirely in the ocean, while others, such as seals and walruses, emerge onto land or ice to rest and breed. The Hall of Ocean Life, in addition to a ninety-four-foot blue whale suspended from the ceiling, contains habitat groups depicting many marine mammals.

In the Hall of North American Mammals, the grandeur and beauty of our continent's vast forests, mountain ranges, rainbow-colored canyons, and grassy plains are settings for the magnificent examples of our native mammals. More than twenty-five Museum expeditions, ranging from Mexico to Ellesmere Land and from the

A jaguar surveys the Mexican landscape at sunset in this habitat group in the Hall of North American Mammals. Its mate is to the right.

Bighorn sheep inhabit the mountain ranges of the western U.S. and Canada. They are adept climbers and can escape predators by scaling cliffs no other mammal would attempt.

Atlantic to the Pacific, secured specimens and materials for the hall. Many of the landscapes that were chosen for backgrounds are located in national parks and other spectacular natural areas. Caribou and musk ox traverse icy tundra; an eight-foot-high kodiak bear rears against the backdrop of a glaciated volcanic peak in Alaska; a mountain lion looks out over the Grand Canyon; two great bull moose lock antlers in desperate combat; mountain goats and sheep stand on craggy peaks; and a herd of bison grazes the Western prairie. Some of the mammals featured here can now be found only in isolated pockets of the altered landscape of much of our continent.

Hall of North American Mammals

In a corridor adjoining this hall, many of the smaller American mammals are displayed in a series of small, windowlike settings. They include the rare black-footed ferret, a weasel, marten, badger, nine-banded armadillo, kit fox, and a flying squirrel.

Hall of North American Forests

There is no division of botany in the Museum, but the Hall of North American Forests contains captivating dioramas of forests from twelve states. The life-sized exhibits show radically different areas of our continent. Each depicts an integrated community with bird, insect, and animal as well as plant life. Other exhibits treat aspects of forest ecology. On display are a section from a bristlecone pine aged 4,500 years and one from the giant sequoia called the Mark Twain Tree.

Hall of Man and Nature

The Felix M. Warburg Memorial Hall (Man and Nature) explores various natural processes from glaciation to photosynthesis and provides information about life in soil and water, the temperature cycle in a lake, seasonal changes, and many other subjects. The hall also investigates the effects of human agricultural activity on the environment.

Anthropology and Human Evolution

The Anthropology Department has 7 curators and 20 scientific associates. The collections, one of the most extensive in the world, contain 8 million artifacts as well as skeletal remains, rare photographs, recordings, and a vast body of research and data on human culture.

Study of anthropology

Because it deals with the human being as a cultural as well as a biological creature, anthropology is both a social and a biological science. It is a vast field, divided into a number of subdisciplines: physical anthropology, the study of man's physical evolution and present-day morphology; archaeology, the study of past cultures based on preserved artifacts and other material remains; and ethnology, the study of human culture based on beliefs, language, customs, art, literature, and social organization. These subdivisions are closely interconnected, offering different perspectives on their common subject, the human being.

The research interests of the anthropologists on the Museum staff reflect the breadth of their field. They range from anatomical and behavioral studies of nonhuman primates to investigations of the Indian caste system. The Museum's vast collections, acquired on field expeditions, are more than an invaluable scientific resource; they spread before us, in the various anthropology halls of the Museum, the breadth and richness of human cultural achievement.

Biology of Man Hall

The Biology of Man Hall deals with our origins and present physical characteristics. *Homo sapiens* is seen from the perspective of the evolutionary events that led to its emergence. We are one of the vertebrates—animals with backbones—and within that subphylum we belong to the class Mammalia. Going a step further, our zoological ties are with the primates, where our companions are lemurs, monkeys, and apes.

At the entrance to the hall, a display of the reconstructed heads of various types of early hominids brings us face to face with our predecessors. The exact facial features of these heads, including the hair, are speculative since the models are based on the often fragmentary remains of skulls.

The Neanderthal were an extinct group of early humans who existed from about 150,000 to 35,000 years ago. Neanderthal remains have been found in Europe, through the Middle East and into Soviet Asia. This painting in the Hall of Asian Peoples shows a Neanderthal camp in Asia perhaps 50,000 years ago.

Replicas of rare human fossils give Museum visitors an idea of the painstaking work required to reconstruct human ancestry. About 20 million years ago there lived a group of primates called *Dryopithecines* (literally "tree apes"), from which sprang both modern apes and modern humans. A late dryopithecine that lived in India and Africa some 15 million years ago, *Ramapithecus*, is thought to be the initial member of the evolutionary sequence leading to *Homo*, the genus to which we belong.

A subsequent evolutionary step is represented by the so-called southern man-apes, the australopithecines of eastern and southern Africa and possibly Asia. The earliest traces of this group date back about 4 million years. *Australopithecus*, whose brain was hardly larger than that of a gorilla, walked on two legs and, even more significantly, made and used primitive bone and stone tools by about 2 million years ago.

Australopithecus

About 1.5 million years ago, *Homo erectus*, the first member of our genus, appeared. This relatively large-brained human lived in caves, used and probably made fire, and flaked reasonably complex stone tools. Distinct populations of *Homo erectus* inhabited Asia, Europe, and Africa and included Java man, Peking man, and Heidelberg man. Still more advanced humans with bigger braincases, who lived about 400,000 years ago and later, are thought to be progenitors of both Neanderthal man and *Homo sapiens*.

Homo erectus

Homo sapiens emerged somewhere in the Old World. The earliest known remains, about 120,000 years old, are from Ethiopia. About 30,000 years ago, *Homo sapiens* spread into Europe, displacing and possibly mixing with Neanderthal man in the process.

Homo sapiens

A series of exhibits in the hall illustrates still another domain in the field of physical anthropology: the way our bodies work.

Indians of North America and the Eskimo

Only a fraction of the Museum's Indian material is on display; the rest, carefully arranged in storage, is preserved for scholars and the edification of future generations.

Early migration to the New World

Although *Homo sapiens* appeared in Eurasia about 30,000 years ago, the species did not colonize North America until some 10,000 years later, spreading through Central and South America over a subsequent 10,000-year period. The people who crossed the land bridge between Siberia and Alaska about 20,000 years ago belonged to the Mongoloid branch of the human species, the same subgroup that includes the populations of most central and east Asian lands. Amerindians, as the original settlers of the Americas are sometimes called, developed many distinctive cultures. At the time of the European discovery of the New World, most Amerindians in North America were organized into hunting and gathering or simple agricultural societies.

The halls featuring the way of life of native North Americans are those of Eastern Woodland Indians, Indians of the Plains, Northwest Coast Indians, and the Eskimo. The adaptations of these peoples to various parts of the North American continent—the forests, plains, coasts, and the arctic—involved a great range of social and technological achievements.

Hall of Eastern Woodland Indians

The earliest evidence of settlement of the woodlands east of the Mississippi River goes back about 12,000 years. The fluted stone spearpoints displayed outside the Hall of Eastern Woodland Indians belonged to a people called Paleo-Indians. Among the game they hunted were woolly mammoth, mastodon, big-horned bison, and the horse, soon to become extinct in North America. Their successors, the Archaic Indians, improved hunting techniques by developing the spearthrower (atlatl), bow and arrow, and stone bola. The Burial Mound People lived from about 1000 B.C. to A.D. 800 in the Mississippi and Ohio River valleys. They are known through their ceremonial mound complexes and richly carved ornaments and pottery. Toward the end of this period the cultiva-

(Opposite) This mask of painted wood and hair represents Tritdoxodunihlnegi, the Siren, and is from Anvik, Alaska.

tion of maize, beans, and squash was introduced from Middle America. At the time of European colonization, the eastern woodland tribes were flourishing. They lived mainly by hunting, fishing, gathering wild plants, and cultivating small garden plots and larger farms. Most tribes grew maize, beans, pumpkins, squash, gourds, sunflowers, and tobacco. They hunted with bows and arrows, snares, and dead-falls and fished with spears, nets, and weirs. Some tribes hunted birds with blowguns.

The diversity of tools, weapons, household goods, and clothing and the various models of ceremonial and other activities displayed throughout the Hall of Eastern Woodland Indians demonstrate the many differences among the tribes of this area. They also show, however, a basic cultural similarity.

Hall of Plains Indians

The Great Plains encompasses the territory from Canada to Texas between the Rockies and the Mississippi. It was, and still is, the home of such tribes as the Sioux, Blackfoot, Mandan, Arapaho, and Comanche. A solitary flint point, found next to a now-extinct species of bison, is datable evidence of human occupation of this area some 10,000 years ago. Like their eastern relations, the early Plains Indians used the atlatl. One of their favorite hunting techniques was to stampede big game over the edge of a steep cliff, a practice that was still in use by the buffalo-hunting Plains tribes when Europeans first encountered them. Although European contact ultimately led to disease, decimation, and the partial destruction of native American societies, it was a European introduction, the horse, that brought the Plains way of life to a peak in the middle of the nineteenth century. Plains Indians became more mobile, and hunting was revolutionized. Their culture became centered on the horse and the buffalo.

This exhibit in the Hall of Plains Indians depicts the Blackfoot "Thunder-Pipe" ceremony, celebrated at the time of the first thunderclap in spring. The owner of the pipe offers the mouthpiece to the Thunder, a Blackfoot deity.

The Kwakiutl Indians of British Columbia created this mask in the 19th century. Called a "transformation mask," it can be opened by pulling cords to reveal another mask within. (The mask is shown here open.) There are a number of extraordinary Kwakiutl masks on display in the Hall of Northwest Coast Indians.

The Plains Indian Hall exhibits household items, weapons, musical instruments, games, and clothing, as well as depicting the ceremonies and customs of the many Plains tribes. Their basic resource, the buffalo, and with it their way of life, almost totally vanished from the prairies in the 1880s.

Hall of Northwest Coast Indians

The Indians of the Northwest Coast occupied North America's shores from Washington State to southern Alaska. The tribes of the area—the Haida, Tsimshian, Bella Coola, Thompson, Tlingit, and Kwakiutl, among others—shared many cultural traits. A fishing, rather than farming, economy supported their large towns. Another common denominator was the tribes' prolific use of the abundant cedar wood growing around them. Their extraordinary woodworking skills and artistry are evident in the hall devoted to their way of life. They made towering totem poles, grave-posts, and house poles depicting, in highly stylized forms, their spiritual an-

Woodworking

cestors, mythical beasts, and animals. They built ceremonial canoes sixty-five-feet long and eight-feet wide, hollowed out from single logs, and constructed large houses using cedar timbers and planks lashed together with spruce roots.

Religion

Shamans played an essential role in the society of these Indians. Their many religious rites and complex mythology were directed mainly toward the Ocean Beings. Some of the tribes were governed by a wealthy aristocracy that owned captives and traded in slaves, sea otter fur, and copper.

Considering that they traditionally used mallets, axes, scrapers, awls, and wedges made of stone or bone, the accomplishments of these people are remarkable. Some of the finest examples of Northwest Coast art found anywhere are displayed in the Museum. A series of murals by Will S. Taylor illustrates the industries and the religious, economic, and social activities of the various tribes.

Hall of Eskimos

The Eskimo live in small groups scattered over the arctic and subarctic coasts of Greenland, Canada, Alaska, and the northeastern tip of Siberia. The traditional culture portrayed in the Hall of Eskimos is a way of life that existed until the early twentieth century. It has since changed in many ways, as a result of contact with the Danes, Russians, Canadians, and Americans.

The Eskimo are thought to be the most recently arrived of the Mongoloid people who populated North America. The earliest traces of their presence, found on the shores of the Bering Sea, are at least 5,000 years old.

Eskimo life

Their distinctive skill lay in their ability to produce housing, weapons, tools, clothing, and other necessities out of the limited resources available in their very harsh surroundings. The sea furnished fish, seal, walrus, and whale; on land, musk ox and caribou were sources of meat, fur, and skin. Raw materials consisted chiefly of animal products such as bone, ivory, sinew, and hide, as well as driftwood, snow, and ice. The Eskimo created snow houses, lit and heated by lamps that used seal oil for fuel and moss for a wick. During the day, the houses were illuminated through ice windowpanes. They built boats called kayaks, with driftwood frames covered with skin, and made dog sleds, harpoons, and spears. Their carvings in stone, bone, and ivory depict mythical beings in the form of animals. The Eskimo believed that deities, as well as the souls of animals, controlled the supply of game and had to be placated to assure hunting success.

The hall reflects the Eskimo's former way of life—a way that typified the human ability not only to survive in the harshest environments but also to survive with humor and tenderness, with an appreciation of nature expressed through art.

Indians of Middle and South America

The Middle and South American collections contain both archaeological and anthropological material, and are among the finest in the New World.

Two exceptions to the hunting and gathering and agricultural societies found by the first Europeans in the New World were the highly developed civilizations of Middle America (Mexico and Central America) and the Andean area to the south.

The Hall of Mexico and Central America is filled with the accomplishments of Amerindian cultures, which were cultivating

This goblet, from the Chimu culture of Northern Peru, was created from an alloy of gold and silver (ca. A.D. 1300-1500).

Hall of Mexico and Central America

maize, squash, beans, and peppers by 5,000 B.C. By the first millennium B.C., during what is called the pre-Classic period, the Olmec people of eastern Mexico were creating extraordinary jade carvings. Examples of these, including an exquisite jade ax head, are displayed near the reproduction of a colossal stone portrait of an Olmec ruler.

Over one thousand years ago, the Toltecs, and later the Aztecs, were creating "tribute" empires centered on monumental pyramids and temples.

The Maya civilization reached its highest peak between A.D. 300 and 900, and then disappeared for as yet unknown reasons. Maya art shows great skill and sensitivity. Their intellectual achievements in mathematics and astronomy, and their development of writing as well as an accurate solar calendar, rank the Maya with the highest of ancient Eurasian cultures.

The early civilizations of Central and South America developed advanced techniques in making ceramics. This classic period Teotihuacan-style ceramic vessel from Central Mexico was made around A.D. 400 to 600.

In this hall, models of restored Middle American buildings, including a gigantic soccer court, as well as replicas of massive stone heads, towering columns, a painted tomb, and the famed twelve-foot-wide Aztec Sunstone, reflect the monumental quality of Mesoamerican art and architecture. The polished jade and obsidian objects (carved without metal tools), the colorful and intricate pottery, the charming figurines, and the finely wrought gold jewelry bring the visitor into intimate contact with a rich cultural heritage that changed drastically with the coming of the conquistadors during the sixteenth century.

The peak of South American culture was reached by the Inca of Peru and neighboring regions. They built large cities of expertly jointed stone buildings and laid out an elaborate network of roads to consolidate their empire. The Inca used advanced techniques to work gold, silver, copper, and even bronze. Their pottery also showed great skill.

Hall of South American Peoples

The Hall of South American Peoples, which opens in 1987, will display examples of Inca cotton and wool textiles. Much of what we know about the Inca way of life and that of their predecessors is revealed by artifacts found in burials, particularly in the mummy bundle, in which the flexed body of the deceased was wrapped in cloth. The Museum's famous Copper Man, however, was an accidental mummification; he was an Indian killed in a primitive copper mine about A.D. 800 and preserved naturally with the help of copper salts.The discovery of the mummy in 1899 caused an argument between the American owner of the mine and the Frenchman who was renting it. The Frenchman claimed the mummy was his since it assayed at close to one percent copper. The American argued he had rented out the mine, not the miners. The two men worked out a deal and the mummy was eventually acquired for the museum by J. P. Morgan.

Pre-Inca cultures included the Chavín, Mochica, Chimú of northern Peru and the Nazca and Paracas of southern Peru. The Nazca created enormous outlines of animal shapes on the desert floor—shapes that can only be fully appreciated from the air. Their polychrome pottery, using up to nine colors, is also displayed in the hall.

Half of the South American Hall will be devoted to the ethnology of that continent, with particular prominence given to the Indians of the Amazon Basin. The aboriginal culture of these peoples will be depicted as fully as possible, with exhibits covering their subsistence, arts and crafts, social life, warfare, ceremonialism, and religion. To portray these cultures vividly, the Museum will draw on its extensive collections from such well-known tribes as the Jívaro, Yanomamö, Mundurucú, Urubú, and Shipibo.

Peoples of Africa

The large African collections, representing over a century of research and collecting, reflect the Museum's long interest in that continent.

Hall of Man in Africa

The Hall of Man in Africa covers an enormous territory that includes several very distinct environments: desert; tropical rain forest and woodland; grassland; and fertile river valleys. All of these regions have been occupied by human beings for thousands of years—actually several million years if we include our species' earliest remains—and each area has distinctive peoples and cultural features. The hall reflects this diversity in its displays and also in its design, which sets each geographical area apart with a different color scheme.

Desert peoples

Much of North Africa consists of the bare dunes and rocks of the Sahara Desert. In historic times it was colonized by the Carthaginians, Greeks, Romans, and Arabs. The Sahara's dry climate is quite recent. Before about 500 B.C. it was a wooded grassland region.

The early inhabitants of this area were hunters and gatherers, and later, nomadic cattle herders. Today the northern deserts are the home of the indigenous Berbers and descendants of the seventh-century Arab invaders. Most contemporary North Africans are Moslem. A diorama in the hall demonstrates the way of life of North African nomads.

(Opposite) This helmet headdress from the Senufo peoples of the Ivory Coast is decorated with two types of mask: a face mask and a "fire-spitter" mask. Gift of Gaston de Havenon.

The barren Kalahari Desert in the south was probably empty of human habitation until the Bushmen made it their home after being displaced from more fertile regions by Zulu invaders from the north and Europeans from the coast. The Bushmen adapted to the harsh environment with the simplest of tools and weapons. Their internal life, however, is rich in creative imagery, illustrated in the hall by white-plumed ostrich feathers that symbolize spiritual well-being and by a miniature bow and quiver, considered powerful "love medicine."

Peoples of the rain forest

The rain forest stretches from coastal Guinea to the central Congo and to the edge of the eastern grasslands. The first hunters and gatherers in this area lived in harmony with the forest, and the surviving Pygmies typify this cultural attitude. They are excellent hunters with spears, bows and arrows, snares, and nets, and they have made the forest their spiritual home. Later Bantu-speaking invaders from the grasslands had a different attitude: they cleared the land and attempted to control the forest. Much of their religion centered on placating evil forest spirits.

Powerful centralized kingdoms, ruled by kings, developed in West Africa. The wealth of musical instruments and elaborate dance costumes displayed in the hall attests to the importance of music and dance as a way of communicating with the spirit world in these communities. Shamans, with their wands, rattles, medicine figures, herbal cures, and oracles, played an essential role in

The Mbuti Pygmies live in the forests of northeastern Zaire. As hunter-gatherers, they move in search of food and are adept with a bow and arrow. Here an Mbuti youth practices his hunting skills.

This headdress, from the Bamana people of Mali, depicts a male antelope. Such headdresses, called chiwara, *represent a mythological being who is said to have given the Bamana their knowledge of agriculture. Gift of estate of Alice K. Bache.*

ensuring the health of individuals and the community. The use of iron was widespread in Africa long before the European conquest. Iron was used to make tools and weapons, and bronze castings of great artistry were produced using advanced techniques such as the lost wax process.

The southern and eastern grasslands were originally occupied by nomadic hunters and gatherers, and later by agriculturists and herders. Herder societies tend to be loosely organized, and concepts of life, wealth, power, and status all center on herds of cattle. Agricultural societies are more complicated and sometimes grouped themselves into large, complex states.

Peoples of the river valleys

Africa's river valleys have always played a special role in its history. Their rich soil frequently produced a surplus of food for settled communities along the banks, while the accessibility of rivers simplified trade and travel. Powerful kingdoms, with splendid royal courts, existed not only along the Niger but also farther south, up and down the Congo; in southern Africa, the valley of the Zambesi River became the center for the dominant Zulu state. Egypt, one of the earliest great civilizations, grew around the Nile and its fertile delta on the Mediterranean. Egypt's influence at the peak of its development extended, like the Nile Valley, deep into Africa.

Peoples of Asia

The Museum's collections contain 60,000 Asian artifacts, one of the best in the New World. Although only 5 percent of these are exhibited in the Gardner D. Stout Hall of Asian Peoples, it is still one of the Museum's largest exhibitions.

Early civilizations

Asia was not only the location of much of humanity's prehistoric development but also the site of the first agricultural villages and earliest civilizations. Peking man, who came into existence some 500,000 years ago, used fire, hunted, and gathered wild plants for food. The specialized tools and ritualized burials of Neanderthal man, who lived about 40,000 years ago, attest to a higher degree of mental and spiritual development. Mesopotamia saw the rise of the earliest advanced civilization, including cuneiform writing and a regulated social order whose codified laws were sometimes chiseled irrevocably into stone pillars. In the Middle East, pantheons of gods and goddesses gave way to several monotheistic faiths. The Hebrews developed Judaism, from which sprang both Christianity and Islam; Zoroastrianism arose in Persia. Two other great world religions, Hinduism and Buddhism, began in India, from whence Buddhism later spread to much of Central Asia, Southeast Asia, Japan, and China.

(Opposite) Kannon, the Buddhist goddess of mercy, is shown in this exquisite ivory okimono *from Japan. The carving depicts a legend in which Kannon repeatedly ensnared herself in a fishing net, thereby preventing the capture of fish for whom she felt compassion.*

The pervasive influence of Buddhism in Tibet is evident in the religious objects used by the monks and lamas who live, even today, in stone monasteries nestled among the mountains of the Tibetan plateau. Intricately painted religious tapestries, animistic ceremonial masks, and twelve-foot-long temple trumpets are a few of the beautiful Tibetan objects in the hall.

Zen Buddhism combines with traditional Shinto beliefs to form the spiritual framework of Japanese culture. A model of a traditional house, masks from the highly stylized No theater, and gracefully carved ivory *netsukes* here reflect the style and elegance—and the emphasis on beauty in nature—that pervade Japanese arts.

A vast civilization of great antiquity, China has had tremendous influence on the surrounding areas. Exhibits, which include

temple images, theater costumes, and an ornate gilded wedding chair inlaid with blue kingfisher feathers, give the visitor to the hall a taste of China's cultural wealth.

India

The subcontinent of India has harbored major civilizations since the days of Harappa, from 2,200 to 1,700 B.C. The majority of Indian peoples share the Hindu world view, blended with various local customs and beliefs. Exhibits here illustrate India's religious statuary, marriage customs, and colorful arts and crafts.

Islamic world

Islam has had a far-reaching cultural and political impact since the beginning of its spread from Arabia in the early seventh century. The variety and wealth of Islamic culture are represented by exhibits based on the Bedouin world of Arabia, as well as by collections of costumes, rugs, musical instruments, paintings, and poetry ranging in origin from northern India to Turkey.

Siberia

Siberia, the harsh world of the Russian arctic, is the home of many non-Russian peoples who herd reindeer, hunt, trap, and fish. Their way of life has almost vanished, along with that of many other primitive Asian societies shown in the hall: the Ainu of northern Japan, the Semai people of the Malay rain forests, and the Kafir of the Hindu Kush mountains.

Central Asia

Central Asia is an area of nomadic cultures. From this part of Asia the mounted armies of Genghis Khan and other great warriors swept west into Asia Minor, Russia, and Europe, south into India, and east into China, establishing powerful empires. The traditional horse gear, household goods, and costumes of these riders of the central steppes are exhibited in several cases.

Asia's colorful diversity is evoked by a market scene from seventeenth-century Samarkand, a caravan crossroads and one of the oldest trading centers in Central Asia.

The Yakut of Siberia believe that illness is caused by an evil spirit who has stolen the sick person's soul. This diorama depicts a shaman healing a woman. In a trance, he goes in search of the woman's soul; his assistant holds him by a chain lest the evil spirit try to seize him.

Peoples of the Pacific

The Pacific artifacts on exhibit in the Museum, many of which were collected by Margaret Mead, reflect the diversity of Pacific cultures.

The Margaret Mead Hall of Pacific Peoples, named after the eminent anthropologist who spent fifty-three years at the Museum, reflects an incredible geographic diversity. Several thousand islands, most of which are inhabited, dot the southern Pacific, ranging in size from tiny, wind-swept atolls to sizable land masses such as Java, New Zealand, and the island continent of Australia. The peoples of the South Seas are equally various, comprising a wide variety of physical types and of cultures. Anthropologists recognize several culturally distinctive areas here: Polynesia, Micronesia, Melanesia, Australia, Indonesia, and the Philippines.

Polynesia

Early European explorers found the Polynesians, or "people of the many islands," on every habitable island from Hawaii southward to New Zealand and east to Easter Island. Highly skilled mariners, the Polynesians navigated enormous distances accurately in outrigger canoes without the help of charts or compasses. Although their islands are so far-flung that in the past the inhabitants were frequently unaware of each others' existence, the Polynesians share mutually understandable languages as well as many myths and customs. Many fine examples of the arts and crafts common to the Polynesians are displayed here, along with some of the unusual accomplishments unique to certain island groups. There are Hawaiian feather capes worn by the aristocracy, made of specific wing feathers plucked from live birds; a replica of a colossal Easter Island stone head; elaborate war clubs and canoe paddles "overcarved" by the Austral and Cook Islanders, with total disregard for practical use; and a series of dried and intricately tattooed human heads from Maori New Zealand, prepared to honor departed chiefs and relatives.

Micronesia

Generally darker skinned and more physically and culturally diverse than the Polynesians, the Micronesians, or "people of the

small islands," inhabit some 2,500 islands that straddle the equator west of Polynesia. In the hall are examples of Micronesian woodcarvings; pronged weapons set with razorlike shark teeth; and heavy armor woven from coconut fiber. The "people of the black islands," the Melanesians, are the darker-skinned inhabitants of New Guinea and those islands eastward to the Fijis and south to the New Hebrides. Theirs is the greatest diversity of physical types and cultures among the South Pacific peoples. The two million people of New Guinea alone, for instance, speak five hundred different languages. Yet there are common denominators. All Melanesians did extensive gardening, growing taro, yams, sweet potatoes, breadfruit, pandanus, and bananas. Their headdresses, and other decorative items connected with status and ritual, often attained elaborate proportions. Examples of household items and articles of personal adornment are displayed in the hall.

Melanesia

Australia

Australia was settled about 26,000 years ago by people from southeast Asia. When they were encountered by Europeans, these aboriginal tribes used extremely simple tools, lived for the most part in makeshift lean-tos, and wore little clothing, if any. They hunted with spear throwers, boomerangs, and snares and gathered wild vegetation. The spiritual aspects of their culture, by contrast, were rich and complex. Their lives focused on a large cycle of an-

The peoples of New Ireland created this mask, representing a spirit, for use during group dances.

This royal cloak and helmet from Hawaii, made out of brilliant bird feathers, was worn only by kings and nobles. The Hawaiians were well-known for their exquisite work with bird feathers, which they used to decorate prestige objects and clothing.

cestor and creation myths that were reenacted in dance, music, and song. Some elements of these myths were also inscribed on rock surfaces or painted on bark.

Indonesia

The East Indies (now Indonesia) include the large islands of Java, Bali, Sulawesi (Celebes), Sumatra, and Kalimantan (Indonesian Borneo). This archipelago shares many cultural features with the Philippine Islands, which lie to the north. Both Indian and Chinese influences are apparent, and Islam has had a powerful impact. Advanced agriculture has long been practiced, and the cultivation of rice in irrigated terraces has been correlated with the existence of extremely complex societies on some of the islands. Dance, music, and theater reached high artistic levels in this area. The hall contains examples of the finely wrought household goods, theatrical equipment, serpentines, beaded weapons, and batik textiles common to these regions of the Pacific.

Minerals, Gems, and Meteorites

Four curators and 8 associates and fellows are part of the Mineral Sciences Department. A laboratory equipped with X-ray diffraction instrumentation, an electron microprobe, and a computer allows them to conduct detailed research, which draws heavily on the collection of 120,000 specimens.

Mineral "species"

The materials of the earth's crust can be classified into approximately 3,000 different kinds of minerals. Each "species" of mineral has a unique arrangement of atoms, giving it a distinct chemical and crystalline identity. The rocks we walk on, and those that fall from the heavens, are composed of minerals. So, too, is the soil we cultivate, the sand on a beach, the salt in our food, our ore and metal, the sparkling diamond, and the glowing ruby. The most abundant minerals are formed at high temperature and pressure deep in the earth's interior; but the vast majority of different kinds are produced close to the earth's surface.

Mineral cycle

The mineral cycle of birth and death is just as dramatic as the changes in life forms on our planet. Minerals are continuously being broken down, re-formed, altered, weathered, dissolved, moved, deposited, and recombined into different kinds of rocks in different environments. They are the ingredients of the churning, submerging, and resurfacing matrix that forms the earth's outermost layers. Earthquakes and volcanic eruptions are the more spectacular and dynamic manifestations of this constant flux. Continents and ocean basins, mountain ranges and deep-sea trenches are less spectacular but equally important expressions of the nature of our planet.

The specific atomic arrangement of a given mineral is mainly the result of the kind of raw material or mix of elements that is present when the mineral forms. Also important are the conditions of heat, pressure, and various other physical factors. Molten rock, called magma, sorts itself into a variety of mineral crystals as it solidifies below or above the earth's surface. Continuous pressure and heat will change the mineral assemblage of some already formed rocks, as will extended contact with air and water.

Mineral collections

Interest in mineral sciences began in the Museum soon after it was founded. The collection today numbers more than one hundred thousand specimens and is the second largest in the United States. Curators and outside scientists use the resources here for research that helps us understand the processes that shaped, and continue to shape, our planet.

Three halls make up the Section of Meteorites, Minerals, and Gems: the Arthur Ross Hall of Meteorites, the Guggenheim Hall of Minerals, and the Morgan Hall of Gems. Together they present a peerless display of intricate crystals and valuable gems, pitted "falling stars," and priceless mineral showpieces, including a captivating overview of the mineral kingdom.

Like animals and plants, minerals can be systematically arranged according to the similarities and differences in their makeup. The Harry Frank Guggenheim Hall of Minerals uses an array of selected specimens to tell the story of mineral relationships and classifications. One group of minerals is composed of a single element, including native metals such as gold and copper and the two forms of pure carbon, graphite and diamond. Other groups are various combinations of several elements—the silicates, for example. Because their main components, silicon and oxygen, are the most abundant elements in the earth's crust, silicates in-

This very large mass of crystallized gold was discovered in a mud-filled pocket at the Empire Star Mines in California. The monetary value of this specimen exceeds its bullion value by several times because of the rarity of its crystalline formations. Gift of Newmont Mining Corporation.

clude the most common rock-forming minerals. Silicates provide a good illustration of the importance of atomic arrangement in determining the final appearance and other properties of a given mineral. Although the hundreds of different silicates vary enormously among themselves, they are all constructed of the same basic building block—the tetrahedral silicon-oxygen molecule. This molecule can be chemically linked to others like it in six basic geometric patterns that determine the crystal structure of the mineral and the kinds of other atoms that can fit into it. Some familiar silicates are quartz, the major component of most forms of sand; its purple variety, amethyst, which has the same characteristic six-sided crystal; mica; and feldspar.

Other exhibits in the hall are devoted to the determination of composition, hardness, cleavage, and other identifying aspects of minerals. Much of the mineralogical research conducted in the Museum makes use of X-ray apparatus and an electron microprobe to study a wide variety of material from the sampled cosmos: the earth, the moon, and meteorites.

That minerals are formed in orderly and predictable ways in specific environments is an important insight. The hall demonstrates the results of melting and solidification, metamorphism through heat and pressure, mixing with gases, and the addition

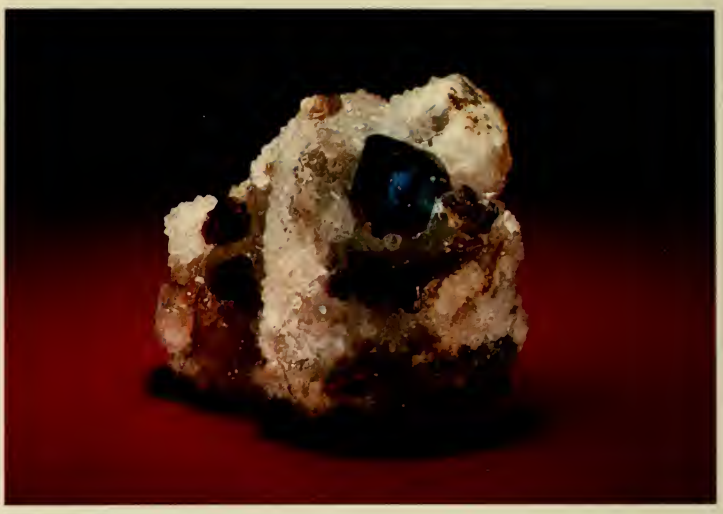
The Star of India is the largest star sapphire in the world, weighing 563 carats. It was discovered in Ceylon (Sri Lanka) several centuries ago and was donated to the Museum by J.P. Morgan in 1901.

and removal of water with both colorful and ordinary mineral specimens. By studying the mineral composition of rocks, mineralogists can gain an understanding of volcanic activity, the rise of mountains, and the drying-up of large bodies of water. Like an illuminated manuscript embellished with ornate capital letters and borders, the scientific story told in the Hall of Minerals is set off by striking ornamental crystals, gigantic mineral formations, and sculptures made out of jade, rock crystal, chalcedony, turquoise, coral, and malachite.

Hall of Gems

The Morgan Hall of Gems contains some of the Museum's finest treasures. Emeralds, rubies, and sapphires shine here both as large natural crystals and as faceted jewels. Sparkling diamonds—sometimes in various colors, sometimes exquisite as examples of the diamond cutter's art—fascinate most viewers. Among the star sapphires is the golfball-sized Star of India, the world's largest ex-

This lovely bicolor elbaite is one of many on display in the hall.



In addition to the spectacular minerals on display, there are smaller but equally beautiful specimens. This scorodite crystal comes from Zacatecas, Mexico.

ample of the way certain minerals bend light rays into a stellate pattern. Artificial gems, including some that are never found naturally, are displayed here too, among many other rare and unusual, as well as common, gemstones.

Hall of Meteorites

The Arthur Ross Hall of Meteorites contains representatives of the mineral kingdom that are visitors from outer space, having fallen in a blaze of glory through the atmosphere to land as pitted, fused, dark brown rocks. Some meteorites are so massive that they form deep craters and partially vaporize where they land, while others are small and appear insignificant. All meteorites, however, contain a wealth of information about the solar system. Different kinds of meteorites originated in very different worlds. Scientists who study meteorites can learn not only about the planetesimals of which they were once a part but also about all planets, including the earth.

World's largest meteorite

The Museum's collection contains fragments from nearly half of all known meteorite falls. The showpiece of the collection, Ahnighito, is the world's largest meteorite on display—a 68,000-pound chunk of iron and nickel. With the aid of an Eskimo guide, the explorer Robert E. Peary found Ahnighito in 1894, near Cape York, Greenland, and carried it back to New York City on board his ship. A team of thirty horses, stretching an entire block, was required to haul Ahnighito the last leg of its journey from the East River to the Museum. Two other fragments from the same fall, the Woman and Dog, were extensively hammered by the Eskimo to remove flakes of iron for tools. Among the other messengers from outer space displayed in the Hall of Meteorites are a meteorite studded with tiny diamonds, an array of tektites, and three moon rocks.

American Museum-Hayden Planetarium

The Hayden Planetarium comprises the Museum's Department of Astronomy. Using the largest planetarium computer automation system in the world and hundreds of special effects projectors, the Planetarium production staff creates a wide variety of shows for the general public as well as special programs for school and preschool children.

Beginnings of astronomy

For thousands of years, people have looked to the heavens and wondered. Early civilizations worshiped objects in the sky and used them to create calendars to mark the passage of the seasons. Today powerful telescopes peer billions of light years out in space, astronauts work in earth-orbiting laboratories, and probes journey to the planets. Astronomers and other scientists explore a dynamic universe populated by black holes, galaxies of stars torn asunder in gigantic explosions, and multicolored clouds of gas and dust where new stars, and possibly new life, are now being born.

To keep pace the American Museum-Hayden Planetarium is using the latest equipment to teach people about these exciting discoveries. At the heart of the Planetarium is the 663-seat Sky

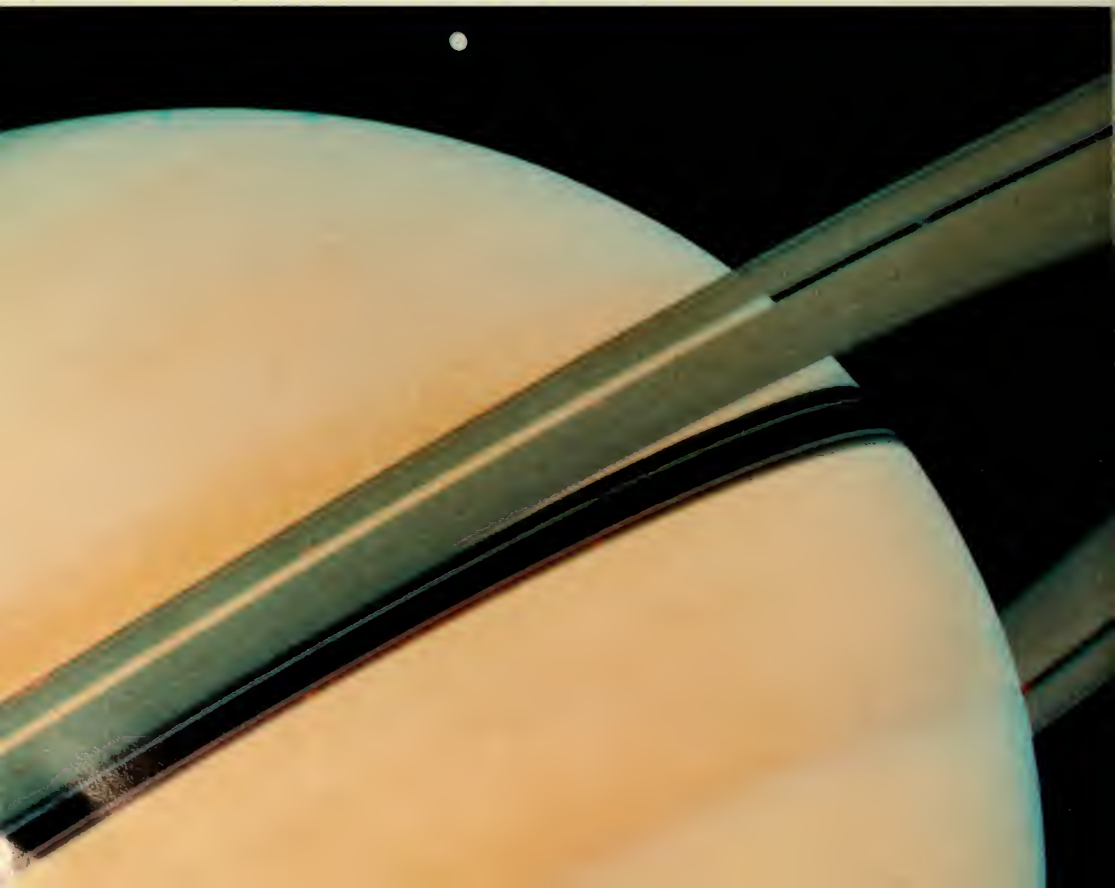
In the Sky Theater, the Zeiss VI star projector, with its control console and new computers, creates visual magic and takes you to the edge of the universe and beyond. Show topics range from black holes to the search for life in space.

Zeiss projector

Theater and, in turn, at *its* center is the Zeiss VI projector. The latest and best of its kind, it is actually over 100 projection devices in one machine. On either end are the star spheres, which use light sources, special glass plates, and lenses to create images of over 8,900 stars. Elsewhere within the Zeiss, other projectors produce images of the sun, moon, planets, constellation outlines, and the glowing band known as the Milky Way. All are interconnected with an elaborate system of gears and motors allowing Planetarium astronomers to show audiences the sky as seen from anywhere on the surface of the earth at any date in history.

Because of the broad scope of topics explored today in astronomy and space science, the Zeiss is supplemented by hundreds of additional special effects projectors located around the perimeter of the Sky Theater. These devices, controlled by the largest computer automation system in any planetarium in the world, take audiences beyond the naked-eye sky and create a dazzling array of scenes. They can re-create the surface of our moon or a satellite of Jupiter where giant volcanoes blast sulfur snow 100 miles into the sky. They can simulate a space flight past Saturn or through the clouds of Venus. They can take you to the edge of a black hole, inside a giant cluster of tens of thousands of stars, or to imaginary worlds never seen before.

The Voyager *flyby gave us our closest look at Saturn and many other planets. The Planetarium's sky shows have educated visitors about our latest knowledge of the universe for over half a century.*
NASA



Sky Theater

The great dome of the Sky Theater is its projection screen. It is made of perforated stainless steel painted white and measures 75 feet in diameter and 48 feet from the floor to the "top of the sky." Through its millions of tiny holes, arrays of large speakers fill the theater with music, dialogue, and sound effects, thus enveloping the audience in sound as well as sight.

In addition to astronomers, writers, and educators, the Planetarium employs its own production team, including artists, model builders, and special effects technicians who create each show as an original product. A variety of other Planetarium programs are also designed for over 90,000 school and preschool children each year. And from time to time special productions are offered from live theater to concerts under the stars.

Space Theater

On the Planetarium's first floor, below the Sky Theater, is the Guggenheim Space Theater. A moving forty-eight-foot model of the solar system hangs from its ceiling, and elsewhere about the room are audio-visual presentations on the planets and our exploration of space.

Nearby is the Astronomical Black Light Gallery where the visitor can walk through giant glowing astronomical scenes, from comets to star clusters to a landscape of the moon.

Elsewhere on the first floor is the fourteen-ton Willamette meteorite, the largest such object from space ever found in the United States; the Art Wall, where the Planetarium features changing shows of space art; and the Richard S. Perkin Library, housing one of the best collections of astronomical books and periodicals in the east.

Hall of the Sun

The Planetarium's second floor features the Billy Rose Hall of the Sun, one of the largest exhibits anywhere on our nearest star. Three major sections focus on the sun as a star, its place in the universe, and its influence on us. Many of the displays are participatory and investigate such questions as, Why is the sky blue? What is a rainbow? How can the sun be a source of power?

The Planetarium's IBM wing, entitled Astronomia, features a potpourri of astronomical lore with pictures and writings from medieval times to the present. Also featured are displays that explain how astronomers measure the distances to the stars and how the distance of a planet affects its motion around the sun. And finally, a long-standing and popular display features a wall of scales where visitors can find out their weight on the moon, Venus, Mars, Jupiter, and the sun.

For half a century, the American Museum-Hayden Planetarium has been "bringing the universe down to earth." Through its many programs and exhibits, it will continue this work as we continue to probe our strange and fascinating universe.

There is a grandeur in this view of life,
with its several powers, having been originally breathed into
a few forms or into one; and that, whilst this planet
has gone cycling on according to the fixed law of gravity,
from so simple a beginning endless forms most beautiful and
most wonderful have been, and are being, evolved.

—*Charles Darwin*, The Origin of Species

This is the *Official Guide to the American Museum of Natural History.*

The *Official Guide* is indispensable for visitors to the Museum. This Museum is one of the largest in the world, and no one could see everything in a day. This *Guide* will help you plan your visit and decide what to see. In beautiful color pictures and an informative text, the *Guide* tells the story of Museum exhibits and what they mean. It includes fascinating background material about the exhibits in the Museum . . . the awesome dinosaurs . . . gems and minerals . . . mammals . . . birds . . . fossils . . . gigantic meteorites . . . American Indians . . . and much more.

The *Official Guide* will help turn your visit into an unforgettable experience in one of the world's great treasure troves of natural science and anthropology—the American Museum of Natural History.