



NINETY-FIFTH ANNUAL REPORT

THE AMERICAN MUSEUM
OF NATURAL HISTORY

JULY, 1963, THROUGH JUNE, 1964



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THE CITY OF NEW YORK
1964

NINETY-FIFTH ANNUAL REPORT OF THE PRESIDENT

*To the Trustees of
The American Museum of Natural History
and to the
Municipal Authorities of the City of New York*

I start this report with an expression of sincere thanks to all our friends, members of the Museum, members of the staff, committee members, and Trustees, who have given so generously of their time and money, or who have helped us through other forms of encouragement to hold the position of leadership which our Museum enjoys. Without their continuing and growing interest, and the response that has accompanied it, we would not be able to record the progress that so happily has been ours over the years.

The Museum's exhibition program is one important measure of our progress and is also one of the strong links of the Museum's work in the field of education. I am glad to report that during the past year solid progress was made in this area of our activity. The Frank M. Chapman Memorial Hall of North American Birds was opened in June. Twenty-seven habitat vistas display 160 species of birds. In this hall we have not only adopted new techniques in displaying bird life, but our artists and preparators have been successful in preserving the immortal works of such a famous staff member as Louis Agassiz Fuertes. As a matter of fact, in this connection every effort is always made by the Department of Exhibition not to erase or replace but to restore and thus enhance the artistic contributions of such men as Akeley, Clark, Horsfall, Jaques, Knight, Leigh, Mueller, and

Wilson who have served the Museum so importantly in earlier years and whose works give indelible character to our exhibits.

A synoptic display of shells was opened this spring as a memorial to Evelyn Miles Keller. One unusual feature of this exhibit is that in many instances full-scale models of mollusks are shown, replicas of the animals that live in these exquisite homes.

Another exhibit that uses venerable and viable techniques is the Exhibition of North American Small Mammals. These groups display sixteen species of North American mammals in their worlds of underbrush or sagebrush or snow.

"The Origin and Structure of Life," the first section of the new Hall of the Biology of Invertebrates, interprets the extraordinary complexities of living cells. The most recent information emerging from the fields of molecular biology, genetics, and organic geochemistry is communicated through the novel use of visual materials and new techniques of display.

"Astronomia," a chronicle of man's progress in comprehending the universe, was opened in June in our Hayden Planetarium. Authentic early implements and instruments that aided man in his grapple with the problems of astronomy and navigation are on display. In addition, fascinating mechanized exhibits help one to understand the majestic procession of the stars.

Many other new halls and exhibits are on the staging platform or in the process of preparation, and all are aimed for completion for our centennial in 1969. Today, however, five-year plans are not long enough. To keep up with the chronometer of change we must think now about what our Museum will look like and be like 25 years from now. We think of this anniversary, as important as it is, not so much as a climax or a summary of the Museum's first 100 years, but, rather, as an occasion to indicate what the Museum must strive for in the 100 years that lie ahead.

Another activity of the Museum — boasting a distinguished record — is the program of the Department of Education. This department came into being in 1872, three years after the Mu-

seum was founded, and has steadily grown in size and in effectiveness. A large number of the current programs of instruction were developed under the wise guidance of the late John R. Saunders, Chairman. For many people the Museum provides the first and perhaps the only opportunity to gain some understanding of the teachings of nature. Thousands upon thousands of school children come to the Museum each year to see our exhibits, hear our lecture programs, and visit our Natural Science Center. A primary aim is to insure that these visits represent time well spent, our basic philosophy being that "every bird and every mammal, every insect and weed and tree that can be recognized and named is something added to man's stature."

For years the Museum has taken its instruction program to schools throughout the city's five boroughs, and I am pleased to report that a generous gift has made it possible to extend this visiting program to hospitals and other institutions in which children, while confined through illness or some other infirmity, can still learn the teachings of nature.

Ten years ago we introduced the use of sound, which gave our famous habitat displays a brand-new educational dimension. Unfortunately, the high cost of maintenance forced us to discontinue the use of our sound tracks, but recently, through improvements in the equipment and faithful taped recordings, the Museum has reinstated "sound" tours in six of our most popular halls. As time goes on, if the public makes sufficient use of the equipment, other halls will be added to the system.

The newest major extension of the educational program, the Natural History Press, has made significant progress in its two years of operation. *Nature and Science*, a magazine for young people, translates science from the technical to the familiar and makes it exciting and understandable. After only one year it has a circulation of 200,000: 147,000 children are classroom subscribers; 45,000 children receive individual home subscriptions; and 15,000 teachers receive the regular edition or the special teaching supplement.

The Natural History Press has published a number of well-received paperback books, such as "Biology of Birds" and "Exploration of the Moon." The first hard-cover book, "Wasp Farm," was nominated for the National Book Award, and other offerings, including "These Fragile Outposts" and "Africa and Africans," have been notably successful. The Press has also established the Man and Nature Lectures. The first series will be held in March, 1965, with Dr. Jacob Bronowski, a noted British scientist and man of letters, as lecturer.

Natural History magazine enjoyed the most successful year for advertising in its history, with a 39 per cent increase in the number of pages of paid space. Its readership also grew steadily. By June, 1964, circulation figures had more than doubled those of seven years ago. In addition, *Natural History* continues to mount in editorial prestige and is receiving an increasing number of unsolicited manuscripts from distinguished scientists.

While the Museum's attendance continues to run at a high figure, the fact remains that the World's Fair has given us direct competition and affected our attendance and to a certain extent our income. However, as a beneficial by-product, hundreds of people who have come to New York from all over the world to see the Fair have visited our Museum. These people, without the World's Fair as a drawing card, might never have taken the opportunity of coming to New York or of visiting our institution.

The Men's and Women's Committees, whose members annually raise funds in support of our scientific and educational activities, reported 2600 contributors, and gifts that reached a total of better than a quarter of a million dollars. This represents an all-time high in the twenty-five-year history of the Contributors' Program. The addition of new working members to the committees and new contributors brought fresh vitality to our efforts and raised the tide of contributions. We are indebted to Mr. Peter M. Flanigan and Mrs. Francis H. Low, chairmen of their two respective committees, for their energetic efforts for the past three years. This year Mrs. Constantine Sidamon-Eris-

toff, assisted by Mrs. Alfred L. Loomis, Jr., and Mrs. Gilbert G. Browne, will head the Women's Committee, and Messrs. L. F. Boker Doyle and Sidney S. Whelan, Jr., will act as co-chairmen of the Men's Committee.

In order to stress the importance of membership in the Museum, a Membership Secretary has been appointed. It will be the function of her office to greet members in our newly decorated Members' Room, to acquaint visitors with Members' Lectures, and to explain the many other advantages and benefits that accrue from membership. In this capacity she will report directly to my office.

The growth and diversification of the problems that cross the Director's desk, amplified by the fact that the heads of all departments report directly to him, have made the administration of the Museum a complex one. Therefore, to strengthen the office of the Director, two Assistant Directors have been appointed, Mr. Walter F. Meister and Dr. Joseph M. Chamberlain. The business responsibilities of the Museum will be delegated and divided between these two offices, leaving the Scientific Staff, Exhibition, and Public Relations Department reporting directly to Dr. Oliver. It is felt that this division of responsibility provides the Director with a more manageable control and that he can now devote the major part of his time to building and balancing the Scientific Staff and to the over-all development of the Museum and its intellectual program.

The field of interest of this Museum is world-wide. In the fulfilling of our scientific and educational responsibilities, we shall continue to explore, collect, exhibit, and interpret the findings of natural science wherever they occur. We shall continue to use all the means available to add new programs to New York's educational and cultural resources and to bring intellectual and esthetic enrichment to the youth of our community.

Alexander M. White

During the year we were saddened by the loss of two valued Trustees of the Museum. On September 23, 1963, Mr. Chauncey J. Hamlin died, thus bringing to a close a Museum association of 39 years during which he served as an active and honorary member of the Board. Mr. Dean Sage died November 1, 1963. He had been associated with the Museum since 1934, and was a member of our Board of Trustees for a quarter of a century.

REPORT OF THE DIRECTOR

The achievements of Galileo Galilei, whose birth 400 years ago has been widely commemorated this year, include one important contribution that is overshadowed in history by the monumental significance of his discoveries. At a time when Latin was the accepted language of scholarship, Galileo wrote of his discoveries and opinions in the common language of his countrymen. By publishing in Italian, he broke with a powerful tradition founded in the concept that scientific knowledge was the private purview of learned men—that it was incomprehensible to the minds of ordinary people. In his own words, he offered his discoveries “for the consideration of every man.”

Scientific thinking in Galileo’s time was dominated by the philosophy of Aristotle who, nineteen centuries earlier, had postulated a perfect, changeless universe of which the earth was the center. In challenging the astronomical validity of that concept, Galileo was also challenging the primacy of man’s place in nature and the universe. Galileo opened the door to the continuing exploration of the relationship of man and nature that has taken us on scientific journeys to the depths of the ocean and to the far reaches of space.

The responsibility to broaden the base of scientific literacy, which Galileo appears to have felt so keenly, is one that for centuries has been largely neglected by the scientific community. This omission on the part of scientists was not without cause. The pursuit of scientific knowledge is exacting. The search for the order in nature by the processes of observation and experimentation takes the scientist through labyrinthine paths. Adherence to the scientific method requires that conclusions which cannot be verified be cast out, and that new observations or new

experiments be conducted. Further, for the scientist verification is not the end of endeavor but only the beginning of the next step in exploring the unknown. A scientist may, therefore, understandably consider any distraction from the pursuit of knowledge to be a sacrifice of the enormous amount of time and energy that he requires if he is to add even one small, new block to the sum of man's knowledge.

Here at the American Museum we have examples in many fields of the exacting efforts that are required of scientists in the conduct of research. Observations and experiments by Museum scientists during the year were directed toward the investigation of exciting and interesting questions, which ranged from the origin of tektites to the evolution of textiles. Studies of the interrelationships of different bony elements of the human skull, of the principles of communication between nations of different ideologies, and of the internal structure of planktonic foraminifera were among those conducted during the year. Museum scientists also compiled data on sounds made by various fishes, and of the functions of these noises. Other projects involved the origin and relationships of the primates, the distribution of venomous spiders, and the theories of trans-Pacific contact between ancient civilizations of the Americas and Asia.

Programs at the Museum's field stations probed the physiology of sharks, the ecology of several species of small mammals, birds, and fishes, the biology of various kinds of weevils, the effects of extracts from cacti and desert plants on the cells of certain microorganisms, and the radiation that emanates from the planet Jupiter.

There is obviously good reason for scientists to wish to remain in the field and the laboratory. There are also valid reasons why they may prefer to address only their colleagues, using a form of time-saving shorthand based on shared professional knowledge. There are, however, tremendously important reasons why the scientist must take time to talk to every man.

The almost incredible advances in scientific progress during

the past few decades make scientific literacy, on a broad scale, mandatory. The developments of the period in which we are living, which have given us new specializations in biology, in chemistry, in physics, and in astronomy, and new insights into the behavior of animals, including our own species, require the communication and interpretation of knowledge to every man.

Furthermore, it can be stated that at no time in history has civilization been confronted with the awesome problems faced today. At no time in history has science had the power it possesses today, or scientists the responsibility they possess. It is absolutely necessary that all men have some understanding of the power of science, because all men have a stake in the uses to which this power is put.

We know that the fund of scientific knowledge is increasing five-fold with each new generation, and we may well ask in what way we can hope to communicate the vastly increased knowledge of our day. For an optimistic approach to the answer, we can go back to Galileo's intellectual adversary, Aristotle, who postulated one idea with which Galileo appears to have agreed wholeheartedly: "All men by nature desire to know." This statement is the key: people want to know; to learn. The first hurdle is passed. It remains for all who have a stake in the advancement of scientific knowledge to build on this desire by utilizing the most effective teaching concepts, by seeking out the best techniques for the presentation of data, and, when existing techniques are not adequate, by creating new ones.

The acceptance of the responsibility to broaden the base of scientific literacy, coupled with the acceptance of the premise that men desire knowledge, is of paramount importance for a great museum of natural history. The American Museum, happily, not only was founded on this premise, but has acted on it for nearly a century. This institution, with its staff of scientists and teachers, its extensive collections, its varied scientific programs, its popular exhibits, its publications for laymen, and its

basic dedication to education, continually seeks new and better ways to bridge the gap between laymen and the great body of scientific information constantly being disclosed. Today, all those who guide and support the course of the Museum, and all those who conduct their life work under its aegis, are contributing toward the fulfillment of this objective.

As President White points out above, we now have a major program to develop new exhibits and bring displays up to date, for a more effective interpretation of science. Our program of popular publications, spearheaded by *Natural History* magazine, and now supplemented by our new magazine for youngsters, *Nature and Science*, is being expanded and improved to enable us to do the best possible job of interpreting the natural sciences for our hundreds of thousands of readers. Our Department of Education is exploring new ways to serve our community more effectively. A basic problem here is that we are called upon to serve no one single community. The Museum serves individuals and organizations, insofar as possible, in nearly the entire world. Naturally our programs of instruction are directed largely to the children and adults of New York City. Our long-standing and happy relationship with the city establishes the instruction of these two groups of our public as our teaching priority. However, various Museum services, such as traveling exhibits, interlibrary loans, and the distribution of slides and films, extend to all parts of the country; and we answer calls for educational assistance from Nigeria, Thailand, and Ecuador—to mention only a few of the distant places where the Museum is helping to bring about public understanding of science.

Finally, the Museum is fortunate in having a staff of scientists who believe, as Galileo did, that their responsibility includes both the search for new knowledge and its dissemination to all who seek it. Our scientists write about their work in books and articles for the layman. They lecture and give other assistance in our various programs of instruction. They discuss

scientific developments informally on our weekly radio program, "Journey Into Nature," and work with representatives of all communications media to interpret science news. At the same time, of course, they develop the intellectual content of all the exhibits of the Museum, which constitute our major medium of science communication to the public. As Galileo wrote in the language of the common man of his day, so our scientists take time from their research and curatorial duties to offer the discoveries of science "for the consideration of every man."

James A. Oliver

REVIEW OF THE YEAR 1963-1964

The distinctions and honors bestowed on our scientists by other organizations during this period are recorded in part, as follows: Dr. James A. Oliver, Director, was the recipient of an Award for Outstanding Achievement from the University of Michigan. He was elected to the Executive Committee of the Biological Sciences Curriculum Study, and served on the Organizing Committee of the XVI International Zoological Congress. Dr. Evelyn Shaw, Associate Curator, Department of Animal Behavior, received a Three-Year Career Development Award from the National Institute of Mental Health and a Guggenheim Fellowship. Dr. Ethel Tobach, Associate Curator, Department of Animal Behavior, received a Five-Year Career Development Award from the National Institute of Mental Health. Dr. Harry L. Shapiro, Chairman and Curator of Physical Anthropology, Department of Anthropology, was invited to deliver the Thomas Burke Lecture at the University of Washington. Dr. Jerome G. Rozen, Jr., Chairman and Associate Curator, Department of Entomology, was elected President of the New York Entomological Society. Dr. Norman D. Newell, Chairman and Curator, Department of Fossil Invertebrates, was elected President of the Committee on Paleocology of the International Paleontological Union. Dr. Otto H. Haas, Curator Emeritus, Department of Fossil Invertebrates, was awarded the Golden Doctorate of Philosophy by the University of Vienna. Mr. Hobart M. Van Deusen, Assistant Curator, Archbold Collections, Department of Mammalogy, was elected a Vice President and Director of the Explorers Club. Dr. Brian H. Mason, Chairman and Curator, Department of Mineralogy, was elected Vice President of the Geochemical Society and Chairman of the Advisory Board for the Nininger Meteorite Collection. Dr. Dean Amadon, Chairman and Lamont Curator of Birds, Department of Ornithology, was elected Vice Chairman of the International Council for Bird Preservation, United States Section. Dr. Robert

Cushman Murphy, Lamont Curator Emeritus of Birds, Department of Ornithology, delivered the Penrose Memorial Lecture before the American Philosophical Society, and was awarded an honorary doctorate by Long Island University. Dr. Edwin H. Colbert, Chairman and Curator, Department of Vertebrate Paleontology, served as Vice President of the Paleontological Society. Dr. Bobb Schaeffer, Curator, Department of Vertebrate Paleontology, served as Vice President of the Society for the Study of Evolution. Mr. Robert F. Mathewson, Resident Director of the Lerner Marine Laboratory, was elected President of the Association of Island Marine Laboratories. Staff members were honored with many other appointments in their professional organizations.

A record of staff changes during the year follows:

In the offices of Administration, Mr. Walter F. Meister and Dr. Joseph Miles Chamberlain were appointed to two newly established posts as Assistant Directors of the Museum, effective July 1, 1964. Mr. Charles A. Weaver, Jr., was appointed Manager, City Relations.

Mrs. Marion B. Carr was appointed Membership Secretary, effective July 1, 1964.

In the scientific departments, the following promotions and appointments were made:

Department of Animal Behavior: Dr. Ethel Tobach, Research Associate, was appointed Associate Curator. Dr. Benjamin B. Kamrin and Dr. Eleanor Lappano-Colletta were appointed Research Associate and Research Fellow, respectively.

Department of Anthropology: Dr. Margaret Mead was promoted from Associate Curator to Curator of Ethnology. Mr. Charles F. Brush was appointed Field Associate.

Department of Astronomy and the American Museum-Hayden Planetarium: Dr. Thomas D. Nicholson was promoted from Assistant Chairman and Astronomer to Chairman and Astronomer, effective July 1, 1964. Dr. Franklyn M. Branley was promoted from Astronomer to Assistant Chairman and Astron-

omer, effective July 1, 1964. Dr. Fred C. Hess was appointed Associate Astronomer, effective July 1, 1964.

Department of Entomology: Dr. Frederick D. Bennett was appointed Field Associate. Mr. Wilton Ivie was appointed Research Fellow.

Department of Fossil Invertebrates: Mr. Erik N. Kjellesvig-Waering was appointed Research Associate.

Department of Ichthyology: Mr. Howard A. Baldwin was appointed Research Associate.

Department of Living Invertebrates: Mr. Anthony D'Attilio and Mr. Morris K. Jacobson were appointed Associates.

Department of Mammalogy: Dr. Sydney Anderson was promoted from Assistant Curator to Associate Curator, effective July 1, 1964. Mr. Hernando de Irmay was appointed Field Associate.

Department of Ornithology: Mr. Robert G. Goelet was appointed Field Associate.

Department of Vertebrate Paleontology: Dr. Malcolm C. McKenna was promoted from Assistant Curator to Associate Curator, effective July 1, 1964.

The Lerner Marine Laboratory: Dr. John M. Arnold was appointed Research Fellow; Mr. W. W. Knight, Jr., Consultant in Marine Biological Indoctrination Programs.

In the Department of Education: Mr. Helmut W. Schiller was promoted to Senior Instructor in Adult Education, effective July 1, 1964.

In the Department of Public Relations: Miss Barbara Kate Swift was promoted from Senior Representative to Assistant Manager. Miss Ann Breen was appointed Senior Representative, effective July 1, 1964.

Two members of the Scientific Staff resigned during the year. They are Dr. James A. Ford, Curator of North American Archeology in the Department of Anthropology, and Dr. Meredith L. Jones, Assistant Curator in the Department of Living Invertebrates. Dr. Ford has accepted a position at the Florida

State Museum; Dr. Jones, one at the United States National Museum.

We were saddened by the death of four members of the staff. Mr. Charles J. Kerr, Acting Bursar, died on November 25, 1963. Mr. Nels C. Nelson, Curator Emeritus of Prehistoric Archeology in the Department of Anthropology, died on March 5, 1964. Dr. James P. Chapin, Curator Emeritus of Birds in the Department of Ornithology, died on April 5, 1964. Mr. John R. Saunders, Chairman, Department of Education, died on May 3, 1964.

DEPARTMENT OF ANIMAL BEHAVIOR

Lester R. Aronson, Chairman

The long-range investigation by the Department of Animal Behavior of problems concerned with the evolution of behavior, the development of behavior in the individual, and the psychophysiological mechanisms of behavior is of growing interest to scientists throughout the world. Of both theoretical interest and practical importance in the affairs of man are the studies of the social interplay that exists among all groups of animals. Through such studies we learn how animals get along with one another, and how they react in a group. It is becoming increasingly apparent that only through knowledge of the behavior of the individual and of the group can we understand and hope to solve many urgent social problems.

The studies described below, and many others which cannot be included in this report, were made possible by contracts with or grants from the Office of Naval Research, the United States Naval Training Device Center, the National Science Foundation, the National Institutes of Health, the Guggenheim Foundation, and the Lincoln Ellsworth Fund.

For more than two decades Dr. T. C. Schneirla and his associates have been unraveling the complex processes that medi-

ate the cyclical raiding, migratory, and reproductive patterns of army ants. Behavior that investigators formerly explained by expressions such as "built in" or "innate" can be understood in terms of the energizing and pacing properties associated with the developing brood of eggs, larvae, pupae, and young workers. Last year Dr. Schneirla investigated the characteristics of two Asian species of army ants. These differ from the Central American species studied earlier in the quality of the temporary nests, the length of the non-migratory period, and the times of day and night at which raiding and migrations occur. The differences can be clearly traced to the reactions and sensitivity of the worker population to the developing brood. Dr. Schneirla plans to follow new lines of research on the similarities and differences in the functional cycle of various species. He will investigate especially the relation of the metabolic condition of workers and brood to phase differences in the cyclical events of the colony.

Dr. Schneirla also plans to extend his theoretical writings on the biological and psychological forces at various phyletic levels that lead to the development of specific behavior patterns. These expositions have stimulated many investigators to study different aspects of this fundamental problem in behavioral biology.

The forebrain of lower vertebrates gave rise during the long course of evolution to the cerebrum of mammals and man. This is the part of the brain that contributes most extensively to higher mental processes. Dr. Aronson and his students have shown previously that the forebrain and cerebellum of fishes do not organize behavior but act as an arousal mechanism that facilitates the functioning of the lower centers of the brain and keeps the behavior of the fishes at a highly effective level. Further studies this year on avoidance conditioning after removal of the forebrain and cerebellum strengthen this conclusion. Intact fishes that are trained to swim through a hole in a partition to avoid shock after a light is turned on "anticipate" the shock

by waiting at the hole or by swimming through it in advance of the signal. Fishes without a forebrain do not show this anticipation. Experiments of increasing complexity are expected to clarify the nature of the facilitation, which Dr. Aronson believes is the key to the evolution of the forebrain.

Dr. Aronson and Mrs. Madeline L. Cooper, in their studies of the sensory factors in the mating behavior of the domestic cat, have discovered that specific sensory losses in male cats cause a gradual decline in mating activity. This theoretically and clinically important finding suggests that a continuing sensory feedback is required for the cats to maintain a high level of sexual activity.

Celestial navigation offers a promising hypothesis as to the means by which birds find their way during homing and migration. Since celestial navigation depends on knowledge of the apparent movement of the sun, moon, or stars, precise statements can be made about sensory capacities necessary for navigation. Dr. Helmut E. Adler is continuing research on the mechanisms and cues used by birds in orientation. He has already determined with remarkable accuracy such basic sensory data for starlings and robins as the thresholds for white light and light of various wave lengths (colors) and dark adaptation curves. This year considerable attention was given to the time sense of birds, because in celestial navigation an individual must react differentially to a given cue at different times of the day. Dr. Adler is also developing an apparatus that will be used to test the ability of a bird to estimate angles, another prerequisite for celestial navigation.

Sounds that many fishes produce, the mechanisms by which they are made, and the ability of fishes to hear are subjects of theoretical and practical interest. Many fishes make sounds when alarmed or under stress, and these sounds have a general influence on other fishes in the vicinity. Some sounds made by fishes, however, have a more specific communicatory function. The toadfish, for example, produces a hooting sound during the

spawning season. The squirrelfish emits a series of staccato sounds which seem to warn away other fishes from its territory. Dr. William N. Tavalga is studying these sounds in the hope of learning their exact functions as signals. He is also investigating geographical variations in the quality of the sound.

Dr. Tavalga has also tested the auditory sensitivity of several species of marine fishes. He found that they were virtually deaf above the level of 2000 cycles per second, and that their best hearing was in the range of 200 to 600 cycles per second. He now plans to study the hearing ability of fresh-water species.

In collaboration with the United States Naval Training Device Center, Dr. Tavalga is establishing a library of tape recordings of sounds made by marine animals. As a result the Museum will soon be a center of bio-acoustic information.

Vision, another major factor in fish behavior, is being studied by Dr. Evelyn Shaw. A fish keeps its place in a school by regulating its swimming speed according to the movement of patterns across its field of vision, Dr. Shaw's experiments indicate. Dr. Shaw placed a tank of young mullets in a position from which the fish could follow stripes on a rotating drum. She found that the fish follow the stripes and increase their rate of speed as the movement of the stripes increases. Such behavior may mean that the movement of fish in a school produces patterns by which each individual adjusts its own direction and swimming speed. One fish moving at a particular rate of speed stimulates others to travel at the same pace. These in turn stimulate the first fish, and in this manner the school maintains its geometrical configuration, an important characteristic of the fish school.

The work of Darwin stimulated an early interest in emotional behavior, but it is only in recent years that the neural, hormonal, and psychological bases for emotion have been recognized. One of the problems in the study of emotionality in animals is the need for objective criteria. Dr. Ethel Tobach's new test, a measurement of the time it takes for food to pass through the intestine of a rat, is very promising. Dr. Tobach plans to

use this test and others to study emotional behavior at different phyletic levels. She hopes to determine whether social organization, the level of neurohumoral integration, and emotional expression are all related.

The first three stages of a renovation of the physical plant of the department were completed during the year. The National Science Foundation, the Office of Naval Research, the City of New York, and the Museum cooperated in this project. Eight new rooms have been constructed, the laboratory and offices of Dr. Schneirla have been renovated, and a new bio-acoustics laboratory has been built. These improvements will provide the staff and students with excellent facilities for their diversified research investigations.

DEPARTMENT OF ANTHROPOLOGY

Harry L. Shapiro, Chairman

Substantial progress was made this year in the exhibition program of the department. Dr. Stanley A. Freed directed the installation of material in the reconstructed Hall of Eskimos, which will be opened during the coming year. Designs have been completed and most of the materials have been selected for the Hall of Eastern Woodlands and Plains Indians, which is under the direction of Dr. Freed, and for the Hall of Man in Africa, which is being supervised by Dr. Colin M. Turnbull. Dr. Margaret Mead is in charge of planning another major exhibition, the Hall of the Peoples of the Pacific, on which considerable progress was also made.

The range and vigor of the research activities in the department have been impressive. Geographically, the projects stretch from Veracruz to New Guinea and to Africa and, at the same time, entail extensive laboratory research in the Museum. In subject matter they range from the most detailed analysis of textile evolution ever attempted to a study of the principles of cross-ideological communication.

Dr. Shapiro continued his studies on the dynamics and inter-relationships of the various bony elements of the human skull. He also advanced the preparation of his field data on Polynesia for publication in a large cooperative symposium planned by Monash University in Australia, and he carried out research on the history and settlement patterns of the Pacific rim.

Dr. Junius B. Bird, working under a grant from the National Science Foundation, made progress on a manuscript relating the results of his extensive survey of prehistoric fabrics to cultural development. The survey employed data-processing methods to analyze coded archeological data in textiles. In another project, undertaken at the request of the Early Sites Foundation, Dr. Bird visited Newfoundland to examine the Norse site at Lance aux Meadows, discovered by Dr. Helge Ingstad and his wife, Mrs. Anne Stine Ingstad, where the evidence presents a convincing picture of Norse origin.

Dr. Gordon F. Ekholm, pursuing his major research interest in the broad problems of trans-Pacific cultural contacts, carried forward studies on the occurrences of artifacts in the form of miniature wheeled animals in Middle America and Asia and on the use of mirrors in the same areas. The objective of these studies is to document, as precisely as can be done with archeological materials, the probable historical relationships between the civilizations of America and those of Asia.

Dr. Robert L. Carneiro completed the first phase of his study of cultural evolution in collaboration with Mr. Stephen F. Tobias of Harvard University. Three hundred and fifty-four cultural traits of 100 pre-industrial societies were analyzed and ranked to determine whether or not a sequence exists in the accumulation of these traits and to what extent the different societies followed this sequence in their cultural evolution.

Dr. Mead continued studies that have been in progress for a number of years. Notable among these is the construction of a cross-cultural model showing the way in which orientation in time and space, and toward the strange and the unknown, is

learned, with special reference to change. The project utilizes materials collected in New Guinea and Bali between 1931 and 1958 and will incorporate additional materials currently being collected. In another phase of her Pacific research, Dr. Mead is directing a long-range field study in cultural systematics on the Admiralty Islands and on the New Guinea mainland. Both of these projects are supported by grants from the National Institutes of Health.

Continuing her work on the principles of cross-ideological communication, Dr. Mead initiated a special project on the use of glyphs, cartoon forms, and secondary language in cross-cultural communication. This study is being carried out under the auspices of the United Nations Committee for the International Cooperation Year (1965).

Dr. Freed divided his research time between North American Indians and village India. He and his wife, Mrs. Ruth S. Freed, conducted a five-month field study of Mojave Indian social organization and role behavior during the reservation period, with reference to changes since aboriginal times. In addition, several papers based on field research done by Dr. and Mrs. Freed in India between 1957 and 1959 were prepared for publication. These deal with urban influences on village life.

Dr. James A. Ford, aided by a National Science Foundation grant, was engaged in an archeological survey in two areas on the Gulf coast of Mexico. It is hoped that this research will further the solution of the problems presented by the premise that the advanced aboriginal cultures of the Andean region of South America, those of Middle America, and those of the eastern part of the United States had a common origin.

Dr. Turnbull, as a part of his African investigations, completed a monograph entitled "The Mbuti of the Ituri: a Study of Cultural Flux." In addition, Dr. Turnbull began research on the survival of African tradition as discernible in the material culture of the Negro American.

The Museum is administering a grant from the National

Science Foundation to support a three-year research project entitled "Determinants of Cultural Isolation." It will be carried out in French Basque communities by Dr. Morton H. Levine, who was granted an Ogden Mills Fellowship by the department in 1962-1963. Dr. Cynthia Irwin-Williams, an Ogden Mills Fellow in 1963-1964, conducted archeological investigations in Mexico. She was also assisted by a grant from the National Science Foundation. Her research will contribute to the formulation of a long-term developmental sequence for Central America.

Although these projects are only a few variegated pieces in the total mosaic of anthropological research conducted in the department, they illustrate the diversity and scope of the programs.

Service to the community and participation in public education are also integral functions of this department. Of particular interest as an example of cooperative efforts with other organizations was the loan this year of more than 250 objects, selected by Dr. Turnbull from the collections of the department, to the African Pavilion at the New York World's Fair. These are being displayed to show some of the individual arts and crafts of the continent as a whole, and to represent 23 of the new nations individually. In addition, members of the department continued in many ways to bring the services of the Museum to the wide public it serves. Among these were teaching and public lecturing, participation in radio and television programs, the writing of books and articles, and the giving of advice and direction to organizations, both scientific and lay, that work in areas in which anthropology plays a significant role.

The department was saddened by the death of Mr. Nels C. Nelson, Curator Emeritus of Prehistoric Archeology, who died at the age of 89 on March 5, 1964. Mr. Nelson, a pioneer in the application of stratigraphic dating to archeology, was well known for his studies of prehistoric life.

DEPARTMENT OF ASTRONOMY AND
THE AMERICAN MUSEUM-HAYDEN PLANETARIUM

Joseph Miles Chamberlain, Chairman

Major changes in the Planetarium building were made this year. The improvements, which involved the three floors and both public entrances to the building, reflect a new trend in planetarium design.

For more than 20 years after the opening of the Planetarium in 1935, the corridor walls and ceilings were dark in color, the corridor lighting was kept at a low level, and the exhibition lighting was subdued. The theory was that Planetarium audiences needed a period of partial dark adaptation in order to enjoy the full effect of the sky presentation in the dome. More recently, however, the need for this transition has been proved to be less important than was once supposed, and the increased use of light and color in exhibition has caused no visual difficulties for the viewers.

The extensive redecoration of the Planetarium in the winter and spring of 1964 emphasized the trend toward a brighter, fresher, and more colorful appearance. New glass and aluminum doors and panels have enhanced both the main entrance on Eighty-first Street and the interior entrance from the Roosevelt Memorial Hall of the Museum. Inside the latter entrance, the exhibition corridor that had been part of the black-light mural area for more than a decade was converted to a white-light area. The Viking rocket and stellar chemistry exhibits were moved into this space, where they are afforded more dramatic presentation. A new exhibition, showing the great observatories of the world and their finest color photographs of celestial objects, was installed inside the main entrance while the murals in the remaining black-light corridors were being restored.

The exciting new exhibition "Astronomia," a gift of the International Business Machines Corporation, was opened on June 29 at ceremonies attended by educators and scientists. This strik-

ing exposition of the history of astronomy is the most important to appear in the Planetarium corridors since the opening of Viking Hall in 1955. The cooperation of the Adler Planetarium, the Harvard College Observatory, the Smithsonian Institution, and the Library of Congress is gratefully acknowledged. Their loans of important objects and rare manuscripts have added immeasurably to the significance of the exhibition.

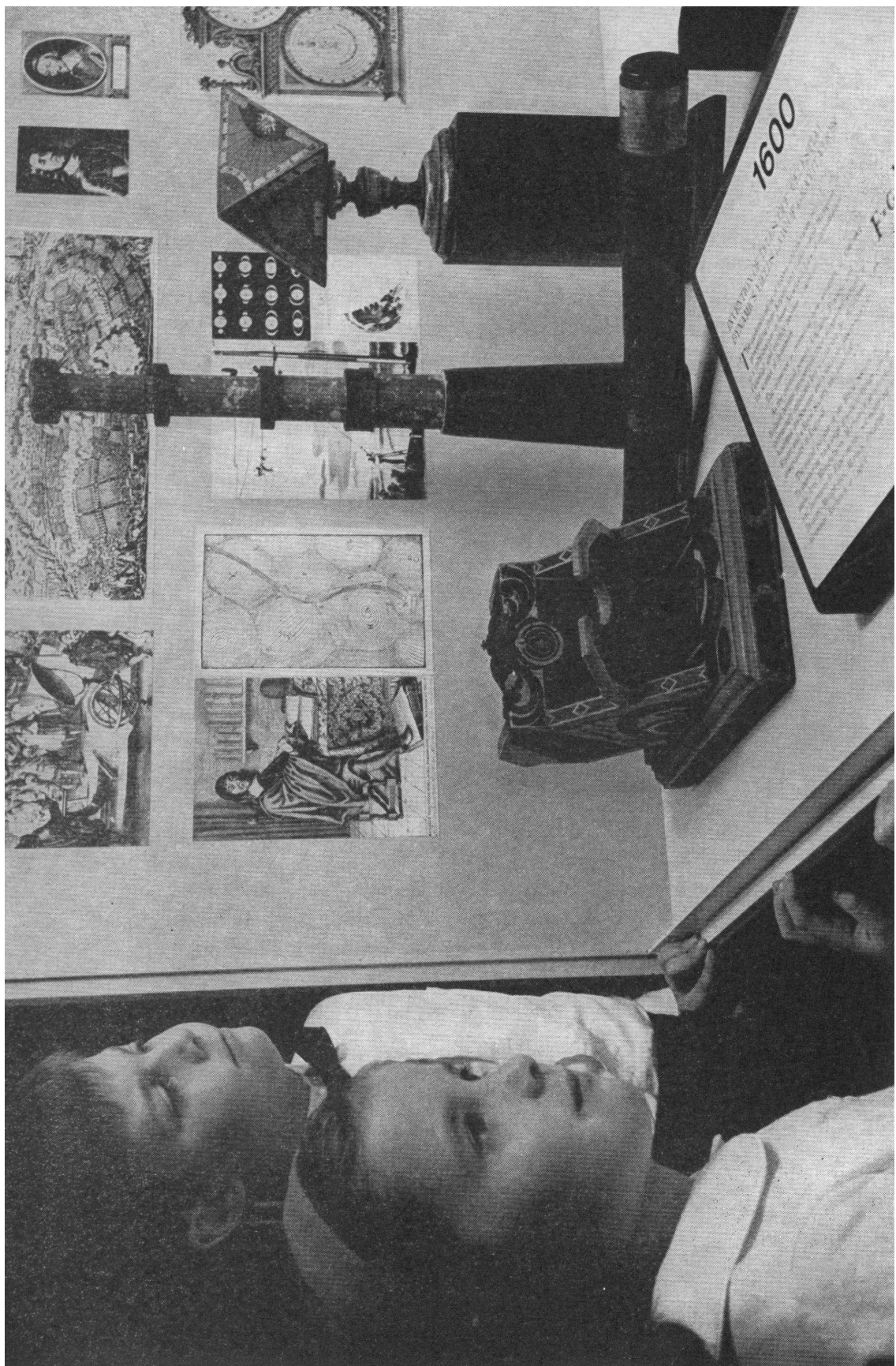
The 400th anniversary of the birth of Galileo was the occasion for an important temporary exhibition of materials relating to the man who was the father of modern astronomy. Among the valuable items included in the display were the only known contemporary portrait of Galileo in the United States and ten rare editions of astronomical writings by Galileo and other scientists of his time. The Planetarium is grateful to Mr. Samuel D. Steinberg of Los Angeles for his loan of the portrait and to Mr. Harrison D. Horblit of New York for lending the books for this commemorative exhibition.

Other developments in exhibition included the acquisition of the Foucault Pendulum from the Seattle World's Fair of 1962 and the addition of a model of the command and service modules of the Apollo spacecraft to the "Man in Space" exhibit supplied by the North American Aviation Corporation.

The public response to all the major programs of the department, including the popular lectures, courses, special lectures for colleges, reservation school lectures, and junior high school program, continued during most of this year at or above the level of the previous fiscal period. However, there was a de-

A major new exhibition hall at the American Museum-Hayden Planetarium depicts the evolution of astronomy during the past six centuries. Called "Astronomia," the exhibition is sponsored by International Business Machines Corporation and includes visitor-participation displays as well as more than 50 rare antique objects never before exhibited in New York. Here, young visitors examine navigation instruments and telescopes of the seventeenth century.

Photograph: Robert E. Smallman



crease in attendance at the public lectures in the late spring, probably attributable to the opening of the New York World's Fair. The total attendance figure of 579,445, therefore, represented a seven per cent decrease from the attendance for the previous year.

The National Science Foundation again sponsored two institutes of education in astronomy offered by the department, one for high school students of exceptional ability and one for teachers and supervisors of the elementary grades. These, together with the regular Planetarium program of courses in astronomy and navigation for laymen, were directed by Dr. Franklyn M. Branley. During the year a third classroom was constructed to allow for a more flexible scheduling of present classes as well as for the development of new courses.

Two students in the National Science Foundation Undergraduate Research Participation Program assisted Dr. Kenneth L. Franklin in redesigning the antenna and some of the receiving equipment for the radio interferometer installed at the Kalbfleisch Field Research Station. As a result, excellent records of the radio bursts emanating from Jupiter were obtained routinely through the year. Dr. Franklin also conducted several other investigations in astronomy, including an expedition to Quebec with Dr. Thomas D. Nicholson to observe the total solar eclipse of July 20, 1963.

Dr. Chamberlain, who has served for many years as Chairman of the Committee on Education in Astronomy of the American Astronomical Society, continued his interest in the problems of education in astronomy by participating in the preparation of a new science curriculum guide for lower elementary grades under the auspices of the American Association for the Advancement of Science.

The staff completed manuscripts for the first eight booklets in the illustrated series *Astronomy Highlights*, edited by Dr. Nicholson, which will be published by the Natural History Press.

DEPARTMENT OF ENTOMOLOGY

Jerome G. Rozen, Jr., Chairman

One of the most important collections ever acquired by the Museum was generously donated to this institution during the year by the distinguished biologist Dr. Alfred E. Emerson. This collection of termites, the largest in the world, contains about one million specimens and includes most of the 1802 known species. Moreover, it contains the type specimens of about 80.7 per cent of all the known living species of termites. This acquisition will be of inestimable value to scientists and students.

The collection represents a major aspect of the life work of Dr. Emerson, who is Professor Emeritus of Zoology at the University of Chicago and also a Research Associate of this department. He will visit the Museum periodically to work with the collection. Dr. Kumar Krishna, a former student of Dr. Emerson and now a Research Associate in the department, supervised the transfer and arrangement of the material and will continue to curate the collection and conduct research connected with it.

Other important acquisitions include specimens of Lepidoptera from Utah and Colorado; a collection of insects from Arizona; a number of specimens, mostly arachnids, from Mexico; and a collection of insects from Panama, Peru, Brazil, and Trinidad. The accessions made during the year, a total of 1,118,777 specimens, bring the number of insects and spiders in the department to approximately 13,290,000.

The department is the second largest repository of entomological material in the Western Hemisphere and serves, therefore, as a source of basic study materials for numerous scientists and graduate students. Members of the department collaborate with scientists on all continents. During the past year more than 150 individuals and organizations called upon us for material, identifications, or data from our collections.

In order to meet the needs of the scientists and students who depend on this material for progress in research, it has become

increasingly necessary to rearrange much of the collection. An important grant from the National Science Foundation during the past year has provided the facilities to make this reorganization possible.

The results of the research programs of the staff were published in a number of papers that not only form the basis for scientific research in taxonomy and evolution but have broad application to medical and agricultural entomology. These programs, which have been reinforced by field studies in various regions of the Americas, were aided by grants from the National Science Foundation and the National Geographic Society.

Most of Dr. Rozen's research activities were concerned with the biology of bees and studies of bee larvae. Because comparatively little is known about bee larvae and about the nesting activities, behavior, and development of bees, these investigations can supply large quantities of data that will permit a more precise evaluation of the relationships among the major categories of bees.

Among the projects Dr. Rozen undertook last year were studies of the larvae and biology of the North American Panurginae and the Anthophoridae. Although two manuscripts treating the Panurginae were essentially completed in 1963, information about several genera was added. His investigations on the Anthophoridae, one of the largest families of bees, have expanded considerably during the past year as a result of collecting activities at the Southwestern Research Station and the William Beebe Memorial Laboratory in Trinidad. Sufficient larval material is now on hand to permit a re-evaluation of the relationships of the subfamilies and tribes within the family.

Dr. Willis J. Gertsch's systematic and biological studies of spiders have been bolstered by new specimens and data from field trips to Mexico and the southwestern United States. Three papers are in press, and others are in various stages of preparation. A revisional study of the family Uloboridae for the region north of Mexico, undertaken with Dr. Martin H. Muma of the

Citrus Experiment Station of the University of Florida, reviews this group of cribellate spiders, many of which have strangely modified the conventional web. A short paper on the American genus *Hypochilus* describing a distinctive new species from Colorado supplements an earlier revisional study of this group of relict spiders. Because of the appearance of much new material, Dr. Gertsch has deferred the completion of his study of the genus *Loxosceles* of South America. Thirty species occur in that region, and two-thirds of these are found in Peru. The bites of at least three species are known to cause severe necrotic lesions and occasionally death in man, and it seems probable that the bites of all species are toxic. One species, the brown spider, has bitten people in various parts of the United States.

Dr. Gertsch's project on cave spiders continues to record exciting new material. Specimens have been unearthed during visits to hundreds of caves in many counties of Texas by Mr. James Reddell of Austin and are found to be very similar to those from other American cave systems.

Dr. Frederick H. Rindge continued his studies of the Geometridae, an important family of moths the larvae of which, known as inchworms, include some serious pests of shrubs and trees. His revisionary studies of the New World *Melanolophia* and several closely allied genera, the first since 1896, have resulted in the preparation of four papers.

Dr. Pedro W. Wygodzinsky is actively pursuing his studies of hemipterous, dipterous, and apterous insects from many areas of the world, and three papers on these subjects were published during the year. A monograph of the assassin bugs of the subfamily Emesinae is being prepared for publication.

Dr. Wygodzinsky carried out extensive field work in Central America and South America in connection with his research project on the origin and evolution of the blood-sucking assassin bugs of the subfamily Triatominae. He traveled to Panama, Peru, and Brazil in September, 1963, and to Trinidad in February, 1964, to make biological observations on and to collect

material of the Triatominae as a basis for future work in the laboratory.

The role of the Research Associates and Research Fellows in curating the various collections of interest to them is a most important one. Drs. Alexander B. Klots and Nicholas S. Obraztsov have worked with the Lepidoptera; Mr. Wilton Ivie continues to give many hours each week to the improvement of the arachnid collection. Mrs. Patricia Vaurie and Mr. John C. Pallister contribute much of their time to work necessary for the maintenance of the Coleoptera collection. Dr. Herbert Ruckes devotes many hours each week to curatorial problems in the Hemiptera. Dr. Krishna, as is mentioned above, has supervised our acquisition of the Emerson termite collection. The department, and the scientists and students who use the collections, are indebted to these individuals for their valuable help.

DEPARTMENT OF FOSSIL INVERTEBRATES

Norman D. Newell, Chairman

During the past year, members of the department were active in research and teaching projects. Their extensive investigations included studies of the organic evolution, historical geology, ecology, zoogeography, and systematics of fossil invertebrates, organisms that comprise more than nine-tenths of all animal life.

Dr. Newell is continuing his work on the revision of fossil and living bivalve mollusks. He has completed a detailed classification of this group for the encyclopedic "Treatise on Invertebrate Paleontology," a work that is appearing serially and that involves more than 150 experts from many countries. Dr. Newell is one of three members of an editorial board responsible for this project, which is financed by grants from the National Science Foundation and the Geological Society of America. He is also engaged in several long-term endeavors that deal with the investigations of Quaternary changes in sea level, the geo-

logic history of the Bahama Islands, and the causes of animal extinction in the past.

Aided by a National Science Foundation grant, Dr. Roger L. Batten undertook field and museum studies in Great Britain, France, Belgium, and Ireland at the invitation of the Geological Survey of Great Britain and of other institutions in western Europe. He studied newly obtained collections of lower Carboniferous gastropods from the Bristol area, one of the largest and best-preserved gastropod faunas of this age ever discovered in England, and revised some basic systematics of 100 species of European gastropods little dealt with since 1883. In addition, he is engaged in writing a textbook on historical geology for college students.

Four Research Associates are making steady contributions of outstanding merit. Dr. Robert M. Finks, probably the leading student of fossil sponges in the world, is continuing his study of Ordovician and Eocene sponges in the Lake Champlain and North Carolina areas. Dr. John Imbrie concluded investigations of shallow-water sedimentation and ecology in the Berry Islands, Bahamas, and is pursuing his work on the applications of computer analysis to geology.

Dr. A. Lee McAlester is preparing a manuscript on a major group of early Paleozoic bivalves for the "Treatise." Mr. Erik N. Kjellesvig-Waering, recently appointed Research Associate, is pre-eminent in studies of fossil eurypterids, particularly on systematics and adaptive morphology. During the year he discovered that early scorpions, probably derived from the eurypterids, were aquatic rather than terrestrial in habitat.

In the acquisition of collections, emphasis is placed on research programs being carried out within the department. Dr. Newell collected well-preserved Permian bivalves in Wyoming, and Dr. Batten obtained several thousand specimens in Scotland and western England. Several other important items were provided through gifts and purchases.

Under the American Museum-Columbia University joint pro-

gram of graduate training in invertebrate paleontology, two doctoral degrees were awarded and two other degree candidates are well advanced in their work. A seminar for postgraduate students at Columbia University was offered at the Museum, and several advanced university students made extensive use of departmental facilities and guidance. Two Columbia undergraduates served as Museum aides under the National Science Foundation Undergraduate Research Participation Program during the summer of 1964.

Members of the department performed more public services than ever before in the answering of inquiries, the making of identifications and loans, the presentation of lectures, and in their work with visiting scholars.

Dr. Otto H. Haas, Curator Emeritus, was awarded the Golden Doctorate of Philosophy by the University of Vienna on the fiftieth anniversary of the receipt of his doctoral degree there, in recognition of outstanding scientific achievement during his career. Most of this work was done while he was an active member of the staff of the American Museum.

The department, in collaboration with the departments of Mineralogy, Micropaleontology, and Exhibition, has laid plans for the new Linsley Hall of Earth History.

DEPARTMENT OF HERPETOLOGY

Charles M. Bogert, Chairman

Advancements in our knowledge of amphibians and reptiles depend, to a large extent, on the integration and interpretation of data obtained by many kinds of specialists. The trend in the work of this department, therefore, continued to be toward more extensive use of a wide variety of research techniques, ranging from those of the physiologist, anatomist, and paleontologist to those of the bio-acoustician. Members of the staff made use of the excellent study collections maintained by the department; whenever possible, however, studies of preserved specimens were

supplemented by investigations of living animals in the field or laboratory.

The investigations conducted by Mr. Bogert were largely concerned with the systematic status of two distantly related groups of reptiles: the fossorial reptiles of the family Amphisbaenidae, and the snakes grouped in the Xenoderminae as a subfamily of the Colubridae. Deficiencies in the classifications of both groups were largely attributable to the difficulties earlier workers had encountered in obtaining suitably representative specimens.

Fossorial reptiles inappropriately called "worm lizards" proved to have an extraordinary modification of the egg-tooth and the features associated with it. Snakes and lizards lose the egg-tooth shortly after they emerge from the egg and never replace it. In amphisbaenids, however, the egg-tooth is replaced by a functional tooth which is often the largest tooth in the upper jaw. Few other reptiles possess a median tooth in the front of the upper jaw, but such teeth are characteristic of amphisbaenids, both fossil and modern. Considered in the light of information derived from other sources, the results of this investigation support the belief that amphisbaenids evolved quite independently from the reptiles ancestral to both snakes and lizards. Consequently, it becomes preferable to recognize three groups, namely, lizards, snakes, and amphisbaenids, instead of only two.

Mr. Bogert, in his study of the specialized vertebrae of colubrid snakes, observed that some changes in their structure were associated with growth. The vertebrae of juveniles differ from those of adults. The study also revealed differences between the vertebrae of males and those of females of the same species. It is probable, therefore, that changes accompanying increments in size are controlled by hormones associated with growth and sex. Furthermore, Mr. Bogert demonstrated that snakes with similar, but not identical, modifications of the vertebrae evolved independently in Asia, Africa, and the Americas. Consequently, there was no legitimate reason for placing such snakes in the

same subfamily, the Xenoderminae. The few features the snakes in the three areas had in common were attributable to convergence rather than to their close affinity.

Mr. Bogert continued field work in the relatively isolated mountains of Oaxaca, Mexico, where he obtained more than 900 specimens to be added to the herpetological collections of the Museum. Among them are four arboreal lizards of the genus *Abronia* that appear to represent species hitherto unknown.

Dr. Richard G. Zweifel completed a study of growth and population changes in the desert night lizard, *Xantusia vigilis*, one of the smallest reptiles in the Americas. Each winter from 1949 to 1957, Dr. Zweifel and Dr. Charles H. Lowe of the University of Arizona visited a 27-acre tract of desert near Los Angeles where they captured, measured, marked, and released several hundred lizards. Recapture of many of the lizards in subsequent years made it possible to obtain information concerning their life history. Notable features are the long life and low reproductive potential of *Xantusia*. The average life span is about four years, even though some individuals survive for more than ten. When the precipitation is less than the six or seven inches that are normal for the winter, many of the females produce no offspring.

Dr. Zweifel continued to supervise herpetological studies at the Kalbfleisch Field Research Station. In the summer of 1963, Mr. F. Harvey Pough, Jr., a student in the National Science Foundation Undergraduate Research Participation Program, carried forward the long-term population study of Fowler's toad and initiated a study involving the turtles of Long Island.

In May, 1964, Dr. Zweifel left for New Guinea to conduct field studies of the amphibians and reptiles of that island.

Preliminary analysis of some of the mating calls of frogs recorded by Mrs. G. Stuart Keith in Africa suggests that the use of bio-acoustical techniques will reveal the existence of species hitherto confused by students whose studies were restricted to morphological characters.

DEPARTMENT OF ICHTHYOLOGY

Charles M. Breder, Jr., Chairman

A major program to expand and improve the research facilities of the department received valuable support this year in the form of a large grant from the National Science Foundation supplemented by funds from the Board of Trustees of the Museum. Plans were approved for new departmental quarters, including laboratories, offices, and storage rooms for the collections, and suitable space for their construction has been allocated.

A second major project of the department was brought closer to realization when the National Science Foundation granted funds to support the publication of the comprehensive manuscript on fish reproduction by Dr. Breder and Dr. Donn E. Rosen that was completed last year.

Dr. Breder, again with support from the National Science Foundation, continued his studies on the ecology of fish-produced sounds and the schooling behavior of fishes. This research is conducted on the Gulf coast of Florida, partly at the Cape Haze Marine Laboratory. Dr. Breder was ably assisted by Miss Sara L. Page, recipient of a fellowship from the Lincoln Ellsworth Fund of the Museum. As one phase of his research on the organization of fish schools, Dr. Breder pursued studies on the problems of hydrodynamics and fluid mechanics inherent in a situation in which fishes swim close together.

Dr. Rosen's activities were concerned mainly with the relationships within the complex that involves the flyingfishes, silver-sides, killifishes, and their relatives, and with the codfishes, toadfishes, and their relatives. As part of this research, which is supported by a grant from the National Science Foundation, he devoted two months to the examination of collections in England where he collaborated with Dr. P. Humphry Greenwood of the British Museum (Natural History).

A study of a type of live-bearing cave fish was advanced almost to completion by Dr. Rosen with support from the Na-

tional Science Foundation. At the same time, taxonomic investigations proceeded on the extensive series of fresh-water fishes from Guatemala collected in the spring of 1963. This work was made possible by a grant from Mr. James C. Greenway, Jr. In addition, Dr. Rosen continued his population and predation studies, using a population of mosquitofish maintained at the Kalbfleisch Field Research Station on Long Island. These studies are being carried out with the assistance of Mr. Vincent Maglio of Queens College, a student in the National Science Foundation Undergraduate Research Participation Program.

A population census of the fishes living in several areas of the Bahamas was undertaken by Dr. C. Lavett Smith as part of a broader biological survey of the Bahamas conducted jointly by the Lerner Marine Laboratory of the Museum and the Bahamian government, with support from the Biology Branch of the Office of Naval Research. Dr. Smith led the first expedition undertaken as part of the survey. He also continued his studies of sea basses and their numerous allies, focusing particularly on the widespread hermaphroditism within the group. This work is supported by a grant from the National Science Foundation. In connection with a study of the fossil remains of Cenozoic catfishes, he began an investigation of the embryology of the living channel catfish.

The investigation by Dr. Phyllis H. Cahn of the functioning and development of a sensory system along the flank of fishes was continued with support from the National Science Foundation. Of particular interest in this research are efforts to relate the patterns of hydrodynamic flow lines produced by swimming juveniles of different species to their different flank sensory structures.

This year the department established a new cataloguing system that will greatly increase the usefulness and availability of the collections. Specimens accessioned during the year include fishes from every continent, including Antarctica, with the great majority coming from the Bahamas. Many of the most inter-

esting specimens were taken during a cruise of the "Vema," the research vessel of the Lamont Geological Observatory.

DEPARTMENT OF LIVING INVERTEBRATES

William K. Emerson, Chairman

Members of the department devoted considerable time to the development of two important exhibitions, both of which were opened in the spring. Dr. Dorothy E. Bliss planned the exhibition "The Origin and Structure of Life" and coordinated the research and design activities for this first section of the new Hall of the Biology of Invertebrates. The exhibition, which incorporates some of the most recent discoveries in molecular biology, genetics, and organic geochemistry, was made possible by a grant of funds from Eli Lilly and Company, which also donated a floor-to-ceiling model of DNA, the complex nucleic acid that determines heredity. Dr. Emerson, with the assistance of Mr. William E. Old, Jr., Specialist in the department, supervised the preparation of the Evelyn Miles Keller Memorial Shell Exhibit, a gift of Dr. Franklin J. Keller of New York in memory of his wife. The display includes about 200 examples of beautiful and unusual shells, as well as full-scale models of several species of mollusks showing the appearance of these animals in life.

Continuing studies by Dr. Emerson of the tropical and subtropical marine mollusks of the Western Hemisphere resulted in the completion of a manuscript on three gastropod families and the publication of a report, by Dr. Emerson and Mr. Old, on the gastropod superfamilies Strombacea, Tonnacea, and Cymatiacea. Investigations of the late Cenozoic invertebrate collections made by Dr. Emerson on the Belvedere Expedition to the Gulf of California in 1962 also were completed, and reports by Dr. Emerson and others were submitted for publication.

Although Dr. Bliss devoted a large portion of her time this year to exhibition activities, she and her assistants made favor-

able progress in her research program, which is supported by a grant from the National Science Foundation. Dr. Bliss, assisted by Mrs. Jane Boyer, completed and published a manuscript on the environmental regulation of growth in the land crab, *Gecarcinus lateralis*. Mr. Christopher Ray, a part-time research assistant, and Mr. James Peterson, a student in the National Science Foundation Undergraduate Research Participation Program, worked on the chemical properties of the hormones that control color change in the same species of crab. Mr. Morris Altman, a full-time assistant, devoted his attention to obtaining and assaying extracts of molt-inhibiting and molt-promoting hormones.

Dr. Meredith L. Jones undertook an extensive statistical treatment of the results of a series of sediment samples collected in San Francisco Bay. The study attempted to put to use as many statistical techniques as possible, all based on a single series of population data, to determine the spatial distribution of the semi-microscopic organisms in the sediments. It is hoped that the project, when completed, will indicate the relative merits of the various statistical techniques used.

Dr. Libbie H. Hyman advanced her work on volume 6, Mollusca, of "The Invertebrates." Her taxonomic studies of the free-living flatworms resulted in the publication of a paper on a didymazoid trematode from the Bahama Islands. Dr. Horace W. Stunkard, continuing his studies of parasites, reported on the first known infection of a human being in North America by the tapeworm *Bertiella studeri*. He also studied and prepared

The structure of a living cell, magnified about 40,000 times, is shown in a Plexiglas model constructed by Freidoun Jalayer of the Department of Exhibition. The cell, together with other models, motion picture films, paintings, and photographs, comprises the exhibition "The Origin and Structure of Life" which deals with one of today's most exciting frontiers of scientific research. Donated by Eli Lilly and Company, the exhibit is the first section to be completed in the new Hall of the Biology of Invertebrates.

Photograph: Maris, Ezra Stoller Associates



for publication a report on a renicolid trematode that infects the kidneys of birds. Dr. Henry E. Coomans pursued his investigations on the systematics and zoogeography of the West Indian molluscan fauna, and Dr. William J. Clench and his colleagues at Harvard University continued to use parts of the mollusk collection in connection with their research projects.

The number of accessions to the department increased significantly over that of the previous year. A total of 150,000 specimens, mostly mollusks, were catalogued, and the reorganization of the mollusk reference collection to accord with modern classification was continued with support from the National Science Foundation. Valuable curatorial assistance was provided by a Lincoln Ellsworth Fellow and several members of the New York Shell Club. The processing of the biological material collected by the "Vema," the research vessel of the Lamont Geological Observatory, also moved forward.

New laboratories and offices for the department were completed and now provide excellent facilities for the staff and the student investigators who work with them.

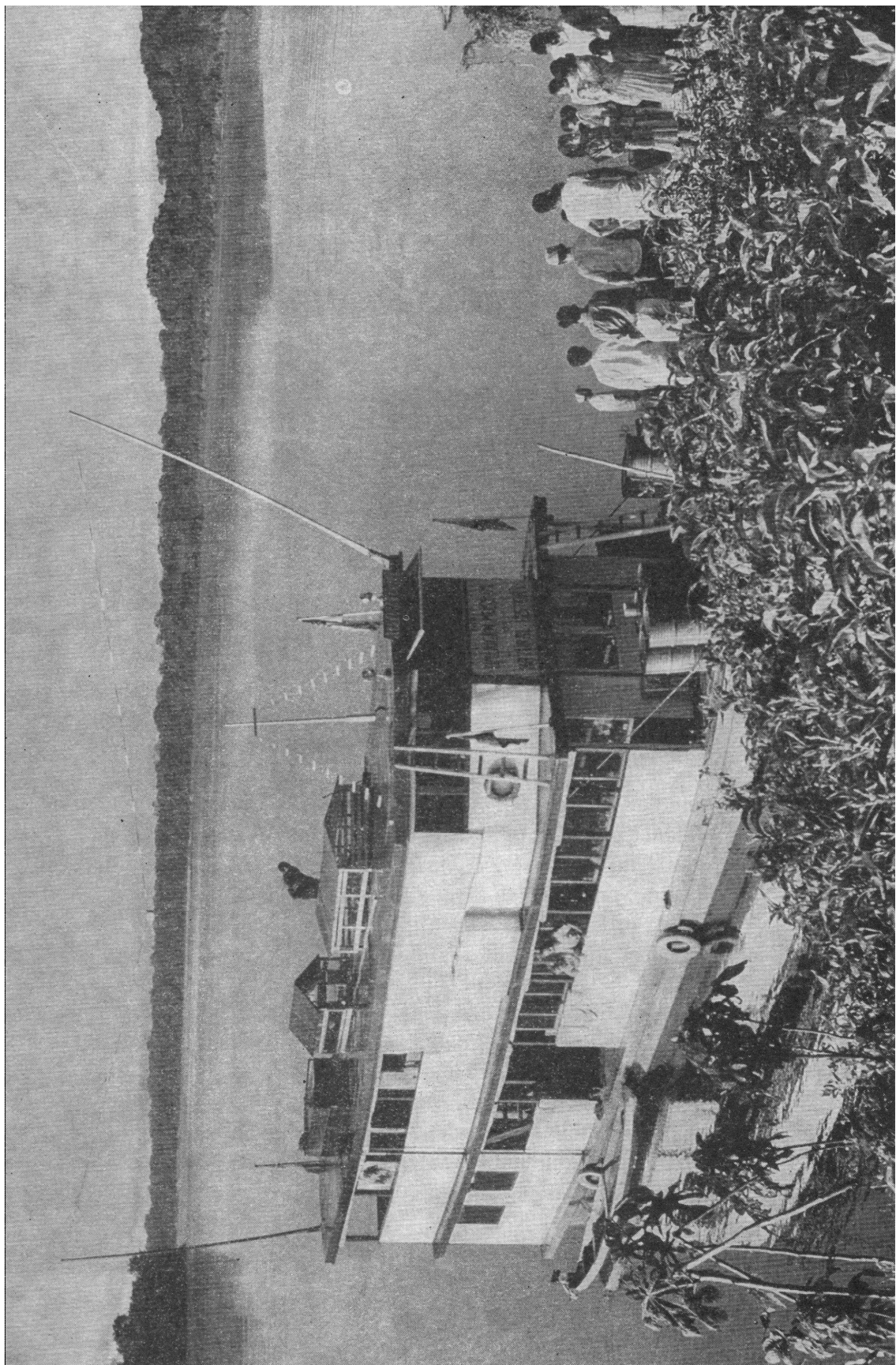
DEPARTMENT OF MAMMALOGY

Richard G. Van Gelder, Chairman

The first year of work on the three-year program to collect South American mammals and their medically important ectoparasites was concluded when collections obtained in Uruguay during 1963 were received at the Museum. The project is being

A houseboat laboratory served as the floating base of operations for the American Museum-Bolivian Expedition which collected mammals and their medically important parasites along the Rio Iténez which forms the northeastern border of Bolivia.

Photograph by Robert F. Sisson
Courtesy *The National Geographic Magazine*
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supported in part by the United States Army Medical Research and Development Command.

Planning for the second year had already been begun and that phase, the American Museum-Bolivian Expedition, is currently in progress. A well-equipped houseboat, christened "Exploradora," was built and launched for exploration of the Rio Iténez and its tributaries in the lowlands of northeastern Bolivia. In April Dr. Van Gelder joined Ing. Hernando de Irmay, Field Associate of the Department of Mammalogy; Sr. Alfredo Ximenez of Montevideo, who also worked with the Uruguayan expedition last year; Mr. Robert F. Sisson of the National Geographic Society, which is providing support for some phases of the Bolivian work; and Bolivian crew members, in the field.

The study of mammals as hosts and their ectoparasites as vectors of disease has special urgency because of an outbreak of hemorrhagic fever in this area. Collecting along a thousand miles of river in a virtually unexplored area of Bolivia on the Brazilian border will be continued in 1964 until the rainy season starts in November.

More than 16,000 parasites collected on the expedition to Uruguay were sorted and sent to specialists for study. Materials from these South American expeditions will require scientific study for many years.

The Department of Mammalogy is called upon almost daily for information or services to students and many other persons, including professional scientists in all parts of the world. The concern of the department in effectively meeting these requests is reflected in two publications by Dr. Sydney Anderson. "Problems in the Retrieval of Information from Natural History Museums" is the title of a brief report by Dr. Anderson published in the proceedings of a conference on data acquisition and processing in biology and medicine. His report on "Collections of Mammals in North America," prepared for the American Society of Mammalogists, indicated that the collection of the American Museum of Natural History is the largest in the

Western Hemisphere under a single administration, and is second only to the combined collections of the Smithsonian Institution and the Department of the Interior (Biological Surveys Collection) in Washington. About one-third of the million and a half specimens reported in the Western Hemisphere are either in Washington or in New York. About five times as much material was lent by this Museum to other institutions for study as was borrowed from other institutions. Many scientists visited the department to study the collections during the year, including individuals from Australia, Korea, Belgium, France, Uruguay, the Soviet Union, Switzerland, Israel, and Germany.

Dr. Van Gelder, in addition to his field work, continued a systematic revision of the classification of skunks of the genera *Conepatus* and *Mephitis*, and he directed a population study of small mammals at the Kalbfleisch Field Research Station. Both projects were supported by the National Science Foundation.

Dr. Anderson completed a number of papers for publication and worked on several more which are now in press or scheduled for press next year. He continued his research investigation of several genera of rodents.

Dr. Karl F. Koopman continued his studies of bats of the Congo and Sudan. In September, 1963, he attended a symposium in Southern Rhodesia on African mammals at which he reported on some of his systematic and zoogeographical studies of African bats. His trip was sponsored by the National Science Foundation. Dr. Koopman also made a six-week trip to England and Africa where he studied specimens in various museums.

Studies of the mammals of the Mexican state of Oaxaca were continued by Mr. George G. Goodwin, who also identified more than 700 specimens for other institutions and answered many other requests for information.

In April Mr. Hobart M. Van Deusen and Mr. Stanley O. Grierson, a naturalist and photographer, departed for Australia and New Guinea on the Seventh Archbold Expedition to New Guinea (1964). The expedition was sponsored by Mr. Richard

Archbold, Research Associate and President of Archbold Expeditions of the Museum, and by grants from the National Science Foundation and the Explorers Club. Their work on the Huon Peninsula of New Guinea was scheduled to terminate in September.

Mr. Fernando Dias de Avila-Pires, Research Associate, was in residence at the Museum on a John Simon Guggenheim Memorial Foundation Fellowship in 1963. He collected data for an historical analysis of the development of mammalogy in Brazil. In addition he conducted a taxonomic study of neotropical primates and studied mammalian distribution in the Amazon Basin. Mr. Jon C. Barlow, Research Associate, participated in the field studies in Uruguay in late May, 1963, and conducted bibliographic work on Uruguayan mammals.

The Exhibition of North American Small Mammals was opened on December 18, 1963. The display, situated in the corridor leading to the Hall of North American Mammals, shows sixteen species of small mammals in their natural environments. This exhibit was made possible by a gift from Mr. and Mrs. Robert D. Sterling. The planning, construction, and installation of remodeled exhibits for the new Hall of Primates have been continued, and the hall is scheduled to be opened next year.

Approximately 2500 specimens were received during the year in 56 different accessions that represent 22 different countries on five continents.

DEPARTMENT OF MICROPALAEONTOLOGY

Brooks F. Ellis, Chairman

The work of the department centers on the study of foraminifera, a group of marine Protozoa with shells, which are extremely important in the interpretation of the fossil record.

Since 1940 Dr. Ellis and Miss Angelina R. Messina have compiled the "Catalogue of Foraminifera," which is distributed

to 342 subscribing oil companies, universities, geologic surveys, and museums throughout the world, and the "Catalogue of Ostracoda." Volumes 19 and 20 were added to the "Catalogue of Ostracoda" this year. Volume 20 closes the series, and all future material will be issued as supplements. Another volume was added to the "Catalogue of Foraminifera," bringing the total number of volumes in the series to 65.

The members of the department completed work on the "Catalogue of Larger Index Foraminifera," aided by a grant from the National Science Foundation. Although the final phase of the project was started only two years ago, the basic material involved represents more than 25 years of continuous data processing. This reference work has great value both for research in pure science and for the oil industry, which uses foraminifera as index fossils in the determination of the location, depth, and nature of oil-bearing rocks.

To make full use of fossil foraminifera in interpreting subsurface geological conditions, micropaleontologists must understand the biology of living foraminifera. For this reason the department maintains biological laboratories in which microbiologists study the ecology, nutrition, and life cycles of present-day foraminifera.

Studies of the living foraminifera of the genus *Allogromia* made by Drs. John J. Lee and Hugo D. Freudenthal have indicated a strong relationship between the kind of food consumed by the organisms and their physical form and structure. They have also shown that, in response to its living conditions, *Allogromia* has the unusual capacity to change its mode of reproduction in any one of six ways. The use of radioactive tracers to tag the food used in these studies has considerably speeded the experiments.

In other investigations the researchers have discovered that, as a result of differences in the nucleus, the internal structure of planktonic foraminifera, which live in the upper 600 feet of sea water, is markedly different from that of the bottom-dwelling

benthonic foraminifera. These studies are supported by grants from the National Science Foundation and the Atomic Energy Commission. The department also collaborated with the Lamont Geological Observatory in the collection and study of living planktonic foraminifera.

Micropaleontology has a roster of approximately 1200 subscribers, in nearly every country of the world. This publication is unquestionably the leading journal in the field, and there is always a substantial backlog of good material to be published.

During the year more than 600 samples and slides were added to the collection of the department by staff members and by other individuals and institutions. They included specimens from the Vienna Basin, the Senegal Basin, Saudi Arabia, South America, and South Pacific areas.

DEPARTMENT OF MINERALOGY

Brian H. Mason, Chairman

Meteorites were the subject of much of the attention of the department, both in the laboratory and in the field, during the year. The keen interest in outer space has led to ever-increasing requests for meteorite and tektite material for research. Heavy demands on the unique meteorite collection of this Museum have resulted, and the necessity for acquiring additional material has become more urgent.

Dr. Mason led a three-month expedition to Australia in 1963. The expedition, sponsored by the National Geographic Society, covered some 15,000 miles from Sydney to Broome on the northwest coast and thence back to Sydney via Perth, Adelaide, and Melbourne. A variety of meteorite material was collected, including several hundred pounds of Wolf Creek and Dalgety Downs meteorites. Careful investigations were made of the Henbury, Boxhole, and Wolf Creek craters; several hundred tektites, many showing significant aerodynamic shaping, were collected, and their distribution was mapped. The expedition

was successful beyond expectations, and Dr. Mason returned to the field in the summer of 1964. He also planned to visit the Soviet Union, having been invited by the Academy of Sciences of the Union of Soviet Socialist Republics to participate in a conference on meteorites in Moscow.

The modest program of meteorite research begun by the department in 1956 has been expanded considerably since 1960, thanks to the financial assistance of the National Science Foundation. It is gratifying to report that the National Science Foundation has renewed its grant through 1966 and that this support will enable the department to plan extended research work on a comparatively long-term basis. Dr. Mason recently completed a survey of the mineralogy of more than 800 different stony meteorites (about 90 per cent of the total) and has developed an improved classification. This survey has revealed a number of meteorites of unusual composition, and research work on these is in hand. During the year Dr. Mason and Dr. H. B. Wiik published seven papers on these researches.

The department conducted its normal curatorial work throughout the year. Some 400 specimens of minerals and gems were catalogued and added to the collections. The staff continued to answer public inquiries and to supply selected collections of minerals to teachers and schools. In addition, about 3000 mineral specimens were identified during the year.

DEPARTMENT OF ORNITHOLOGY

Dean Amadon, Chairman

The outstanding event of the year was the opening, on June 9, of the Frank M. Chapman Memorial Hall of North American Birds. The week of the opening marked the 100th anniversary of the birth of Dr. Chapman, the renowned ornithologist who directed the growth of this department and helped to popularize the study of birds. The 160 species of North American birds include the threatened and the thriving, the beautiful and the

bold, the rare and the common, the majestic and the comical. This hall, a splendid addition to the educational resources of the Museum, was made possible by the combined support of the City of New York, the Board of Trustees, and friends of the Museum.

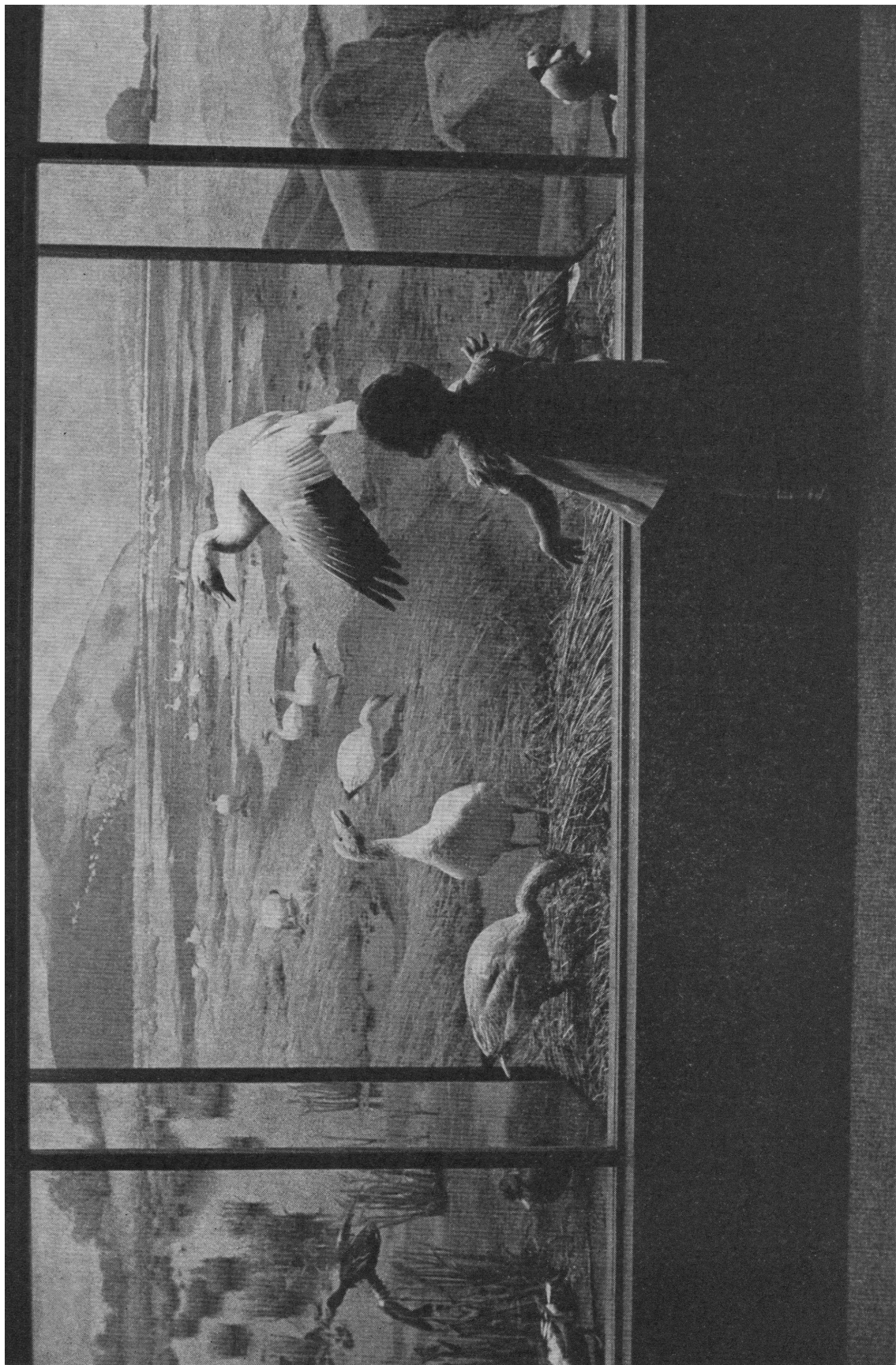
The year has also been one of steady scientific advance and considerable progress in writing and publication. Two major technical volumes were completed: "Waterfowl of the World," volume 4, by Captain Jean Delacour, and "Birds of Costa Rica," a comprehensive report on their distribution and ecology, by Dr. Paul Slud, which is being published as volume 128 of the *Bulletin of the American Museum of Natural History*. A score of papers by members of the department appeared in scientific journals, and, in addition, two popular books, "Biology of Birds" by Dr. Wesley E. Lanyon and "Fish-Shaped Paumanok" by Dr. Robert Cushman Murphy, were published.

The principal expedition mounted by the department is that of Dr. E. Thomas Gilliard, who went to West Irian (West New Guinea) for additional study of rare bower birds and birds of paradise. Dr. Gilliard began his field work in that part of Indonesia in the spring and will return to the United States in the fall. The expedition is supported by the National Geographic Society and by the Museum through a grant from the Leonard C. Sanford Trust Fund.

Dr. Amadon, at the invitation of the University of California, participated in the Galápagos International Scientific Project, which was supported by the university and the National Science Foundation. Dr. Amadon delivered a lecture on the status of evolutionary studies of island birds during a symposium at the

A flock of migrating Snow Geese is shown in one of the 27 habitat group exhibits in the new Frank M. Chapman Memorial Hall of North American Birds. The scene represents a location on the St. Lawrence River in Quebec where the geese pause in their southward migrations to feed on sedge at low tide.

Photograph: Arline Strong



Berkeley campus of the university. This will be published in a special commemorative volume. An expedition to the Galápagos following the symposium was an interdisciplinary investigation of the extremely interesting flora and fauna of the islands. During the course of five weeks of field work, Dr. Amadon represented the Museum and the International Council for Bird Preservation at the opening of the Charles Darwin Research Station on Santa Cruz Island. Dr. Amadon also continued his work on birds of prey by conducting field studies on the native hawk of the Galápagos.

Dr. Gilliard, in addition to his expedition to West Irian, completed a manuscript on birds of paradise and continued writing scientific reports on earlier collections.

Dr. Charles Vaurie completed an extensive paper on the birds of Mongolia and finished the second volume of his book on Palearctic birds. He also began a revision of a South American family of birds, the Cracidae, or curassows.

Dr. Lanyon divided his research efforts between studies of crested flycatchers (genus *Myiarchus*) and investigations of some of the birds of the Kalbfleisch Field Research Station of the Museum, of which he is Resident Director.

Dr. Murphy continued work on his handbook of the petrels. His book on the ecology of Long Island, past and present, mentioned above, was based on the Penrose Memorial Lecture, which he delivered before the American Philosophical Society.

Captain Delacour, in addition to writing his book on waterfowl, began work on a book on the curassows, which he and Dr. Amadon plan to write together. Mr. Eugene Eisenmann continued his studies of various tropical American birds. Mr. Crawford H. Greenewalt continued basic research on the biomechanics of the avian voice and also traveled to Brazil for further studies of hummingbirds. Mr. James C. Greenway, Jr., began the preparation of an annotated catalogue of the type specimens in the collections of the department. Mr. and Mrs. G. Stuart Keith returned from a two-year field trip in East Africa. Mr. Keith

brought back a carefully selected collection of birds, which contained several species that were new to the department or poorly represented, as well as very extensive film and tape footage. Dr. Douglas A. Lancaster returned from a field trip to South America where he studied tinamous. Dr. William G. George conducted studies of the classification of birds that he collected in Peru, under a National Science Foundation grant, during the year he spent as a Research Fellow of the department.

The department received a number of rare birds as a result of a plan to fill gaps in its vast collection. Among the acquisitions was the type specimen of the Blue-fronted Eupherusa, a beautiful species of hummingbird described recently by Dr. R. T. Orr of the California Academy of Sciences. The specimen was collected during field work financed in part by this Museum.

The department could not function on its present scale without the assistance of various agencies and individuals. The support given by the honorary members of the department is deeply appreciated. Mention should also be made of the help given by Mr. Frank B. Smithe, who is sponsoring a book on the birds of Tikal, Guatemala, that will be published under Museum auspices, and of Mr. John H. ("Ben") Phipps, who has agreed to sponsor the book on curassows that Captain Delacour and Dr. Amadon are writing.

The individuals who serve on the committees for the Frank M. Chapman Memorial Fund and the Leonard C. Sanford Trust Fund deserve the thanks of the Museum and particularly of the Department of Ornithology. The support of scientific research by means of these funds spreads good will for the Museum throughout the world. Further, the department benefits directly in many instances by receiving subsidies for field work conducted by staff members, by receiving specimens, and most significantly by having the stimulating presence of young research scientists who are in residence as Research Fellows, sponsored by the Frank M. Chapman Memorial Fund.

The department was saddened by the death of Dr. James P. Chapin, Curator Emeritus of Birds, whose major work, "The Birds of the Belgian Congo," will remain a lasting memorial to this internationally known authority on the birds of Africa.

DEPARTMENT OF VERTEBRATE PALEONTOLOGY

Edwin H. Colbert, Chairman

Vertebrate paleontology, like its modern relative, vertebrate zoology, covers all the backboned animals from the agnathans, early jawless "fishes," through the placental mammals. The study of living vertebrates has long been subdivided into the separate disciplines of ichthyology, herpetology, ornithology, mammalogy, and even primatology. Investigations of the fossil forms, however, have been gathered into one collective study, vertebrate paleontology. Actually, knowledge of the extinct vertebrates, of their stratigraphic occurrence, paleoecology, structure, classification, and evolution, is now so extensive that specialization is essential if research is to have depth and meaning.

This need for concentration is reflected in the interests of the staff members and Research Associates in the Department of Vertebrate Paleontology. The fields of study of the three curators represent major subdivisions in the study of vertebrates. Dr. Bobb Schaeffer specializes in fishes; Dr. Colbert, in amphibians and reptiles; and Dr. Malcolm C. McKenna, in mammals. Each curator is engaging in one or more long-range projects related to his special area of interest, as well as short-range studies.

Dr. Colbert is preparing a monographic revision of the Triassic dinosaurs of North America. This project centers on the excellent skeletons of the primitive dinosaur *Coelophysis* that were obtained in New Mexico several years ago. Another major undertaking involves the relationships of the Triassic tetrapod faunas in various parts of the world. In order to make detailed, *in situ* studies of Triassic formations and their faunas, Dr. Colbert

recently traveled to South Africa, Israel, India, New Zealand, and Australia and returned with extensive information. During this trip he participated in the collection of sauropod dinosaurs in the Kota Beds of central India. The specimens are the earliest large sauropod dinosaurs ever discovered and as such constitute a major find.

Other projects being pursued by Dr. Colbert include a series of studies on the Triassic reptiles of New Jersey and on certain Cretaceous dinosaurs of North America.

Dr. Schaeffer has concentrated on the Triassic fishes of North America and is writing several papers on these forms. A more extensive project in which he is engaged involves the paleogeographic, paleoecologic, and phyletic analysis of the Mesozoic fishes of the world. Data are being assembled and correlated from many sources for a monograph. Dr. Schaeffer's less extensive projects relate to various aspects of fish history, particularly the evolution of adaptation and its significance in relation to function.

Dr. McKenna is focusing his attention on the anatomy and evolutionary diversification of fossil and recent insectivores. These primitive placental mammals are particularly important in relation to the origin of many other placental orders, including the order to which man belongs, the primates. Dr. Childs Frick has made available his important collection of fossil insectivores for this study. Dr. McKenna is also engaged in a long-range revision of mammalian classification, which will supplement and bring up to date the classification published by Dr. George Gaylord Simpson in 1945. Dr. McKenna's short-range projects include studies of Paleocene faunas and various problems in Tertiary stratigraphy.

The basic data for all these activities are derived from field studies and specimens collected on expeditions. The extensive trips Dr. Colbert made in the last few years in connection with his Triassic tetrapod program were undertaken with the aid of a National Science Foundation grant. Dr. Schaeffer has made

several study trips to Europe and will collect Triassic and Jurassic fishes in New Mexico, Utah, Colorado, Wyoming, and Texas. Dr. McKenna has a long-range stratigraphic and collecting program in the early Tertiary of Texas, Wyoming, California, and Montana.

Many of these research projects and field programs involve some degree of collaboration with other individuals and institutions. Dr. Colbert has received the cooperation of colleagues in many countries in the course of his travels and is also collaborating with vertebrate paleontologists at Princeton University and the Texas Memorial Museum. Dr. Schaeffer is profiting from collaboration with scientists at the United States National Museum of the Smithsonian Institution, Princeton University, the University of Wyoming, Texas Technological College, the British Museum (Natural History), and the Museum National d'Histoire Naturelle in Paris. Dr. McKenna has received fruitful cooperation from the Frick Laboratory at the American Museum, and he has continuing relationships with the University of Colorado, Princeton University, the University of Wyoming, various subdivisions of the University of California, several European institutions, and some in the Soviet Union.

The department furnished specimens and data to virtually every major center of vertebrate paleontology in this country and to several abroad. Especially important were several large shipments of fossil mammal casts and scientific literature to the Paleontological Institute of the Academy of Sciences of the Union of Soviet Socialist Republics and to the Paleontological Institute of the Mongolian People's Republic. Substantial assistance was also rendered to the Museum National d'Histoire Naturelle in Paris and to the Institut für Paläontologie und Historische Geologie der Universität in Munich, Germany.

During the fall semester of 1963-1964, Dr. Schaeffer presented his course on the history of fishes for Columbia University students, and in the spring semester of 1964 Dr. McKenna offered his course, also for students at Columbia, on the history

of mammals. Classes taught by the curators are held in the Museum where the study collections can be used as teaching materials. At the present time the curators are also working with four graduate students. Both the formal classes and the guidance of graduate students continue to be an important and rewarding aspect of the work of the department.

SPECIAL ACTIVITIES
ARCHBOLD BIOLOGICAL STATION
LAKE PLACID, FLORIDA

Richard Archbold, Resident Director

Forty-seven visiting investigators representing fourteen institutions conducted field studies at the station during the year. Among the projects continued from previous years were parasitological investigations by Dr. Lawrence R. Penner of the University of Connecticut, light-trapping of nocturnal insects by Dr. Stuart W. Frost of Pennsylvania State University, and a long-range study of seasonal changes in south Florida by Dr. Austin L. Rand of the Chicago Natural History Museum. Dr. David G. Kissinger of Atlantic Union College did further field work for his research on the biology of various weevils and collected a number of unique specimens that possibly represent new species.

Dr. Roger A. Morse of Cornell University undertook four investigations into the behavior and ecology of the honeybee *Apis mellifera*. One study concerned the effect of light on comb construction; and another, the effect of sound on swarming behavior. Two additional studies dealt with the effects on the bees of some chemical products used in agriculture.

Dr. Allan F. Archer of Tift College, Georgia, conducted a field and laboratory project as a part of his study of tropical American genera of web spiders. The collecting of specimens for this work was aided by Dr. Penner, Mr. Archbold, and others. Mr. Archbold and Dr. Leonard J. Brass also assisted Dr. P. Barry Tomlinson of the Fairchild Tropical Garden in the collection of

palm specimens for anatomical studies.

Dr. Brass reorganized the herbarium of the station and made progress in the task of bringing identification up to date. In addition, Dr. Brass collaborated with scientists in Australia and New Zealand on a number of problems concerning the Australasian region.

KALBFLEISCH FIELD RESEARCH STATION

HUNTINGTON, LONG ISLAND, NEW YORK

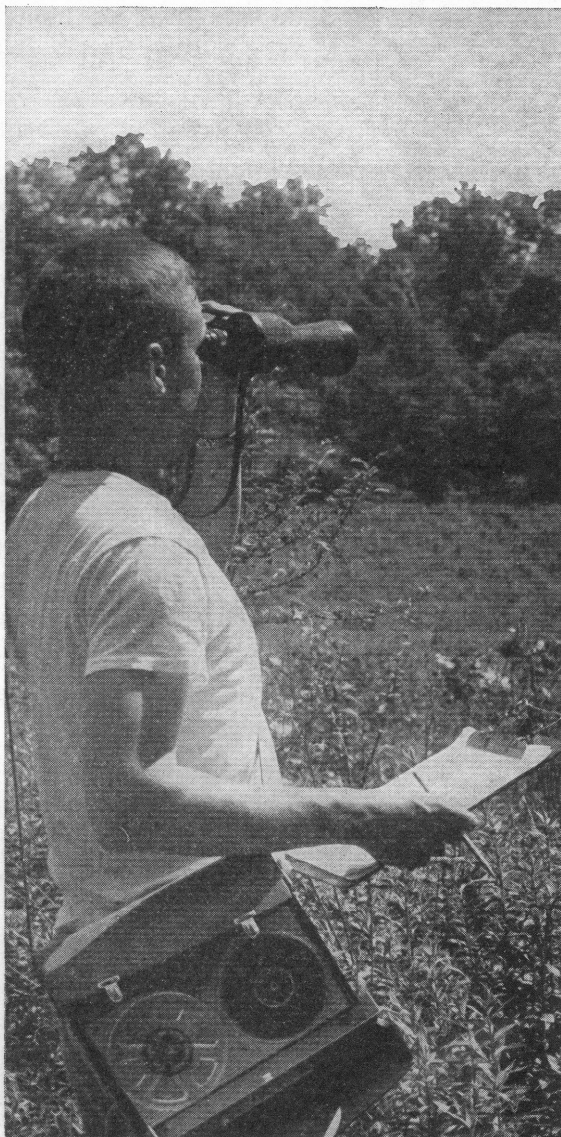
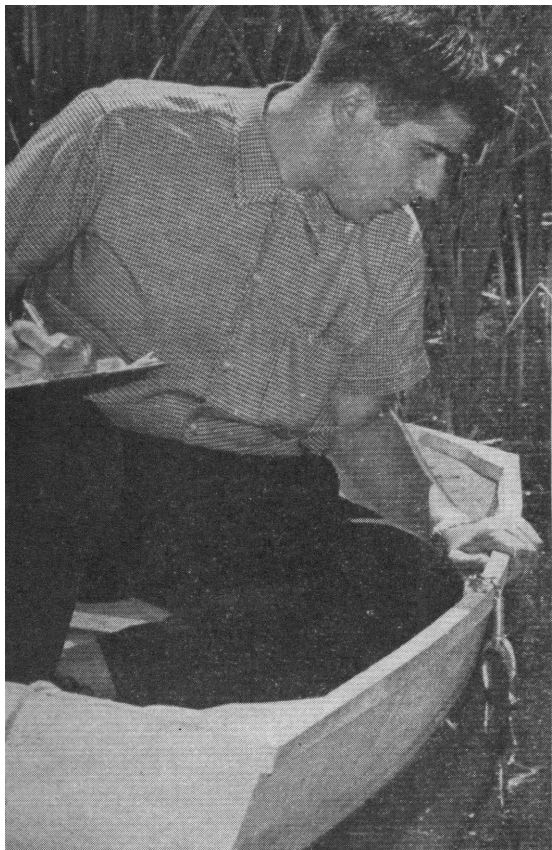
Wesley E. Lanyon, Resident Director

Seven members of the Museum staff continued long-term research projects at the station this year. Most of these involved investigations of the dynamic and intricate fluctuations of populations, examined through studies of populational genetics, plant succession, breeding ecology, and populational ecology. A central theme of this research by staff members continues to be an integrated and interdisciplinary approach to the interrelationships between plant succession, in a variety of communities on the station, and the temporal changes in the populations of vertebrate animals that utilize those communities.

Research on the genetics of introduced populations of mosquitofish and spinetail platyfish was continued by Dr. Donn E. Rosen of the Department of Ichthyology. Dr. Jack McCormick, Consultant in Ecology at the station, carried on his analysis of local flora and the study of plant succession in representative communities. Dr. Max K. Hecht of the Department of Vertebrate Paleontology initiated a study of the population dynamics

Through the National Science Foundation Undergraduate Research Participation Program, college students receive an unusual opportunity to work on research projects under the direction of Museum scientists. At the Kalbfleisch Field Research Station on Long Island, student participants in the program carried out field work during the summer for long-range studies in ichthyology, radio astronomy, vegetation, and ornithology.

Photographs: Anthony J. Ferraro, *The Long Islander*



and breeding ecology of the spotted salamander.

Three staff members pursued research in populational ecology. Dr. Richard G. Zweifel of the Department of Herpetology worked with specimens of Fowler's toad, painted turtles, and other reptiles and amphibians; Dr. Richard G. Van Gelder of the Department of Mammalogy studied the populational ecology of several species of small mammals; and Dr. Lanyon conducted similar investigations with the breeding birds of the station.

In addition, Dr. Kenneth L. Franklin of the Department of Astronomy continued his study of low-energy radiation emanating from the planet Jupiter.

Two significant additions to the research facilities were completed this year. An experimental pool was constructed for ichthyological and herpetological investigations. This concrete pool and a connecting circular channel have a capacity of 4700 gallons and are completely enclosed in a protective canopy of nylon netting. The facility was used for the first time in a study of predator-prey relationships that is being conducted by Dr. Rosen. An aviary, measuring 20 by 30 feet, was prepared in one of the grassland communities of the station and will be used by Dr. Lanyon for the breeding of meadowlarks.

A series of aerial photographs, the first taken in 1930, was acquired from the Long Island Park Commission and the United States Department of Agriculture. These reveal the former appearance and land use of the station and adjacent property. Aerial photographic coverage of the station will be continued in the future, at approximately eight-year intervals.

Nine college undergraduates were in residence during the summers of 1963 and 1964, assisting the Museum staff members. The students were sponsored in part by the Undergraduate Research Participation Program of the National Science Foundation. In addition, several high school volunteer students were in residence during the summer program. Through this apprenticeship, these young men and women gain valuable insight into the techniques, methods, and theories of research.

LERNER MARINE LABORATORY
BIMINI, BAHAMAS

Robert F. Mathewson, Resident Director

The extent and diversity of studies conducted this year at the Lerner Marine Laboratory by the more than 150 visiting investigators emphasized the importance of expanding the facilities of the laboratory to meet the needs of scientists who wish to study tropical and subtropical marine biology. Subjects of research included the ecology of sponges; the functioning of the pituitary gland in exophthalmic fishes; the formation of carbonate sediments on the Bahamian sea floor; biochemical factors in the embryonic development of cephalopod mollusks; and the synthesis of holothurin, a toxin derived from sea cucumbers that has been shown to have dramatic control of abnormal cell growth. Among the several projects involving sharks were immunology studies, research on body fluids as drug transport mechanisms, electrophysiological recordings, and studies related to shark attractants and repellants.

Of exceptional interest was a research effort pursued during the winter months by Dr. C. Lloyd Claff of the Single Cell Research Foundation, Randolph, Massachusetts, and Mr. Arnold H. Blaufuss of Chicago, Illinois. Dr. Claff pioneered in the development of a heart-lung machine that has been used successfully in hospital operating rooms. His work at the laboratory was aimed at increasing the efficiency of this machine through the development of methods for the transmission of oxygen across membranes, a technique that can serve as a blood oxygenator when the lungs are bypassed during an operation.

Dr. Perry W. Gilbert of Cornell University, Chairman of the Shark Research Panel of the American Institute of Biological Sciences, conducted tests in the shark pens for the National Aeronautics and Space Administration on the characteristics of a survival "package" designed to aid the recovery of space-vehicle instruments. Dr. Gilbert also continued his studies in

shark behavior and physiology. Scientists of the University of Miami, under the direction of Dr. John C. Steinberg, continued to carry out studies in marine bio-acoustics at the laboratory. Dr. John M. Arnold of the University of Minnesota, a Research Fellow of the laboratory, studied the functions of the biochemicals that apparently control some aspects of embryonic development in cephalopod mollusks.

The year marked the beginning of an extensive biological survey of the marine environment of the Bahamas in which scientists of various disciplines, from many institutions, are taking part. The survey is a cooperative project of the laboratory, the Bahamian government, and the Biology Branch of the Office of Naval Research. A preliminary aerial reconnaissance of the islands this year was followed by the start of the first surveying cruise. The cruise was devoted to studies in ichthyology, algology, botany, and toxic marine plants and organisms.

With the able guidance and generosity of Mr. W. W. Knight, Jr., Consultant in Marine Biological Indoctrination Programs, a program was developed to acquaint graduate students from mid-western universities with the marine ecology of the Bahamas. Participating in the meetings held at the laboratory to plan the program were representatives of the Biology Branch of the Office of Naval Research, the Division of Experimental Biology of the National Science Foundation, several universities, and the Museum. Under the program, the students will investigate a variety of marine environments in the Bahamas with the use of the "J. A. Oliver," the research vessel of the laboratory.

In November the Association of Island Marine Laboratories of the Caribbean held its fifth annual meeting at the Lerner Marine Laboratory. Twenty-five scientists from other member laboratories attended, and papers were presented from various disciplines.

During the year the Resident Director continued his collaborative research with Dr. Edward S. Hodgson of Columbia University and Dr. Gilbert of Cornell University on elasmobranch

sensory systems. Preliminary work was done on the feasibility of obtaining electrophysiological recordings from the olfactory lobes of nurse sharks. Mr. Mathewson also pursued studies, in collaboration with Dr. Gerard M. Lehrer of Mount Sinai Hospital, New York, on the supramedullary neurones in fish, a project that is supported by a grant from the Damon Runyon Foundation.

SOUTHWESTERN RESEARCH STATION
PORTAL, ARIZONA

Vincent D. Roth, Resident Director

A growth in the number of visitors, an increase in the collection, and additions to the physical facilities were three aspects of the expansion that characterized the Southwestern Research Station this year.

The number of guests at the station rose from the 213 of the previous year to 329. The visitors included 58 scientists who represented 31 institutions in many sections of the United States, Finland, India, and England. These individuals were engaged in fifteen fields of study, ranging from acarology to watershed management. More than a third were entomologists. In addition, seven classes with 102 students made weekend visits, and the station was host to 28 scientists at the Annual Conference of Arizona Economic Entomologists.

This increase can be attributed in part to the volume of information that was disseminated about the station in the mass media and by Mr. Roth. Mr. Roth attended meetings, conferences, and seminars at which he showed slides and talked to a total of 540 scientists. He also visited 21 institutions in Texas, New Mexico, Arizona, and California, meeting with 69 scientists.

Several long-term research projects were continued. Dr. E. Wilbur Cook of Centre College, Kentucky, returned to conduct his fourth year of studies dealing with extracts from cacti and desert plants. These extracts have been found to cause the cells

of certain microorganisms to vary in form, colony, appearance, and physiological activity.

Mr. Christopher J. Schubert of the Department of Education of the Museum finished his second year of research on the "Geology of the Chiricahua Mountains and Vicinity." Mr. Schubert is planning to draft geologic maps, to establish several representative structure sections of the region, and to relate the sequence of physical events to the present geology in order to clarify and integrate the currently limited geologic information into a comprehensive report.

Dr. Martin H. Muma of the Citrus Experiment Station at Lake Alfred, Florida, began a three-year study of the biology of the Solpugida, an order of spiders, which included observations on mating habits and the partial rearing of some of the solpugids. Mr. Roth is continuing a revision of the spiders of the family Agelenidae of South America, and is writing two short papers on nomenclatural and taxonomic problems of spiders in this family.

All the collections were enlarged. The most important of these extensions, a large number of beautifully prepared Lepidoptera, was added to the entomological collection by one of the volunteers, Mr. Noel McFarland. Misses Constance Chesebrough and Julie Franklin, also volunteers, contributed good collections of ants and ant lions. Dr. William A. Weber of the University of Colorado Museum, aided by Mr. Roth, collected 102 species of lichens from the Chiricahua Mountains. This collection is now one of the best in the western United States.

Within the station, extensive painting, repairs, additions, and conserving maintenance, including the removal of outside wiring, are improving the appearance and condition of the facilities.

DEPARTMENT OF EDUCATION
Lois H. Heilbrun, Acting Chairman

The department suffered a great loss in May with the sudden death of its Chairman, Mr. John R. Saunders. Mr. Saunders, who had been a member of the department since 1928, was appointed to the chairmanship in 1952. Under his administration, the present divisions of General Education, Adult Education, Circulating Exhibits, and Special Projects were established; the programs for adults were considerably expanded; and the Natural Science Center for Young People was opened.

A second severe blow, occurring less than three weeks after Mr. Saunders' death, was the death of Miss Josephine A. Barry, secretary of the department for the past 34 years.

All the major programs of the department were continued during the year. In the various teaching and lecturing programs, 149,879 individuals received a total of 286,685 student hours of instruction. "The World We Live In" program, which provides an all-day museum experience for classes of grades three through nine, served over 32,000 New York City school children. Increases in attendance were noted in several areas, including the Nurse Education Program in which the number of students was more than twice the figure for the previous year. The number of visitors to the Natural Science Center increased by more than a thousand, and attendance at the "Adventure" lecture series, which is given for the children of Museum members, was 20 per cent higher than that of last year.

The program of instruction for children confined to hospitals and special schools reached four times as many boys and girls as in the previous year. This increase was made possible by a grant from the Avalon Foundation, which enabled the department to extend the program from a two-month to a nine-month basis.

Fourteen series of lectures were offered for adults. Subjects ranged from the archeology of the Mediterranean area to draw-

ing and painting from nature. Nine series of field walks and a weekend field trip were also conducted. In addition, 21 courses for teachers, accredited by the City College of New York, were given in cooperation with the Board of Education. Other continuing adult programs included free slide and gallery talks and Wednesday film showings.

Circulating exhibits were sent to 439 schools, libraries, and other institutions, and eighteen new exhibits for circulation were constructed during the year. Of particular interest were three displays of dolls of various regions of the world. These exhibits contain models and maps, in addition to the dolls, and many teachers have found them particularly useful with non-English-speaking children, who have been motivated by the exhibits to read the labels, to look up unfamiliar words, and to do further reading.

Two new services begun by the department in April were the operation of an information desk and the establishment of an Acoustiguide rental system. The Museum had been without an information desk for a number of years, and the establishment of the new desk has been welcomed by both visitors and staff. The information clerks dispense a wide variety of information from simple directions to the public to help to teachers in the planning of meaningful visits for their classes.

In 1954 the Museum pioneered in the use of sound tours in this country with Guide-a-phone, a system that was replaced in 1961 by Soundtrek. Both were radio installations. Since early in 1962, when Soundtrek was discontinued, visitors have con-

Ways of life in distant lands become understandable and exciting to New York City school children in the "World We Live In" program. Using ethnic materials from the Museum collections, students take part in "demonstrations" of social, economic, and cultural aspects of everyday life in other countries. Here, Museum instructor Mrs. Marjorie Ransom costumes a boy for his role in a demonstration of market day in a Mexican village.

Photograph: Arline Strong



tinued to ask for such a service. In March of this year the Museum entered into an agreement with Autolecture, Inc., for its tape-playing instruments known as Acoustiguides. Under the terms of the agreement, the Museum received 100 instruments, 50 each of two separate tours. One tour covers the exhibits of mammals, forests, and Indians of North America; the other is related to the exhibits of dinosaurs, African mammals, and birds of the South Pacific. The scripts, written by Mrs. Heilbrun, were narrated by professional actors.

DEPARTMENT OF EXHIBITION AND GRAPHIC ARTS

Gordon R. Reekie, Chairman

Four major exhibits were completed and opened in the Museum last year, and substantial progress was made on the design and preparation of several new halls. New personnel authorized for the Exhibition Division made possible the carrying of the increased work load of the accelerated exhibition program.

The opening of the Exhibition of North American Small Mammals took place on December 18, 1963; the Evelyn Miles Keller Memorial Shell Exhibit, on March 24, 1964. "The Origin and Structure of Life" was opened on May 20, 1964. The Frank M. Chapman Memorial Hall of North American Birds was opened on June 9, 1964.

With the opening of these exhibits, efforts are being concentrated on other areas.

Reconstruction of the Hall of Primates is nearing comple-

A Kaibab squirrel peers from a snowy perch in the newly opened Exhibition of North American Small Mammals. The habitat group, representing a location on the Kaibab Plateau in Arizona, is one of fourteen groups in the corridor adjunct to the Hall of North American Mammals. The exhibition is the gift of Mr. and Mrs. Robert D. Sterling.

Photograph: Robert E. Smallman



tion. Some of the exhibits have been installed, and plans call for the opening of the hall within the coming year.

Good progress was made in the Hall of Early Mammals, which is also scheduled for opening in the year ahead. Another important occupation of the department has been the design and preparation of some of the displays that will complete the Hall of the Biology of Invertebrates: exhibits on evolution, classification, and behavior.

A good start has been made on the installation of materials in the Hall of Eskimos, which is being completely redesigned. Two-thirds of the exhibits for the Hall of Eastern Woodlands and Plains Indians have been completed and are in storage, awaiting the structural remodeling of the hall. Similarly, further preparation of exhibits for the Hall of Ocean Life awaits extensive structural alterations of that hall.

Final selection and organization of material is taking place for the Hall of the Peoples of the Pacific. Design of the Hall of Man in Africa has been completed, and the first exhibits are now being built.

An exhibit that serves as an introduction to the work of the Museum was installed in the New York City Pavilion at the World's Fair. Artifacts, back-lit transparencies, and decorative art work were combined in a display showing the interrelationship of research and exhibition at the Museum.

From July to September, 1963, there were five exhibits of Museum material displayed in the five branches of the Bowery Savings Bank. An adaptation of the Corner Gallery Exhibit, "Dating the Past with Atoms," was installed in the main office on Forty-second Street, while ivory carvings, mineral specimens and art objects, Peruvian textiles and pottery, and South American birds and featherwork were displayed at the other branches.

Two exhibits that originated in the Museum were returned after several years of circulation by the Traveling Exhibition Service of the Smithsonian Institution. They were "Charles Darwin: The Evolution of an Evolutionist," and Mr. Crawford

H. Greenewalt's photographs of hummingbirds.

Four groups in the Hall of Birds of the World were renovated last year. These are the Australian Bird Life Group, the Subantarctic Bird Life Group, the Alpine Bird Group, and the Gobi Desert Group.

A routine but important aspect of the work of the Exhibition Division is the cleaning and repair of exhibits. This is general maintenance of exhibits, as distinct from the kind of restoration that is being done in the Hall of Birds of the World and the Hall of Indians of the Northwest Coast. For example, during the past year, all the exhibits in the Hall of Man and Nature (Warburg Memorial) were cleaned, as were the open displays in the Hall of the Men of the Montaña. Some of the exhibits in the Hall of the Biology of Man were renovated, and others were changed and brought up to date. Minor repairs were made in nearly every hall.

The success of the exhibit "Partners in Discovery" in the Corner Gallery made advisable its extension through 1964. In addition, the exhibit "Man in Space" remained on display throughout the year.

The members of the Graphic Arts Division had an active year. This division, which is supervised by Mr. Joseph M. Sedacca, was expanded during 1963 to meet the needs of the Natural History Press. They designed, illustrated, and produced all the issues of the magazine *Nature and Science* and provided illustrations for the *American Museum Science Books* series. During the same time members of the division prepared illustrations for the scientific publications, including *American Museum Novitates*, the *Bulletin*, and *Curator*, as well as for exhibits.

A year ago the Print Shop was made a division of the Department of Exhibition and Graphic Arts. This logical move made possible greater efficiency in scheduling printing operations according to their priority, as well as utilizing to greater advantage the production knowledge of the department. During the year, upon the recommendation of Mr. Philip Duffy,

Print Shop Manager, and outside advisers, the Museum purchased a new Heidelberg cylinder press and a Vandercook proof press. The former has made possible a remarkable increase in the speed of printing forms, folders, and leaflets, while the latter has greatly simplified the printing of exhibit labels.

LIBRARY

George H. Goodwin, Jr., Librarian

The Library of the American Museum of Natural History, one of the finest collections of literature in the natural sciences in the world, was used last year not only by the staff of the Museum, but also by thousands of scientists, students, and researchers from universities, colleges, foundations, museums, and industrial organizations throughout the country. In addition, through the medium of interlibrary loans, books and periodicals were sent to hundreds of libraries in this country and abroad.

In order that the Library may preserve its priceless research collection and continue to fill its role in scientific research, it has become necessary to undertake a large-scale bookbinding program. A grant from the National Science Foundation, received last year, has made this project possible. To date, more than 5600 volumes have been processed. This number will have reached more than 16,000 by the completion of the program. Further, with the financial support of Mr. and Mrs. Robert D. Sterling, many rare works are being repaired, cleaned, and treated with preservative by Mrs. Nancy Russell, restorer of rare books.

As the budget permits, the Library continues to obtain out-of-print and rare items, in addition to the essential reference works. As the result of exchange agreements and purchases, 16,165 periodical items, 1977 books, and 243 new serial titles were added to the collection during the year. One of the latest acquisitions is "Svenska Vetenskapsakademien, Stockholm. Handlingar" (volumes 1-9, 1740-1748), a rare set containing

many early papers of Linnaeus. Another important accession is the "Author and Subject Catalogue of the Peabody Museum of Archaeology and Ethnology." The addition of this new book catalogue, one of the best reference works to appear in many years, has greatly facilitated research in the anthropological literature of the Library.

The Friends of the American Museum Library, led by Mr. Cyril F. dos Passos, continued their efforts in support of projects that will further enhance the value of the Library to science.

PUBLICATIONS

SCIENTIFIC PUBLICATIONS

Ruth Tyler, Editor

The Department of Scientific Publications published seven articles in the *Bulletin*, totaling 695 printed pages; 40 numbers in *American Museum Novitates*, 760 printed pages; and one part in *Anthropological Papers*, 93 printed pages.

In the press at the end of the fiscal year were five articles for the *Bulletin*, totaling 1890 typewritten pages, and fifteen papers for the *American Museum Novitates* series, totaling 900 typewritten pages. Two papers for the *Bulletin* (404 typewritten pages) and nine for *American Museum Novitates* (343 typewritten pages) awaited publication in the editorial office.

During the period September 11 to February 17, 182 hours of editorial work were spent on "Modes of Reproduction in Fishes" by Charles M. Breder, Jr., and Donn E. Rosen. In June, support for the publication of this work (which totals more than 3000 typewritten pages) was given by the National Science Foundation. It will soon be in press.

CURATOR

Harry L. Shapiro, Editor-in-Chief

Comments from the readers of *Curator* continue to give evidence of its usefulness to members of the museum profession, both in this country and abroad. In addition, a growing and sustained reader interest in the magazine is reflected in the fact that the rate of subscription renewal is extremely high while the number of subscribers continues to increase.

An analysis of the subscription list made by the late John R. Saunders, Secretary of the Editorial Board, revealed that *Curator* has subscribers in every one of the 50 states of the United States, as well as in 41 other countries. At the time Mr. Saunders made his analysis, subscriptions were divided about equally between institutions and individuals.

NATURAL HISTORY PRESS

Franklyn M. Branley, Chairman, Editorial Board

The Natural History Press, a division of Doubleday & Company, Inc. which serves as publisher for the Museum, has been an important medium for broadening the educational activities of the Museum.

In the fall of 1963, one year after its inception, the Natural History Press published four paperback books in the series *American Museum Science Books* and one volume in hard covers. The paperbacks were "Exploration of the Moon," by Franklyn M. Branley; "Biology of Birds," by Wesley E. Lanyon; "Indians of the Northwest Coast," by Philip Drucker; and "Indians of the Plains," by Robert H. Lowie. The hard-cover volume, "Wasp Farm," by Howard Ensign Evans, was nominated for the National Book Award.

During the first half of 1964, an equal number of new books was brought out. The four paperbacks were "Africa and Africans," by Paul Bohannon; "A Short History of Biology," by

Isaac Asimov; "Photographing Nature," by David Linton; and "Invitation to Anthropology," by Douglas L. Oliver. "These Fragile Outposts," by Barbara Blau Chamberlain, was published in hard covers.

The year 1963-1964 marked the beginning of an exciting publishing venture. The Press introduced *Nature and Science*, an entirely new science magazine for the middle-elementary grades. The reception of the magazine has been excellent and has proved that *Nature and Science* can make a distinctive and highly effective contribution to science education in the United States.

During this year, eight 32-page booklets about various aspects of astronomy were prepared by the staff of the American Museum-Hayden Planetarium under the general title of *Astronomy Highlights*. The booklets, the first of several in a series, will be available for general distribution in the fall of 1964.

A new lecture series presenting essays on the world of science and the humanities, called the Man and Nature Lectures, was set up by the Natural History Press. The annual series of four lectures will be offered for the first time in the spring of 1965, with Dr. Jacob Bronowski, a noted British scientist, as the first lecturer.

NATURAL HISTORY

Robert E. Williamson, Managing Editor

Natural History magazine maintained its high editorial standards by continuing to solicit manuscripts from outstanding scientists in various disciplines. At the same time, an interesting measure of the growing prestige of the magazine was the increase in the number of unsolicited manuscripts of high caliber received from colleagues of the published authors.

In addition to articles on research and field work by members of the Museum staff, the magazine published original papers by eminent authorities associated with such organizations as the

United States Geological Survey, the National Museum of Canada, the Department of Biology at Tufts University, the Department of the History of Science and Medicine at Yale University, the Fogg Art Museum of Harvard University, Oxford University, and the Nordiska Museet in Stockholm.

There has been a noticeable increase in requests from publications for permission to reprint articles from *Natural History*. A prime example was "Waters of the World," by Raymond Nace, which appeared in the January, 1964, issue. Requests for permission to reprint this article, in English or in translation, came from numerous publishers in this country and abroad, including the *United Nations News*, the United States Information Agency, and the People-to-People Program.

A very successful seminar entitled "Institute for the Evaluation and Promotion of Science Materials for Secondary Schools" was sponsored jointly by the magazine and Rutgers University in November, 1963. The event, an outgrowth of the annual young people's book survey in the magazine, brought together 387 teachers, librarians, and publishers, and laid the foundation for similar institutes to be given by other organizations in different parts of the country.

Circulation of the magazine continued to grow during the year. The total paid circulation of 150,230 established a new high for the fifth consecutive year. Gross advertising billing totaled \$124,700, as compared with \$92,000 for the previous fiscal year.

PLANT OPERATION AND MAINTENANCE

Paul Henry Grouleff, Plant Manager

Under the accelerated program to expand and rehabilitate exhibition areas, construction was completed this year in four sections: the Hall of Primates, the Hall of the Biology of Invertebrates, the Hall of Eskimos, and the Exhibition of North American Small Mammals. Finished exhibits were installed in

the display of North American Small Mammals and in the first section of the Hall of the Biology of Invertebrates. Other projects completed during the year included the building of a new laboratory for the Department of Animal Behavior, the reconstruction of the Seventy-seventh Street entrance and foyer, the conversion of electrical power from direct to alternating current, and the rehabilitation of various roofs.

In addition to providing funds for the construction of the foregoing projects and others now being processed, the City of New York has authorized funds for the designing of two new exhibitions, the Hall of the Peoples of the Pacific and the Hall of Earth History.

The Museum mechanics have been fully occupied throughout the year maintaining the Museum complex and furnishing technical support to the Department of Exhibition. The Custodial Services Division continues to have inadequate manpower for carrying out all the tasks that it should do, but the essential work is being performed satisfactorily.

ATTENDANCE

During the fiscal year here reported on, 2,343,177 people visited the Museum, and 579,445 visited the Planetarium, making a combined total of 2,922,622. This figure represents a decrease of 139,126 from the combined attendance for the preceding fiscal year.

THE AMERICAN MUSEUM OF NATURAL HISTORY

FINANCIAL STATEMENTS

FOR THE YEARS ENDED JUNE 30, 1964 AND 1963

**THE AMERICAN MUSEUM OF
BALANCE SHEETS, June**

ASSETS:	1964	1963
Current funds:		
General funds:		
Cash	\$ 399,818	\$ 302,376
Accounts receivable	240,975	235,136
Inventories, principally publications, at cost	61,461	60,861
Prepaid expenses	80,695	72,947
	<u>\$ 782,949</u>	<u>\$ 671,320</u>
Special funds:		
Cash:		
Demand deposits	\$ 151,158	\$ 440,628
Time deposits	577,408	251,039
Investments (market June 30, 1964, \$347,000)		
(Note 1) :		
U. S. Government bonds	350,000	600,000
Preferred stock		2,387
Accounts receivable	23,917	17,375
	<u>\$ 1,102,483</u>	<u>\$ 1,311,429</u>
	<u>\$ 1,885,432</u>	<u>\$ 1,982,749</u>
Endowment funds:		
Cash:		
Demand deposits	\$ 7,446	\$ 12,465
Time deposits	1,000,000	700,000
Investments (market June 30, 1964, \$41,972,000)		
(Note 1) :		
Bonds	15,870,610	16,863,711
Preferred stocks	1,742,313	1,742,380
Common stocks	13,496,262	12,360,120
	<u>\$32,116,631</u>	<u>\$31,678,676</u>
Investment in bonds of The American Museum of Natural History Planetarium Authority, \$570,000 principal amount, at cost (Note 3)	<u>\$ 425,000</u>	<u>\$ 425,000</u>
Pension funds:		
Cash:		
Demand deposits	\$ 79,863	\$ 67,654
Time deposits	600,000	500,000
Investments, at cost (market June 30, 1964, \$9,096,000)		
Bonds	5,542,651	5,551,429
Preferred stocks	469,620	474,897
Common stocks	1,800,236	1,389,136
	<u>\$ 8,492,370</u>	<u>\$ 7,983,116</u>
	<u>\$42,919,433</u>	<u>\$42,069,541</u>

The accompanying notes are an integral part of these statements.

NATURAL HISTORY

30, 1964 and 1963

FUNDS AND LIABILITIES:		1964	1963
Current funds:			
General funds:			
Accounts payable and payroll taxes withheld	\$	87,348	\$ 110,938
Deferred income, principally unearned subscriptions		590,656	617,891
Advance from City of New York		150,000	
		<u>828,004</u>	<u>728,829</u>
Deficit		45,055	57,509
	\$	<u>782,949</u>	<u>\$ 671,320</u>
Special funds:			
Balances of funds received or appropriated for specific purposes	\$	1,102,483	\$ 1,311,429
	\$	<u>1,885,432</u>	<u>\$ 1,982,749</u>
Endowment funds:			
Endowment funds, income available for:			
Restricted purposes	\$14,015,008	\$13,786,580	
Unrestricted purposes	7,821,813	7,721,513	
Funds functioning as endowment, principal and income available for:			
Restricted purposes	2,478,448	2,446,812	
Unrestricted purposes (Note 2)	7,801,362	7,723,771	
	<u>\$32,116,631</u>	<u>\$31,678,676</u>	
Funds invested in bonds of The American Museum of Natural History Planetarium Authority	\$	<u>425,000</u>	<u>\$ 425,000</u>
Pension funds:			
Pension fund balance	\$	8,490,243	\$ 7,980,989
Welfare fund balance		2,127	2,127
	\$	<u>8,492,370</u>	<u>\$ 7,983,116</u>
	<u>\$42,919,433</u>	<u>\$42,069,541</u>	

The accompanying notes are an integral part of these statements.

GENERAL FUNDS
SUMMARY STATEMENTS OF CHANGES
for the years ended June 30, 1964 and 1963

	<i>1964</i>	<i>1963</i>
Deficit, beginning of year	\$ 57,509	\$ 94,376
Less, Transfer from unrestricted funds functioning as endowment	<u>57,509</u>	<u>94,376</u>
	<u>—</u>	<u>—</u>
Income:		
Appropriation from the City of New York	\$1,770,487	\$1,702,175
Endowment funds	1,215,513	1,190,722
Outside trusts and foundations	59,591	64,112
Gifts and grants	256,263	230,381
Other (Notes 2, 3 and 4)	466,870	504,821
	<u>\$3,768,724</u>	<u>\$3,692,211</u>
Expenses:		
General administration	\$ 592,347	\$ 679,700
Educational activities	1,537,441	1,472,596
Operation and maintenance of physical plant	1,346,938	1,280,794
Pension and other social benefits	337,053	316,630
	<u>\$3,813,779</u>	<u>\$3,749,720</u>
Deficit, end of year	<u>\$ 45,055</u>	<u>\$ 57,509</u>

The accompanying notes are an integral part of these statements.

SPECIAL FUNDS
SUMMARY STATEMENTS OF CHANGES
for the years ended June 30, 1964 and 1963

	<i>1964</i>	<i>1963</i>
Balance, beginning of year	<u>\$1,311,429</u>	<u>\$1,257,434</u>
Income:		
Endowment funds	\$ 232,541	\$ 222,583
Gifts and grants	940,130	801,581
Other	193,731	242,510
Transfer from endowment funds	46,530	36,000
	<u>\$1,412,932</u>	<u>\$1,302,674</u>
Expenditures for the special purposes and objects for which the funds were established	\$1,566,878	\$1,248,679
Transfer to endowment funds	55,000	
	<u>\$1,621,878</u>	<u>\$1,248,679</u>
Balance, end of year	<u>\$1,102,483</u>	<u>\$1,311,429</u>

The accompanying notes are an integral part of these statements.

ENDOWMENT FUNDS
SUMMARY STATEMENTS OF CHANGES
for the years ended June 30, 1964 and 1963

	<i>1964</i>	<i>1963</i>
Balance, beginning of year	<u>\$31,678,676</u>	<u>\$31,192,863</u>
Additions:		
Gifts, bequests, etc. (Note 2)	\$ 193,024	\$ 249,792
Net profit on sales of investments	399,911	484,590
Transfer from special funds	55,000	
	<u>\$ 647,935</u>	<u>\$ 734,382</u>
Deductions:		
Expenditures for:		
Custodian fee	\$ 5,000	\$ 5,000
Plant alteration and rehabilitation	83,400	70,693
Transfers to general funds:		
For payment of certain expenses (included in general funds, other income)	17,541	42,500
To dispose of operating deficit of preceding year	57,509	94,376
Transfer to special funds	46,530	36,000
	<u>\$ 209,980</u>	<u>\$ 248,569</u>
Net additions	<u>\$ 437,955</u>	<u>\$ 485,813</u>
Balance, end of year	<u>\$32,116,631</u>	<u>\$31,678,676</u>

The accompanying notes are an integral part of these statements.

PENSION FUNDS
SUMMARY STATEMENTS OF CHANGES
for the years ended June 30, 1964 and 1963

	<i>1964</i>	<i>1963</i>
Balance, beginning of year	<u>\$7,983,116</u>	<u>\$7,567,933</u>
Additions:		
Contributions of members	\$ 174,293	\$ 162,689
Contributions of Museum	208,436	194,452
Income from investments	355,494	334,137
Net profit on sales of investments	102,102	39,309
	<u>\$ 840,325</u>	<u>\$ 730,587</u>
Deductions:		
Payments to members and beneficiaries	\$ 325,518	\$ 310,450
Expenses	5,553	4,954
	<u>\$ 331,071</u>	<u>\$ 315,404</u>
Net additions	<u>\$ 509,254</u>	<u>\$ 415,183</u>
Balance, end of year	<u>\$8,492,370</u>	<u>\$7,983,116</u>

The accompanying notes are an integral part of these statements.

NOTES TO FINANCIAL STATEMENTS

1. The land, buildings and equipment utilized by the Museum are either owned by the City of New York or were charged off at the time of purchase and, therefore, are not reflected in the balance sheet. Land and buildings owned by the Museum are not significant in amount. No valuation of exhibits, collections, library, etc., has been established for balance sheet purposes.

Investments are recorded at cost in respect of those purchased, and in respect of those acquired by gift, bequest or otherwise, at market valuations at the dates of acquisition, probate court valuations or valuations established by the trustees.

2. The Museum owns an interest in certain mining properties acquired through a bequest. No valuation has been recorded on the books for the interest in these properties and, therefore, it is not reflected in the balance sheet. However, the Museum receives royalties from this source and such royalties are recorded, when received, as additions to unrestricted funds functioning as endowment (as bequests) or to current general funds. During the years ended in 1964 and 1963, royalties received amounted to \$55,292 and \$64,753, respectively, of which \$50,000 was credited to general funds (other income) in each year.
3. The Planetarium Authority is operated under the supervision of the Museum's management. Its financial statements and the auditors' opinion with respect thereto are annexed. Interest income received from the Planetarium amounted to \$25,650 in each of the years ended in 1964 and 1963. These amounts are included in other income of the general funds.
4. Other income of the general funds for the years ended in 1964 and 1963 includes net income from magazine and book shop operations of \$64,149 and \$89,563, respectively. Gross income from magazine and book shop operations amounted to \$1,073,192 and \$1,094,077 for the respective years.

LYBRAND, ROSS BROS. & MONTGOMERY
Certified Public Accountants

The Board of Trustees,
The American Museum of Natural History,
New York, N. Y.

We have examined the balance sheet of THE AMERICAN MUSEUM of NATURAL HISTORY as of June 30, 1964 and the related summary statements of changes in funds for the year then ended. Our examination was made in accordance with generally accepted auditing standards, and accordingly included such tests of the accounting records and such other auditing procedures as we considered necessary in the circumstances. We made a similar examination for the year ended June 30, 1963.

In our opinion, the accompanying balance sheets and related summary statements of changes in funds present fairly the financial position of The American Museum of Natural History at June 30, 1964 and 1963 and the results of its operations for the years then ended, on a consistent basis.

Lybrand, Ross Bros. & Montgomery

New York, August 17, 1964

**THE AMERICAN MUSEUM OF NATURAL HISTORY
PLANETARIUM AUTHORITY**

FINANCIAL STATEMENTS

FOR THE YEARS ENDED JUNE 30, 1964 AND 1963

**THE AMERICAN MUSEUM
PLANETARIUM
BALANCE SHEETS, June**

ASSETS:	1964	1963
Cash	\$ 49,036	\$ 85,195
Accounts receivable	1,888	1,169
Inventory, principally publications, at cost	24,020	23,444
	<u>\$ 74,944</u>	<u>\$109,808</u>
 Equipment, fixtures, etc. (Note 1) :		
Zeiss planetarium instrument, at cost	\$135,059	\$135,059
Less, Allowance for depreciation	30,385	23,632
	<u>104,674</u>	<u>111,427</u>
 Furniture, fixtures and equipment, at cost, less allowance for depreciation, \$139,526	 <u>1</u> 104,675	 <u>1</u> 111,428
Building, at cost (Note 1)	569,209	569,209
Land (donated by the City of New York)	<u>—</u>	<u>—</u>
	<u>\$673,884</u>	<u>\$680,637</u>
Prepaid insurance	<u>\$ 2,543</u>	<u>\$ 2,753</u>
	<u>\$751,371</u>	<u>\$793,198</u>

The accompanying notes are an integral part of these statements.

OF NATURAL HISTORY

AUTHORITY

30, 1964 and 1963

	1964	1963
LIABILITIES:		
Accounts payable	<u>\$ 2,612</u>	<u>\$ 1,265</u>
4½% Refunding Serial Revenue bonds, past due (Note 2)	<u>\$570,000</u>	<u>\$570,000</u>
Accrued interest, past due	<u>\$315,450</u>	<u>\$315,450</u>
	<u>\$888,062</u>	<u>\$886,715</u>

CONTRIBUTED CAPITAL AND DEFICIT:

Contributed capital:		
Charles Hayden	\$156,869	\$156,869
Charles Hayden Foundation	<u>250,925</u>	<u>250,925</u>
	407,794	407,794
Deficit, as annexed	<u>544,485</u>	<u>501,311</u>
	<u>\$136,691*</u>	<u>\$ 93,517*</u>
	<u>\$751,371</u>	<u>\$793,198</u>

* Denotes deduction.

The accompanying notes are an integral part of these statements.

STATEMENTS OF INCOME, EXPENSES AND DEFICIT

for the years ended June 30, 1964 and 1963

	1964	1963
Income:		
Admission fees, less allowances and commissions	\$357,585	\$374,687
Special lectures and courses	13,316	13,423
Miscellaneous	<u>3,837</u>	<u>4,357</u>
	374,738	392,467
Auxiliary activity, sales booth	79,038	81,131
Total	<u><u>\$453,776</u></u>	<u><u>\$473,598</u></u>
Expenses:		
Preparation, presentation and promotional:		
Salaries	\$160,201	\$155,680
Supplies and expenses	<u>30,981</u>	<u>30,827</u>
	<u>191,182</u>	<u>186,507</u>
Operation and maintenance:		
Salaries	104,042	99,430
Supplies and expenses	29,634	32,229
Renovating and refurbishing expenses	<u>39,729</u>	<u></u>
	<u>173,405</u>	<u>131,659</u>
Administrative and general:		
Salaries	7,500	7,500
Pension fund, social security and other employee benefits	24,735	24,050
Miscellaneous	<u>10,366</u>	<u>9,563</u>
	<u>42,601</u>	<u>41,113</u>
Auxiliary activity, sales booth	57,359	61,562
Total	<u><u>\$464,547</u></u>	<u><u>\$420,841</u></u>
Income (loss) before interest and depreciation	<u><u>(\$ 10,771)</u></u>	<u><u>\$ 52,757</u></u>
Interest on past-due 4½% Refunding Serial Revenue bonds	\$ 25,650	\$ 25,650
Provision for depreciation (Note 1)	<u>6,753</u>	<u>6,753</u>
Total interest and depreciation	<u>32,403</u>	<u>32,403</u>
Net income (loss) for year	<u>(43,174)</u>	<u>20,354</u>
Deficit, beginning of year	<u>501,311</u>	<u>521,665</u>
Deficit, end of year	<u><u>\$544,485</u></u>	<u><u>\$501,311</u></u>

The accompanying notes are an integral part of these statements.

NOTES TO FINANCIAL STATEMENTS

1. The Authority's corporate charter terminates when all its liabilities, including its bonds, have been paid in full or have otherwise been discharged. At that time, title to its personal property passes to The American Museum of Natural History and title to its real property passes to the City of New York to be maintained and operated in the same manner as other city property occupied by the Museum. It is the policy of the Authority to capitalize only major additions and replacements of equipment, machinery and other plant items and to provide for depreciation of such items over their anticipated useful lives. Fully depreciated assets are carried at the nominal value of \$1. Because of the nature of the ownership of the property, provision for depreciation of the building is considered unnecessary.
2. The Planetarium Authority bonds were purchased by The American Museum of Natural History in 1948. The Charles Hayden Foundation contributed \$200,000 to the Museum toward the purchase of such bonds.

LYBRAND, ROSS BROS. & MONTGOMERY
Certified Public Accounts

The Members of The American Musuem of
Natural History Planetarium Authority,
New York, N. Y.

We have examined the balance sheet of THE AMERICAN MUSEUM of NATURAL HISTORY PLANETARIUM AUTHORITY as of June 30, 1964 and the related statement of income, expenses and deficit for the year then ended. Our examination was made in accordance with generally accepted auditing standards, and accordingly included such tests of the accounting records and such other auditing procedures as we considered necessary in the circumstances. We made a similar examination for the year ended June 30, 1963.

In our opinion, the accompanying balance sheets and related statements of income, expenses and deficit present fairly the financial position of The American Museum of Natural History Planetarium Authority at June 30, 1964 and 1963 and the results of its operations for the years then ended, on a consistent basis.

Lybrand, Ross Bros. & Montgomery

New York, August 17, 1964.

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