



NINETY-SEVENTH ANNUAL REPORT
**THE AMERICAN MUSEUM
OF NATURAL HISTORY**
JULY, 1965, THROUGH JUNE, 1966



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THE CITY OF NEW YORK
1966

NINETY-SEVENTH 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*

Major changes are taking place at the Museum as we prepare to celebrate our one hundredth anniversary in 1969. This transformation involves almost the whole Museum: exhibition halls, research and teaching facilities, public cafeterias, storage areas, and service departments are being newly built, extensively reconstructed, or modernized.

The accomplishment of our objectives has necessarily resulted in a dislocation of many of our service areas and some inconvenience to our visitors. We regret the disappointment that is felt at times by individuals or groups who find that certain exhibits have been moved or are undergoing construction, and we appreciate the patience and understanding that our public has shown. We are certain that the end result—a newer, more beautiful, and more meaningful Museum—will make the temporary difficulties eminently worth while.

It is our sincere hope and our expectation that our centennial program will have broad implications for our public, our sponsors, our staff, and in fact for the whole scientific and educational community. I would like, therefore, to give you an interim report on this program in order that you may share the sense of progress that is felt here.

First, it should be pointed out that no important public program can be carried out successfully without help from many quarters. The American Museum of Natural History is fortunate in having

such help. We continue to have productive and harmonious relationships with the officials of the City of New York. We now welcome our new partners, Messrs. John V. Lindsay, Mayor; Mario A. Proccacino, Comptroller; Thomas P. F. Hoving, Commissioner of Parks; and Bernard E. Donovan, Superintendent of Schools, all *ex-officio* Trustees of our Museum. In addition to the valued aid we receive from the City of New York many government agencies, private foundations, our Trustees, our members, and countless individuals contribute generously and regularly to our efforts with their time and money, and we are most grateful for their support. Our Director, our scientific and educational staff, and all our employees deserve appreciation and recognition for their competent work.

The most extensive phase of our centennial planning involves our exhibition halls. Since the beginning of our expanded exhibition program in 1959, we have opened nine permanent halls, six special exhibitions, and eighteen temporary exhibits. By 1969, our centennial year, eight additional permanent halls that are now being developed will have been completed. They range in subject matter from a comprehensive study of life in the oceans to a view of the cultural patterns and social organization of the peoples of Africa and of the Pacific. Specifically, these are the halls of Indians of the Plains, the Biology of Invertebrates, Ocean Life, Biology of Fishes, Earth History, Man in Africa, Mexico and Central America, and Peoples of the Pacific.

The first of these halls scheduled for completion is the exhibition of Indians of the Plains, to be opened next year. This will be a companion to the highly effective Hall of Indians of the Eastern Woodlands, which was opened last spring.

Concurrent with this work is the progress being made on a major hall interpreting another scientific field, the biology of living invertebrates. Exhibits now in preparation will complete this hall and round out a comprehensive study of the origin of life and structure of the cell, and of the reproduction, growth, adaptations, and classification of living invertebrates. This hall is so complex in subject matter, and involves the work of so many departments,

that sections are being opened as they are completed, in order to make this important educational material available to students and teachers as quickly as possible.

The Hall of Ocean Life, the largest hall in the Museum, is a duplex construction of literally monumental proportions. A dramatic feature of this exhibition will be a breaching blue whale, 91 feet in length. The lower level of the hall will be rimmed by fifteen habitat groups depicting life in the sea. On the balcony will be an exhibition of the Biology of Fishes. More than four hundred individual models of fishes and marine mammals are being sculptured for this hall. With the rapidly growing interest in marine biology and the increased use of the resources of the oceans, we feel that this hall will add a timely and important dimension of interest.

Similarly, the increasing emphasis that our schools are placing on the study of the earth sciences makes it essential that we be prepared to meet the needs of this new generation of students. To this end we are building the new Lindsley Hall of Earth History. The Department of Fossil Invertebrates has primary responsibility for this exhibition, but the diffusion of subject matter and the wealth of material to be covered are such that members of the departments of Mineralogy, Micropaleontology, and Education are collaborating on this project. A generous gift from the John Lindsley Fund is making this exhibition possible.

The Hall of Man in Africa will also take its place as one of the great educational presentations of the Museum, as the visitor is given a continent-length view of the cultural life of the African peoples.

The Museum has long been known for its outstanding collections of the archeology of Mexico and Central America, the latter collection comprising the finest material from that region in any museum in North America. We are now renovating the Hall of Mexico and Central America in order to provide an appropriate setting for the important artifacts and relics that are exhibited.

The Hall of Peoples of the Pacific will replace two out-of-date exhibitions that have been closed for some time, the Hall of the Philippines and that of the South Seas. Exhibits will portray the

cultural and social organization of the people of the Philippines, Polynesia, Melanesia, Micronesia, and Australia.

The subject matter of each of these halls is different. Each represents a different region of the world and a different field of study. But common to all our exhibitions is the increasing emphasis we are placing on their educational effectiveness and the understanding of scientific concepts. Every new technique that can add to the teaching value of a display is used. Many such techniques have been and continue to be pioneered here.

Sound, animation, films, and various kinds of audio-visual aids are incorporated in the halls wherever it is felt that they can be used advantageously. Science, art, and technology are combined to assure the highest level of aesthetic and educational worth.

For a long time we have been in need of larger restaurants for the public. A new public cafeteria will be completed in 1967. It will be air-conditioned and equipped and decorated so as to provide comfortable dining in an attractive atmosphere. We have commissioned Ugo Mochi, a well-known artist, to make decorative panels in silhouette for this restaurant, depicting plant and animal life around the world.

On weekends and holidays this cafeteria will accommodate family groups and individuals. On weekdays it will be used by classes. Combined with our existing cafeterias this will give us far more flexibility and will more than double our capacity for food services to the public.

Important in the modernization of our plant are the extension and improvement of research facilities for the scientific staff.

During the past year the new laboratories, offices, library, and storage areas of the Department of Ichthyology were completed and now provide that department with the finest quarters in the Museum, setting a standard that we hope to achieve for all departments. A grant from the National Science Foundation and an award of funds from the Board of Trustees made this construction possible.

In last year's report I sorrowfully recorded the death of a close friend of the Museum, Mr. Childs Frick. Since then we have

learned from his heirs that he has left a generous bequest to the Museum to provide for the proper housing, care, and scientific study of the unequaled collection of fossil vertebrates of North America that he amassed during his lifetime, as well as the publication of scientific papers based on this material.

We are in the process of working out final arrangements with our Trustee Dr. Henry Clay Frick, his sisters, and their lawyers that will insure the preservation and appropriate use of Childs Frick's internationally famous collections. With the retirement of Dr. Harold E. Anthony, Curator Emeritus of Mammals, who was in charge of the Frick Laboratory, Dr. Malcolm C. McKenna of the Department of Vertebrate Paleontology has been appointed Frick Associate Curator to guide the scientific studies and curatorial work that will assure the most significant utilization of the Frick collections.

The Men's and Women's Committees of the Museum work devotedly and effectively each year to raise funds that are essential to the development and progress of our educational and scientific programs. Last year these committees again reached a new record, reporting gifts in the amount of \$290,000 from 2500 contributors. We extend our warm thanks to Messrs. L. F. Boker Doyle and Sidney S. Whalen, Jr., Co-chairmen of the Men's Committee, and to Mrs. Constantine Sidamon-Eristoff, Chairman of the Women's Committee, and her Assistant Chairmen, Mrs. Alfred Lee Loomis, Jr., and Mrs. Gilbert G. Browne, for their effective leadership. The Chairmen of both committees have agreed to continue for the coming year, and Mrs. Eristoff will be assisted this year by Mrs. Hart Fessenden and Mrs. Vincent de Roulet.

An important factor in the success of our educational and scientific programs is the continued stimulation of public interest. It is gratifying to report that membership in the Museum is proving a rich source of this stimulation, and during the past year our membership has increased appreciably.

We were deeply saddened by the death of Mrs. Ruth Hoe Sterling, the wife of one of our Honorary Trustees, Mr. Robert D. Sterling. During the past fifteen years of her association with the

Museum, Mrs. Sterling gave her enthusiastic support to many important programs and her sponsorship to some of the finest exhibitions in the Museum. She was known to many members of the Museum staff, and her encouragement and abiding interest will long be remembered by all.

We take pleasure in recording the addition of Mr. Richard Borden to our Board of Trustees and the election of Mrs. Richard Derby and Mr. Edgar M. Queeny as Honorary Trustees.

The American Museum of Natural History occupies a central position in the cultural and educational life of the city, and a key role in the learning and teaching of fundamental scientific principles. As we near the rounding out of our first century, we shall continue to bend all our efforts to the enhancement of our exhibitions and the enrichment of our educational services in the interest of advancing man's knowledge of the world in which we live.

Alexander M. White

REPORT OF THE DIRECTOR

The place and importance of basic scientific research in our society are being discussed with increasing frequency by scientists, educators, administrators, and representatives of government. Some of the questions that regularly arise concern the value of basic research as a goal in itself, the relationship of research to technology, the monetary priorities that should be awarded to the conduct of different types of research, and the relationship of basic research to the development and training of future scientists.

These questions are not only important to the pursuit of scientific effort but are also highly pertinent to our goals as a society and a nation. Many responsible individuals are therefore involved in the consideration of these questions and are re-evaluating the problems in relation to other areas of human welfare.

The American Museum of Natural History is known throughout the world for its unexcelled exhibitions and its role as an educational institution. What is less frequently recognized is the fact that the splendid displays and other educational presentations of the Museum are based on the research of generations of scientists. Today, the members of our distinguished scientific staff are deeply involved in research as well as in the development of our educational presentations. Most of the research being conducted comes under the heading of basic inquiry, that form of scientific endeavor about which there is a recurrence of misunderstanding and misgiving today.

During the Second World War our government was forced to recognize the importance of having a vast inventory of knowledge about the world in which we live. This knowledge, catalogued and filed in an orderly system, was readily available as needed to develop the technological tools required to win a global war. As the war came to an end, one of the great scientific leaders of this country, Dr. Vannevar Bush, stated that our wartime technological de-

velopments had all but exhausted the knowledge built up in the past through basic research and that, if the war had continued, we would have been virtually bankrupt scientifically.

As a result of the urgent recommendations made by Dr. Bush in his book "Science, the Endless Frontier" and of the statements by other responsible leaders, the Federal Government embarked on the most extensive program in support of basic scientific research ever undertaken. Well-informed persons have no doubts about the relationship between this increased production of knowledge and our increased well-being and greatly improved standard of living. Yet these lessons of the past are fading from our immediate sphere of urgency, and new matters hold our attention.

Thus we find that after 20 years of enlightened progress in all fields of science, the policies on which the support of science have been based are now being seriously questioned. Isolated attacks on the practicality of basic research have been voiced from time to time by pragmatically minded individuals. However, there is now a rising chorus of voices calling for the concentration of scientific talent on specific programs of applied investigation.

The failure to give adequate support and attention to programs of basic research can result only in the devitalization of all science. Basic research, directed toward obtaining new insights or developing workable hypotheses about a subject for the sole purpose of exploring the unknown, provides the store of knowledge that forms the base of any human progress. Such knowledge, developed only for the sake of "knowing," rather than for any practical implications or applications, has proved time and again to be a key to a greater understanding of life.

When Gregor Mendel reported the results of his experiments on sweet peas, which showed a pattern of inheritance of certain characteristics, the future implications of this great work were not even remotely anticipated. Today Mendel is considered the father of modern genetics. His discoveries, carefully recorded statistically, established the basis of one type of inheritance and paved the way for later studies that were to lead to knowledge of heredity in human beings. In fact, our knowledge of inheritance in man,

domestic animals, and economically important plants has been built on a foundation of knowledge obtained from basic research on the hereditary mechanisms of micro-organisms, fruit flies, moths, mice, and other animals.

At the present time, after centuries of investigation, we still have only a partial inventory of the living organisms of the earth and far from adequate data about many important characteristics of even the better-known animal and plant forms.

The scientists of our Museum are contributing substantially to the completion of that inventory and to our understanding of the world in which we live. Some members of our staff are studying the history of the earth and of the forms of life that existed in the past. Others are recording and interpreting the evolution, behavior, and interrelationships of living and extinct forms. Several are investigating potential causes for the extinction of species. One group is concerned solely with the study of man, in terms of both the past and the present, and is investigating his evolution, biology, social organization, and cultural patterns.

Directly applicable to the problems of the day are studies of peoples in the developing nations. The findings of these investigations are often of great value both to the new governments and to our own government in its international relations. At the Museum, the Department of Anthropology is making substantial contributions to the knowledge of social customs of groups in Africa, Australia, Europe, India, New Guinea, Indo-Malaysia, the Caribbean, and South America, as well as in the United States.

Many of the studies pursued by our staff come under the heading of systematic biology, a field that has often in the past been treated as a step-child, but which is now being developed along broad new lines and is receiving increasing recognition as the fundamental field of biology. Without accurate knowledge of the specific kind of organism one is working with—including an understanding of its evolution, behavior, distribution, relationships, and characteristics—no meaningful investigation can be conducted on that form. Thus modern systematics forms the basis for all other types of biological investigation, and the systematist, in turn, may make use of all forms of bio-

logical, biochemical, and biophysical data in drawing conclusions.

It is essential that all these lines of basic inquiry be pursued vigorously. The exploding demands of the human population are wiping out the record of life in the past. In many areas the fossils that comprise the history of life are in as much danger of being destroyed as are some of the present-day forms of life. The loss of already dead animals and plants may not be so serious as the extinction of living organisms, but it is a loss to our understanding of the evolutionary record.

The extermination of living forms is proceeding at an alarming rate, probably incalculable. Many people are concerned about the preservation of some of the larger or more unusual species, but, as Dr. Jerome G. Rozen, Jr., points out in the annual report of the Department of Entomology, some insects are as threatened with extinction today as is the whooping crane. Equally endangered are other kinds of life that have not attracted public attention. Yet many of these less-heralded species may bear more importance to man's welfare, or to the increase of man's knowledge, than those receiving special protection. Until we have more knowledge of the flora and fauna of the world, we cannot evaluate the significance of the loss of any single species.

The foregoing remarks have been addressed mainly to answering questions concerning the value of basic research as a goal in itself and its relationship to the applied areas of man's endeavors. The question of the monetary priorities that should be allocated to the support of basic research must be answered in terms of the need for both a continuously growing corpus of scientific knowledge and for the training of scientists. Since the Second World War two government agencies, the National Science Foundation and the Office of Naval Research, have been the major sources of support for basic research in a number of areas of biology, anthropology, and the earth sciences. Their support has resulted in the development of vigorous programs that are directly related to national goals. It is interesting to note that, for every dollar received from the Federal Government, the American Museum of Natural History spends two dollars from private sources for the support of its research programs.

The final question raised in the opening paragraph pertains to the relationship of basic research to the development and training of future scientists. This is a matter of tremendous importance, not only to the future of basic research but to all science and technology.

If basic research is to flourish, individuals must learn relevant techniques through the actual performance of such research in an environment compatible with the spirit of science, under the guidance of those who are committed to the advancement of science. Such training is important also to progress in applied fields and in technology. Dr. George B. Kistiakowsky of Harvard University made this observation in the report of the National Academy of Sciences on "Basic Research and National Goals": "On the basis of extensive personal experience and observations, I believe that education and research in basic science form the best base from which young scientists can develop their skills in applied work."

One of the primary causes of the increasingly serious shortage of qualified scientists available for basic research is the drain of these individuals to more highly paid positions in the applied fields of science. There is an ever-growing demand for scientists who have been trained in basic research to staff the vast programs of applied science of the Federal Government and of industry.

The American Museum of Natural History, since its founding in 1869, has been dedicated to education on all levels. From approximately the beginning of the present century the Museum has had formal training programs at the college and graduate levels. The present extent of this work is described in the reports of several of the departments, as is the record of achievement of individuals who have studied under the guidance of our scientific staff.

For the future, we are eager to see that our excellent staff and facilities are used as fully as is practical to advance our knowledge of the world in which we live and to insure an inspired, well-trained generation of scientists.

James A. Oliver, *Director*

REVIEW OF THE YEAR 1965–1966

The distinctions and honors bestowed upon our scientists by other organizations during this period include the following:

Dr. James A. Oliver, Director, was elected Vice President of the New York State Association of Museums and Chairman of the Cultural Institutions Group of New York City.

Dr. Joseph M. Chamberlain, Assistant Director, was elected a member of the Council of the American Association of Museums.

Department of Animal Behavior: Dr. T. C. Schneirla, Curator, was elected a Fellow of the Animal Behavior Society. Dr. William N. Tavolga, Research Associate, was elected President of the Chapter of Sigma Xi of the City College of New York.

Department of Anthropology: Dr. Margaret Mead, Curator of Ethnology, was selected as one of the 20 outstanding American women of the twentieth century by the Women's Advisory Council, New York. She also received the *Wisdom* Award of Honor.

Department of Entomology: Mr. Cyril F. dos Passos, Research Associate, was awarded the degree of Doctor of Science by Wittenberg College.

Department of Fossil Invertebrates: Dr. Norman D. Newell, Chairman and Curator, received the Hayden Medal and Memorial Award of the Academy of Natural Sciences of Philadelphia, for accumulative contributions in geology and paleontology.

Department of Herpetology: Mr. Charles M. Bogert, Chairman and Curator, was awarded the honorary degree of Doctor of Laws by his alma mater, the University of California at Los Angeles.

Department of Living Invertebrates: Dr. Horace W. Stunkard, Research Associate, who received his undergraduate training at Coe College, Cedar Rapids, Iowa, has been informed that his alma mater has established the "Horace W. Stunkard Merit Scholarship," and that the first award will be made in December, 1966.

Department of Mammalogy: Dr. Richard G. Van Gelder, Chairman and Associate Curator, was elected a Fellow of the New York

Zoological Society.

Department of Micropaleontology: Miss Angelina R. Messina, Associate Curator and Editor, received the AMITA Award for 1965 from the American Italian Women's Association.

Department of Ornithology: Dr. Robert Cushman Murphy, Lamont Curator Emeritus of Birds, was awarded the Explorers Club Medal.

Department of Vertebrate Paleontology: Dr. Edwin H. Colbert, Curator, was elected a member of the Council of Paläontologische Gesellschaft for 1966–1967.

A record of staff changes, including those that took effect July 1, 1966, follows.

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

Dr. Bobb Schaeffer was promoted from Curator to Chairman and Curator, Department of Vertebrate Paleontology.

Dr. William K. Emerson was promoted from Chairman and Associate Curator to Chairman and Curator, Department of Living Invertebrates.

Dr. Leonard J. Brass was appointed Curator Emeritus, Archbold Collections, Department of Mammalogy.

Dr. Pedro W. Wygodzinsky was promoted from Associate Curator to Curator, Department of Entomology.

Dr. Karl F. Koopman was promoted from Assistant Curator to Associate Curator, Department of Mammalogy.

Dr. Lester L. Short, Jr., was appointed Associate Curator, Department of Ornithology.

Dr. Malcolm C. McKenna was appointed Frick Associate Curator, Department of Vertebrate Paleontology.

Dr. Richard H. Tedford was appointed Associate Curator, Department of Vertebrate Paleontology.

Mr. Guy G. Musser was appointed Assistant Curator, Archbold Collections, Department of Mammalogy.

Mr. Ted Galusha was appointed Assistant Curator of the Frick Collections, Frick Laboratory.

Mr. Morris F. Skinner was appointed Assistant Curator of the

Frick Collections, Frick Laboratory.

Mr. Beryl E. Taylor was appointed Assistant Curator of the Frick Collections, Frick Laboratory.

Mr. Robert Stolberg was appointed Scientific Assistant, Department of Animal Behavior.

Miss Margaret R. Bullitt was appointed Scientific Assistant, Department of Ichthyology.

Miss Susan T. Koelle was appointed Scientific Assistant, Department of Vertebrate Paleontology.

Mrs. Shirley M. Skinner was appointed Scientific Assistant of the Frick Collections, Frick Laboratory.

Mr. Raymond J. Gooris was appointed Scientific Assistant of the Frick Collections, Frick Laboratory.

Mr. George Krochak was appointed Scientific Assistant of the Frick Collections, Frick Laboratory.

Mrs. Bessie M. Hecht was appointed Administrative Associate, Department of Animal Behavior.

Dr. Asher E. Treat was appointed Research Associate, Department of Entomology.

Dr. Harold L. Cousminer was appointed Research Associate, Department of Micropaleontology.

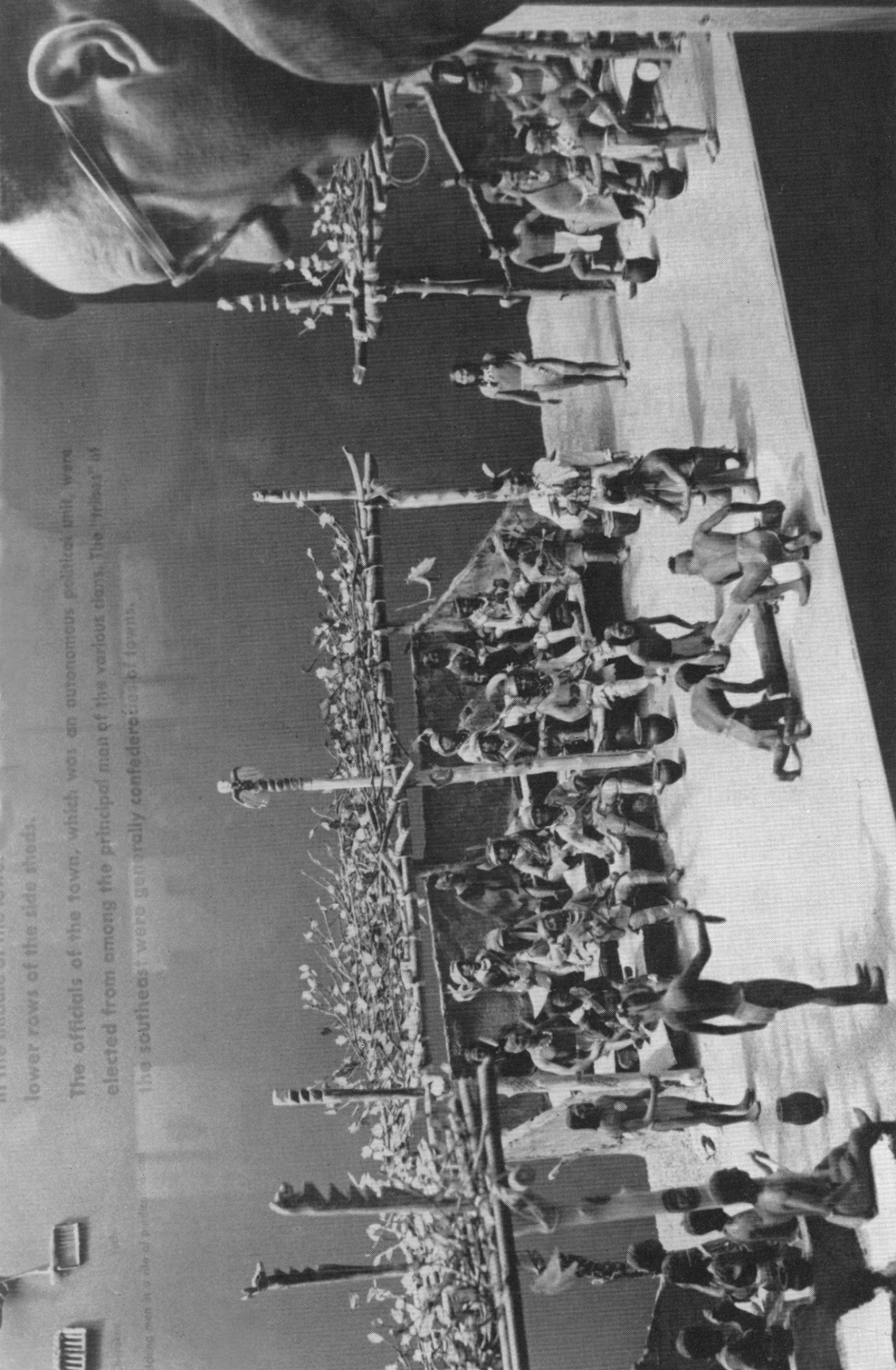
Mrs. Ronald Keith was appointed Associate, Department of Herpetology.

Mr. Ranil Senanayake was appointed Field Associate, Department of Herpetology.

Dr. David Jacobs was appointed Research Fellow, Department of Animal Behavior.

The rite of the Green Corn Dance is depicted in one of the delicately modeled exhibits in the new Hall of the Indians of the Eastern Woodlands. Ceremonial music is played in the background. Dr. Stanley A. Freed, of the Department of Anthropology, who supervised the construction of the hall, surveys the miniature scene.

Photograph: Morris Warman



lower rows of the side sheds.

The officials of the town, which was an autonomous political unit, were elected from among the principal men of the various clans. The "highest" of the southeast were generally confederates of towns.

Dr. Stanley Pierce was appointed Research Fellow, Department of Micropaleontology.

In the Department of Exhibition and Graphic Arts, Mr. Robert G. Bryant was appointed Assistant Manager of Graphic Arts.

In the Library, Mr. J. Frederick North was appointed Senior Librarian, Acquisitions.

In the office of Publications, Mr. James K. Page, Jr., was appointed Editorial Director of the Natural History Press. Mr. Thomas S. Childs, Jr., was appointed Associate Editor of the Natural History Press Book Program.

In the Business and Service Offices, Mrs. Marion B. Carr was appointed Keeper of Memorabilia. Mr. Joseph F. Roche was appointed Purchasing Agent.

Dr. Sune Engelbrektson resigned as Chairman, Department of Education. Dr. Fred C. Hess resigned as Associate Astronomer, Department of Astronomy and the American Museum-Hayden Planetarium. Miss Katharine Beneker resigned as Assistant to the Chairman and Keeper of Memorabilia, Department of Exhibition and Graphic Arts. Mrs. Helene J. Jordan resigned as Executive Editor of *Natural History* magazine. Miss Barbara Kate Swift resigned as Assistant Manager, Office of Public Relations.

Mr. William F. Mussig retired as Purchasing Agent, Business and Service Offices.

We were deeply saddened by the deaths of two members of the staff of the Department of Entomology. Dr. Herbert Ruckes died on December 23, 1965, at the age of 70. Dr. Nicholas S. Obraztsov died on May 6, 1966. Both men were highly productive Research Associates of the department during a long period and rendered distinguished service to the Museum and to science.

DEPARTMENT OF ANIMAL BEHAVIOR

In view of the continuing emphasis on the training of future scientists in this country, it is of interest that the Department of Animal Behavior is actively engaged in a master-apprentice system of advanced education for scientific research. Student participation in the scientific activities of the department has been increasing steadily during the past several years. Students at different levels of development—high school, undergraduate, graduate, and post-graduate—are assisting in many research projects or are carrying out projects on their own initiative. The personal attention that our staff has given these students is especially noteworthy today, when bulging enrollments in colleges have increased the student-to-faculty ratio to the point where professors are unable to give students the individual attention that is so critical an ingredient in the training of scientists.

In recent years formal programs in graduate studies have been established cooperatively with New York University and the City University, through which students take courses at their respective universities while conducting research for their master's and doctoral dissertations in the animal behavior laboratories of the Museum. Less formal arrangements are in effect with several other academic institutions. Students have participated in virtually all the research projects carried out during the year. The department has two post-doctoral trainees, ten graduate students, 29 undergraduate students, and eight high school pupils. Most of the college undergraduates were participants in the Undergraduate Research Participation Program of the Museum, which is administered by Dr. Evelyn Shaw and Mrs. Bessie M. Hecht. This program is supported by the National Science Foundation.

In a project supervised by Dr. Lester R. Aronson, six undergraduates worked with Mrs. Harriett Kaplan, a graduate student at New York University, in an investigation of the function of the fore-brain of fishes through studies of learning processes. Because it was

a primitive forebrain such as that in fishes which gave rise to the cerebral cortex of mammals, knowledge of the neural organization of the forebrain of these lower vertebrates is important for our understanding of the evolution of the cortex. In the human brain the cerebral cortex of the forebrain is responsible for higher mental processes, but in fishes the forebrain appears to function as an arousal, energizing mechanism, making the fishes fully responsive to external stimulation. Through the employment of avoidance conditioning techniques, two main experimental phases have been carried out. The fish learned to associate sound with electric shock (a 500-cycle hum), and subsequently they avoided the area of shock when the sound was turned on.

In the first experimental procedures the fish were trained to avoid the shock and then the forebrain was removed, and in the second, the forebrain was removed first and then the fish were trained to avoid the shock. In those fish that were trained first and then operated on, the ability to avoid the shock diminished, whereas the fish that were first operated on and then trained avoided the shock only after very long periods of training and, even then, only irregularly.

Four undergraduates and two graduates participated in Dr. Aronson's project on mating behavior in cats. That program, a continuing one, has been concerned chiefly with the interplay of several factors on behavior, namely, hormones, the nervous system, and the influence of individual experiences. Among male cats after desensitization of a specific penial nerve, positional disorientation in relation to the female occurs during sexual contact. Whereas normal males are ready to mate at any time of the year, these desensitized and disorientated males develop distinct seasonal cycles in sexual arousal reminiscent of their wild ancestry. This cyclical phenomenon is followed over a period of several years with a gradual depression of all sexual activity.

Dr. Theodore C. Schneirla, assisted by several graduate students, is expanding his comparative studies of doryline (army) ants. He has found that an Old World genus, *Aenictus*, has the simplest and most primitive pattern of organization in its preda-

tory and migratory functions. His studies indicate that two genera found in the New World, *Eciton* and *Neivamyrmex*, have more specialized patterns in the same activities.

Mr. Howard Topoff, a graduate student working with Dr. Schneirla, is studying oxygen consumption as a barometer of physiological activity in worker ants. He has discovered evidence that at the onset of migratory activity the workers of *Neivamyrmex* increase the consumption of oxygen and that this process is reversed when they enter a quiescent period.

It is well established that visual attraction is the primary cohesive and orienting force in schooling fish. Dr. Evelyn Shaw is attempting to elucidate the biological basis of this phenomenon by studying the reaction of fish to moving black and white vertical stripes. In past experiments she has demonstrated not only that young schooling fish move in response to the moving stripes, but also that they tend to swim ahead of the pattern. Results of a new study by Dr. Shaw and five undergraduate assistants show that young fish of non-schooling species also respond to moving patterns, but this response diminishes as the non-schooling individuals grow older. These facts correlate with the observation that the fry of many so-called non-schooling species do school, but disperse as they grow older. In another study of the function of the lateral line system in schooling behavior, a cinematographic technique was developed whereby it is possible to study changes in sensory receptors of this system while the fish swim freely. This technique makes possible analysis of sensory function in conjunction with unhampered behavior.

Dr. William N. Tavolga is extending his researches into the ability of fish to discriminate sounds at different frequencies and different intensities. For several years he has studied hearing in marine fishes. Turning now to fresh-water fishes, he has found that goldfish can discriminate differences of two or three per cent in frequency, a discriminator equal to a half-tone on the musical scale. Goldfish can also detect differences in intensity of four or five decibels. These findings are significant, because the goldfish has no cochlea, the seat of pitch discrimination in the human inner

ear, and therefore must use a mechanism which is totally different from that of mammals to discriminate between sound frequencies.

Dr. Ethel Tobach, aided by four undergraduates, continues her research into the mathematical analysis of behavioral activity. Using the computer at the Courant Institute of Mathematics, New York University, she has developed a program which permits flexibility in statistical analyses so that many experimental variables can be incorporated into a single experiment. Data derived from previous studies on the effects of early environment on later behavior in the rat are being processed in the computer. The results show that animals reared in an unstable environment appear not to be disturbed by changes in the environment which would affect animals reared in a stable environment. This lack of response in the former case could be maladaptive if such an animal were placed in a strange and hazardous situation.

Dr. Helmut E. Adler, with five student assistants, has employed a computer to simulate certain aspects of bird orientation and navigation. The success of migrating birds in reaching their goals has provoked considerable theoretical explanation and experimental study. On close analysis it is found that orientation need not be perfect. In fact, through computer analysis Dr. Adler has shown that even completely random movement will bring a model bird to its "goal" if given sufficient time. With just a very slight degree of orientation, the chances for reaching a "goal" are considerably enhanced. It now seems probable, from the computations, that migrating birds need not maintain a direct course toward their goal. Even with a crude navigational system and considerable deviation from the correct course, the migrators should be able to reach their summer or winter quarters.

Dr. Adler is continuing his studies on diurnal rhythms in birds, and also on their ability to judge the position and movement of celestial objects, by use of a sky simulator which he developed.

Dr. Benjamin B. Kamrin, assisted by two undergraduate students, has initiated a challenging study of the relation of the immune mechanism to behavior. Individuals are said to be allergic or hyperimmune when they are very sensitive to foreign proteins.

Conversely, individuals that do not react at all to foreign protein substances are described as hypoimmune. Using chicks made hypoimmune by a technique known as egg parabiosis, Dr. Kamrin found that they were behaviorally different from normal chicks in that they had a greater tendency to follow moving objects and a greater tendency to escape from a confining area.

Field studies were carried out during the year by Dr. Schneirla, who investigated army ants in Panama; by Dr. Shaw, who studied schooling fish in eastern Long Island; by Dr. Tobach, who observed and collected sea hares in California; and by Dr. Tavalga, who studied sound production in fishes in Florida.

A Symposium on Marine Bio-Acoustics organized by Dr. Tavalga brought together more than 160 scientists, engineers, and students from many parts of the world who discussed, over a period of three days, a variety of theoretical and technical problems. The conference was sponsored by the Museum and the United States Naval Training Device Center.

Departmental research investigations were aided by grants from the National Science Foundation, the National Institutes of Health, the Office of Naval Research, and the Frank M. Chapman Memorial Fund of the Museum.

The expanded research of the staff has been helped greatly by the student-scientist symbiosis, and the department hopes to continue to encourage students and have them join in the many facets of research in animal behavior.

Lester R. Aronson, *Chairman*

DEPARTMENT OF ANTHROPOLOGY

Anthropology deals with conditions both as they exist now and as they existed many years ago. A characteristic of these conditions is change—a continuing, inexorable change that forces the anthropologist to observe and record as much as possible immediately, knowing that in two years, or even two days, the situation may have altered irretrievably. The Department of Anthropology, with proj-

ects and interests in many parts of the world and in many periods of history and prehistory, reacts to this pressure and takes advantage of the changes it encounters. A famine in Africa exposes Dr. Colin M. Turnbull to previously unsuspected behavior on the part of the tribesmen. Construction of a highway in Peru prompts Dr. Junius B. Bird to suggest that preservation be made of a site, in the path of the highway, containing rich artifacts from a period just after the Spanish conquest. The increasing population in India presents Dr. Harry L. Shapiro with an opportunity to study the effect of crowding and tensions on the biology of human beings.

Although anthropologists, when they are in the field, cannot make time stand still, at home they can have the satisfaction of communicating to Museum visitors a representation of the culture of a society as it has existed during a given period. Such a representation was made brilliantly during the past year in the Hall of the Indians of the Eastern Woodlands, which was developed under the direction of Dr. Stanley A. Freed. The success of the hall owes much to the technique of showing the objects on display in use in their original setting. These exhibits, shown without distracting detail or lengthy written captions, have proved enormously effective in explaining the object and its place in the life of the people who used it.

The research program of the department is notable in many respects. It reflects an increasing cooperation with other institutions in many regions, both at home and abroad. It is characterized by a wide geographical distribution and a broad spectrum of subject. Further, the scope has been combined with a high degree of pioneering and fundamental research. For example, Dr. Robert L. Carneiro's work on cultural evolution is breaking new ground and

A mural for the Hall of Man in Africa is executed by Mr. Robert W. Kane of the Department of Exhibition. The mural depicts two aspects of ancient Egyptian life: religion and agriculture.

Photograph: The New York Times (Sam Falk)



promises to provide an important conceptualization of cultural dynamics. Dr. Turnbull's study of hunting and gathering economies has already attracted considerable attention. Dr. Richard A. Gould's project is still another example of a promising new approach to the enrichment of archeological techniques. His study of "living archeology" represents an attempt to understand more fully what can be deduced from archeological remains. He is approaching this by studying a living culture in terms of the archeology of the ancestors. Or, to put it another way, he is analyzing an archeological culture on the basis of a living culture of the same type. In the same vein Dr. Margaret Mead's work in New Guinea has already provided new insights into cultural mechanisms, and Dr. Shapiro's work in India may well open up new fields in human biology.

Dr. Turnbull's research in Uganda deals with a little-known mountain tribe, the Tueso or Ik of northern Karamoja. He left New York in May, 1965, came back for a brief visit in April, 1966, to participate in the Wenner-Gren conference on "Man the Hunter," and returned to Africa later that month. In order to study the Ik, who live in the mountains above the Uganda-Kenya border, Dr. Turnbull made his headquarters in a mud hut in a village near Pirre. It was a time of severe drought, which had destroyed the crops of the Ik and the prospects for planting in the coming season. During his visit, northern Uganda was invaded by the Turkana from Kenya, who, also being in need of food, took over the grazing lands in one of the two major centers of Ik habitation. Dr. Turnbull was able to record excellent information on the intertribal economic and political relationships. In his studies of the Ik, he observed that the hardier tribesmen were able to find food, but that the very young and the old went hungry and sometimes starved to death. The relatives of the starving were indifferent to their plight. He found that, although basic family structures exist, a lack of concern and affection for parents, children, and mates makes the relationships of the Ik different from those he has observed in any culture. The Ik are also distinctive because of their language. Dr. Turnbull outlined the Ik vocabulary and determined the basic grammatical pattern of the tongue, which is

utterly unknown to any of the neighboring tribes and also unlike any African language with which Dr. Turnbull is familiar. He sees in it a possible linguistic connection with the Bushmen, whom the Ik somewhat resemble physically.

In his other studies of the peoples of east Africa, Dr. Turnbull took still and motion pictures of BaKiga smelters and smiths of Kigegi demonstrating their processes and made language recordings among three tribes of Karamoja. He expects to complete his investigations in the late summer or early fall of 1966.

Dr. Shapiro made two visits to Calcutta, where his pioneering study on the relation between the crowding and tensions brought by urbanization and the biological development of human populations is being carried out. He submitted a research program to his host, the Indian Statistical Institute. He has selected his research site and organized and trained a field staff for the study. Another project continued by Dr. Shapiro during the year was the making of arrangements for a study of Geel, Belgium, a town that is famous for its care of the mentally ill. The Geel study will be sponsored by the Medical School of the University of Louvain, Belgium; the Psychiatric Institute of Columbia University College of Physicians and Surgeons, New York; and the Department of Anthropology of the Museum.

During the past year, Dr. Bird continued his studies of South American prehistory. His review and analysis of artifacts that have been interpreted erroneously as evidence of man's presence in South America possibly 30,000 years ago was published, and he continued the preparation of a monograph devoted to the period of coastal occupation in Peru between 2500 and 350 B.C. His work in this field has already had a profound influence on interpretations of Peruvian archeology.

On a recent trip to Peru, Dr. Bird studied collections, planned future work, and collected botanical material needed for identification of archeological specimens. In the course of the trip he obtained data on comparative material, some of which has been dated by radiocarbon at about 3700 B.C. Dr. Bird visited the Inca citadel at Machu Picchu, the sites of Puruchuco and Pachacamac

near Lima, Trujillo, the Huaca Prieta site in the Chicama Valley, and an area south of Pirua on the Hacienda Vicus. It is at the Huaca Prieta site that highway construction is to take place, and Dr. Bird has suggested that the highly productive deposits be saved by having the area declared a national monument.

The principal research interest of Dr. Gordon F. Ekholm during the past year has been the accumulation of data for a paper on the scroll-motif in early China and Mesoamerica. The purpose of the study is an attempt to document the thesis that early contact probably existed between China and Mesoamerica.

Dr. Mead has been associated with a number of research projects in the past twelve months. A four-year program on the cultural structure of imagery, which involves a comparative study of the people of Montserrat, the West Indies, with the Manus and Iatmul peoples of New Guinea, is now in its second year. The project, sponsored by the Museum and the National Science Foundation, is the first complete, comparative, areal study involving work in linguistics, kinship, technology, and psychological testing. Materials range in depth of time from thirteen years to 38 years and include data collected by Dr. Mead, Dr. Rhoda Metraux, Prof. Gregory Bateson, and the late Dr. E. Thomas Gilliard and Mrs. Gilliard.

Dr. Mead's field study of cultural systematics in New Guinea, on which she is working with Dr. Theodore Schwartz and Dr. Lola Schwartz, entered its fourth year. Her trips to the Admiralty Islands in 1964 and 1965 have made it possible to round out the record of political change that began among the Manus people in 1946. The earlier investigations were reported by Dr. Mead as "New Lives for Old" and by Dr. Schwartz as "The Paliau Movement in the Admiralty Islands, 1946-1954" in Volume 49, Part 2 of the *Anthropological Papers of the American Museum of Natural History*, published in 1962.

In another project in New Guinea for which Dr. Mead served as principal investigator, Dr. Schwartz and Mrs. Barbara Honeyman Heath collaborated on a photographic somato-typing study as part of an investigation of the growth and processes in the Manus.

The research is being carried out in cooperation with the Institute

of Child Health, Department of Growth and Development, University of London. A serological study of the representatives of 150 sibship groups was conducted in Peri village in the Admiralty Islands with the cooperation of Dr. V. Zigas of the Papua-New Guinea medical service and Dr. Carleton Gajdusek, United States National Institute of Neurological Diseases and Blindness, and the University of Melbourne.

Dr. Carneiro continued his work on the application of scale analysis to cultural evolution to determine whether there is a regular sequence in the evolution of certain cultural traits by various societies. He began a study of the relationships between population size and social organizations. Dr. Carneiro's manuscript for a book, "Seven Tribes of Lowland South America," is in progress.

The research of Dr. Freed was divided between North American Indians and village India. He published two papers on role behavior among American Indians and has completed a manuscript on India.

An extensive field trip has been undertaken by Dr. Gould, who is making an archeological and ethnographic field study of the ecology of aborigines of the Gibson Desert, Western Australia. He has selected for study a small cave some 290 miles north of Perth which seems to represent a single cultural occupation marked by the presence of distinctive microlith-like tools. The site is shallow but undisturbed. Dr. Gould has also examined a rock alignment along the west shore of Lake Moore near which archeological sites may be found.

A study of the isolation of the Basque people is being made by Dr. Morton H. Levine, Ogden Mills Fellow for 1963-1964, under a grant from the National Science Foundation administered by the American Museum. Dr. Levine has selected two villages for his research, one in which the inhabitants have frequent contacts with non-Basques and the other in which the population rarely does. In his wide-ranging investigation, he has solicited data from 300 households in both villages, gathered information from qualified informants, and collected blood samples, measurements, photographs, and medical histories.

Mr. Gary S. Vescelius, a Peruvian archeologist, was appointed Ogden Mills Fellow for 1965–1966. He is preparing a monograph on the prehistory of the Department of Ancash, Peru, a summary of the results of his field work in that area, and re-interpreting the data obtained by previous investigators.

The collections of the department were enriched by 67 accessions in the past year, including 53 gifts and ten purchases. Outstanding new items are a bronze group from Tibet, a jeweled inlay plaque from Nepal, and a carved club from the Cook Collection, Tonga.

Harry L. Shapiro, *Chairman*

DEPARTMENT OF ASTRONOMY AND THE AMERICAN MUSEUM—HAYDEN PLANETARIUM

An important function of the Planetarium is its service as an authoritative center of accurate astronomical information in the New York community. On three occasions this year, each lasting for several days, the time, experience, and knowledge of the entire staff were devoted almost entirely to providing information and commentary to the public and to the news media on astronomical events of widespread public interest.

The first of these occasions was the sudden appearance of the comet Ikeya-Seki in October, 1965; the second was the bright fireball that streaked across the sky of the eastern part of the United States on April 25, 1966; the third was the successful flight and landing on the moon of Surveyor I in June, 1966. In each case, every available member of the staff was called upon to explain, describe, or comment on the event—by telephone, by letter, and in newspaper, radio, and television interviews. More than 2400 telephone calls of inquiry about Ikeya-Seki were recorded on one day alone.

Informational services dealing with other astronomical matters of a less spectacular nature were also performed throughout the year in increased volume over previous years. The extension of

this function of the Planetarium has been made possible by the initiation and continuation of several activities designed to provide service on a regular basis without serious disruption of the other programs of the institution. Among these activities are Dial-A-Satellite, a telephone answering service supplying daily information about the appearance of artificial satellites and other interesting sky phenomena over the New York metropolitan area, and the Sky Reporter radio service, in which two-minute taped recordings on current astronomical subjects are prepared and distributed weekly for broadcast by 26 radio stations in metropolitan New York and nearby New Jersey and Connecticut.

The enhanced reputation of the Planetarium as the primary source of astronomical information in the New York area undoubtedly contributed to the increase this year in the number of visitors. Attendance at the sky presentation in the Theater of the Stars exceeded the annual average of the past decade, a figure that includes the peaks in attendance following the opening of the space age ten years ago.

Participation in Planetarium courses established a new record with a total registration of 1210 people, an increase of ten per cent over the total registration in the preceding year. Twenty-one courses were presented, eight of them offered in two or more terms. New offerings included a series of summer evening lectures on life beyond the earth; several in-service courses for secondary school teachers of earth science, financed by the New York State Department of Education; and a spring series of lectures on how to use a telescope. The State Department of Education also provided funds for two other programs for secondary school teachers: a workshop in astronomy and an in-service course in astronomy and meteorology. The summer institute in astronomy for high school students and the in-service institute in astronomy for elementary school teachers were offered again with continued support from the National Science Foundation.

The program of research in radio astronomy conducted at the Kalbfleisch Field Research Station was interrupted for a period of four months by the breakdown and necessary repair of key

equipment. However, records of radio bursts from Jupiter acquired on two channels for the purpose of recording right-hand and left-hand circular polarization provided valuable training experience for two students in the National Science Foundation Undergraduate Research Participation Program who assisted in the radio astronomy work during the summer. One student designed in great detail a unique polarization analyzing interferometer which shows exceptional promise; the other designed and nearly completed the construction of a device for providing calibration marks on the records. This research was directed by Dr. Kenneth L. Franklin.

In other research activities, Dr. Nicholson participated in the design, evaluation, and testing of a hand-held space sextant for use in the Gemini manned space flight program and, depending on the success of the instrument, for eventual use as part of the navigation system in the Apollo manned lunar excursion program.

Plans were completed during the year for a new hall of weather exhibits and for the installation of modern, colorful, temporary exhibition cases that were made available without cost by New York World's Fair exhibitors.

Thomas D. Nicholson, *Chairman*

DEPARTMENT OF ENTOMOLOGY

Bees, scorpions, spiders, moths, and black flies are among the insects and arachnids that continue to offer interesting opportunities for research to scientists in the Department of Entomology. Most of the basic research and field work of the staff is supported by grants from the National Science Foundation.

The unraveling of the threads of relationships among the higher bees is the research task to which Dr. Jerome G. Rozen, Jr., devotes his attention. Either during the Cretaceous period or shortly afterward, bees evolved from sphecoid wasps. Their appearance was related closely to the ascendancy of the angiosperm flowering plants on which bees are completely dependent for food. In the ensuing 100 million years bees inhabited almost all parts of the

world and underwent extensive evolutionary radiation. From the more primitive solitary bees, social bees arose hundreds of times, and cuckoo or parasitic bees evolved a score of times. It is no wonder that the phylogenetic lineages of many of the families, sub-families, and tribes of bees are obscure.

During the year, Dr. Rozen published a paper on the larvae of the Anthophoridae, one of the largest families of bees. Another paper which is in press is the result of Dr. Rozen's study of the pupae of the Andrenidae, which he undertook with the assistance of Miss Karen Yager, a student in the National Science Foundation Undergraduate Research Participation Program.

The research of Dr. Willis J. Gertsch reflects his broad interest in the biology and systematics of the class Arachnida, which includes a large assemblage of animals of marked economic and medical importance, among them scorpions, black widow spiders, and tarantulas. He has had a paper accepted for publication on the scorpions of our southwestern deserts. Other studies by Dr. Gertsch concern the genus *Loxosceles*, which continues to hold the attention of physicians and venomologists because of the increasing number of records of necrotic bites in the southern and western areas of the United States. In South America, *Loxosceles laeta* is a particularly dangerous species, with numerous records of necrotic symptoms, particularly in Ecuador, Peru, and Chile. In these areas, it is frequently associated with neurotoxic and haemotoxic symptoms, resulting in death in about ten per cent of the cases.

Dr. Gertsch is also investigating the systematics and phylogeny of the cave spiders. The cave habitat is a microcosm of uniformity where high humidity and equable temperatures rule the lives of those animals trapped within its limits. So strictly limited are the cave spiders to their habitat that each cave or cave system is a dead-end laboratory in which the processes of evolution can be timed and observed. Often blind and long-legged, cave spiders are derived from quite separate family groups.

Dr. Frederick H. Rindge is continuing his studies on the Geometridae, one of the largest families of moths. Found throughout the world, these moths range in size from very small to several inches

in breadth of wings. The caterpillars of these moths are called inchworms, or loopers, and are often serious pests of fruit trees, forest trees, and shrubs. Another economic pest being investigated by Dr. Rindge is a species of *Anacamptodes*, which was introduced recently into Hawaii. In a paper he has submitted for publication, Dr. Rindge names nine new species and three new subspecies of this genus.

A rarely studied insect that is extremely close to the hypothetical ancestors of the true bugs is one of the research projects of Dr. Pedro W. Wygodzinsky. Use of the compound microscope has enabled Dr. Wygodzinsky to find sets of hitherto unused characters among the Enicocephalidae, mostly in the arrangement of the hairs on the legs and wings. These features are expected to place the taxonomy of this group on a sounder basis.

The Nearctic Crambinae, a group of small moths, including many of great economic importance, are being studied by Dr. Alexander B. Klots. In preparation for a monograph, Dr. Klots has visited all the major European museums, has seen virtually every type that is available, and has borrowed all the pertinent material to make this study complete.

Dr. Kumar Krishna, in addition to carrying on an active research program, is responsible for the care and study of the termite collection, which was acquired as a gift from Dr. Alfred E. Emerson in 1964. This is the largest, most complete, and most important termite collection in the world. The formidable task of curating this material, all of it in liquid preservative, and making it available to reputable scholars is a continuing obligation.

The leaf beetles of the family Chrysomelidae and the beetle fauna of Peru and Chile are among the research subjects of Mr. John C. Pallister. Mr. Cyril F. dos Passos has turned to other studies of North American butterflies since the publications of his check list of North American Rhopalocera, which has become a standard for classification of these Lepidoptera. A revision of the weevil genus *Metamasius* is the present project of Mrs. Patricia Vaurie. Mr. Wilton Ivie spends most of his time on systematic studies of the spider family Linyphiidae. The linyphiids, an important group

of northern spiders, are noted for ballooning activities in which they send out silken threads and fly through the air in tremendous numbers.

The field work of the department is an integral part of the research program. The assembling of large lots of significant material and relevant biological information is a principal step toward the preparation of complete and meaningful taxonomic studies. Field acquaintance with research subjects often contributes critical data to specific projects. In a rapidly changing world, in which man is appropriating, modifying, and despoiling more and more of the natural community for his own purpose, it is imperative to secure the basic material from threatened areas. Destruction of a habitat may mean total elimination of a species, and some insects and spiders are quite as vulnerable as the whooping cranes.

Field trips to Trinidad and the Southwestern Research Station at Portal, Arizona, have provided Dr. Rozen with a wealth of new material and biological information on the lives and habits of bees. Dr. Gertsch collected some 7500 specimens of spiders and scorpions in Arizona, New Mexico, and Mexico. Dr. Rindge, using a portable generator with both ultraviolet and fluorescent lights, was very successful in collecting moths at night in the Rocky Mountains. He has now built up the best representative collection of this group from the Rocky Mountain area. His latest trip produced 16,460 specimens, 13,426 of them Lepidoptera, of which 5795 were geometrid moths. A far-ranging field trip by Mr. Wilton Ivie resulted in the collection of nearly 20,000 spiders, together with thousands of specimens of other orders.

The department is the repository of one of the largest collections of insects and arachnids in the world. Some of the material is unexcelled because of the species represented, the number of specimens, and the wealth of type material. Last year, 146,358 specimens were added by field work, by bequest, and by purchase. Two important acquisitions are a collection of 9500 tenebrionid beetles from South America received through the generosity of Dr. David Rockefeller, and 12,546 butterflies and moths from Spain and northern Europe which were obtained during the year

from Señora Marianna de Ibarra.

The tempo of work for the Hall of Biology of Invertebrates, an important area of departmental responsibility, has increased during the past year. Dr. Rozen is chairman of the committee on the hall and has worked with members of the departments of Living Invertebrates, Animal Behavior, and Exhibition on the development of this complex exhibition. An exhibit on the mechanisms of evolution developed by Dr. Rozen and Miss Alice Gray was opened in March. The exhibit on classification is being designed, and the scientific scripts for the alcove on "Invertebrates and Man" have been written by Miss Gray, Dr. Gertsch, and Dr. Wygodzinsky.

The Department of Entomology was saddened by the sudden and unexpected deaths of two of its most active Research Associates, Dr. Herbert Ruckes and Dr. Nicholas S. Obraztsov. Both were closely identified with the department for many years and rendered distinguished service in fields in which they had gained international recognition. Dr. Ruckes, a Research Associate since 1953, was interested largely in the systematics of the stink bugs of the family Pentatomidae, on which he was an acknowledged authority. He died on December 23, 1965, at the age of 70. Dr. Obraztsov, who became a Research Associate in 1959, was the world authority on the Tortricidae, a large and economically important family of moths found throughout the world but more numerous in the Northern Hemisphere. He was 60 when he died on May 6, 1966. Both men were working actively at the time of their deaths.

Jerome G. Rozen, Jr., *Chairman*

DEPARTMENT OF FOSSIL INVERTEBRATES

The responsibility of the Department of Fossil Invertebrates is much broader in scope than the image of invertebrate paleontology as a hobby would indicate. The intellectual scope and fundamental contributions to society, although little publicized, are broad and numerous, covering more than 99 per cent of known species of animals, including both fossil and living animals capable of pres-

ervation as fossils. This subject is devoted to many aspects of invertebrate animals: their nature, diversity, distribution, history, evolution, and ecology. Because of inevitable emphasis on the study of man's closest relative, the vertebrates, the greater part of the animal kingdom remains poorly known or completely unknown; such is particularly true of the history of invertebrates.

The work of the department broadly overlaps the range of activities and interests of two other Museum departments, Living Invertebrates and Micropaleontology, but the emphasis in invertebrate paleontology is directed toward problems of classification, evolution, and history of invertebrate animals and their geologic applications. These subjects all figured prominently in the work of the Department of Fossil Invertebrates during 1965–1966.

Invertebrate paleontology supplies the main basis for deciphering geologic history during the past one-half billion years. With the aid of invertebrate fossils, the origin and distribution of petroleum, natural gas, coal, and many valuable sedimentary deposits vital to society, such as salt, potash, phosphorus, sulphur, building and chemical products of many kinds, are regularly studied by industry, and the conditions under which they were formed are interpreted. Since most of the surface of the earth is blanketed by fossiliferous sedimentary rocks and since an overwhelming preponderance of the fossils are remains of fossil marine invertebrates essential to the recognition, mapping, and classification of sedimentary deposits, it is clear not only that invertebrate paleontology has profound philosophical significance to man (the origin of and unfolding drama of marine life and kaleidoscopic changes in past earth conditions) but also that it performs a unique and substantial contribution to man's material needs and comforts. Obviously, it is not possible for a small department such as this to touch all the major fields of inquiry pertaining to these animals, but the department has been active in both theoretical and practical facets of invertebrate paleontology.

The scope of this branch of paleontology will be illustrated in the projected Lindsley Hall of Earth History, now in preparation and expected to be opened in 1968. An outstanding event during

the past fiscal year was the receipt of a fifth contribution by the John Lindsley Fund for the projected hall. The new hall will use the most modern techniques, including films, dioramas, models, and specimens of minerals, to explain the sequence of events that have shaped and reshaped the crust of the earth and resulted in the changing distribution of land, seas, and mountain ranges. Exhibits will trace the evolution of animal communities as shown in the fossil record, with particular emphasis on invertebrate marine life and the history of the oceans.

Thus, the popular image of invertebrate paleontology as primarily a collector's hobby is inadequate to convey the continuing extensive contributions that this science makes to human philosophy (the antiquity and history of the earth) and physical welfare of man (essential guidance in the exploration for many useful earth products).

During the fiscal year members of the department have been active over a wide range of the diverse subject matter of the science. Of the nine staff members, seven, including non-resident Research Associates, are university professors engaged in training students for careers in geology and paleontology. One, Mr. Erik N. Kjellesvig-Waering, is manager of the Pan American Trinidad Oil Company, and in this capacity as well as through his basic research in paleontology he makes substantial contributions to society.

The output of able graduate students trained in part in the Museum laboratories is equal to that of any institution of higher learning in the United States. This year one graduate student

A model of the new Lindsley Hall of Earth History is examined by Dr. Norman D. Newell (left), Chairman of the Department of Fossil Invertebrates, and Dr. Walter D. Kring, Trustee of the John Lindsley Fund. Contributions by the Lindsley Fund have made possible the construction of the hall, which will open in 1968. Conceived by Dr. Newell, the new hall will use the most modern techniques to explain the events which have shaped the crust of the earth.

Photograph: The American Museum of Natural History



assumed teaching duties at Queens College of the City University of New York, one at Oberlin College, Ohio, and one has accepted a professional position at Harvard University to take effect when he receives the doctoral degree next year. This student will be our second graduate to join the Harvard faculty. Currently, ten candidates for doctoral degrees in invertebrate paleontology are advancing under staff direction of the joint American Museum-Columbia University program.

Members of the department were unusually active this year in participation in national and international technical symposia and lectureships by invitation at a number of institutes and universities.

Dr. Roger L. Batten had the distinction of being the first non-British paleontologist to be invited to publish a monograph in the official publication of the Paleontographical Society of Great Britain, the oldest paleontological society in the world. The first part of Dr. Batten's monograph appeared in April, with Part 2 to follow.

In the area of scientific research, much of the time of the two curators, Dr. Norman D. Newell and Dr. Batten, is devoted to studies of the morphology, classification, and early history of the major groups of mollusks—the gastropods and pelecypods. Because of such activity and the work of their students, the American Museum is receiving international recognition as a center of activity in this area of interest. Other long-term programs within the department are the work on early history and evolution of sponges by Dr. Robert M. Finks, research on computer programs for the studies of population structure in planktonic foraminifera and other areas of interest to biologists and geologists by Dr. John Imbrie, research on eurypterids and scorpions by Mr. Kjellesvig-Waering, who has extended his interest to living representatives of the latter group, studies by Dr. A. Lee McAlester, who is actively prosecuting his studies of early Paleozoic marine bivalves and certain modern representatives of the same groups, and research on Japanese fossil faunas by Dr. Keiji Nakazawa.

Norman D. Newell, *Chairman*

DEPARTMENT OF HERPETOLOGY

What any individual herpetologist does depends in part upon the nature and extent of the equipment, the collections, and other facilities available to him. Nevertheless, his talents, training, background, and interests play a more significant role in determining the character and quality of his investigations. If he is employed by a large museum, he may legitimately devote his efforts to systematic studies of amphibians and reptiles. But he must also be aware of investigations dealing with these two groups of vertebrates that are often carried out by specialists in other disciplines; by endocrinologists, toxicologists, or neurophysiologists, for example.

The goal of the department, therefore, in addition to research in the field for which it is equipped, is the accumulation and critical synthesis of information pertaining to the biology of amphibians and reptiles. The results of many investigations dealing with these animals are intrinsically important. They may be of interest *per se*. Furthermore, they broaden our understanding of life itself, to the extent that the investigator endeavors to integrate his work with other fields, thereby contributing his share to the unification of biological knowledge. To reach its objectives, therefore, the department must do more than maintain collections. It must also maintain a staff with the requisite background and breadth of interest to make the most effective use of these collections, as well as its library, indexes to the literature, and other facilities that permit the department to serve as a center for the unification and dissemination of all that has been learned about amphibians and reptiles.

Within the last year the projects initiated, continued, or completed by the scientific staff of the Department of Herpetology ranged from ecological and behavioral investigations to systematic, biogeographical, anatomical, and taxonomic studies. They dealt with frogs, turtles, lizards, snakes, and amphisbaenians that were

obtained or studied in Ceylon, India, New Guinea, New Britain, Puerto Rico, Hispaniola, Nicaragua, Mexico, and the United States. Some of these investigations were confined almost entirely to the field. Others were carried out largely in the laboratory, but most of them combined laboratory and field studies. They generally entailed the use of specimens, library facilities, and the indexes to the literature maintained by the department.

Dr. Charles M. Bogert collaborated with Mr. Vincent D. Roth, Director of the Southwestern Research Station, in an investigation of ritualistic combats between male snakes of the same species. This study, prompted by the photographs and other data obtained by Mr. Roth, entailed a review and re-appraisal of the literature dealing with male combat in snakes. Dr. Bogert and Mr. Roth were able to show that it is normally a manifestation of male rivalry and that such struggles ordinarily permit the larger of the two males to resume courtship.

During the course of his field investigations in Ceylon during the summer of 1965, Dr. Bogert had the able assistance of a graduate student, Mr. Ranil Senanayake. Their work in Ceylon revealed the existence of an undescribed dwarf toad that proved to be restricted to the coastal plain of the more humid, southern portion of the island. Mr. Senanayake, now a Field Associate of the department, was able to extend the investigation and obtain additional specimens of the new toad after Dr. Bogert had returned to New York. Dr. Bogert collaborated with Mr. Senanayake in describing the new species, ascertaining its relationships, and summarizing all that could be learned of its habits, habitat, and behavior. Their report of this investigation, now in press, covers the behavior and distributions of the dwarf toads of India and Ceylon. The divergence of the two species is interpreted in terms of the sporadic disruptions of land connections between India and Ceylon that presumably led to the isolation of two distinctive populations of dwarf toads on the island.

Miss Ann P. Porter, who had held the post of Scientific Assistant during the year, collaborated with Dr. Bogert in three investigations of Mexican reptiles. They described a new species of *Geophis* on

the basis of a specimen that Dr. Willis J. Gertsch of the Department of Entomology had obtained in the state of Colima, Mexico, during the summer of 1965. Other investigations of the small, fossorial snakes of the genus had been carried out in the state of Oaxaca in previous years. Dr. Bogert had obtained specimens of a species that had remained virtually unknown, even though one specimen of uncertain origin had been obtained and described nearly a century earlier. This investigation was extended to include a review of the characters that served to diagnose and define the genus and the species.

Another investigation was similar in scope, although Dr. Bogert and Miss Porter were dealing with a group of lizards that includes alligator lizards and glass lizards (*Ophisaurus*) of the United States. The preliminary investigation dealt primarily with the arboreal members of the group, those assigned to the genus *Abronia*, most of which are exceedingly difficult to find. Field work in Oaxaca had revealed the existence of an extraordinarily distinct but undescribed species taken in the Sierra Madre del Sur. Dr. Bogert and Miss Porter have described the new species and initiated a more comprehensive investigation of all the lizards in the group.

Studies of the egg-tooth of snakes, lizards, and amphisbaenians, along with an investigation of the systematic implications of variations in the tongue of lizards, were continued by Dr. Bogert. Many years may be required to assemble the material that will be needed to complete these investigations.

Dr. Richard G. Zweifel completed or continued investigations of both a systematic and ecological nature. His study of a type specimen of a frog, *Cornufer unicolor*, recently rediscovered in the Paris Museum, showed that it could not have been found in New Guinea, as had been supposed. The specimen was undoubtedly from the island of Hispaniola in the West Indies where it is a common form. A manuscript dealing with this study has been accepted for publication in *Copeia*, and Dr. Zweifel submitted another paper dealing with the technical aspects of the change in names to the *Bulletin of Zoological Nomenclature*.

A variety of sources, including primarily the Archbold Expedi-

tions, the expeditions of the late Dr. E. Thomas Gilliard, and the expedition of Dr. Zweifel in 1964, contributed over the years to the excellent collection of frogs of New Guinea that the Museum possesses. Visits to European and Australian museums in 1964 enabled Dr. Zweifel to examine much critical type material, and he is now in a position to undertake more extensive systematic revisions of Papuan frogs than he has attempted in the past. The first investigation to be undertaken is a revision of the subfamily Asterophryinae of the family Microhylidae, a family that has undergone extensive speciation and adaptive radiation in New Guinea. Early results of this investigation show that there are several undescribed species in the group and that present concepts of generic limits may require revision. Observations made in the field in New Guinea in 1964 will contribute materially to the study.

Also related to Dr. Zweifel's interest in the fauna of the New Guinea region is his description of a new species of lizard of the bizarre genus of skinks *Tribolonotus*, which will appear in *American Museum Novitates*.

Three investigations in the field of population ecology occupied part of Dr. Zweifel's time in this fiscal year. He and Dr. Charles H. Lowe of the University of Arizona completed a study of the desert night lizard, *Xantusia vigilis*, that they had initiated more than a decade ago. The study, which appeared in *American Museum Novitates*, deals with the growth and movements of individuals, variation in population size, variation in breeding success from year to year, and related aspects of ecology.

Two field studies similar in design and scope to that of the desert night lizard have been in progress at the Kalbfleisch Field Research Station on Long Island for several years, where Dr. Zweifel has supervised students enrolled in the Undergraduate Research Participation Program, in addition to taking an active part in the field work himself. The principal species being studied here are Fowler's toad, *Bufo woodhousei fowleri*, and the painted turtle, *Chrysemys picta*. Repeated captures of marked individuals reveal the amount of their growth and the extent of their movements. Variation in the sizes of the populations and in the size and age

of individuals composing them is being studied, with particular reference to the influence of variables in the environment. It should be interesting to compare the results of these investigations with similar studies made of the same species in different environments in other parts of the country.

The influence of temperature on the life processes and activities of amphibians and reptiles has been a subject of study in the Department of Herpetology for many years. Dr. Zweifel worked on two research projects in this field. The first, based on field and laboratory work done at the Southwestern Research Station several years earlier, is a study of the temperature tolerance of embryos of desert frogs and toads and of the rates at which embryos develop under different temperature conditions. The second is an investigation of the influence of temperature on the characteristics of mating calls of two species of toads. The latter study is also concerned with the effects of body size and hybridization on the mating calls.

Charles M. Bogert, *Chairman*

DEPARTMENT OF ICHTHYOLOGY

The new laboratories and offices of the Department of Ichthyology were officially opened and occupied in mid-May after two years of planning and construction. The facility includes 7000 square feet of work and study space distributed among three office-laboratories, a laboratory for chemical work, an accessions and processing room, a library, osteology storage area and student offices, three smaller secretarial and cataloguing offices, a 3000-square-foot storage range for the alcohol-preserved research collection of more than half a million fish specimens, and five major walk-in storage areas for chemicals, glassware, and other actively used supplies and instruments. There are also provisions for a greenhouse (to be installed at a later date). The new facility, which was built with funds granted by the National Science Foundation and by the Trustees of the Museum, is the first thoroughly up-to-

date and integrated assemblage of laboratories and study areas that the department has had, and it provides the opportunity for a rapid expansion of the research programs of the staff.

Three expeditions were undertaken by the members of the department during the fiscal year. The 1966 Guatemalan Expedition of the Museum visited previously uncollected areas of the largest drainage of Central America, the Rio Usumacinta basin, where Dr. Donn E. Rosen and Dr. Reeve M. Bailey obtained thousands of fish specimens, as well as reptiles, amphibians, and mammals. The trip was supported by funds donated by Mr. James C. Greenway, Jr. Dr. C. Lavett Smith twice participated in the Biological Survey of the Bahamas being conducted by the Lerner Marine Laboratory. He obtained thousands of specimens for the rapidly growing research collection. The combined field trips of the department added more than 66,000 fishes to the present research material.

Work on publications during the year included "Modes of Reproduction in Fishes," by Dr. Charles M. Breder, Jr., and Dr. Rosen, which was completed after 33 years of compilation and writing. Also during the year Dr. Rosen, Dr. P. Humphry Greenwood of the British Museum (Natural History), Dr. Stanley H. Weitzman of the United States National Museum, Smithsonian Institution, and Dr. George S. Myers of Stanford University joined in producing a new provisional classification of the modern bony fishes. Dr. James W. Atz published two works on aspects of sexuality in fishes: one on hermaphroditism, and the other, with Dr. Grace E. Pickford of Yale University and Dr. Brian Lofts of St. Bartholo-

The newly constructed facilities of the Department of Ichthyology, comprised of laboratories, offices, a processing room, a library, and storage space, house 3000 to 4000 fish skeletons and half a million preserved fish specimens. The skeleton of a parrotfish is examined here by Mrs. Sylvia A. Karchmar of the Department of Ichthyology. In the foreground is the skeleton of a queen triggerfish.

Photograph: Morris Warman



mew's Medical College, London, on the hormonal control of sexual development. Dr. Breder produced a major contribution to our understanding of the formation of fish schools, Dr. Rosen reassessed the relationships of some fresh-water African and Malagasy fishes, Dr. Greenwood wrote several outstanding papers on African fishes, and Dr. Klaus D. Kallman published several papers on the genetics of sex-determining mechanisms and the hereditary characteristics of some fishes that reproduce by a form of parthenogenesis.

Several important contributions by Dr. Smith on the classification and reproductive characteristics of sea basses, and by Dr. Rosen on new fishes collected on the 1963 and 1966 Guatemalan Expeditions, were prepared for publication. Dr. Smith is also preparing a manuscript on the ecology of the ocean, with particular reference to coral-reef fishes.

Dr. Rosen and Dr. Greenwood are continuing their joint researches on teleostean fish classification; and Dr. Atz and Dr. Kallman, on the genetics of natural fish populations. Dr. Smith will continue his work on the biology and classification of the hermaphroditic sea basses.

During the year, work continued on rehabilitation of the systems for storing, sorting, and retrieval of data and specimens in the osteological and alcohol-preserved collections. The over-all value of the collections to the staff and to visiting scientists has already been increased immensely by these improvements. The National Science Foundation provided support for several of the new systems as well as for much of the research done by Dr. Breder, Dr. Rosen, and Dr. Smith.

Donn E. Rosen, *Chairman*

DEPARTMENT OF LIVING INVERTEBRATES

Research activities resulted in the publication of 49 papers by members of the department during the year. Their projects included studies of the chemical and physical properties of the neurohor-

mones that control color changes in land crabs; the taxonomy of some new and poorly known mollusks that were found in the digestive tracts of toadfishes caught off the Brazilian coast; and the anatomy and ecology of marine nemertian worms from the waters of Dominica in the West Indies.

Dr. William K. Emerson advanced his long-range program of research on the taxonomy and distribution of the late Cenozoic molluscan faunas of the New World by completing a detailed zoogeographic analysis of the shallow-water mollusks from the oceanic islands of the tropical eastern Pacific Ocean. The results of this study suggest that the paucity of Indo-Pacific faunal elements in the insular populations that fringe the western edge of Ekman's East Pacific Barrier, an oceanic desert, reflects the present impoverishment of the coral-reef biotope in tropical west American waters. The absence of coral atolls is believed to be a primary factor in limiting the composition of the modern Panamic faunal province. These interesting conclusions were the subject of a paper prepared by Dr. Emerson for presentation at the Eleventh Pacific Science Congress in Tokyo in the summer of 1966.

Dr. Emerson, in collaboration with Mr. William E. Old, Jr., specialist in the department, made considerable progress on a survey of the fossil and Recent molluscan faunas of the Galapagos Islands. A joint study by Dr. Emerson and Mr. Old on mollusks that had been ingested by bottom-feeding fishes taken off the coast of Brazil resulted in the completion of two papers. In one of these Dr. Emerson described an interesting new species of cassid snail.

The multifaceted research program of Dr. Dorothy E. Bliss and her associates on neuroendocrine regulation in land crabs continued. This year, Dr. Bliss put particular emphasis on determining the neurohormones that control color change. She made satisfactory progress in characterizing two chromatophore-activating neurohormones, one that concentrates red pigment in the erythrophores and a second that disperses black pigment in the melanophores. In addition, Dr. Bliss and her researchers gave much attention to localizing the sites within the central nervous system where neuro-

hormones that regulate the uptake and retention of water are synthesized. She presented results of some of the research on water uptake and retention at a Symposium on Neurosecretion held in conjunction with the annual meeting of the American Association for the Advancement of Science in Berkeley, California.

Dr. Bliss, in her studies, which were supported by grants from the National Science Foundation, was assisted during the year by Miss Stefanie Wang and Messrs. Edwin A. Marinez and Morris Altman.

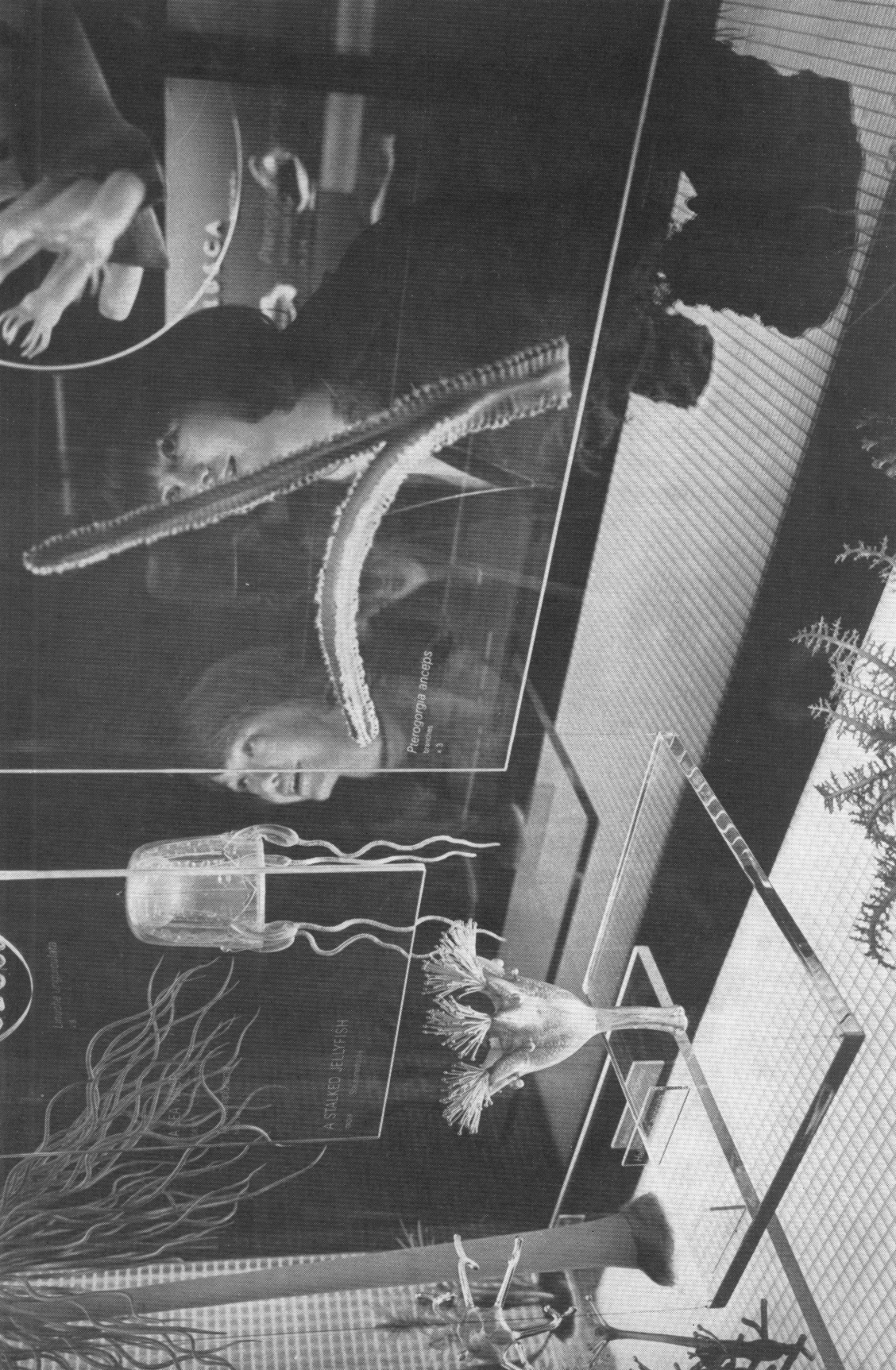
Dr. Ernst Kirsteuer investigated the systematics and ecology of the Nemertini and the Enteropneusta from the Indian Ocean. These studies resulted in the publication of two papers and the completion of a third in manuscript form. In addition, he initiated a study on a largely neglected group of marine invertebrates, the Archiannelida, based on material from the Red Sea, and a manuscript describing his findings has been submitted for publication. His projected long-term investigations hold considerable promise of increasing greatly our present knowledge of these organisms, which are rarely studied and therefore poorly known.

At the invitation of the Smithsonian Institution, Dr. Kirsteuer devoted two months of field work to a biological survey of the island of Dominica, West Indies. He also cooperated with the Duke Marine Laboratory at Beaufort, North Carolina, on a survey of the Beaufort Shelf Transect and undertook preliminary work on the Nemertini collected in this project.

Dr. Libbie H. Hyman, continuing her work on her treatise "The Invertebrates," nearly completed volume 6 on the Mollusca. She also published a paper on the presence of chitin in certain groups of invertebrates.

Delicate glass models of jellyfishes, hydroids, and corals fascinate visitors to a new exhibit in the Hall of the Biology of Invertebrates. These unique models were the work of Mr. Hermann O. Mueller, a famous glassblower, who created hundreds of models of invertebrates at the Museum over a period of 40 years.

Photograph: Birns and Goldberg



Pterogorgia anceps
Liliopsis
3

A STALKED JELLYFISH
1900
S. S. S. S.

Liliopsis
3

Dr. Horace W. Stunkard pursued, with his characteristic vigor, investigations on the morphology, life histories, and ecology of parasitic flatworms, a research program supported by the National Science Foundation.

Other members of the department who reported progress in their studies of various collections were: Dr. William J. Clench, working with certain pulmonate gastropods; Dr. John D. Soule, with marine bryozoans; Dr. Donald F. Squires, with stony corals; Mr. Anthony D'Attilio, with muricid gastropods; and Mr. Morris K. Jacobson, with land shells from Nicaragua and Cuba, a project in collaboration with Dr. Clench. Dr. Linda B. Habas undertook a study of possible organs of salt and water uptake in land crabs and the manner in which hormones control such uptake.

Two exhibitions prepared under the scientific supervision of Dr. Bliss, with the assistance of Mrs. Judith A. de Graaff, were opened to the public in the Hall of Biology of Invertebrates. These include a striking new display of the famous glass models of invertebrates that were created many years ago by Mr. Hermann O. Mueller, and an exhibition on bioluminescence. In the latter, models of some invertebrates are mounted in dioramas having special lighting that enables visitors to see how these animals glow in darkness.

Approximately 80,000 specimens were catalogued and added to the reference collections. Funds for the purchase of specimens and notable gifts of valuable specimens were received from Mr. and Mrs. Flynn Ford of St. Louis, Missouri; Mr. Irving Podell of New York City; Major George Robinson of St. Petersburg, Florida; Mr. and Mrs. Clifford Ames of the Philippines; and Mrs. Waverly Harmon of New York City. The purchase of some 7500 specimens of mollusks, including many species not previously represented in the collections, was made possible by income received from the Beatrice S. Procter Fund. Among acquisitions of unusual interest were three recently collected specimens of the legendary cone shell, *Glory-of-the-Sea*, from the Solomon Islands.

William K. Emerson, *Chairman*

DEPARTMENT OF MAMMALOGY

The most fundamental aspect of all biological studies is classification. Without the knowledge of the identity of an animal, all further information is of diminished value. Anatomy, physiology, and behavior differ not only from one species to another but also within a species. The variation in characters within a species may be a function of the age of the individuals, their sex, the geographic area in which the populations evolved, the inherent genetic plasticity of the populations, or of any of a number of other factors. To produce the most meaningful studies of classification of mammals, the investigator needs not only adequate collections of specimens for study comparisons but also as much data about the animals as can be obtained. He then must analyze and evaluate all the available information to determine the identity and evolutionary position of the species that he is studying.

The work of the Department of Mammalogy is dedicated to studies of the classification and distribution of mammals. The base from which this work starts is the collection of mammals housed in the Museum. This collection, which is now approaching 210,000 specimens and is the second largest in the Western Hemisphere, serves as a great and continually growing library of information about the 4000 known species of mammals. The past year saw the conclusion of an extensive field effort that added many important and valuable specimens to the collection.

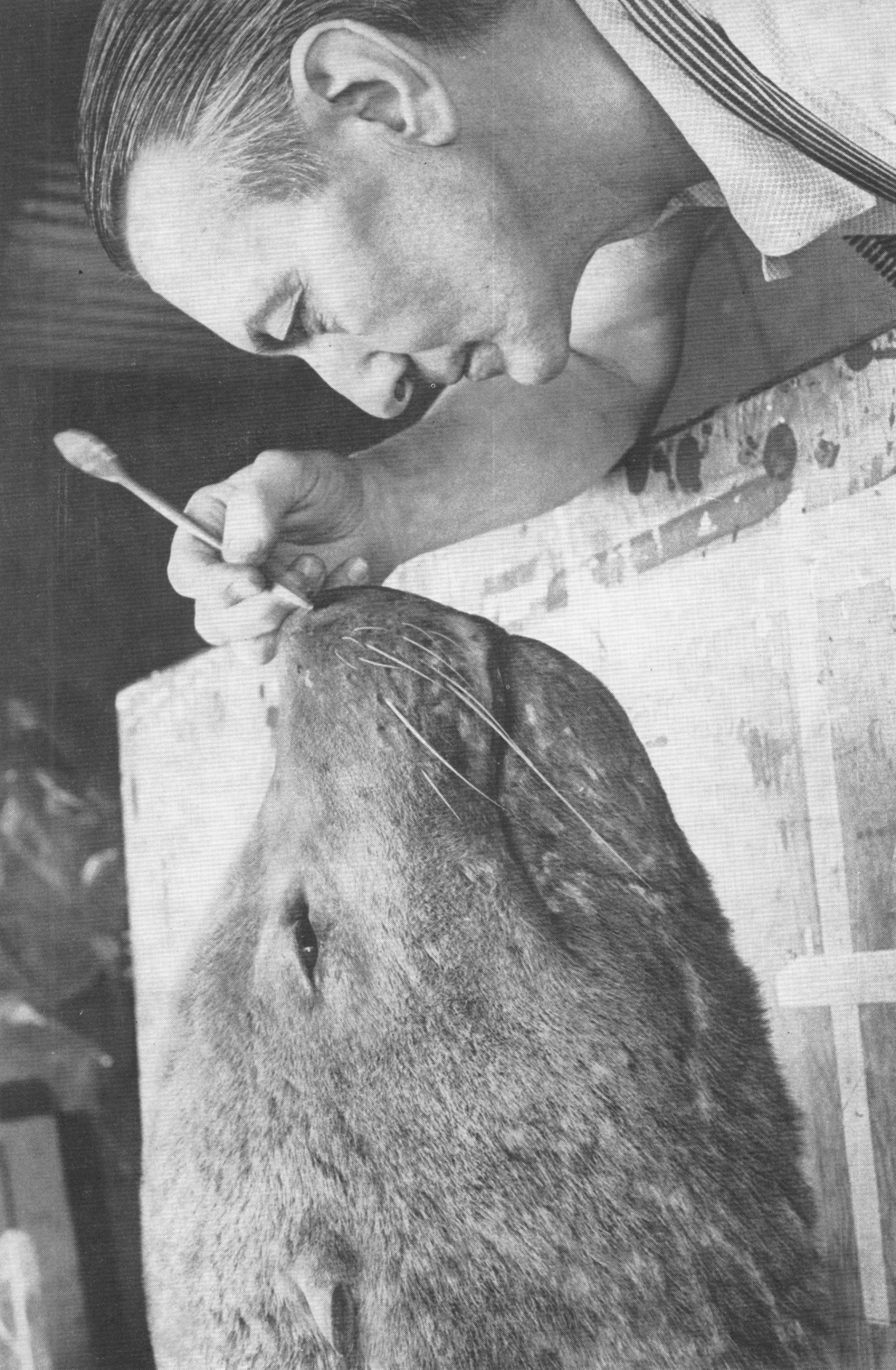
In November, 1965, the department concluded three years of field work in South America under the auspices of the United States Army Medical Research and Development Command. The basic program was to obtain mammals and medically important insects from specific areas of South America, and to identify the hosts of ectoparasites. The last two years encompassed even broader aspects of the biological and medical problems. The 1962-1963 field season was spent in Uruguay, where the largest collection of Uruguayan mammals ever made was obtained. Drs. Richard G. Van Gelder, Karl F. Koopman, and Sydney Anderson each spent two or more months in the field, together with Uruguayan and

Brazilian colleagues and students from the United States. Already, a new species of tick has been described from the more than 17,000 ectoparasites collected, and one group of rodents formed the basis for a revision of the scapteromyine rodents prepared by Mr. Philip Herskovitz of the Field Museum of Natural History. The large and excellent series of hog-nosed skunks collected on the expedition is being studied by Dr. Van Gelder to analyze the cranial variation found in a single population of this species, under a program originated with the aid of a grant from the National Science Foundation. Mr. Jon C. Barlow, Field Associate, used both the collections of the department and his six months of field experience in Uruguay as the basis for his doctoral dissertation, "Land Mammals from Uruguay: Ecology and Zoogeography," and received the degree of Doctor of Philosophy from the University of Kansas in 1965.

The second and third years of the South American field work were spent in eastern Bolivia in the Amazon drainage forest and savanna. Each of the curators of the department spent two or more months a year in the field as a leader of the expedition. In order to be able to travel in the region, which is accessible only by river, the American Museum-Bolivian Expedition constructed the "Exploradora," a 63-foot houseboat, which served as a base and laboratory for the two field seasons of the expedition. The outbreak of hemorrhagic fever in the area visited by the expedition led the expedition to broaden its scope to cooperate with the Middle America Research Unit which was investigating the disease. Serum from the mammals was collected and sent to the Middle America

A giant sea lion that will be a part of a habitat group in the Hall of Ocean Life is prepared for display by Mr. Ludwig Ferraglio of the Department of Exhibition. The animal is about twelve feet long and weighed more than a ton in life. The new hall, which will be the largest in the Museum, will also contain a 91-foot model of a blue whale and models of such other marine animals as a giant squid and a killer whale.

Photograph: The New York Times (Sam Falk)



Research Unit to be tested for hemorrhagic fever antibodies in hopes of establishing whether or not the virus was widespread in the mammalian fauna of the region. With the aid of funds from the National Geographic Society, the expedition also made extensive collections of birds, reptiles, amphibians, fishes, and insects for the appropriate departments of the Museum. At the present time the mammal collections are still being processed and, although not yet fully studied, have indicated a number of significant zoogeographic and taxonomic items of importance. The collections of bats are particularly rich, and extensive primate collections are also featured in the material obtained.

One of the continuing problems resulting from the acquisition of specimens is making knowledge about them available. Museum collections, as we have said above, are libraries of knowledge, and institutions frequently lend and borrow specimens from one another. However, the collections of mammals in North American museums and universities number 300, and total some one and a half million specimens, and it is often difficult for an investigator to determine just which institutions might have material he needs. Because the collections of this Museum are unsurpassed in specimens from many regions of the world, we receive numerous inquiries from our colleagues. Some can be answered readily, but often it is difficult to provide the information because of the great amount of time involved in retrieving data. For this reason, the Department of Mammalogy initiated a data-retrieval system for its collection in 1966, after a year of investigation. The development of this system was supported in part by the United States Army Medical Research and Development Command. Preliminary studies were made, using an optical coincidence system and a specially developed coding system which maintains the evolutionary classification of mammals. These investigations showed that 10,000 specimens per month can be put into the system. For each specimen, five items of information (identity, locality, sex, month of collection, and type of preparation) are entered into the system. Scanning time for data is at a rate of one minute per 10,000 specimens. In addition the department has devised a system for retrieving information

about the ectoparasites associated with mammals in the collection and is now investigating the possibility of entering bibliographic information in the same way. Drs. Van Gelder and Anderson prepared a paper about the subject for publication in *Curator*, and Dr. Anderson presented a paper about the system at the meetings of the American Society of Mammalogists in 1966.

In addition to the major field work in South America, the curators continued long-term studies of fauna in other parts of the world. Dr. Anderson prepared the introduction, vegetation map, and faunal analysis for his study of the mammals of Chihuahua, Mexico, and published notes on a kit fox and pocket gophers from Mexico. Dr. Koopman continued his study on bats of the Sudan and analyses of the New World bats. He completed a paper on bats of Iceland and published one on bats of southern Africa. Mr. Hobart M. Van Deusen nearly completed a report on the 1964 Archbold Expedition to the Huon Peninsula, New Guinea, and completed two papers on marsupials of New Guinea. Curator Emeritus George G. Goodwin continued to work regularly in the department and completed the first draft of his long-term study of the mammals of Oaxaca, Mexico.

Richard G. Van Gelder, *Chairman*

DEPARTMENT OF MICROPALEONTOLOGY

Long-range plans to provide micropaleontologists with reference works devoted to the various groups of microfossils moved steadily ahead during the fiscal year. A grant from the National Science Foundation, activated July, 1965, will enable the department to compile and publish a three-volume "Catalogue of Index Smaller Foraminifera." The first two years of this three-year project, under the direction of Dr. Brooks F. Ellis and Miss Angelina R. Messina, will be devoted to the gathering of material, and the remaining one to the printing and distribution of the work. An international committee of 40 leading micropaleontologists will provide advice on selection and other problems. Together with the three-volume "Catalogue of Index Larger Foraminifera," the second volume of

which was issued early in 1966, the new project will provide complete coverage of the index foraminifera.

Three supplements were issued this year: one to the "Catalogue of Foraminifera," bringing the number of volumes to 66, and two to the "Catalogue of Ostracoda." Volume 11 of *Micropaleontology*, the quarterly journal, was published in 1965 and contained 27 papers.

In addition to the grant from the National Science Foundation for the "Catalogue," the department was awarded funds by the Atomic Energy Commission to continue tracer work on nutrition, life cycles, and mineral-nuclide cycling. An additional award by the National Science Foundation supported work on the Allogromidae, and the H. B. Cantor Foundation donated funds for the purchase of a fully equipped Zeiss photomicroscope.

Work in the living foraminifera laboratories during the year included improvement in the production of stock cultures and the development of synzenic bacteria-free cultures of *Allogromia latcollaris*, which will permit study under more rigidly controlled conditions. Dr. Hugo D. Freudenthal conducted laboratory studies on the nutrition, physiology, cytology, and life cycles of planktonic foraminifera of the northwest Atlantic Ocean. Dr. John Lee continued studies on nutrition, physiology, and mineral cycling of foraminifera and collaborated with Dr. Stanley Pierce on environmental influences on the morphology, life cycle, and taxonomy of the Allogromidae.

The department continued to collaborate with both the Haskins Laboratories, Inc., and the Lamont Geological Observatory.

Attractive and informative exhibits dealing with applied paleontology are being prepared for the new Lindsley Hall of Earth History. These exhibits will show the use of megafossils in the mapping of surface geology and as indicators of paleo-temperatures. The exhibits will also explain how microfossils are used in locating subsurface structure, in stratigraphic correlation, and in archeology.

Brooks F. Ellis, *Chairman*

DEPARTMENT OF MINERALOGY

The research investigations carried on in the Department of Mineralogy are aimed at increasing our knowledge of the origin and evolution of the earth's crust. The excellent mineral and meteorite collections of the Museum, together with the growing collection of important rock suites, provide the raw material for much of this research and also give rise to an increasingly heavy demand for cooperation with other institutions. An active program of acquisition is pursued in order that these unique collections will continue to provide the source material for extensive basic research.

Mr. D. M. Vincent Manson has been studying the detailed chemical and mineralogical variations in basaltic rocks, the most abundant rock type in the earth's crust. The use of computers for data retrieval and multivariate statistical analysis has proved invaluable in these studies, and programs developed in this department are now widely used in other institutions for similar research problems in the earth sciences.

Active cooperation is continuing with the departments of Fossil Invertebrates, Education, and Exhibition in the preparation of exhibits for the Lindsley Hall of Earth History. Considerable time and thought have also been devoted to the preparation of plans for essential renovations in the Morgan Memorial Hall of Minerals and Gems. These plans have as their goal the presentation of an integrated story illustrating the nature and occurrence of the raw materials of the earth's crust. The opportunity of presenting to full advantage the natural aesthetic qualities of the specimens, highlighted by the magnificent gem collection, makes this a particularly rewarding task.

The departments of Mineralogy and Education of the Museum and the Department of Education of the City of New York have initiated a program in which 12,000 New York school students taking the Pathways 7 course will visit the Museum each semester as part of their education in the earth sciences.

Some 300 rocks, minerals, meteorites, and gems were added to the collection and catalogued during the year, and a number of

gems stolen in 1964 were returned. Approximately 2000 specimens of minerals and rocks were identified for the public, and hundreds of queries were answered by mail. The number of queries from the public is growing larger, perhaps because of the increasing emphasis that is being placed on the earth sciences.

D. M. Vincent Manson, *Assistant Curator*

DEPARTMENT OF ORNITHOLOGY

Members of the Department of Ornithology were involved in research, publication, field work, and exhibition during the year.

Dr. Dean Amadon's book "Birds Around the World," a geographical look at evolution and birds, was published by the Natural History Press. "Hawks and Eagles of the World," on which Dr. Amadon collaborated with Mr. L. H. Brown, is in press, and Dr. Amadon is writing a book on curassows and related gamebirds with Dr. Jean Delacour.

Dr. Paul Slud, a Research Associate whose appointment terminated at the end of the fiscal year, has completed a manuscript on "The Birds of Cocos Island [Costa Rica]," which complements his "The Birds of Costa Rica: Distribution and Ecology." The Frank M. Chapman Memorial Fund is sponsoring the publication by the Natural History Press of two books by the late E. Thomas Gilliard, "Birds of Paradise and Bowerbirds" and "Handbook of New Guinea Birds," the latter written with Dr. Austin L. Rand.

A four-year grant from Mr. and Mrs. Dan P. Caulkins will enable Mr. John Bull to do the necessary research and writing of the book "Birds of New York State," which will be published by the Natural History Press. A book on the birds of Tibet is planned by Dr. Charles Vaurie, who studied at museums in Leningrad, Warsaw, Berlin, Amsterdam, and London in preparation for writing the volume.

Field activities took members of the department to the West Indies, Panama, South America, Canada, and Alaska during the year. Dr. Wesley E. Lanyon continued his long-range studies of the

Myiarchus flycatchers on St. Lucia, Haiti, and Grand Cayman Islands in the West Indies, a project that is sponsored by the Leonard C. Sanford Trust Fund. Other continuing field investigations were made by Mr. Eugene Eisenmann in Panama and by Dr. Edwin O. Willis, who studied ant-following birds in Panama and northern South America. Mr. G. Stuart Keith observed birds in western Canada and Alaska.

Dr. Lanyon, who serves also as director of the Kalbfleisch Field Research Station at Huntington, Long Island, continued his research on birds at the station. His project involves techniques of banding, analysis of vocalization, and the rearing of chicks in soundproof chambers. Other research includes that of Dr. Vaurie on the classification and evolution of the Cracidae, that of Mr. Crawford H. Greenewalt on the biomechanics of bird song, that of Mr. James C. Greenway, Jr., on a catalogue of the type specimens of birds in the collections of the Museum, and that of Mr. Keith on the birds of east Africa.

Members of the department continued to seek specimens to fill gaps in the collection. The only male specimen of a nearly extinct species of curassow to reach a North American museum was received in an exchange with the Rio de Janeiro Museum. The sole species of South American parrot not in the collection was also acquired. Mr. Eisenmann brought back a small but valuable collection of birds from his Panama expedition. Approximately 125 specimens were donated by recipients of Chapman awards.

Plans were made for a new exhibit on bird migration to replace the exhibit on this subject in the Sanford Memorial Hall of the Biology of Birds. The exhibit was made possible by a bequest from the estate of Mr. T. W. Earhart in memory of Dr. Chapman.

Grants in the amount of approximately \$50,000 were made by the Frank M. Chapman Memorial Fund Committee to assist ornithologists, chiefly students, in all parts of the world. One-fifth of the amount is used to enable students to study the collections of the department.

Friends of the department again played a major role in its activities. Mr. and Mrs. W. Allston Flagg are supporting the costly and

urgent task of cleaning and restoring the priceless collection of paintings by John James Audubon. Mr. Frank B. Smithe is financing the preparation of his book "The Birds of Tikal," which will be published by the Natural History Press. Mr. Charles E. O'Brien was aided by Mr. Allan O'Connell and a number of part-time workers, including Miss Helen Hays and Mrs. Martha W. Toreller, in caring for the huge departmental collection and in assisting visiting scientists.

Dean Amadon, *Chairman*

DEPARTMENT OF VERTEBRATE PALEONTOLOGY

The primary concern of vertebrate paleontologists is to increase man's understanding of the history and evolution of the vertebrates. The acquisition of new collections and new facts and the development of new ways of looking at old facts make vertebrate paleontology a continually rewarding field in which to work. During the year Dr. Edwin H. Colbert conducted investigations of primitive Triassic dinosaurs. Dr. Bobb Schaeffer completed a comprehensive review of the evolution of sharks from the Devonian Period to the present. Dr. Malcolm C. McKenna studied the basic radiation of the placental mammals.

Dr. Schaeffer's study showed that shark evolution occurred in three successive levels: the cladodont, the hybodont, and the modern. At every level all the evolving sharks undergo broad common adaptations. In spite of a relatively poor fossil record, it has been possible to chart the major changes in the shark skeleton and to find a relationship between these changes and modifications in the locomotor mechanisms and the feeding of sharks.

Dr. Schaeffer also completed the first comprehensive report on the Upper Triassic fishes of western North America and, assisted by Miss Marlyn Mangus, continued his project on the basic evolutionary development of the higher bony fishes. He is studying the possibility that the various kinds of bony fishes evolved from a primitive, presently unknown, ancestral stock before the Devonian

Period. Evidence indicates that the various groups of higher bony fishes developed their backbones independently, and that, during their development, there was wider variation in the patterns of the vertebrates of some types than of others. The study, which will be completed with the help of Mr. Richard Lund, a graduate student at Columbia University, will collect available evidence on these questions and interpret the evolutionary patterns in extinct groups of fishes.

Dr. Colbert, in pursuit of his study of the dispersal and paleoecology of Triassic terrestrial vertebrates, made a field trip to west Texas, New Mexico, Arizona, and Utah to review the continental Triassic sediments of these areas. He was accompanied by Dr. W. A. Crompton, Director of the Peabody Museum of Yale University; Dr. Georg Haas, Professor of Zoology at Hebrew University, Jerusalem, Israel; and Mr. Mario Barberena of the University of Rio Grande dô Sul, Brazil. Since all members of the group have wide experience with Triassic sediments and fossils of other areas, the trip was in effect a small symposium on the southwestern Triassic as compared with continental Triassic beds in other parts of the world.

Later, Dr. Colbert spent two months in southern Germany, where scientists made their first studies of the period that came to be known as the Triassic. With the help of many German scientists, he made detailed studies there. He then went to Israel, where he collected fossils in the Negev. In particular, he found a specimen of a Triassic placodont reptile that fills a gap in the collections of the department.

Dr. Colbert also continued to study the rich fossil beds of the Granton Quarry of North Bergen, New Jersey. One fossil found in the quarry was the skeleton of a gliding reptile, one of the earliest to indicate aerial locomotion among vertebrates. The study of this reptile led, as a correlative project, to an analysis of gliding in the modern lizard *Draco*, a study that considered not only anatomical adaptations and muscular control but also aerodynamic problems. Dr. Colbert was also concerned with the Mesozoic reptiles, particularly a new Jurassic pterosaur, or flying reptile, from

Cuba, the first pterosaur of this age known from the Western Hemisphere.

Dr. McKenna continued two long-term projects, one a study of the evolutionary diversification of the insectivores, and the other a classification of all the mammals. As part of the latter study he prepared a new classification of the prosimian primates. Dr. McKenna also prepared reports on the results of an exchange visit to the Soviet Union and cooperative studies with the Polish Academy of Sciences, involving especially work on early Tertiary and late Mesozoic mammals. He also carried on research on mid-Tertiary camels and prepared a paper on the nature of the fossil mammal fauna found in early Tertiary deposits on the West Coast.

Edwin H. Colbert, *Chairman*

SPECIAL ACTIVITIES

ARCHBOLD BIOLOGICAL STATION

LAKE PLACID, FLORIDA

Forty-two investigators from 26 institutions carried on research at the station during the past year. One of the visiting scientists was Dr. L. L. Pechuman of Cornell University, who specializes in the systematics and biology of horseflies and deerflies (Tabanidae). After sampling the fly fauna at the station and comparing it with specimens collected in March and April, Dr. Pechuman concluded that none of the species found in abundance in March and early April was still present in May, indicating that, in this area of Florida, the Tabanidae are pests only in March and April.

Another Cornell scientist, Mr. Thomas E. Pliske, investigated the courtship behavior of the queen butterfly by studying chemical communication among the species. He also studied the defensive secretions, or pheromones, of various other arthropods collected on the station.

Dr. Thomas Eisener, also of Cornell, continued his investigation on fluids secreted by the grasshopper *Romalea* as a defensive

mechanism. The defensive effectiveness of a secretion discharged from certain glands of arctiid moths was also investigated. The researchers observed extremely interesting results when they tested this mechanism against predatory orb-weaving spiders. The moths, caught in the spider webs, were rejected by the predators, which cut the flying insects free from the strands.

Dr. Harry Huizinga of the University of North Carolina is studying the life history of parasites. He spent several days at the station collecting a parasitic nematode (flatworm) from the bodies of the water turkey and fresh-water fishes. Larval stages of this parasite are commonly found in the organs of local fresh-water fishes. The water turkey, a large cormorant-like bird, is often infected by this parasite after consuming the fish.

A new apparatus that electrically shocks bees and causes them to sting was tested by Dr. Roger A. Morse of Cornell. The purpose of the test was to obtain the fraction of bee venom that contains the material that is responsible for an alarm triggering odor in bees.

Dr. Rulf Boch of the Department of Agriculture of Canada worked with Dr. Morse during part of his stay. They tested several substances that give off odors for their attractiveness to foraging honey bees. The substances were also tested on swarms of bees.

Dr. Leonard J. Brass, Associate Curator of the Archbold Collections and Staff Botanist at the station, retired on March 31, 1966. During the months before his retirement, he worked toward bringing the nomenclature for the station herbarium up to date.

Richard Archbold, *Resident Director*

THE KALBFLEISCH FIELD RESEARCH STATION
HUNTINGTON, LONG ISLAND, NEW YORK

An air-conditioned laboratory for research in herpetology was constructed during the year, and environmental chambers for rearing birds were developed in which temperatures, light, and sound can be controlled.

Dr. Richard G. Zweifel of the Department of Herpetology is using the new laboratory in connection with his continuing studies of the amphibians and reptiles at the station. Dr. Wesley E. Lanyon developed the environmental chambers in which he is rearing passerine birds from the egg stage. The new facility will enable him to determine the necessity for birds to learn vocal patterns from experienced individuals.

Seven members of the staff of the American Museum of Natural History used the station during the past year for long-term field studies. Dr. Kenneth L. Franklin of the Department of Astronomy investigated radiation from Jupiter; Dr. Zweifel, the population ecology of Fowler's toads, painted turtles, and other amphibians and reptiles represented at the station; Dr. Donn E. Rosen, Department of Ichthyology, the population ecology and genetics of an introduced mosquito-fish.

At the station, also, Dr. Richard G. Van Gelder of the Department of Mammalogy conducted studies on the population ecology of several species of small mammals living at the station; Dr. Lanyon, on the population ecology and behavior of the breeding birds; Dr. Jack McCormick, Consultant in Ecology, on the analysis of the flora at the station and of plant succession in representative communities; and Dr. Max K. Hecht, Department of Vertebrate Paleontology, on the breeding ecology of the spotted salamander.

Ten college undergraduates who were in residence during the summer of 1965 assisted the members of the staff in their research. Their studies were sponsored largely by the National Science Foundation Undergraduate Research Participation Program. Several high school volunteers also assisted in the summer research program. Members of biology classes from Queens College and Adelphi College visited the station during the year.

In addition, Dr. Daniel Marine of the Department of Biology of Queens College initiated a field study of the distribution and systematics of *Drosophila* at the station, and Mr. John Landry, a graduate student at the University of Connecticut, collected data for his doctoral thesis on the systematics of deer mice.

A paper based on birds collected at the station, the Slate-Colored

Junco and the White-Throated Sparrow, was published in *The Condor* during the year. This was the work of Drs. Lester L. Short, Jr., and Stephen W. Simon of Catonsville College, Catonsville, Maryland. Several other publications based on research at the station are in press.

Mr. Edward Szalay has replaced Mr. William Hutchin as the superintendent of the station.

Wesley E. Lanyon, *Resident Director*

LERNER MARINE LABORATORY
BIMINI, BAHAMAS

Although Hurricane Betsy caused some damage to the facilities of the laboratory when it struck the island in September, 1965, activity continued to be heavy. More than 150 investigators conducted research during the year on such topics as the acoustical behavior of fishes, the formation of limestone from organic material, and the nature of the hormones secreted by lobsters. The Biological Survey of the Bahamas completed its second year of full-scale operation, with 30 scientists participating in month-long cruises through the islands of the Bahamas. They found many new specimens to add to the collections of the Museum.

Research on sharks, always an important part of the work at the laboratory because of the ready availability of several species in the area, was set back somewhat by the hurricane. An estimated \$10,000 in damage was done to the shark pens, and the extraordinarily high tides caused by the hurricane allowed 112 sharks to swim out of their pens to freedom.

Twelve of the sharks had been used for research that was virtually complete when the hurricane struck and Dr. Perry W. Gilbert of Cornell University, Chairman of the Shark Research Panel, estimated that the loss delayed the work of his research team by six months. The loss of the other 100 sharks, which were being used by Dr. M. Michael Sigel of the University of Miami in an investigation

of immunology and infection in fishes, was a heavy blow to the project.

Dr. Gilbert is continuing his work on the visual apparatus of sharks. During the year he, together with Mr. Mathewson and Dr. Edward S. Hodgson of Columbia University, published a report on their research into the effects of chemical stimuli on the brain activity of sharks. Another paper was published by Mr. Mathewson and Dr. A. K. O’Gower on aspects of vision in sharks. Capt. H. David Baldrige of the Naval Medical Research Institute studied the response of sharks to various substances, establishing a baseline for developing a test for screening potential shark repellents. Dr. Lois E. Rasmussen of the National Institutes of Health is studying the normal levels of proteins and enzymes in the nervous tissue, cerebrospinal fluid, and blood of the more dangerous species of sharks, so that the effects of stress on the sharks can be determined.

As part of the biological survey, Dr. Frank J. Schwartz of the University of Maryland plans an intensive program of tagging sharks, skates, and rays in the Bahamas. Dr. Schwartz is attempting to learn whether the laboratory will be able to meet its research needs for 600 sharks a year without “fishing out” the surrounding waters. He will also try to determine whether the rays and sharks are permanent residents of the islands or are migratory. The information will help determine whether conservation measures will be needed to insure an adequate supply of sharks and rays for research.

Another interesting project at the laboratory originated in the discovery that fish that were caught at depths of 80 to 150 feet died if they were brought rapidly to the surface. Some died immediately, while others lived 48 to 72 hours, showing signs of heart attacks resulting from the blockage of coronary blood vessels. Mr. Frank A. Ferren, Jr., of the University of Miami, working with Mr. Mathewson and Dr. Sigel, is attempting to discover the cause of the blood vessel damage. The investigators will also study the electrocardiographic changes that occur when a fish is brought to the surface suddenly. The findings may be of value to human divers who experience sudden decompression.

In a basic study of the food supply of the sea, Dr. Gerald S. Posner of the City College of New York has begun a project to determine whether the lack of any specific nutrients is limiting the growth of phytoplankton in subtropical waters. Water samples are taken from various depths, enriched with nutrients, and returned to the ocean for several days. The production of plankton in the enriched water is compared with that in water samples kept in an incubator on shore. Most previous studies of plankton production have been on a much smaller scale and have been limited to surface water.

A study of the manner in which mammals and fishes metabolize fats under such stresses as exposure to cold and prolonged physical activity has been begun by Dr. Rodolfo Paoletti of the University of Milan. Samples of various tissues have been collected from fishes and marine mammals to determine the composition and concentration of fats in them. Comparisons of differences in fat metabolism in these animals and in species from Europe may produce useful information on the evolution and biochemical adaptation of metabolism under various environmental conditions.

A project in the relatively new field of molecular evolution has been begun by Dr. E. A. Bernard of the State University of New York at Buffalo. Dr. Bernard is studying the evolution of an enzyme called pancreatic ribonuclease, which is found in cows and has been intensively investigated by biologists. By looking for the enzyme in sharks and bony fishes, Dr. Bernard hopes to gather information about its origin and evolution. He has found that sharks lack the enzyme, although they have pancreases. In bony fishes, where pancreatic tissue exists in scattered islands, a small amount of the enzyme, differing somewhat from the bovine variety, was found. Further studies will show the extent to which comparable enzymes of different species are related.

Support from private sources has enabled the start of phase 1 of a building program, which requires dredging and the construction of a new sea wall, animal pens, and piers. Phases 2 and 3 involve construction of a new residence and laboratory, preliminary sketches of which are being studied.

The laboratory and the American Institute of Biological Sciences, with the support of the Office of Naval Research, held the first interdisciplinary symposium on shark biology. Fifty-nine participants from universities in many countries presented papers in such disciplines as taxonomy, zoogeography, anatomy, physiology, behavior, neurology, and biochemistry. The proceedings are being published by the Johns Hopkins Press.

The laboratory owes particular thanks to Mrs. Helen Hayes, Head of the Office of Naval Research Oceanic Biology Programs, and to Messrs. George H. Kisbany and Silvio Ferraris of the Office of Naval Research in New York for their support during the year.

Robert F. Mathewson, *Resident Director*

SOUTHWESTERN RESEARCH STATION
PORTAL, ARIZONA

The number of visitors for the year totaled 442 and included scientists and students from 39 institutions in places as far separated as Connecticut, California, Egypt, and Argentina. Seven student groups used the facilities of the station for classes in range management, vertebrate natural history, ecology, wildlife management, and geology. Research projects carried out included work in entomology, ornithology, herpetology, botany, arachnology, mammalogy, astronomy, anthropology, bacteriology, and genetics.

Among the studies was one by Dr. Charles W. Foreman of the University of the South, Sewanee, Tennessee, on comparative studies on ionographic properties of mammalian hemoglobin. Miss Mary Jane West, a graduate student of the University of Michigan, collected, dissected, and observed the behavior of four *Polistes* wasps, *apachus*, *major*, "*canadensis*," and one undetermined. Drs. Robert and Richard J. Lasiewski of the University of California at Los Angeles studied the physiological responses of the two largest species of hummingbirds occurring in the United States, the Blue-

Throated and Rivoli's hummingbirds. A paper on this study is in preparation.

Mr. Vincent D. Roth, the Resident Director, continued his researches on spiders of the family Agelenidae, various South American genera of spiders, as well as the arachnid fauna of Baja California, the region in which he and Mrs. Roth made a month-long collecting trip.

Vincent D. Roth, *Resident Director*

DEPARTMENT OF EDUCATION

Several important innovations resulted this year from continued development of the departmental curriculum to meet the needs and interests of various groups and of individuals at different age levels.

A new series of Saturday afternoon lectures entitled "Exploring the World of Nature," offered for mass audiences of children and adults, made use of a wide variety of audio-visual effects. The topics covered included dinosaurs, snakes and other cold-blooded animals, big game mammals of Africa and North America, and life at the edge of the sea. The success of the program, which had a total attendance of 2563, encouraged the department to make the series available to school groups on weekdays during the coming year. It will be offered in addition to the regular school program "The World We Live In," which has proved eminently successful in supplementing classroom teaching in science and social studies for scheduled classes of children in grades 3 to 9. The latter program, in which 32,691 children participated during the past year, requires an individual Museum instructor for each class, but in the program entitled "Exploring the World of Nature" one instructor can lecture to as many as 800 children. The program can thus be offered to unscheduled groups to provide a focus that might otherwise be lacking in their Museum visit.

A pilot program, "History of the Earth," was presented in cooperation with the Office of Science Education of the New York City Board of Education as part of the Pathways program in the

city's new junior high school science curriculum. Sessions were held three days a week in the spring for seventh grade pupils who made an intensive one-day study of fossils and minerals in the exhibition halls of the Museum. In view of the enthusiastic response of both pupils and teachers, the department and the Board of Education decided to expand the Pathways program in the Museum to other fields and grade levels. Two topics will be offered in the coming year, "Biology of Man" and "From Fish to Man," with sessions five days a week.

A third significant innovation in the department was the participation of the Natural Science Center for Young People in Operation Headstart, sponsored by the city for pre-kindergarten children. Scheduled groups of these youngsters visited the center in July and August for instruction that utilized exhibits of small live animals and plants native to the metropolitan area. During the school year the center continued to provide similar instruction at a more advanced level for classes in the primary grades. Some 4500 children, considerably more than in previous years, received instruction in scheduled groups at the center.

Other programs for young people included Saturday morning courses in archeology, amphibians and reptiles, nature study for beginners, and the ecology of mammals. Each six-session course was presented in both the spring and the fall. "Principles of Geology," the highly successful series of lectures and field trips designed for high school science majors, was offered for the sixth consecutive year with support from the Texaco Corporation.

Several special services of the department are designed to carry the educational function of the Museum out to the community. Foremost among these is the program of instruction for children confined to hospitals and special schools, which was conducted for the third successive year under the sponsorship of the Avalon Foundation.

Two hundred natural science kits, prepared by the staff of the Natural Science Center, were distributed to schools in the city with the assistance of volunteers from the New York Garden Clubs. The kits contain expendable materials, including mosses, fungi, shells,

feathers, and insects, and constitute excellent resource material for children in kindergarten and the primary grades.

Other extension services, including the film and slide libraries and circulating exhibits, continued to provide education in the natural sciences to groups outside the Museum.

Among the adult education programs offered were evening lecture series on Mexican archeology, the wildlife crisis in the United States, and the peoples of the Pacific. Daytime programs included gallery talks, the popular illustrated lecture series "The Living World," a twelve-session program for senior citizens in which slide talks were combined with tours of Museum exhibits, and field walks in geology, botany, and ornithology. The department also conducted field trips of several days' duration for the study of wildlife and geology in upstate New York, on Long Island, and in the New Jersey pine barrens.

Twenty-five Museum courses, accredited by the Board of Education and the City College of New York, were offered for New York City teachers. These had a total enrollment of 1087.

Two new taped tours were added to the Acoustaguide service, a library of portable audiotapes with earphones that provide commentary on certain exhibits in the Museum. The new additions are a 30-minute tour of exhibition highlights and an hour-long tour of the two dinosaur halls. The first six of a series of twelve "Museum Trail" booklets were made available at the Information Desk in December. Written by members of the department, they are designed for use in the exhibition halls by groups or individuals.

Among the more specialized activities of the department is the Louis Calder Natural Science Laboratory, which opened in June, 1965, and is supervised by the staff of the Natural Science Center for Young People. The laboratory contains facilities and equipment that are made available for research and exhibition projects selected from among applications submitted by young people. During its first year of operation projects were carried out in the laboratory by nine boys and girls, ranging in age from nine to sixteen. One boy conducted a learning experiment with ants, another prepared an exhibit of an Indian shell heap he had discovered, and a third

carried out a project in horticulture. The other youngsters worked on study collections of local rocks and minerals, fossils, shells, leaves, and insects. Although use of the equipment is necessarily limited to a small number of young people, the laboratory offers boys and girls a unique opportunity to pursue in depth a serious interest in natural science.

Sune Engelbrektson, *Chairman*

DEPARTMENT OF EXHIBITION AND GRAPHIC ARTS

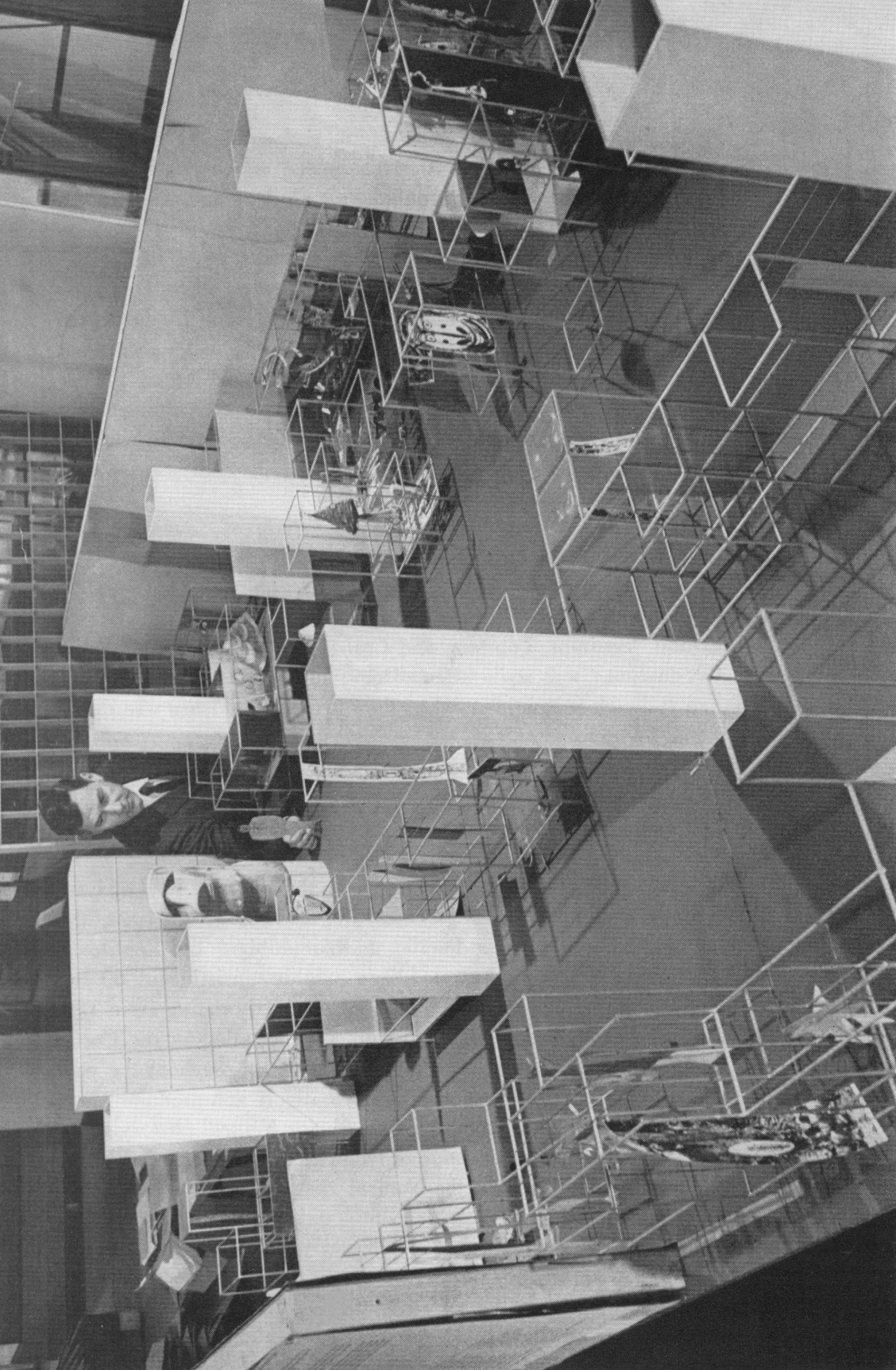
The exhibition expansion program continued to gain momentum during the past twelve months, and benefited from the interest and enthusiasm of the members of the three divisions of the department: Exhibition, Graphic Arts, and the Print Shop.

The Hall of Indians of the Eastern Woodlands was completed and opened to the public on May 23, 1966. This is one of the most colorful of the new exhibition areas in the Museum. The nature of the material demanded bright but sympathetic background treatment, and a color scheme of unusual range and complexity was selected for the display panels and cases. The atmosphere is further enhanced by the sound of music appropriate to the activities portrayed in specific displays.

In the Hall of the Biology of Invertebrates, six important exhibits were finished. Three of these, the exhibits on Protozoa, the glass

A model of the Hall of the Peoples of the Pacific, which is being developed under the direction of Dr. Margaret Mead, of the Department of Anthropology, indicates how various cultural patterns of Pacific Island groups will be interpreted. Mr. Philip Gifford, also of the Department of Anthropology, holds a scale model of a man to show the size of the completed hall.

Photograph: The New York Times (Sam Falk)



models of Coelenterata and Rotifera, and a display on the phenomenon of bioluminescence, were opened to the public. The exhibits on behavior were scheduled for public opening in late summer of 1966.

The displays on bioluminescence are excellent proof of the value of intelligently applied animation to natural history exhibits. Seven circular dioramas, three and one-half feet in diameter, portray bioluminescent situations in a tropical rain forest, a subtropical woodland, in the depths of the sea, at the surface of the sea, in the tidal zone and bay waters, and on the beach. Incandescent and ultraviolet light provide a complete one-minute sequence of day-light-darkness-daylight, which is viewed through binnacle-like domes on top of the dioramas.

Above these exhibits is mounted a group of four models of fireflies, mechanized to produce light signals exactly as these fireflies do in nature.

In conjunction with the opening of this section of the hall, the exhibit "Shrimps, Lobsters, and Crabs: Much Ado about Decapod Crustaceans" was re-installed. This exhibit was very popular but had to be closed in 1962 when the old Hall of Fishes was demolished.

An important step in the program was the beginning of work on the Hall of Mexico and Central America, which is being renovated and modernized to provide an appropriate setting for the material it houses.

Work continued, in various stages, on the Lindsley Hall of Earth History, and on the halls of Ocean Life, the Biology of Fishes, Man in Africa, Peoples of the Pacific, and Amphibians and Reptiles.

"Natural History Illustrated," an exhibit consisting of 60 rare books, paintings, engravings, and field notebooks dating from 1536 from the collections of the Museum, was installed in the Corner Gallery in July, 1965, and remained on view throughout the year.

The Graphic Arts Division worked creatively and productively on a variety of projects, including artwork for *Natural History* magazine, the design and production of *Nature and Science*, and the illustrations for five books of the Natural History Press.

In addition, the Graphic Arts Division continued to produce all the posters and promotional literature requested by the Department of Education and the Planetarium.

In the Print Shop, the volume of work remained high. A substantial amount of time was spent on the production of labels for exhibits, including all those in the Hall of Indians of the Eastern Woodlands.

Gordon R. Reekie, *Chairman*

LIBRARY

The resources of the Library were used more extensively during the past twelve months than during any comparable period in the 63 years of its formal existence. The figures for attendance (15,625), for circulation (52,212), for reference queries (14,351), and for loan requests (1664) lend emphasis to the fact that, despite the massive outpourings of aid to college, university, school, and public libraries by the Federal Government, the Museum Library plays an increasingly important role in the research activities of many individuals.

Among those who take advantage of the priceless resources of the Library are visiting scholars, college and university students, and representatives of commercial organizations, federal and state governments, other museums, and foreign libraries.

The greatest use of the Library is by undergraduate and graduate students seeking those books and journals not to be found in their academic libraries, and by scholars intent on discovering the more obscure and rare references to source material in the natural sciences. Obviously, although the colleges and universities of the nation are finding substantial support for their library programs through such federal legislation as the Higher Education Facilities Act, they continue to call upon the resources of others. If it were not possible to depend on such special libraries as the Library of the American Museum of Natural History, there is reason to believe that their research activities would be seriously hampered.

Both reference work and inter-library borrowing reflected the extended activity. In addition to 1085 inter-library loan requests which were filled by lending the actual item in question, 579 requests were filled by the substitution of Xerox copies. These figures represent an increase over those of the fiscal year 1964–1965, which in turn were larger than those for the preceding twelve months. During the year, the Library borrowed 127 volumes for use by Museum scientists.

There was a slight increase both in the number of periodical items (17,023) and books (1916) added to the collection. In addition, 491 new serial titles were acquired as the result of both purchase and exchange agreements. The last figure represents nearly a 50 per cent increase over the number of serial titles added during the fiscal year 1964–1965.

Many gifts were received which greatly enhanced the value and usefulness of the collection. Mr. Cyril F. dos Passos, a long-time benefactor of libraries, presented a magnificent eight-volume set by Ernst and Engramelle, "Papillons d'Europe," Paris, 1779–1792, particularly noteworthy because of its rarity and its exquisite color plates. Señora Marianna de Ibarra of Palma de Mallorca, Spain, presented Comte Georges Buffon's nine-volume work, "Museo Pin-toresco de Historia Natural," 1852–1858, and Andres Ferrer de Valdecebro's rare "Gobierno General, Moral, y Politico, Hallado en las Fieras, y Animales Sylvestres," Madrid, 1680.

Mrs. Nancy Russell continued her duties as a restorer of rare books. She examined and repaired a total of 1715 volumes.

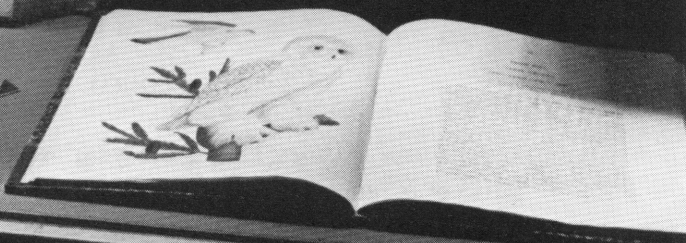
"Natural History Illustrated," an exhibit of 60 rare books, engravings, paintings, and field notebooks from the collections of the Museum, was on view in the Corner Gallery throughout the year. Here a visitor examines Alexander Wilson's "The Natural History of the Birds of the United States," a classic work of American ornithology. A mounted specimen of a snow owl and a copper plate for one of the engravings are displayed above the book.

Photograph: Morris Warman



One of the original manuscript pages is the illustration of the
American Goldeneye. From the illustration for the first edition of
the book, the illustration of the Goldeneye was taken. The illustration
of the Goldeneye was taken from the original manuscript. The
original manuscript was not from 1825 to 1826 in public domain.
The picture is for the original and the reproduction of the original.

AMERICAN GOLDEN EYE (1825-1826)
The illustration of the American Goldeneye was taken from the original manuscript. The illustration of the Goldeneye was taken from the original manuscript. The original manuscript was not from 1825 to 1826 in public domain. The picture is for the original and the reproduction of the original.



“Natural History Illustrated,” an exhibit of rare books and paintings depicting illustrations in the natural sciences, was opened in the Corner Gallery on July 6, 1965. It is the first time that many of the rare items in the collection have been put on display.

The Library is grateful to interested friends who provide essential help for many of its operations. During the past year, much financial and moral support was received from such generous contributors as Mr. Cyril F. dos Passos, Dr. Robert M. Stecher, Mr. Robert D. Sterling, and the late Mrs. Sterling.

George H. Goodwin, Jr., *Librarian*

PUBLICATIONS

CURATOR

Curator, a quarterly professional journal, had its most successful year, reaching a paid subscription list of 931.

This forum for the museum profession reaches individuals and institutions in every area of the United States and in 45 other countries. The scope of subject matter is broad and covers topics of interest to people engaged in many aspects of museology, from the care of scientific collections to the restoration of rare paintings, and the development of information-retrieval systems. The comments of readers make it clear that this journal is providing useful and stimulating information.

Harry L. Shapiro, *Editor-in-Chief*

NATURAL HISTORY

Natural History ended the year with a total paid circulation of 185,665, an increase of 15,159 over the total for last year. The number of revenue pages and income from advertising also exceeded the totals for last year.

The magazine continued to receive numerous unsolicited manuscripts of high quality, as well as many directly sought by the edi-

torial staff. Among the latter were several by members of the scientific staff of the Museum, who also helped by offering suggestions.

Requests for reprints of articles that have appeared in the magazine continued, particularly for the annual survey of science books for young people. In just three years this round-up of current scientific literature has established its influence as a vital force in the selection of science books by schools and libraries throughout the nation. More than 3000 reprints of the survey were sent out without charge during the year.

Robert E. Williamson, *Managing Editor*

NATURAL HISTORY PRESS BOOK PROGRAM

The Book Program of the Natural History Press published fourteen books in its third year of operation. The most notable publication was "Ideas in Modern Biology," edited by Dr. John A. Moore, Professor of Zoology at Columbia University and a Research Associate in the Department of Herpetology. This volume, which is one of the most significant books to be published during the year in the field of zoology, comprises the proceedings of the General Plenary Symposia of the XVI International Congress of Zoology, held in 1963.

Another highlight was the publication of "The Identity of Man" by Dr. J. Bronowski, Deputy Director of the Salk Institute for Biological Research. The book is based on the lectures Dr. Bronowski delivered in 1964 inaugurating the annual program of Man and Nature Lectures sponsored by the Natural History Press and the Museum. The 1965 series of Man and Nature Lectures delivered by Dr. George Wald of Harvard University will be published later in the year.

Two books by Museum scientists also appeared under the Natural History Press imprint this year. They are "Birds Around the World" by Dr. Dean Amadon and "Wayward Servants" by Dr. Colin M. Turnbull. During the year "Bird Migration" by Dr. Donald R. Griffin of The Rockefeller University and the New York

Zoological Society received the Seventh Annual Phi Beta Kappa Award in Science.

James K. Page, Jr., *Editorial Director*

NATURE AND SCIENCE

Nature and Science has continued to provide students and their teachers with lively, accurate, and up-to-date information on science. The service provided by the magazine to the elementary school curriculum was augmented by five Resource Study Units. Each of these 24-page collections of past articles from the magazine explores a single topic, such as "Investigations with Plants" and "You and the Land." Eight large wall charts reproduced from previous issues were also made available to schools. Plans for next year include the publication of an advanced edition of *Nature and Science* for junior high school students.

Franklyn K. Lauden, *Managing Editor*

SCIENTIFIC PUBLICATIONS

The office of Scientific Publications published seven articles in the *Bulletin*, totaling 1112 printed pages; 29 numbers in *American Museum Novitates*, totaling 664 pages; one part of *Anthropological Papers*, totaling 108 pages; and one James Arthur Lecture on the Evolution of the Human Brain of 54 pages. The combined totals represent 1938 printed pages.

In the zoological series (*Bulletin* and *American Museum Novitates*) there are 40 papers in press totaling approximately 2000 printed pages; the majority of these should be issued in the calendar year 1966.

"Modes of Reproduction in Fishes" by Dr. Charles M. Breder, Jr., and Dr. Donn E. Rosen, was completed during the fiscal year, with support from the National Science Foundation.

Ruth Tyler, *Editor*

PLANT OPERATION AND MAINTENANCE

Again this year the Museum was engaged in an active program of construction and maintenance. The work was financed by the City of New York through the Capital Budget program, by grants from the Federal Government, and by funds from the Board of Trustees.

Among the major items completed during the year was the installation of new laboratories and offices for the Department of Ichthyology. These were installed with the help of a grant from the National Science Foundation and funds from the Board of Trustees. The four other major capital improvements were financed by the City of New York. These included conversion of the steam heating systems, a survey to determine the requirements for modernization of the present electrical distribution system, repointing of exterior masonry work, and the structural remodelling of the new Hall of Man in Africa.

Additional capital improvements started during the fiscal year were the construction work for the new cafeteria and the installation of a new security fence around the courtyard.

The maintenance force continued their strenuous efforts to offset the wear of time on our nineteen-building complex.

Paul H. Grouleff, *Plant Manager*

ATTENDANCE

During the fiscal year here reported, 2,244,806 people visited the Museum, and 586,727 visited the Planetarium, making a combined total of 2,831,533.

THE AMERICAN MUSEUM OF NATURAL HISTORY

FINANCIAL STATEMENTS

FOR THE YEARS ENDED JUNE 30, 1966 AND 1965

THE AMERICAN MUSEUM OF
BALANCE SHEETS, June

ASSETS:	1966	1965
Current funds:		
General funds:		
Cash	\$ 468,568	\$ 514,670
Accounts receivable	395,931	269,086
Inventories, principally publications, at cost	50,943	53,397
Prepaid expenses	90,237	73,090
	<u>\$ 1,005,679</u>	<u>\$ 910,243</u>
 Special funds:		
Cash:		
Demand deposits	\$ 462,036	\$ 438,839
Time deposits	1,125,752	981,158
Accounts receivable	18,581	23,788
	<u>\$ 1,606,369</u>	<u>\$ 1,443,785</u>
	<u>\$ 2,612,048</u>	<u>\$ 2,354,028</u>
 Endowment funds:		
Cash:		
Demand deposits	\$ 54,916	\$ 43,511
Time deposits	75,000	1,500,000
Investments (market June 30, 1966, \$48,689,000)		
(Note 1):		
Bonds	20,881,981	19,247,445
Preferred stocks	2,141,407	1,709,309
Common stocks	15,696,949	14,716,193
	<u>\$38,850,253</u>	<u>\$37,216,458</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	\$ 65,881	\$ 100,309
Time deposits	20,000	700,000
Investments, at cost (market June 30, 1966, \$10,314,000):		
Bonds	6,482,156	5,706,207
Preferred stocks	475,759	468,961
Common stocks	2,337,235	1,980,731
	<u>\$ 9,381,031</u>	<u>\$ 8,956,208</u>
	<u>\$51,268,332</u>	<u>\$48,951,694</u>

The accompanying notes are an

NATURAL HISTORY
30, 1966 and 1965

FUNDS AND LIABILITIES:	1966	1965
Current funds:		
General funds:		
Accounts payable and accrued liabilities	\$ 137,884	\$ 125,688
Deferred income, principally unearned subscriptions	744,005	671,376
Advance from City of New York	150,000	150,000
	<u>1,031,889</u>	<u>947,064</u>
Deficit	26,210	36,821
	<u>\$ 1,005,679</u>	<u>\$ 910,243</u>
Special funds:		
Balances of funds received or appropriated for specific purposes	\$ 1,606,369	\$ 1,443,785
	<u>\$ 2,612,048</u>	<u>\$ 2,354,028</u>
Endowment funds:		
Endowment funds, income available for:		
Restricted purposes	\$15,426,230	\$14,567,285
Unrestricted purposes	8,185,965	7,983,657
Funds functioning as endowment, principal and income available for:		
Restricted purposes	4,596,145	4,536,081
Unrestricted purposes (Note 2)	10,641,913	10,129,435
	<u>\$38,850,253</u>	<u>\$37,216,458</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	\$ 9,381,031	\$ 8,954,081
Welfare fund balance		2,127
	<u>\$ 9,381,031</u>	<u>\$ 8,956,208</u>
	<u>\$51,268,332</u>	<u>\$48,951,694</u>

integral part of these statements.

GENERAL FUNDS
SUMMARY STATEMENTS OF CHANGES
for the years ended June 30, 1966 and 1965

	<i>1966</i>	<i>1965</i>
Deficit, beginning of year	\$ 36,821	\$ 45,055
Less, Transfer from unrestricted funds functioning as endowment	<u>36,821</u>	<u>45,055</u>
	<u>—</u>	<u>—</u>
Income:		
Appropriation from the City of New York	\$1,809,282	\$1,760,079
Endowment funds	1,446,685	1,328,928
Outside trusts and foundations	24,899	24,674
Gifts and grants	290,620	276,299
Other (Notes 2, 3 and 4)	<u>493,221</u>	<u>476,901</u>
	<u>\$4,064,707</u>	<u>\$3,866,881</u>
Expenses:		
General administration	\$ 665,755	\$ 673,308
Educational activities	1,639,077	1,585,349
Operation and maintenance of physical plant	1,383,472	1,303,340
Pension and other social benefits	<u>402,613</u>	<u>341,705</u>
	<u>\$4,090,917</u>	<u>\$3,903,702</u>
Deficit, end of year	<u>\$ 26,210</u>	<u>\$ 36,821</u>

The accompanying notes are an integral part of these statements.

SPECIAL FUNDS
SUMMARY STATEMENTS OF CHANGES
for the years ended June 30, 1966 and 1965

	<i>1966</i>	<i>1965</i>
Balance, beginning of year	<u><u>\$1,443,785</u></u>	<u><u>\$1,102,483</u></u>
Income:		
Endowment funds	\$ 343,220	\$ 313,649
Gifts and grants	1,433,386	1,161,113
Other	284,999	242,817
Transfer from endowment funds	84,749	191,470
	<u><u>\$2,146,354</u></u>	<u><u>\$1,909,049</u></u>
Expenditures for the special purposes and objects for which the funds were established	\$1,749,963	\$1,549,078
Transfer to endowment funds	233,807	18,669
	<u><u>\$1,983,770</u></u>	<u><u>\$1,567,747</u></u>
Balance, end of year	<u><u>\$1,606,369</u></u>	<u><u>\$1,443,785</u></u>

The accompanying notes are an integral part of these statements.

ENDOWMENT FUNDS
SUMMARY STATEMENTS OF CHANGES
for the years ended June 30, 1966 and 1965

	<i>1966</i>	<i>1965</i>
Balance, beginning of year	<u>\$37,216,458</u>	<u>\$32,116,631</u>
Additions:		
Gifts, bequests, etc. (Note 2)	\$ 634,994	\$ 4,627,536
Net profit on sales of investments	894,674	698,634
Transfer from special funds	233,807	18,669
	<u>\$ 1,763,475</u>	<u>\$ 5,344,839</u>
Deductions:		
Custodian fee	\$ 5,000	\$ 5,000
Transfers to general funds:		
For payment of certain expenses (included in general funds, other income)	3,110	3,487
To dispose of operating deficit of preceding year	36,821	45,055
Transfer to special funds	84,749	191,470
	<u>\$ 129,680</u>	<u>\$ 245,012</u>
Net additions	<u>\$ 1,633,795</u>	<u>\$ 5,099,827</u>
Balance, end of year	<u>\$38,850,253</u>	<u>\$37,216,458</u>

The accompanying notes are an integral part of these statements.

PENSION FUNDS
SUMMARY STATEMENTS OF CHANGES
for the years ended June 30, 1966 and 1965

	<i>1966</i>	<i>1965</i>
Balance, beginning of year	<u>\$8,956,208</u>	<u>\$8,492,370</u>
Additions:		
Contributions of members	\$ 187,510	\$ 177,986
Contributions of Museum	224,667	213,116
Income from investments	397,197	372,573
Net profit on sales of investments	10,299	65,944
	<u>\$ 819,673</u>	<u>\$ 829,619</u>
Deductions:		
Payments to members and beneficiaries	\$ 389,488	\$ 360,581
Expenses	5,362	5,200
	<u>\$ 394,850</u>	<u>\$ 365,781</u>
Net additions	<u>\$ 424,823</u>	<u>\$ 463,838</u>
Balance, end of year	<u><u>\$9,381,031</u></u>	<u><u>\$8,956,208</u></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 1966 and 1965, royalties received amounted to \$36,017 and \$41,219, respectively. Such amounts were credited to general funds (other income) in the respective years.
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 1966 and 1965. These amounts are included in other income of the general funds.
4. Other income of the general funds for the years ended in 1966 and 1965 includes net income from magazine and book shop operations of \$82,770 and \$79,081, respectively. Gross income from magazine and book shop operations amounted to \$1,288,321 and \$1,173,347 for the respective years.

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, 1966 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, 1965.

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, 1966 and 1965 and the results of its operations for the years then ended, on a consistent basis.

LYBRAND, ROSS BROS. & MONTGOMERY

Certified Public Accountants

New York, August 11, 1966.

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

FINANCIAL STATEMENTS

FOR THE YEARS ENDED JUNE 30, 1966 AND 1965

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

ASSETS:	<i>1966</i>	<i>1965</i>
Cash	\$ 75,829	\$ 55,076
Accounts receivable	2,473	2,626
Inventory, principally publications, at cost	<u>24,269</u>	<u>26,027</u>
	<u><u>\$102,571</u></u>	<u><u>\$ 83,729</u></u>
Equipment, fixtures, etc. (Note 1) :		
Zeiss planetarium instrument, at cost	\$135,059	\$135,059
Less, Allowance for depreciation	<u>43,890</u>	<u>37,138</u>
	91,169	97,921
Furniture, fixtures and equipment, at cost, less allowance for depreciation, \$139,526	<u>1</u>	<u>1</u>
	91,170	97,922
Building, at cost (Note 1)	569,209	569,209
Land (donated by the City of New York)	<u>—</u>	<u>—</u>
	<u><u>\$660,379</u></u>	<u><u>\$667,131</u></u>
	<u><u>\$762,950</u></u>	<u><u>\$750,860</u></u>

The accompanying notes are an

OF NATURAL HISTORY
AUTHORITY

30, 1966 and 1965

LIABILITIES:	1966	1965
Accounts payable	\$ 5,096	\$ 3,841
4½% Refunding Serial Revenue bonds, past due (Note 2)	570,000	570,000
Accrued interest, past due	315,450	315,450
	<u>\$890,546</u>	<u>\$889,291</u>

CONTRIBUTED CAPITAL AND DEFICIT:

Contributed capital:		
Charles Hayden	\$156,869	\$156,869
Charles Hayden Foundation	250,925	250,925
	<u>407,794</u>	<u>407,794</u>
Deficit, as annexed	535,390	546,225
	<u>\$127,596*</u>	<u>\$138,431*</u>
	<u>\$762,950</u>	<u>\$750,860</u>

* Denotes deduction.

integral part of these statements.

STATEMENTS OF INCOME, EXPENSES AND DEFICIT

for the years ended June 30, 1966 and 1965

	1966	1965
Income:		
Admission fees, less allowances and commissions	\$373,109	\$346,133
Special lectures and courses	17,286	11,951
Miscellaneous	4,725	7,167
	<u>395,120</u>	<u>365,251</u>
Auxiliary activity, sales booth	82,360	79,807
Total	<u>\$477,480</u>	<u>\$445,058</u>
Expenses:		
Preparation, presentation and promotional:		
Salaries	\$161,355	\$158,577
Supplies and expenses	29,915	24,417
	<u>191,270</u>	<u>182,994</u>
Operation and maintenance:		
Salaries	108,062	108,281
Supplies and expenses	28,051	22,944
	<u>136,113</u>	<u>131,225</u>
Administrative and general:		
Salaries	7,500	7,500
Pension fund, social security and other employee benefits	27,526	25,134
Miscellaneous	11,737	11,499
	<u>46,763</u>	<u>44,133</u>
Auxiliary activity, sales booth	60,096	56,043
Total	<u>\$434,242</u>	<u>\$414,395</u>
Income before interest and depreciation	<u>\$ 43,238</u>	<u>\$ 30,663</u>
Interest on past-due 4½% Refunding Serial Revenue bonds	\$ 25,650	\$ 25,650
Provision for depreciation (Note 1)	6,753	6,753
Total interest and depreciation	<u>\$ 32,403</u>	<u>\$ 32,403</u>
Net income (loss) for year	\$ 10,835	(\$ 1,740)
Deficit, beginning of year	546,225	544,485
Deficit, end of year	<u>\$535,390</u>	<u>\$546,225</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.

The Members of The American Museum 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, 1966 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, 1965.

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, 1966 and 1965 and the results of its operations for the years then ended, on a consistent basis.

LYBRAND, ROSS BROS. & MONTGOMERY

Certified Public Accountants

New York, August 11, 1966.

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