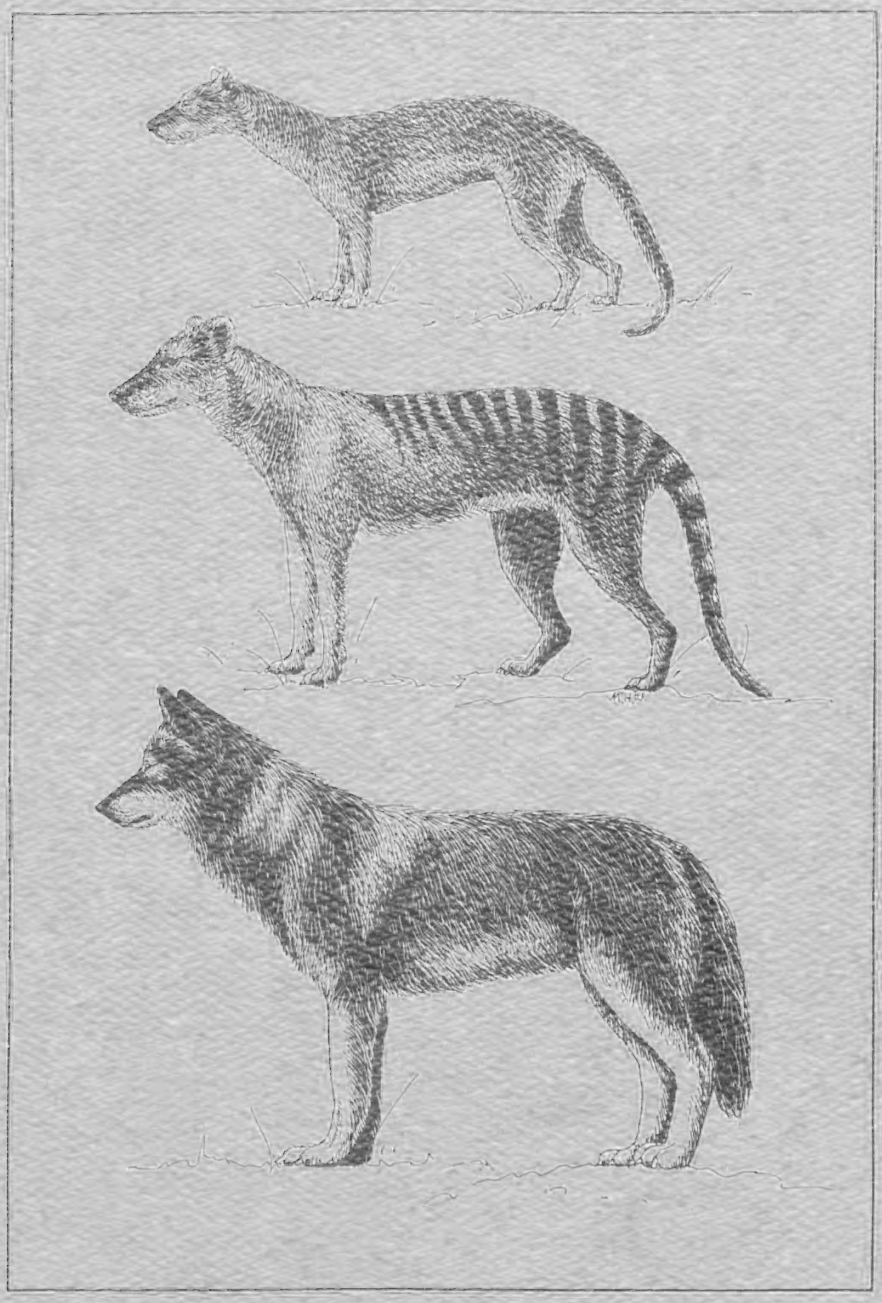
FIELD MUSEUM OF NATURAL HISTORY

COLLECTIONS AND RESEARCH



1989 REPORT

TO

THE BOARD OF TRUSTEES

Illustration by
Marlene Hill Werner
Field Museum of Natural History

Collections and Research
Vice President Jonathan Haas
Field Museum of Natural History
Chicago, Illinois 60605

FIELD MUSEUM OF NATURAL HISTORY
COLLECTIONS AND RESEARCH

Report to the Board of Trustees

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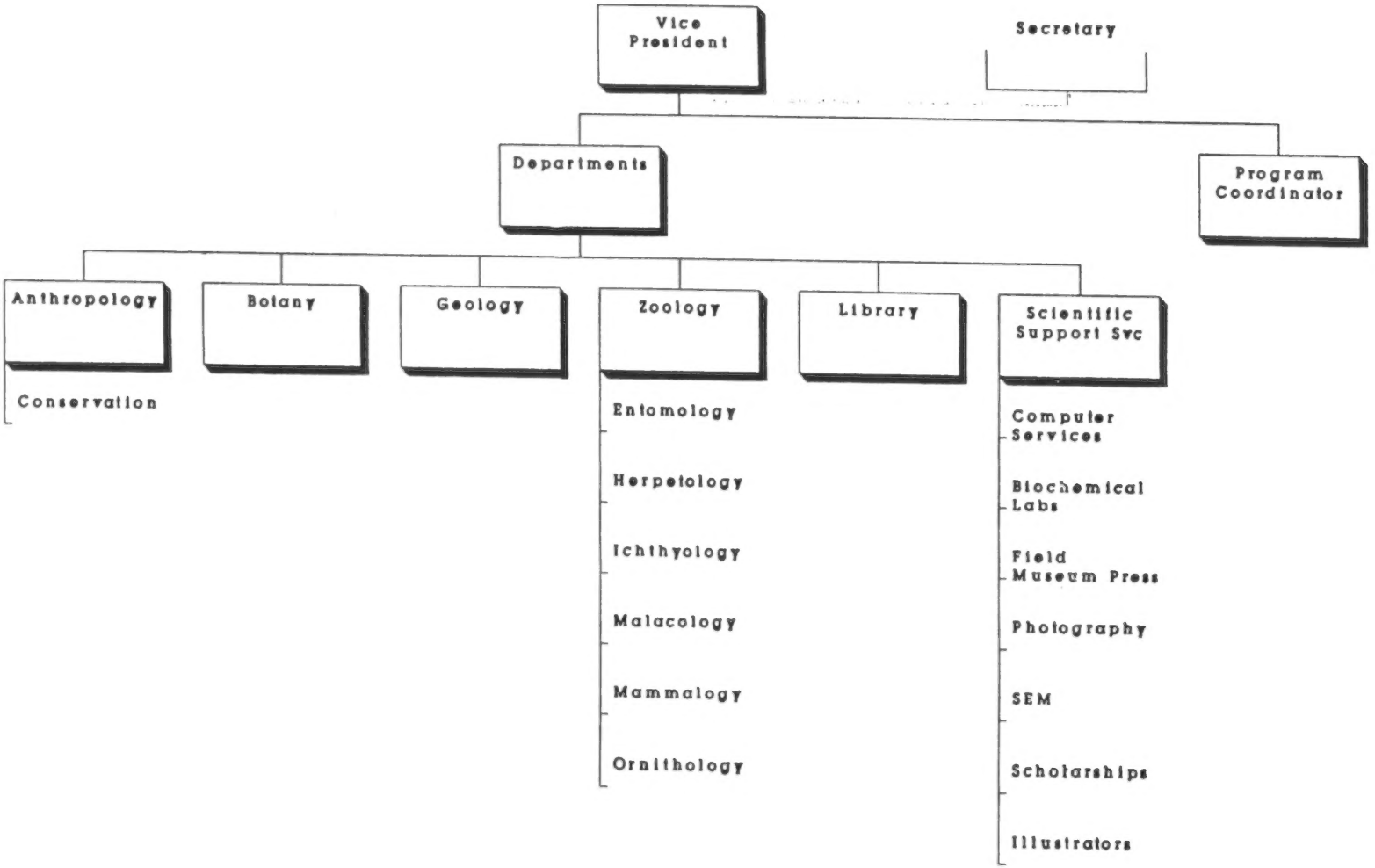

1990

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Zbigniew Jastrzebski, M.F.A.....Senior Scientific Illustrator
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Scanning Electron Microscope

Betty Strack.....SEM Technician

Biochemical Laboratories

John Hall, Ph.D.....Manager, Biochemical Laboratories

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Harold K. Voris, Ph.D.*, 1990.....Scientific Editor, Field Museum Press
.....Managing Editor, Field Museum Press
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Nina Cummings, B.A.....Photo Researcher
Nance Klehm.....Department Clerk
Diane Alexander White, B.A.....Photographer

*Second listing. Name appears already in staff list.

COLLECTIONS AND RESEARCH - OVERVIEW

The 1980s witnessed a significant transformation of the Collections and Research division of Field Museum. The separation of Public Programs and Collections and Research into different divisions was an administrative recognition of the growing complexity of the two central elements of the Museum's mission: discovery and dissemination of knowledge of natural history based on our collections. Organized as a separate division, Collections and Research has been able to focus more of its energy and intellectual resources on addressing broad substantive issues in the realms of biology, geology and anthropology.

When Collections and Research was set up in 1984, Dr. Harold Voris, then Curator and Chair of Zoology, was appointed as the first Vice President of the Division. Dr. Voris was faced with the challenge and opportunity to affect the future direction of collections-based research at Field Museum. This was a time of major change in the curatorial ranks and among the professional services staff. Building on a strong research base and working with dedicated departmental chairmen, Dr. Voris brought in a new generation of scientists and professionals, a generation devoted to exploring the frontiers of their disciplines. Today, Field Museum is significantly advancing its position of international leadership in research in cultural and natural sciences.

In 1989, the transition in Collections and Research continued, when Dr. Voris returned to his position as Curator in Zoology, and Dr. Jonathan Haas came to Field Museum

to assume the position of Vice President. Coming from the outside and as an anthropologist, Dr. Haas brings a new dimension to the office of the Vice President. With new leadership and solid fiscal and intellectual foundations, the Collections and Research Division in the 1990s can focus attention on a broad range of goals and objectives that will further enhance the quality of scientific endeavor at Field Museum. Below are outlined some of the central challenges being addressed as we close out the 1980s and look to the celebration of the Museum's centennial.

Women and Minority Scientists

We are seeking to enrich the quality of the professional staff in Collections and Research by finding appropriated means of bringing women and minority scientists into the scholarly community. The curatorial faculty at Field Museum today consists entirely of white men. Although there are valid historical reasons for the development of this faculty, there are also valid reasons for now seeking to diversify the faculty. Of course, the most direct and immediate way to have women and minorities join the curatorial faculty would be to hire them directly to fill open positions. Toward this end, we are pursuing a vigorous affirmative action policy in the recruitment of new curators. However, in some fields, particularly in biology and paleontology, there is a severe shortage of women and minorities engaged in collections-oriented research. Despite our best efforts to recruit such individuals, therefore, the efforts are thwarted by a general lack of qualified candidates.

Rather than simply accept this situation the Collections and Research Division is taking proactive steps find ways to encourage women and minorities to enter the natural history fields and to come to Field Museum for direct experience in collections-based research. A new affirmative action committee, chaired by Dr. Charles Stanish, Assistant Curator of Anthropology, has been established with three goals: to investigate the status of women and minorities in the natural sciences; to explore the reasons for the underrepresentation of such individuals; and to search for new and innovative ways to enrich the diversity of scientists at Field Museum. We are also working with the Development Division to initiate a new endowment program for both post- and pre-doctoral scholarships for women and minorities.

Interdisciplinary Research

It is important to encourage integrative, interdisciplinary research that intersects some of the arbitrary barriers among departments. As we succeed in building the foundations of knowledge in anthropology, botany, geology and zoology, it becomes increasingly apparent that the solutions to broad problems in natural history are to be found in research across disciplines. While the anthropologists focus on cultural evolution and the biologists on evolutionary biology, these are but different aspects of a common process, the evolution of living systems. To understand this process will then require bringing together anthropology and biology to look for common ground as we seek to explain how and why all living creatures evolve.

Similarly, research on biodiversity cannot be fully separated from cultural diversity. As the world is faced with unprecedented extinction of animal and plant species, so is it faced with the extinction of cultures and ethnic groups. Humans are an integral part of all environments today, from the tropical rainforests to the driest deserts, and biological and cultural extinctions are going hand-in-hand. There are no strictly environmental problems - there are problems in the ways people deal with their environment. To most effectively apply and relate the research done at Field Museum to these human/environment problems, we must look for ways to communicate and interact across our disciplinary boundaries. The Spring Systematics Symposium series, under the direction of Dr. Matthew Nitecki, continues to serves as an excellent vehicle for engaging interdisciplinary discussion, and stimulating interdisciplinary research. In 1989, the Symposium was on "History and Evolution," and the 1990 Symposium will be on "Evolutionary Ethics." We have also taken the first steps to initiate a new interdisciplinary Fieldiana series to publish broad synthetic works aimed at explaining patterns in the evolution of living systems.

Collections Management and Conservation

As the curatorial staff has become less directly involved in the development of public exhibits and more focused on grant-supported research, there also has been a parallel increase in the professionalization of the collections management and conservation staffs. In all of the departments, the collections managers are taking more and more responsibility for the actual "curation" of the specimens and artifacts.

These individuals oversee incoming and outgoing loans, accession of new collections, and generally act to maintain the integrity and welfare of the collections. In recognition of the growing role of collections management, Dr. Haas has convened a new standing committee of the collections managers, conservators and registrars with direct responsibility for collections care and maintenance. Each collections area, for example, fishes or fossil vertebrates, has a representative on this committee. The immediate goal of this committee is to ensure that the well-being of the collections is not overlooked in the face of increased attention to basic research.

Teaching and Training Young Scientists

For Field Museum to be most effective in achieving its mission, we must find active ways to incorporate collections-based research in the broader anthropological and biological sciences. One direct way of accomplishing this goal is directly through publication. As listed in this report, the Museum's curators and associated scientists have published widely, with articles and books directed to both scientific and public audiences. Another way to reach outside the immediate museum community is through teaching and student training. Although there have long been informal relations between individual curators and local institutions, in 1989 we began to formalize these relations to the mutual benefit of all parties.

Specifically, the Museum has a new arrangement with the University of Chicago Biological Sciences Collegiate Division whereby the Museum has the status of a

department in the Division's governing committee, and the commitment to teach five classes a year at the University. These courses allow the curators an opportunity to participate in the education of the next generation of scientists and bring students into their respective research projects, as well as augment their annual salaries. With our arrangement with the University of Chicago as a model, we have started discussions with the Biological Sciences Department at the University of Illinois at Chicago to find productive ways for Museum curators to work with students, serve on graduate committees and teach some classes. We are also working with the UIC Anthropology Department to pursue the possibility of establishing a joint Museum/University Ph.D. program. At a very preliminary level, we have recently been approached by Biological Sciences at Northwestern University to see if Museum curators might be able to teach there as well.

With the growth of opportunities to work with students at local universities, we come to face with the question of the appropriate role for the Museum to be playing in the education of biologists and anthropologists. The Museum is not a university and we do not want teaching to detract from the research and curatorial responsibilities of the curators. At the same time, in recent years there has been an alarming shortage of scientists trained in the critical areas of systematics and collections-oriented research in biology and anthropology. Teaching courses in such subjects is one way the Museum can address this problem. Another possibility would be to have a highly-focused training program in collections research at the Museum for a select group of interested students. In 1990 we will be exploring the idea of having approximately 10

students come to study and work at Field Museum for a semester. These students would take classes offered by curators at local universities, and each student would work directly with one curator on a special project centered on some aspect of the collections. This program will be self-supporting through the payment of tuition by the students. Neither this training program nor any of the relationships with the local universities will involve an individual curator teaching more than one class per year.

The Relationship with Public Programs

Collections and Research will be working hard with the Public Programs Division to find the most effective ways to achieve appropriate scientific and curatorial input into the development of public exhibits. In order to insure the highest standards of scientific accuracy in the public exhibits of Field Museum, it is vital that curators and other knowledgeable scientists be intimately involved in exhibit development. In 1988, new guidelines were developed to facilitate the relationship between the two divisions, and Dr. Haas has been working closely with Mr. Michael Spock, Vice President for Public Programs, in implementing these guidelines. Together, they have taken the first steps in appointing content specialists and point person advisors for the second phase of the Pacific exhibit, the Animal Kingdom exhibit, and Life Over Time. They are also actively looking to find the right content specialist for the new Africa exhibit. Since the Museum does not have an Anthropology curator specializing in the people and material culture of Africa, they are looking for an outside specialist who would then be appointed as a Visiting Curator for the duration of the exhibit and as a

Research Associate thereafter.

Native Peoples

The passage by the Board of Trustees of a policy for the repatriation of human remains in 1989 marked a new era in the way Field Museum works with different cultures and ethnic groups represented in our rich anthropological collections. The policy provides a means for different groups to reclaim for reconsecration the human remains of their ancestors that may be held by the Museum. Soon after the adoption of this policy we received our first request for the return of human remains from the Blackfeet Indian Tribe of Montana. We are now working with tribal representatives to expedite the return of the remains of 34 individuals clearly identified as Blackfeet. The tribal representatives have been most gracious in agreeing to allow basic analysis of these remains by physical anthropologists prior to their return.

The development and implementation of this policy is the first step in trying to find new kinds of relationships with native people in determining the proper treatment, display and disposition of our collections of material culture from different peoples around the world. While the Museum's collections taken together are a priceless world resource, individual parts of the collection also often represent a precious source of information on the past customs, arts, technology and ritual of a specific culture. Over the past century, Field Museum has collected and curated artifacts, works of art, ceremonial objects, and other objects of material culture from myriad

peoples, past and present, around the world. In many cases the items we have collected are sacred or require special treatment according to the beliefs of the people who made them. While we have an overriding fiduciary responsibility to maintain the integrity and well-being of all our collections, we also have an obligation to be sensitive to the beliefs and needs of different cultures. To enhance our lines of communciation with native peoples, a new Native American internship program has been initiated, and the first two interns began working early in 1990 to help develop procedures for fully implementing the new repatriation policy. We will also be bringing in a group of national Indian leaders to open a dialogue about the future of relationships between the Museum and native groups.

Collections Storage

As part of the Centennial Directions Capital Campaign, $4.5 million was raised for the construction of a new collection storage facility for the Botany and Geology departments of the Collections and Research Division. After the engineers and architects carefully examined the existing building supports and the loading requirements for botanical and geological specimens, it was concluded that the proposed construction of a new storage facility was feasible within the boundaries of the $4.5 million available. The proposed project will construct a four-level lightwell infill in the center lightwell on the east side of the building. As part of the project, the piers will be strengthened and the loading capacity of this area will be increased. This will provide Collections and Research with an additional 31,800 sq. ft. of storage space.

In this lightwell, Collections and Research will have four levels: second floor, second floor mezzanine (with concrete floor), third floor, and fourth floor. The Geology Department will have the second floor and second floor mezzanine levels, approximately 15,900 sq. ft. Entrance to this area will be through the public second floor area (Hall 24). There will be stairs and a dumbwaiter to the mezzanine level. The Botany Department will have the third and fourth floor levels, approximately 15,900 sq. ft. Entry will be through the adjacent third floor herbarium directly north of the new lightwell. There will be stairs and a dumbwaiter to the fourth floor level.

The construction of this new storage facility will solve the storage needs for the immediate future of at least five years, probably seven years, and possibly ten years. Beyond the ten year horizon, however, the question of storage facilities for the Museum's collections must again be faced and we are going to have to consider major new storage facilities. For the long term future of the four disciplines at Field Museum, there will have to be a commitment over the course of the next 30 years to the construction of four major new storage areas, one for each department. The most likely location of such storage facilities would be beneath the terraces at the four corners of the building. While it is difficult to look so far into the future, the construction of the terraces would solve the institution's storage needs for 50 to 100 years.

There is a finite future to collecting in the realm of natural history. The levels of collecting pursued in the past century cannot continue unabated. Even today it is difficult if not impossible to remove archaeological specimens from most foreign countries. Similar restrictions are beginning to be seen for biological and geological specimens as well in some areas. We are all aware of the decimation of the natural environment on a global scale, and the number of specimens left to collect will decline accordingly. The next 25 to 30 years must be seen as a window of opportunity to continue collecting and documenting the biological and cultural diversity of the world. When that window closes, the collections of the Field Museum and our sister natural history museums will stand at the heart of all future studies of the evolution of living systems and the preservation, or resurrection, of the world's biosphere.

ANTHROPOLOGY

ANTHROPOLOGY

BENNET BRONSON (Ph.D. 1976, Pennsylvania). Chairman and Curator, Asian Archaeology and Ethnology. Joined Field Museum in 1971.

CURRENT RESEARCH:
Bronson is continuing his work on ancient trade in Southeast Asia and on the history of metallurgy and related technologies. He conducted two months of archaeological field work during 1989, excavating at two sites in southern Thailand that yield large quantities of early Chinese and Middle Eastern trade goods. He also participated in smaller collections-oriented projects focused on the traditional material culture of China.

TEACHING:
3 student interns (1 undergraduate, 2 graduates) from the University of Illinois, Urbana, and Loyola University, Chicago.

GLEN COLE (Ph.D. 1961, University of Chicago) Curator, Prehistory. Joined Field Museum in 1965.

CURRENT RESEARCH:
Cole's current research is mainly concerned with a congeries of central African stone industries, collectively known as "Sangoan". The Sangoan concept is ill-defined, in part because the artifactual material on which it is based, from the Sango Hills of southwestern Uganda, has never been adequately described. Some years ago, Cole gathered data on that part of the type collection that remains in Uganda and on the largest single collection that had been sent abroad, that at the University of Cambridge in England. In April of 1989, it was possible to visit the Cambridge museum to study material that had not been available on his earlier visit. Also, certain of the previously studied material was checked to clear up discrepancies in his earlier data. The new data have been incorporated into his data base and revisions of the paper are well along. Cole is continuing to study and catalog material from Field Museum's large collection of Middle Stone Age artifacts from Nelson Bay Cave on the southern Africa coast. Regrettably, progress on this project has been seriously delayed as Ms Deborah Green, a volunteer who had been doing most of the routine cataloging work, moved from the Chicago area mid 1989. Ms Lisa Labinger, a new volunteer, is being trained to continue the cataloging project. A good deal of research was done on burial practices of the Northwest Coast Indians of North America, initially in regards the development of a repatriation policy, but also in connection with the preparation of a paper written with Lyle Konigsberg, a Field Museum Research Associate, on The Field Museum of Natural History Human Osteological Collection. The paper is currently being revised and should be submitted for publication soon.

JONATHAN HAAS (Ph.D. 1979, Columbia) Curator, New World Archaeology. Joined Field Museum in 1989.

CURRENT RESEARCH:
Research during the year was devoted to two projects in the Southwestern United States. Haas completed a monograph on the results of a project investigating the origins of warfare among the prehistoric Anasazi Indians of northeastern Arizona. This monograph is to be published by the School of American Research Press. The second project, the Northern Rio Grande Research Project, is focused on examining the impact of the early Spanish explorers and colonists on the native Pueblo Indians of northern New Mexico in the 16th and 17th centuries. This is a long-term project looking at patterns of demographic, economic and political change among the native peoples in the first decades after contact. In the first stage of research, he is analyzing a large collections of ceramics excavated from 13 large pueblo ruins in the Rio Grande Valley in an attempt to determine how many people lived in these villages and when they were abandoned.

ADJUNCT APPOINTMENTS:
External Faculty, Santa Fe Institute

PHILLIP LEWIS (Ph.D. 1966, University of Chicago) Curator, Primitive Art and Melanesian Ethnology. Joined Field Museum in 1952.

CURRENT RESEARCH:
Phillip Lewis' current research is concerned mainly with fieldwork carried out by Lewis in New Ireland, in Melanesia from 1953 to 1981, which can be titled SOCIAL CHANGE IN NEW IRELAND. At the center of this study is a series of three village maps from 1953-54, 1970 and 1981 (drawn by Lewis during each of these periods of fieldwork), and a fourth map done by Hortense Powdermaker in 1929 when she studied the same village. The four maps show changes in the village settlement pattern from 1929 through 1981 and additionally can serve as the framework for a discussion of general social change, including changes in the ceremonial and art systems of the society. Another aspect of ongoing research is to complete for publication the paper, FUTURE OF NEW IRELAND ART, presented at the 4th International Symposium of the Pacific Arts Association in Honolulu in August of 1989. The proceedings of the PAA symposia are always published, although not very quickly. At any rate the paper is in the hands of the editorial board of PAA, awaiting further developments.

CHARLES STANISH (Ph.D. 1985, University of Chicago), Assistant Curator, Middle and South American Ethnology and Archaeology. Joined Field Museum in 1987.

CURRENT RESEARCH:
Stanish's speciality is the archaeology of the South Central Andes, an area that encompasses southern Peru, Bolivia and northern Chile. His specific research interests include the evolution of complex societies in the Andes, one of the great nuclear centers of civilization in the world. After several years of research in the

coastal valley of Moquegua, he has begun a new long-term research program in the Titicaca Basin of southern Peru. In the last two years, Stanish and his team have discovered and excavated archaeological sites that range in date from 1300 B.C. to the Spanish Conquest along the shores of lake Titicaca.

ADJUNCT APPOINTMENTS:
Adjunct professor, University of Illinois at Chicago, Department of Anthropology

TEACHING:
New World Political Economy (University of Illinois at Chicago)
Seminar in Andean Prehistory (University of Illinois at Chicago)

JOHN TERRELL (Ph.D. 1976, Harvard), Curator, Oceania. Joined Field Museum in 1971.

CURRENT RESEARCH:
My research colleague, Dr. Robert L. Welsch, and I are co-investigators on a $106,000.00 N.S.F.-funded research project refining the scientific usefulness of our world-famous ethnological collections from Melanesia. We are developing a reliable, quantified database of information on these collections, which richly document the astonishing cultural diversity of this part of the world. The focus of our current work is on the Museum's remarkable the A. B. Lewis Collection of material culture (and its associated field documentation) from the North Coast of New Guinea. We have already discovered as a result of our investigations that trade networks on this coast were far more extensive and complicated at the turn of the century (when the collection was put together by Field Museum Curator Lewis) than previously known. As part of this work, we will be on an expedition to New Guinea during the spring of 1990.

ADJUNCT APPOINTMENTS:
Adjunct Professor, Department of Anthropology, Northwestern University

TEACHING:
Supervision of three Northwestern University graduate students (funded by N.S.F. grant): Ms Leslie Ashbaugh, Ms Barbara Hsiao, and Mr. John Nadolski

JAMES W. VANSTONE (Ph.D. 1954, Pennsylvania) Curator, North American Archaeology and Ethnology. Joined Field Museum in 1966.

CURRENT RESEARCH:
In 1989 research included the following projects: (1) Work continued on the preparation of a final report on archaeological excavations at an historic Yupik Eskimo site on the Alaska Peninsula in 1985. This study is being carried out in cooperation with Dr. Don E. Dumond, University of Oregon. (2) Work ontinues on projects related to the traditional ethnography of Inupiat Eskimos of the Kotzebue Sound region, Alaska based on historical research and field work undertaken with Charles V. Lucier (retired) in 1949-52. A paper on the use of the traditional oil

lamp among Kotzebue Sound Inupiat has been completed and submitted to Arctic Anthropology. Papers on historic pottery and traditional seal hunting techniques in the area should be completed in 1990. (3) A study of Inupiat Eskimo material based on collections in the Folken Museum Etnografiska, Stockholm was completed in 1989 and accepted for publication in Fieldiana: Anthropology. (4) Work was begun on a study of Plains Cree material culture based on a collection made in 1892 for the World's Columbian Exposition.

BOTANY

BOTANY

JOHN J. ENGEL (Ph.D. 1972, Michigan State University) Chairman and Curator, Bryology. Joined Field Museum in 1972.

CURRENT RESEARCH:
The research of John Engel deals with the systematics and phytogeography of south temperate and subantarctic Hepaticae (liverworts). The focus of Engel's research is on both monographic and floristic studies of temperate Australasian hepatics. His monographic work involves treatment of the large and complex family Geocalycaceae, which is particularly diverse in south temperate and subantarctic regions. Engel is also working on the *Flora of New Zealand*, a major project in collaboration with Dr. R.M. Schuster, a Research Associate of Field Museum. The product of this project will be a book-form, illustrated treatment. Engel also authors *Index Hepaticarum Supplementum*. Each supplement covers a two-year period, and indexes all new taxa and combinations of liverworts and hornworts during that period. This is an ongoing project for the International Association of Bryologists.

WILLIAM BURGER (Ph.D. 1961, Washington University) Curator, Vascular Plants. Joined Field Museum in 1965.

CURRENT RESEARCH:
William Burger is currently preparing a treatment of the coffee family (Rubiaceae) for the Flora Costaricensis series. This is an ecologically important family of shrubs and trees in the evergreen tropics, with more than 350 species in Costa Rica. This work is being carried on in collaboration with Dr. Charlotte Taylor of the University of Puerto Rico, who is a specialist in the Rubiaceae family. Studies of Costa Rican plants over the last 25 years have shown that a number of unrelated plant families display similar patterns of geographic and ecological differentiation between closely related species. These species-pairs are being surveyed to elucidate the ways in which species have originated in a tropical environment.

ADJUNCT APPOINTMENTS:
Committee on Evolutionary Biology, University of Chicago.

MICHAEL O. DILLON (Ph.D. 1976, University of Texas) Associate Curator, Vascular Plants. Joined Field Museum in 1978.

CURRENT RESEARCH
Michael Dillon's current research consists of several projects, all centered in South America. 1) He continues to contribute treatments in his area of expertise (Asteraceae, sunflower family) for the Museum's ongoing *Flora of Peru* project documenting the flowering plants and ferns of Peru. Active field work in certain areas of Peru has been suspended due to unfavorable political and economic

conditions. 2) Last year marked the completion of 3 years of NSF supported field studies in the lomas formations of western Peru and Chile. Intensive collecting has allowed construction of a computerized data base of this highly endemic desert formation. Results are currently being analyzed and production of the first published flora for this region has begun. 3) Biological inventory of the Bosque Monteseco is a multi-disciplinary project aimed at conserving an important forest in northern Peru. Several plant and animal species new to science are being described and preliminary data indicate that the forest is a Pleistocene relict. The inventory has yielded much important biogeographic information useful in reconstruction of the past climates and vegetation. Plans are being made to expand the inventory to other pockets of forest in the area.

GREGORY M. MUELLER (Ph.D. 1982, University of Tennessee) Assistant Curator, Mycology. Joined Field Museum in 1985.

CURRENT RESEARCH:
Gregory Mueller's research is involved with fungi that form ectomycorrhizae, a mutually beneficial relationship between certain fungi and the roots of many important forest trees that is essential for both the trees and fungi to thrive. Three interrelated projects are being undertaken. 1) Work is continuing on the New World taxa of the mushroom genus *Laccaria*. Additional specimens for this study were obtained during field work to Costa Rica in November. Much progress was made also in the laboratory component of this project. Synthesis of these data is now being completed and several publications, including a treatment of the North American taxa will be forthcoming in 1990. 2) Field trips were undertaken to two study areas that are being extensively sampled to determine species composition and distribution of mushrooms and other fungi. These localities are in central and southern Costa Rica in Central America and the Aldo Leopold Memorial Reserve in central Wisconsin. 3) Work investigating the synthesis of ectomycorrhizae between seedlings of pines and southern beech (Nothofagus) and isolates of *Laccaria* is ongoing.

ROBERT STOLZE (B.S. 1949, Notre Dame) Associate Curator, Pteridophytes. Joined Field Museum in 1963.

CURRENT RESEARCH:
Robert Stolze's current research involves a 6-year project, "Pteridophyta of Peru", being authored jointly with Dr. Rolla M. Tryon, Harvard University. This floristic study is being published in *Fieldiana* in six parts, the first two of which are completed. Tryon and Stolze author most of the work, but certain genera are being contributed by recognized specialists. Approximately 100 genera and 1000 species of ferns and fern allies will be treated. No field work is involved, but in addition to the superb Peruvian collections at Field Museum and Harvard, thousands of specimens borrowed from over 20 leading herbaria around the world will have been examined during the course of study. This will be the first modern pteridophyte flora for an Andean region and will provide a source of fundamental information for botanists, zoologists, ecologists and biogeographers. Although

there are no active grants, initial research was supported by the National Science Foundation in the amount of $54,215.00.

GEOLOGY

GEOLOGY

JOHN R. BOLT (Ph.D. 1968, University of Chicago), Chairman and Curator, Fossil Reptiles & Amphibians. Joined Field Museum in 1972.

CURRENT RESEARCH:
John Bolt's current research is focused on two interrelated areas: the early evolution of land-living vertebrates, and the early evolution of the ear and hearing. Work on early land-living vertebrates includes study of 335 millon year old amphibians he collected from SE Iowa in 1986 and 1988. A preliminary report on this work appeared in the British publication Nature in 1988, and a second paper was completed in 1989 and will appear in National Geographic Research in 1990. Studies of otic (ear) evolution and function are being carried out with a colleague at the University of Chicago. The next paper in a series they have done together is currently being written for delivery in May, 1990, at a conference in Sarasota titled "The Evolutionary Biology of Hearing".

ADJUNCT APPOINTMENTS:
Adjunct Associate Professor, Geology, University of Illinois in Chicago;
Lecturer, Committee on Evolutionary Biology, University of Chicago.

PETER R. CRANE (Ph.D. 1981, University of Reading, U.K.) Associate Curator, Paleobotany. Joined Field Museum in 1982.

CURRENT RESEARCH:
Peter Crane's current research focusses on the origin and early evolution of angiosperms (flowering plants); a group of 200-300 thousand living species (including all major crop plants) that presently dominates the vegetation of most terrestrial ecosystems. Recent work has addressed four questions: to which living or fossil seed plants are angiosperms most closely related? what are the closest living relatives of early fossil angiosperms? what was the timing and pattern of the early angiosperm diversification? and what vegetational and other biotic changes occurred in association with the angiosperm diversification between about 130 and 65 myr B.P.? Current field work in eastern North America, central Portugal and Ecuador has been designed to collect well-preserved microscopic flowers of early angiosperms and related plants from the mid-Cretaceous (about 100 myr B.P.). Scanning electron microscopy of this material is providing both important systematic data, as well as a secure basis for ecological interpretations of the fossil palynological record. Ultimately, these studies and associated global syntheses of palynological data currently underway in the Department of Geology, will provide a detailed understanding of the large-scale biotic and environmental changes that occurred during a critical period of Earth history when large oceans and land masses began to assume their current position.

ADJUNCT APPOINTMENTS:
Lecturer, Committee on Evolutionary Biology, University of Chicago
Research Associate (Professor), Department of the Geophysical Sciences, University of Chicago
Adjunct Professor, Department of Botany, University of Massachusetts

TEACHING:
The Evolutionary History of Plants, Department of Botany, University of Massachusetts (1989)

JOHN FLYNN, (Ph.D. 1983, Columbia) Associate Curator, Fossil Mammals. Joined Field Museum in 1988.

CURRENT RESEARCH:
John Flynn continues integrating a wide variety of geologic techniques (including paleomagnetic analyses performed in the new Field Museum Paleomagnetics Laboratory) in studies of geologic time, plate tectonics, and mammalian evolution. In South America, Flynn is completing a study (funded by the National Science Foundation) of the geochronology of strata containing 10-20 million year old mammalian faunas (Colombia and Chile); continuing a project (Eppley Foundation) on a new 15-20 million year old terrestrial mammal and marine fauna from Chile, in which it is possible to constrain the timing and rate of uplift of the southern Andes Mountains; exciting reconnaisance discovery (National Geographic Society) of a new 30 million year old mammal fauna from the high Andes of central Chile, on the flanks of Volcan Tinguiririca, representing a new Land Mammal Age partly filling a previous gap of 15 million years in our knowledge of the South American fossil mammal fauna; and reconnaisance work (National Geographic) collecting fossil pinnipeds (seals & sea lions) and birds from 10-15 million year old marine deposits of coastal northern Chile. Flynn also continues to pursue his interest in carnivore evolution and phylogeny. He completed a chapter on early fossil Carnivora for a book to be published by Cambridge University Press, and he has been invited to present a paper on carnivore evolution for a June 1990 international symposium sponsored by the Werner-Gren Foundation and American Museum.

ADJUNCT APPOINTMENTS:
Lecturer, Committee on Evolutionary Biology, University of Chicago.
Lecturer, Biological Sciences Collegiate Division, University of Chicago.
Paleontology and Stratigraphy program, Geophysical Sciences, University of Chicago.
Research Associate, American Museum of Natural History.
Adjunct Faculty, Rutgers University.

LANCE GRANDE (Ph.D. 1983, City University of New York/American Museum of Natural History) Associate Curator, Fossil Fishes. Joined Field Museum in 1983.

CURRENT RESEARCH:
Although Lance Grande's 1989 research continued to include studies on Antarctic fossil fishes and on the history of the North American fish fauna, his major work last year was on an NSF-supported project on the comparative anatomy and evolution of fossil and living paddlefishes. In late January of 1990, he submitted a 250-page manuscript (with over 100 figures) resulting from this interdisciplinary work to the Journal of Vertebrate Paleontology. This will be published as a special monograph. Paddlefishes (family Polyodontidae) are a group of extremely rare fishes of which very little anatomical information was known previous to this study. The two living species are often referred to in the literature as "living fossils", and well-preserved fossil forms (mostly collected by Grande) are known as far back as 70 million years ago. This study has answered important questions not only about the family Polyodontidae, but also about the early origin and evolution of Actinopterygii, the group that contains most of the over 25,000 living species of fishes. Grande also presented papers on Fossil Herrings and Biogeography in Austin, Texas (at the annual Society of Vertebrate Paleontologists meeting), and San Francisco (invited special paper at the American Society of Ichthyologists and Herpetologists meeting). At the S.V.P. meeting, he was moderator for the sessions on fossil fishes.

ADJUNCT APPOINTMENTS:
Adjunct Lecturer, University of Chicago
Member, Committee on Evolutionary Biology, University of Chicago
Research Associate, Department of Vertebrate Paleontology, American Museum of Natural History, New York.

TEACHING:
Fall 1989, Grande taught "Systematic Ichthyology" (BioSci. 260) at the University of Chicago.

SCOTT LIDGARD (Ph.D. 1984, Johns Hopkins University) Assistant Curator, Paleoecology and Invertebrate Paleontology. Joined Field Museum in 1984.

CURRENT RESEARCH:
Lidgard's research focuses on colony growth and form in cheilostome bryozoans, and most recently on the convergent evolution of tree-like forms from encrusting ancestors. These studies show that repeated emergence of these erect taxa had widespread, and previously unrecognized consequences for the tempo of cheilostome diversification in the early Cenozoic. Collaborative studies by Lidgard and Crane on the history of Cretaceous vegetation associated with the diversification of flowering plants documented large-scale latitudinal trends in changing floristic diversity in the Northern Hemisphere. Based on the species composition of fossil pollen and spores assemblages, angiosperms first became prevalent at low paleolatitudes, then rapidly radiated

during the mid-Cretacous interval, and by the end of the Cretaceous comprise more than half the species in most assemblages. However, the dominance of flowering plants at the end of this interval is much higher (60-80%) at low paleolatitudes than at high ones (30-50%).

ADJUNCT APPOINTMENT:
1985-Lecturer, Committee on Evolutionary Biology, University of Chicago

MATTHEW H. NITECKI (Ph.D. 1968, University of Chicago). Curator, Fossil Invertebrates. Joined Field Museum in 1965.

CURRENT RESEARCH:
My interests focus in four areas: I. Problematic Fossils. Reconstruction of the history of the biosphere is among the main goals of evolutionary biology, and problematic fossil groups play a pivotal role in this, for it is they that require us to reshape our ideas of the history of life. The problematic fossils that I study do not fit into any living phylum, and thus represent the record of early experiments with life. I am in the process of preparing major papers on cyclocrinitids, and on receptaculitids. II. History and Sociology of Science. I have conducted a series of studies designed to provide some evidence on when, why, and by whom scientific theories are *accepted*. I am seeking to determine the underlying structure of scientific attitudes and beliefs, not only about facts and relationships, but also about the nature of science: its practices, processes, and norms. I have begun to devise a methodology for testing why and when scientific theories are *rejected*. III. Theoretical Evolutionary Biology. There is now increasing interest in representing ideas through multiauthor books, which are usually the result of symposia in which the editor essentially assumes the role of senior author. The most successful are generally the interdisciplinary conferences that are catalysts for the initiation and development of new lines of research. There is currently more interest in the application of evolutionary accounts and methodologies in the social sciences and humanities than at any time since the days of Darwin. Furthermore, the current interest is more methodological and less "sociopolitical." To some extent, this rebirth of interest has been stimulated by the publication of previous Field Museum Spring Systematics Symposia volumes. The issues already discussed or planned for the future are not only of broad general interest but also of great significance for understanding the nature of historical inquiry and its relation to the general issue of human evolution. The thirteenth annual Spring Systematics Symposium is now upon us, and we are planning for next year. IV. I am now an editor of the *Paleontological Journal*.

ADJUNCT APPOINTMENTS:
University of Chicago: Lecturer
University of Chicago Committee on Evolutionary Biology: Curator

TEACHING:
University of Chicago: Introduction to Evolutionary Biology

ED OLSEN (PhD. 1959, University of Chicago) Curator, Mineralogy. Joined Field Museum in 1960.

CURRENT RESEARCH:
Enrichment factors of REE and certain trace elements in phosphates and silicates of IIIAB, IAB and PALL meteorites are sensitive detectors of crystallization processes and changes in redox states during core formation of the minor planets of the Inner Solar System, 4.6×10^9 years ago. Excesses of 53Cr give short time scale chronologies for the core formation process [i.e. 53Mn undergoes isomeric decay (EC) to 53Cr with t $= 3.8 \times 10^6$ years]. I am searching for 53Cr excesses by IMP with chemistry being first performed by ASEM and EMP on quite small samples collected from core (IIIA) and core-mantle boundary (PALL) materials. Am also running REE and trace element profiles in the IMP laboratory at the University of Chicago. So far a good 53Cr excess has been measured in one IIIA and a (model) isochron gives a formation time of only 27m.y! Numerous REE patterns have been collected in individual phases in PALL. They fall into two distinct groups corresponding to the two oxygen isotope groups of these meteorites. I have been able to confirm that oxidation state does increase during core formation, something I postulated years ago. Finally, I am working on the unusual phase relationships in the (anhydrous) Fe-Mn phosphate minerals in these meteorites. No data apparently exist in the literature.

ADJUNCT APPOINTMENTS:
Adjunct Professor, University of Illinois at Chicago, Geological Sciences.
Research Associate (Professor), Geophysical Sciences, University of Chicago.

ZOOLOGY

ZOOLOGY

BARRY CHERNOFF (Ph.D. 1983, University of Michigan), Associate Curator. Joined Field Museum in 1987.

CURRENT RESEARCH:
One aspect of Barry Chernoff's research includes phylogenetic studies and revisions of silverside fishes (Atherinidae) and tetras from South America (Characidae and Anostomidae). Along these lines, he continues research on phylogenetic relationships of the Atherinomorpha. The Atherinomorpha have been one of the most hotly debated superorders of fishes-- results thus far indicate that the Atherinomorpha may not be monophyletic and that the atheriniformes may be the sister group to mugiliform fishes (mullets). This research is important because it will radically alter our view of acanthopterygian fishes. Much of the data from silverside and tetra research fits into the second phase of Chernoff's studies on the theory and methodology of morphological evolution. In 1990, he hopes to complete his studies on mathematical relationships between the molecular clock hypothesis and the geometry of evolutionary trees. He will also be continuing and implementing studies on the phylogenetic implications of modifications to developmental factors and patterns of ontogenetic covariance.

ADJUNCT APPOINTMENTS:
Adjunct Assistant Professor of Biology, University of Pennsylvania

Professor of Neotropical Zoology, Universidad Centrale de Venezuela

Associate Professor of Evolutionary Biology, University of Chicago

TEACHING:
Systematic Biology, University of Chicago

LAWRENCE R. HEANEY (Ph.D. 1979, University of Kansas), Assistant Curator, Mammals. Joined Field Museum in 1988.

CURRENT RESEARCH:
Lawrence Heaney's current research centers on patterns of mammalian diversity, with a special interest in island ecosystems. His long-term studies on the origin, evolution, and ecology of mammals in Southeast Asia are continuing, with specific studies of patterns of diversity along elevational gradients, and of distributional patterns of fruit bats, now nearing completion. New emphases include genetic aspects of diversification of bats and rodents, and analysis of extinction patterns under natural and human-induced conditions. These studies are carried out in collaboration with the Philippine National Museum, Philippine Parks and Wildlife Bureau, and two Philippine universities. During 1989 Heaney presented results of

Italy, was a featured speaker at the annual meeting of the Captive Breeding Specialist Group, Species Survival Commission in Austin Texas, and was an invited speaker at an endangered species workshop in Tucson, Arizona sponsored by the University of Arizona and the Smithsonian Institution.

ADJUNCT APPOINTMENTS:
Member, Committee on Evolutionary Biology, University of Chicago
Research Associate, Smithsonian Institution
Graduate Committee (Ph.D.), Boston University
Graduate Committee (MSc), University of Illinois at Chicago

ROBERT F. INGER (Ph.D. 1954, University of Chicago) Curator, Amphibians & Reptiles. Joined Field Museum in 1946.

CURRENT RESEARCH:
Inger's research is centered on the systematics and evolution of communities of amphibians and reptiles in Bornean forests, a long range program involving field and laboratory work. Although a primary goal has been analysis of variation of these communities in primary rain forest, this year work has been expanded to investigate the effects of selective logging. The expansion not only will help in understanding processes affecting variation in the communities of pristine forests, but also contribute to the growing science of conservation biology. The ecological aspects of this work are a joint effort with Harold Voris.

ADJUNCT APPOINTMENTS:
Lecturer, Committee on Evolutionary Biology, University of Chicago.
Honorary Curator of Reptiles, Sarawak Museum.

JOHN KETHLEY, (Ph.D. 1969, University of Georgia) Associate Curator, Insects. Joined Field Museum in 1970.

CURRENT RESEARCH:
John Kethley's current research involves the systematics and ecology of deep soil mites, especially early derivative taxa. A completely new procedure for collecting all developmental stages of these microarthropods was demonstrated at the International Workshop on Modern Techniques in Soil Ecology. His systematic research has resulted in the description of a new family of primitive soil mites from Gary, Indiana, and a new taxon based on a Devonian age mite fossil. His synthesis of the systematics and ecology of prostigmatid soil mites is due to be published early in 1990 as chapter 21 in Soil Biology Guide, D.Dindal (ed.) (John Wiley & Sons).

ADJUNCT APPOINTMENTS:
Lecturer, Ohio State University
Lecturer, Committee on Evolutionary Biology, University of Chicago

TEACHING:
Systematics and phylogeny of prostigmatid mites in Soil Acarology, Medical and Veterinary Acarology, and Agricultural Acarology, Summer Institute of Acarology, Ohio State University.

SCOTT LANYON (Ph.D. 1985, Louisiana State University) Associate Curator, Division of Birds. Joined Field Museum in 1985.

CURRENT RESEARCH:
Scott Lanyon continues to concentrate his research efforts on the elucidation of phylogenetic relationships within the New World Blackbirds (Icterinae). Within this assemblage of some 97 species it is possible to find examples of virtually every behavior pattern known to occur within song birds: monogamy, polygyny, promiscuity, delayed maturation, sexual size dimorphism, sexual dichromatism, brood parasitism, vocal mimicry, territoriality, coloniality, extensive geographic variation, etc... As interesting and as well studied as this group is, no phylogeny has been proposed for the group. Lanyon is studying allozymes and cranial morphology in an effort to generate such a phylogeny. This portion of the study should be completed in early 1990. To obtain additional characters with which to generate reliable phylogenetic hypotheses, Lanyon initiated development of a DNA sequencing laboratory in 1989. Blackbird DNA will be analyzed in 1990. A second aspect of Lanyon's research program concerns the philosophy and methodology of phylogeny reconstruction. He has completed the development of computer algorithms for summarizing results from studies of independent sets of systematic characters and is now writing an accompanying manuscript. Lanyon also worked with Barry Chernoff and Steve Ashe on a manuscript concerning the reality of "species". Lanyon hopes to publish both of these manuscripts in 1990.

ADJUNCT APPOINTMENTS:
Lecturer, University of Chicago.
Adjunct Professor, Illinois State University.
Graduate Committee Member for University of Illinois, Chicago Circle graduate student

TEACHING:
Reading courses in systematics, University of Chicago.

HYMEN MARX (B.S. 1949, Roosevelt University,) Curator and Head, Division of Amphibians and Reptiles. Joined Field Museum in 1949.

CURRENT RESEARCH:
Long-range project of researching the sister group to the true vipers --the pit vipers (Viperidae: Crotalinae) is partly completed. Analysis of the 61 morphological characters is in manuscript (40 ms pp., 62 tables). The pit vipers have more than twice the number of species as true vipers. The character analysis coding is on the computer. (with J.S. Ashe). The manuscript of convergent locomotion in

sidewinding snakes is almost completed. (with H. Greene and C. Luke). A manuscript on a bibliography of herpetological identification aids (keys and checklists) has been started. This manuscript will be organized according to taxonomy and geography from over 2,000 references.

ADJUNCT APPOINTMENTS:
Lecturer, Committee on Evolutionary Biology, University of Chicago

ALFRED F. NEWTON, Jr. (Ph.D. 1973, Harvard), Assistant Curator, Insects. Joined Field Museum in 1985.

CURRENT RESEARCH:
Newton's current research revolves around studies on the evolution of the large beetle family Staphylinidae (over 45,000 named species). He continues a long-term study of the higher-level classification and evolution of the group by focussing on reconstructing the phylogeny of one of the family's four main lineages, and is currently analyzing over 70 characters in the ten higher taxa of this lineage. With the aid of a 3-year NSF grant awarded this year, he has also begun a systematic revision of the 160+ New World species of the genus *Platydracus*, whose species promise to be of special interest for understanding the origin of current distribution patterns of forest-dwelling insects in the Neotropics. A recent two-month trip to study types and other specimens at eight European museums has greatly advanced both projects. Study of collections during this trip also aided another long-term project, improving knowledge of the staphylinoid fauna of Australia and other southern temperate areas with the ultimate aim of using this group to help understand the origin of southern disjunct distribution patterns that are very common within the group. Newton has also completed a study of beetles associated with slime molds in India (with mycologist S. L. Stephenson), and a review of the present state of knowledge of larvae of staphylinoid beetles.

BRUCE D. PATTERSON (Ph.D. 1981, New Mexico State) Associate Curator, Mammals. Joined Field Museum in 1981.

CURRENT RESEARCH:
Patterson continues his wide ranging program of studies on the evolution, ecology, and distribution of mammals, chiefly those in the New World tropics. This year marked the completion of one series of studies and the inception of their successors. He was an invited speaker at three symposia on conservation biology and one on temporal changes in ecological communities, presenting papers at two additional scientific meetings during the year. Also during the year, he wrote and submitted papers for publication on (1) the genetics and morphology of pocket gophers, (2) habitat associations of small mammals in Andean rainforests of Chile, (3) phylogenetic relationships of epauletted fruit bats (Sturnira), and (4) the temporal dynamics of nested subset patterns of distribution. In November and December, he made his first expedition to the Atlantic Forest habitats of southeastern Brasil, designated one of the world's

most pressing conservation priorities by the MacArthur Foundation, World Wildlife Fund, et al.

ADJUNCT APPOINTMENTS:
Lecturer, Committee on Evolutionary Biology, University of Chicago
Adjunct Professor, Department of Biological Science, University of Illinois, Chicago.

TEACHING:
Field techniques in Mammalogy, Museu de Zoologia, Universidade de Sao Paulo

ALAN SOLEM, (Ph.D. 1956, University of Michigan) Curator and Head, Division of Invertebrates. Joined Field Museum in 1956.

CURRENT RESEARCH:
Alan Solem's current research focuses on two main projects: 1) evolution, ecology, phylogeny of the desert adapted land snails living in the western two-thirds of Australia; how they relate to taxa from the monsoon tropics of both the Old World and New World; the patterns of both regional and local diversity shown for all land snails in these regions; and the various ways in which land snails adjust their reproductive and activity cycles to the stress of desert conditions; and 2) study of the feeding apparatus of land snails from all geographic regions of the world and biomes to elucidate common patterns of structural change to dietary specializations and the extent to which phylogeny of the 30,000 species of land snails can be deduced from feeding structures.

ADJUNCT APPOINTMENTS:
Lecturer, Committee on Evolutionary Biology, University of Chicago.
Research Associate, Northwestern University.

HAROLD K. VORIS, (Ph.D. 1969, University of Chicago) Curator, Amphibians and Reptiles. Joined Field Museum in 1973.

CURRENT RESEARCH:
Harold Voris is currently pursuing three research topics, all based in Southeast Asia. In the lowland tropical rain forests of Borneo he is studying the natural changes in communities of amphibians and reptiles that occur over time and differences in these communities that occur from place to place. This year comparisons between logged forests and undisturbed forests are adding another dimension to the comparisons. In the Pulau Tiga marine park off the north coast of Borneo Voris is studying the ecology of the banded sea krait, an amphibious sea snake. And, in the Straits of Johore between Malaysia and Singapore a project on the mechanisms of colonization of the edible crab by barnacles was successfully completed and accepted for publication.

ADJUNCT APPOINTMENTS:
Member, Committee on Evolutionary Biology, University of Chicago.

COLLECTIONS AND RESEARCH

RESEARCH ASSOCIATES, FIELD ASSOCIATES, ASSOCIATES
1989

Department of Anthropology

Associates

Dorothy Baumgarten
Asian Material Culture

Louva Calhoun, B.F.A.
Anthropology

Sol Century
Asian Material Culture

Connie Crane, A.B.
North American Ethnology

Patricia Dodson, M.A.
Latin American Archaeology & Ethnology

Carolyn Moore, B.A.
Asian Material Culture

Col. Millard E. Rada, E.E.
Museology

Llois Stein
Oceanic Material Culture

Research Associates

Dean E. Arnold, Ph.D.
Mesoamerican & S. American Arch. and Ethnology

Eloise Richards Barter, M.A.
North American Ethnography

Robert J. Braidwood, Ph.D.
SW Asia and Old World Archaeology

James A. Brown, Ph.D.
North American Archaeology

Patrick H. Carmichael, Ph.D.
South American Archaeology and Ethnology

William J. Conklin, M.A.
Peruvian Architecture and Textiles

Winifred Creamer, Ph.D.
SW U.S. & Central American Arch. & Ethnohistory

Phillip J. C. Dark, Ph.D.
African Ethnology

Jack L. Davis, Ph.D.
Mediterranean Archaeology

Fred R. Eggan, Ph.D.
North American and Philippine Social Anthro and Ethnology

Richard De Puma, Ph.D.
Etruscan Archaeology

Patricia S. Essenpreis, Ph.D.
North American Archaeology

Robert Feldman, Ph.D.
Andean Archaeology

Gray Graffam, M.A.
Andean Archaeology

Chuimei Ho, Ph.D.
East & SE Asian Archaeology & Art History

Bill Holm, M.F.A.
Northwest Coast Indian Art and Material Culture

F. Clark Howell, Ph.D.
Old World Prehistory

Maxine Kleindeinst, Ph.D.
Old World Prehistory

Alan L. Kolata, Ph.D.
Andean & Mesoamerican Archaeology & Ethnohistory

Lyle Konigsberg, Ph.D.
Physical Anthropology

Frederick W. Lange, Ph.D.
SW U.S. & Central American Arch. & Ethnohistory

Donald W. Lathrap, Ph.D.
South American Archaeology

Charles E. Lincoln, M.A.
Mayan Studies

Michael E. Moseley, Ph.D.
South American Archaeology

Charles R. Ortloff, M.Ae.E.
Peruvian Archaeology

Robert B. Pickering, Ph.D.
Human Osteology

George I. Quimby, M.A.
Museology and North American Culture History

David Reese, Ph.D.
Archaeozoology & Paleomalacology

Johan G. Reinhard, Ph.D.
Nepal, Bolivia, and Peru

Mario A. Rivera, Ph.D.
South American Archaeology

Amy Oakland Rodman, Ph.D.
Textiles

William Rostoker, Ph.D.
Metallurgy

Robin Torrence, Ph.D.
Aegean & Pacific Archaeology & Ethnohistory

Ronald L. Weber, Ph.D.
Amazon Basin & NW Coast U.S. Arch. & Ethnology

Robert L. Welsch, Ph.D.
New Guinean and Indonesian Ethnology

Department of Botany

Associate

Betty Strack, M.S.
Mycology

Field Associates

Sandra Knapp, Ph.D.
Vascular Plants

Marko Lewis
Bryology

Antonio Molina R.
Vascular Plants

Research Associates

Janis B. Alcorn, Ph.D.
Ethnobotany

Kerry A. Barringer, Ph.D.
Vascular Plants

Robert F. Betz, Ph.D.
Vascular Plants

William T. Crowe, J.D., A.M.
Archeobotany

Sylvia Feuer, Ph.D.
Palynology

Robin B. Foster, Ph.D.
Vascular Plants

Nancy Garwood, Ph.D.
Biology

Sidney F. Glassman, Ph.D.
Vascular Plants

Luis D. Gòmez, Ph.D.
Vascular Plants and Mycology

Jorge Gomez-Laurito, B.S.
Flora Costaricensis

Arturo Gomez-Pompa, Ph.D.
Vascular Plants

Rogers McVaugh, Ph.D.
Vascular Plants

Lorin I. Nevling, Jr., Ph.D.
Vascular Plants

Richard W. Pohl, Ph.D.
Vascular Plants

Patricio P. Ponce de Leon, Ph.D.
Mycology

Ursula Rowlatt, D.M.
Vascular Plants

Abundio Sagástegui, Ph.D.
Vascular Plants, Flora of Peru

Rudolf M. Schuster, Ph.D.
Bryology

Rolf Singer, Ph.D.
Mycology

D. Doel Soejarto, Ph.D.
Vascular Plants

Tod F. Stuessy, Ph.D.
Vascular Plants

Pablo E. Sanchez Vindas, M.Sc.
Flora Costaricensis

Department of Geology

Associates

Doris Nitecki, M.A.
Assist in Research projects with Matthew Nitecki

Field Associates

Thomas Guensburg, Ph.D.
Fossil Vertebrates

Research Associates

Edgar Allin, Ph.D.
Fossil Vertebrates

David Bardack, Ph.D.
Fossil Vertebrates

Frank Carpenter, Sc.D.
Fossil Invertebrates

Robert Clayton, Ph.D.
Geochemistry

Albert Dahlberg, Ph.D.
Fossil Vertebrates

Andrew Davis, Ph.D.
Geochemistry

Robert DeMar, Ph.D.
Fossil Vertebrates

Daniel Fisher, Ph.D.
Fossil Invertebrates

Gary Galbreath, Ph.D.
Fossil Vertebrates

Lawrence Grossman, Ph.D.
Meteoritics

Antoni Hoffman, Ph.D.
Fossil Invertebrates

James Hopson, Ph.D.
Fossil Vertebrates

David Jablonski, Ph.D.
Fossil Invertebrates

Michael LaBarbera, Ph.D.
Fossil Invertebrates

Ricardo Levi-Setti, Ph.D.
Fossil Invertebrates

Ernest Lundelius, Ph.D.
Fossil Vertebrates

Frank McKinney, Ph.D.
Fossil Invertebrates

J. Michael Parrish, Ph.D.
Fossil Reptiles

Everett Olson, Ph.D.
Fossil Vertebrates

David Raup, Ph.D.
Fossil Invertebrates

J. John Sepkoski, Ph.D.
Fossil Invertebrates

Paul Sipiera, Ph.D.
Meteoritics

Joseph V. Smith, Ph.D.
Minerology

Leigh Van Valen, Ph.D.
Fossil Vertebrates

Associates

John Clay Bruner, M.S
Fossil fishes

Sophie Ann Brunner
Preparation of skeletons

Edward C Dickinson
Philippine birds

Ingrid Fauci
Maintenance of K.P. Schmidt Library

Dorothy Karall, B.A.
Illustration

Anthony Milewski, B.S.
Large mammal comparative ecology

Harry G. Nelson, M.Sc.
Systematics of dryopoid Coleoptera

Raymond Pawley, B.S.
Donations of specimens to herpetology collection

Mr.& Mrs. William Street
Travel-adventure book on an Iranian expedition

Field Associates

Fred Aslin
Geology, Biology

Jan Aslin
Geology, Biology

Barbara Becker, M.A.
Zoological research, mammal expeditions

Barbara L Clauson, M.S.
Specimen preparation; ornithological expedition

Ismail Ghazally, Ph.D.
Sponsors research projects in Malaysia for FMNH

Robert Izor, B.S
Carnivores of South America

Douglas Kelt, B.S.
Chilean mammals

Vince Kessner
Land Snails

Bong Heang Kiew, Ph.D.
Sponsors fieldwork on sea snakes in Malaysia

Thomas Lemke, Ph.D.
Phyllostomatid bats

David Matusik
Lepidoptera taxonomy

Edward Moll, Ph.D.
Biology of fresh water turtles

John Murphy, M.A.
Animal behavior and ecology

Laurie Price
Land Snails

Robert Stuebing, M.S.
Malaysian ecology

Walter Suter, Ph.D
Systematics of Scymaenidae (Coleoptera)

Research Associates

Peter L Ames, Ph.D.
Syringeal morphology of passerine birds

Warren Atyeo, Ph.D
Systematics of Acari

William J Beecher, Ph.D.
Jaw & limb adaptations among passerine birds

Donald S. Chandler, Ph.D
Systematics of Pselaphidae (Coleoptera)

David R. Cook, Ph.D
Systematics of Acari

Joel Cracraft, PH.D.
Avian systematics and evolutionary biology

Gustavo Cruz, M.S.
Marine and freshwater fishes of South America

Sharon Emerson, Ph.D.
Functional anatomy of anura

Angelo Capparella, Ph.D.
Neotropical birds and geographic variation

Jack Fooden, Ph.D.
Asian primates

Milton Gallardo, Ph.D.
Chilean mammals

Elizabeth-Louise Girardi, Ph.D.
Land Snails

David Greenfield, Ph.D.
Ecology of marine & freshwater fishes

Terry Greenfield, Ph.D.
Marine and freshwater neotropical fish

Myriam Ibarra, Ph.D.
Neotropical freshwater fishes

Bruce C. Jayne, Ph.D.
Marine and estuarian snakes

William B. Jeffries, Ph.D.
Epifauna of sea snakes, crustaceans

Linda K Kinkel, Ph.D.
Ring-billed Gulls

R. Eric Lombard, Ph.D.
Functional anatomy of reptiles

Peter E Lowther, Ph.D.
Field Museum nest and egg collection

Patricia McGill-Harelstad, PhD
Behavior and ecology of Herring Gulls

Peter Meserve, Ph.D
Population ecology of small mammals

Debra K Moskovits, Ph.D.
Rainforest tortoises

W. Wayne Moss, Ph.D
Systematics and phylogeny of bird skin parasites

Charles Nadler, M.D.
Species of the squirrel family: Sciuridae

Roy A. Norton, Ph.D
Systematics of Acari

Charles Oxnard, Ph.D.
Vertebrate anatomy

Philip D Perkins, Ph.D
Aquatic Coleoptera

Ronald Pine, Ph.D.
Taxonomy of South American mammals

Stephen Pruett-Jones, Ph.D.
Behavior and ecology of Birds of Paradise

George B. Rabb, Ph.D.
Taxonomy of salamanders: phylogeny of snakes

Charles Reed, Ph.D.
Morphology and evolution of mammals

Scott K. Robinson, Ph.D.
Evolutionary ecology within the Icterinae

H. Bradley Shaffer, Ph.D.
Phylogeny of salamanders

Ronald Singer, D.Sc.
Mammalian anatomy

Donald Stewart, Ph.D.
Napo collections

Margaret K. Thayer, Ph.D
Systematics of Staphylinidae (Coleoptera)

Jamie Thomerson, Ph.D.
Central and South American fishes

Robert Timm, Ph.D.
Host parasite relationship in mammals

John A. Wagner, Ph.D
Systematics of Pselaphidae (Coloeoptera)

Richard Wassersug, Ph.D.
Tadpole research

John Wible, Ph.D.
Higher level taxonomy of mammals

Glen E Woolfenden, Ph.D.
Florida Scrub Jay

Guanfu Wu
Chinese fauna, systematics

Chang Man Yang, B.S.
Decapods

Ermi Zhao, Ph.D.
Chinese fauna, systematics

VISITING SCIENTISTS AND CURATORS

Each year there are literally hundreds of students and scientists from around the world who come in to use the Field Museum collections and consult with the curators or professional services staff. The individuals listed below were each working at the Museum for a more extended period of time, ranging from a week up to a year.

Anthropology

Dr. James Cheverud, Associate Professor, Northwestern University and
Dr. Lyle Konigsberg, FM Research Associate and Postdoctoral Scientist at the Southwest Foundation for Biomedical Research in San Antonio, Texas.
Worked on Human Osteology Collection

Dr Patrick Carmichael, FM Research Associate, Postdoctoral Research Fellow, Dept. of Archaeology, University of Calgary and
Dr. Brenda Kennedy, Sessional Instructor, Dept. of Archaeology University of Calgary, Calgary, Alberta, Canada,
Worked on the Human Osteology Collection.

Dr. Pamela Willoughby, Assistant Professor and SSHRC Canada Research Fellow, University of Alberta, Edmonton, worked on African Stone Age materials.

Dr. Winifred Creamer, FM Research Associate, working on the Northern Rio Grande Research Project.

Dr. Robert L. Welsch, FM Research Associate and Co-Principal Investigator, A. B. Lewis Project

Dr. Robin Torrence, FM Research Associate andLecturer in Archaeology & Prehistory, University of Sheffield (funded by the Wenner-Gren Foundation for Anthropological Research, Inc.): studying obsidian-tipped weapons from the Admiralty Islands in our Melanesian Collections

Robert Feldman, FM Research Associate, worked on Peruvian archaeological collections

Chuimei Ho, FM Research Associate, worked on archaeological materials from Ko Kho Khao.

David Reese, FM Research Associate, worked on archaeological faunal materials.

Ronald Weber, FM Research Associate, North West Coast, U.S. archives and collections.

Botany

Dr. Robin Foster, FM Research Associate, field and collections research on vascular plants.

Biol. Jesús García, Assistant Prof./Researcher, Mycology, SEP, CD. Victoria Tamaulipas, Mexico

Dr. Roy Halling, Assistant Curator, Mycology, New York Bot. Garden (NSF grant)

Dr. Egon Horak, Prof. Mycology, Zurich, Switzerland (Swiss grant)

Dr. Michael J. Huft, Visiting Assistant Curator/Field Museum, research on vascular plants.

Mr. David Lewis, Chemist, Vidor, TX

Dr. Jean Lodge, Researcher, Mycology, Center for Ecological Research, San Juan, Puerto Rico

Andrew Methven, Assistant Professor., Mycology, Eastern Illinois. U.

Dr. A. Sagástegui, FM Research Associate, Univ. Antenor Orrego, Trujillo, Peru

Dr. Rolf Singer, FM Research Associate, research, Mycology.

Dr. Djaja Doel Soejarto, FM Research Associate, research on vascular plants.

Betty Strack, FM Associate, mycology.

Dr. Charlotte M. Taylor, University of Puerto Rico, Assistant Professor

Geology

Robert A. Gastaldo, Visiting Curator at Field Museum and Professor, Department of Geology, Auburn University (NSF Mazon Creek Collection Grant)

Andrew N. Drinnan, Visiting Scientist at Field Museum and Lecturer, Department of Botany, University of Melbourne (NSF Paleobotany Research Grant)

Richard Madden, Duke University, graduate student.

Javier Guerrero-Diaz, Duke University, graduate student, and INGEOMINAS (Geological Survey of Colombia; Geologist, Section of Paleontology and Stratigraphy)

Gregory Buckley, Rutgers University, Graduate Student.

Dominique Didier; University of Massachusetts, graduate student.

Erick K. Findeis; University of Massachusetts, graduate student.

K. A. Frickhinger; Fossilien-Galerie Gehlen, Planegg, West Germany; paleontological book author.

Dr. John Lundberg; Duke University; Professor.

Judith Sharjo; University of Mass., graduate student.

Dr. Gary Johnson; University of South Dakota; Professor.

Jon Moore; Yale University graduate student.

Dr. J. T. Eastman; Ohio University; Professor.

Dr. Clyde Barbour; Wright State University; Professor.

Dr. William Bemis; University of Massachusetts; Associate Professor; N.S.F. grant.

Dr. Detlev Thies; Inst. fur Geolog. & Palaont., University, Hanover, Germany; Professor.

Ann Schaeffer-Elder; Dinosaur National Park; park naturalist and preparator.

Dr. David Bardack; FM Research Associate, Professor, University of Illinois at Chicago.

John Huss; University of Chicago, graduate student.

Kaustuv Roy; University of Chicago, graduate student.

Bret Beall, Univ. Michigan
Frederick Schram, Natural History Museum, San Diego
Steve Sroka, University of Illinois
working on Mazon Creek project.

Zoology

Dr. Peter Ames, Harza Engineering Company, FM Research Associate, worked on syringeal morphology of passerine birds.

Clyde Barbour, Professor of Biology, Wright State University, Ohio. Funded from Bass Fund.

Dr. William Beecher, Chicago Academy of Sciences, FM Research Associate, worked on jaw and limb morphology of passerine birds.

Meriel Brooks. University of New Mexico, Funded from Schmidt Fund.

Mrs. Sophie Ann Brunner, FM Associate, worked on the preparation of skeletons.

Dr. Joel Cracraft, University of Illinois at the Medical Center, FM Research Associate, worked on avian systematics and evolutionary biology.

Dr. Sharon Emerson, University of Utah, FM Research Associate, worked on functional anatomy of anura.

Mrs. Ingrid Fauci, Associate, worked in the K.P. Schmidt Library carding and filing reprints, and on literature searches related to research activities.

Mr. Pedro Gonzales, Philippine National Museum; Head, Zoology Section

Dr. Paul D. Heideman, University of Texas at Austin; Postdoctoral Fellow

Dr. Bruce Jayne, Michigan State University, FM Research Associate, worked on marine and estuarian snakes.

Dr. William B. Jeffries, Dickinson College, FM Research Associate, worked on the epifauna of sea snakes and crustaceans.

Dr. Dorothy Karall, FM Associate, worked on mounting and labeling scientific illustrations.

Richard Leschen, University of Kansas, Lawrence; Graduate Student

Dr. R. Eric Lombard, The University of Chicago, FM Research Associate, worked on the functional anatomy of reptiles.

Dr. Peter E. Lowther, FM Research Associate, worked on Field Museum nest and egg collection.

Antonio Machado, Professor of Neotropical Zoology, Universidad Central de Venezuela, Caracas, Zoology.

Dr. Patricia McGill-Harelstad, Brookfield Zoo, FM Research Associate, worked on behavior and ecology of Herring Gulls.

Mr. David Matusik, FM Field Associate, worked on the taxonomy of Lepidoptera.

Mr. John Murphy, FM Field Associate, worked on completing a book on herpetology of Trindad using Field Museum collections.

Dr. Philip Myers, University of Michigan; Curator of Mammals; University of Michigan.

Dr. Shun-Ichiro Naomi, Natural History Museum & Institute, Chiba, Japan, Assistant Curator.

Jose Luis Navarrete-H., UNAM Facultad de Ciencias, Mexico City, Mexico; Biology.

Mr. Harry Nelson, FM Associate, worked on the systematics of dryopoid Coleoptera.

Dr. George Rabb, Brookfield Zoo, FM Research Associate, worked on the taxonomy of salamanders and the phylogeny of snakes.

Dr. John Rawlins, Carnegie Museum, Pittsburg, Curator, NSF Collections Grant.

Dr. Eric A. Rickart, Utah Museum of Natural History; Curator of Mammals and Birds

Dr. Scott Robinson, State Natural History Survey Division, Research Associate, worked on evolutionary ecology within the Icterinae.

Dr. J. L. David Smith, University of Minnesota; Assistant Professor of Wildlife Biology; Univ. Minnesota

Dr. Walter Suter, Carthage College, Field Associate, worked on the systematics of Scymaenidae (Coleoptera)

Tan Fui Lian, Sabah Parks, Mlaysia, Office of Ecology, Mt. Kinabalu Park; funded by Sabah Parks.

Dr. Margaret Thayer, FM Research Associate, worked on the systematics of Staphylinidae (Coleoptera)

Ms. Ruth Utzurrum, Silliman University, Philippines; Associate Chairman

Dr. John Wagner, Kendall College, FM Research Associate, worked on the systematics of Pselaphidae.

Dr. Richard Wassersug, Dalhousie University, FM Research Associate, worked on tadpoles.

1989 PUBLICATIONS

ANTHROPOLOGY

Ruth Andris

1989. Fast, Efficient Emptying of Wastewater with a Small Submersible Pump. *The American Institute for Conservation of Historic and Artistic Works Newletter*, 14 (1): 12.

Bennet Bronson

1989. (with W. Rostoker and J. Dvorak) Smelting to Steel by the Japanese Tatara Process. *Archeomaterials*, 3 (1): 11-25.

1989. Reply to Prakash comment. *Archeomaterials*, 3 (1): 95-96.

1989. The Extraction of Natural Resources in Thailand. Pp. 291-302 in *Culture and Environment in Thailand*. Siam Society, Bangkok.

1989. (with C.M. Ho and L. Adler) Ceramic Cricket Jars in the Field Museum. *Field Museum of Natural History Bulletin*, 60 (8): 6-15.

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1989. (with P. Charoenwongsa and A. Srisuchat) Questions and Answers About the 1983 Excavations at Koh Kho Khao and Laem Pho. *Silpakon, Journal of the Fine Arts Department of Thailand*, 33 (1):34-37.

Robert A. Feldman

1989. A Speculative Hypothesis of Wari Southern Expansion. pp. 72-97 in *The Nature of Wari. A Reappraisal of the Middle Horizon Period in Peru*. (R. M. Czwarno, F. M. Meddens, and A. Morgan, eds.) BAR International Series 525.

Jonathan Haas

1989. *The Evolution of the Prehistoric State*. Korean Edition.

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1989. Foreword to *Bone Chemistry and Human Behavior*. (T. Douglas Price, ed.) Cambridge University Press.

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1989. Foreword to *The Emergence of Modern Humans in the Later Pleistocene*. (Erik Trinkhaus, ed.) Cambridge University Press.

Ho Chuimei

1989. Ceramics Found in Ko Kho Khao and Laem Pho. *Journal of Trade Ceramics*. Fukuoka, Japan.

1989. (with B. Bronson and L. Adler) Ceramic Cricket Jars in Field Museum. *Field Museum of Natural History Bulletin*, 60 (8): 6-15.

Phillip Lewis

1989. REVIEW. Exhibition and Catalogue - An Assemblage of Spirits: Idea and Image in New Ireland. *Pacific Studies*, 12 (2): 140-146.

David Reese

1989. Tracking the Extinct Pygmy Hippopotamus of Cyprus. *Field Museum of Natural History Bulletin*, 60 (2): 22-29.

1989. Faunal Remains from the Altar of Aphrodite Ourania, Athens. *Hesperia*, 58 (1): 63-70.

1989. On Cassid Lips and Helmet Shells. *Bulletin of the American Schools of Oriental Research*, 275: 33-39.

1989. The Natufian Shells from Beidha. Pp. 102-104 (Appendix D) in *The Natufian Encampment at Beidha: Late Pleistocene Adaptation in the Southern Levant*. (B.F. Byrd) Moesgard, Arhus (Denmark): Jutland Archaeological Society Publications XXIII: 1.

1989. Recent and Fossil Marine Invertebrates. Appendix 2 in *Knossos*. From *Greek City to Roman Colony. Excavations at the Unexplored Mansion II*. (H. Sackett, et. al.) London.

Charles Stanish

1989. Household Archaeology: Testing Models of Zonal Complementarity in the South Central Andes. *American Anthropologist*, 91 (1): 7-25.

1989. Tamano y Complejidad de los Asentamientos Nucleares de Tiwanaku. Pp. 41-57 in *Arqueologia de Lukurmata* v. 2. (A. Kolata, ed.) La Paz: Instituto Nacional de Arqueologia.

1989. Zonal Complementarity in the South Central Andes. Pp. 303-320 in *Ecology, Settlement and History in the Osmore Drainage*. (D. Rice and C. Stanish, eds.) British Archaeological Reports International Series.

1989. (with M. Bermann, P. Goldstein, and L. Watanabe M.) The Collapse of the Tiwanaku State: A View from Osmore. Pp. 269-286 in *Ecology, Settlement and History in the Osmore Drainage*. (D. Rice and C. Stanish, eds.) British Archaeological Reports International Series.

1989. (with D. Rice) Introduction. Pp. 1-14 in *Ecology, Settlement and History in the Osmore Drainage*. (D. Rice and C. Stanish, eds.) British Archaeological Reports International Series.

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John Terrell

1989. What Lapita is and what Lapita isn't. *Antiquity*, 93: 623-626.

Robert Welsch

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James VanStone

1989. Nunivak Eskimo (Yuit) Technology and Material Culture. *Fieldiana: Anthropology*, n.s., no. 12.

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1989. Guest Editorial. *Arctic*, 42 (2): iii.

BOTANY

John J. Engel

1989. Index Hepaticarum Supplementum: 1980-1981. *Taxon* 38: 414-439.

William Burger

1989. Tropical forests and the number of plants and animals on planet earth. *Field Museum Bulletin* 60 (1): 8-14.

1989. REVIEW. Flora of Panama Checklist and Index, W. g. D'Arcy. *Taxon* 38(3): 443-444.

Michael O. Dillon

1989. A New Species of *Symplocos* (Symplocaceae) from Northern Peru. *Brittonia* 41: 32-34.

1989. The Botanical Response of the Atacama and Peruvian Desert Floras to the 1982-83 El Niño Event. 18 pps. (In: P. W. Glynn [ed.], Global Ecological Consequences of the 1982-83 El Niño-Southern Oscillation, Elsevier Science Publishers, New York).

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Gregory M. Mueller

1989. Phenetic and cladistic analyses of the genus *Laccaria*. *Mycological Society of America Newsletter* 40: 40.

Robert Stolze

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GEOLOGY

Peter R. Crane

1989. (with S. Blackmore) Editors. The Evolution, Systematics and Fossil History of the Hamamelidae. Volume 1, *Introduction and "Lower" Hamamelidae*. Oxford: Oxford University Press.

1989. (with S. Blackmore) Editors. The Evolution, Systematics and Fossil History of the Hamamelidae. Volume 2, *"Higher" Hamamelidae*. Oxford: Oxford University Press.

1989. Paleobotanical evidence on the early radiation of non-magnoliid dicotyledons. *Plant Systematics and Evolution*, 162:165-191.

1989. Patterns of evolution and extinction in vascular plants. In: K. C. Allen & D. E. G. Briggs (eds) *Evolution and the Fossil Record*. pp. 154-187. Belhaven Press.

1989. Early fossil history and evolution of the Betulaceae. In: P. R. Crane & S. Blackmore (eds) *Evolution, Systematics and Fossil History of the Hamamelidae*, pp. 87-116. Oxford: Oxford University Press.

1989. (with S. H. Lidgard) Paleolatitudinal gradients and temporal trends in Cretaceous floristic diversity. *Science*, 246: 675-678.

1989. (with M. J. Donoghue, J. A. Doyle & E. M. Friis) Reply to Martin et al. *Nature*, 342: 131-132.

1989. (with E. M. Friis & K. R. Pedersen) Reproductive structure and function in Cretaceous Chloranthaceae. *Plant Systematics and Evolution*, 165: 211-226

1989. with Drinnan, A. N.) Cretaceous paleobotany and its bearing on the biogeography of austral angiosperms. In: T. N. Taylor & E. L. Taylor (eds) Antarctic Paleobiology and its Role in the Reconstruction of Gondwana, pp. 192-219. New York: Springer-Verlag.

1989. (with Friis, E. M.) Reproductive structures of Cretaceous Hamamelidae. In: P. R. Crane & S. Blackmore (eds) *Evolution, Systematics and Fossil History of the Hamamelidae*, pp 155-174. Oxford: Oxford University Press.

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1989. (with Pedersen, K. R. & E. M. Friis.) The morphology and phylogenetic significance of Vardekloeftia Haryris (Bennettitales). Review of Palaeobotany and Palynology, 59:7-24.

Andrew N. Drinnan

1989. (with P. R. Crane) Cretaceous paleobotany and its bearing on the biogeography of austral angiosperms. In: T. N. Taylor & E. L. Taylor (eds) Antarctic Paleobiology and its Role in the Reconstruction of Gondwana, pp. 192-219. New York: Springer-Verlag.

John J. Flynn

1989. (editor) Mesozoic/Cenozoic Vertebrate Paleontology: Classic Localities, Contemporary Approaches, Field Trip Guidebook T322, 28th International Geological Congress, American Geophysical Union, Washington, D.C., 77 pages.

1989. Mesozoic/Cenozoic Vertebrate Paleontology: Classic Localities, Contemporary Approaches, IN: J.J. Flynn (ed.), Mesozoic/Cenozoic Vertebrate Paleontology: Classic Localities, Contemporary Approaches, Field Trip Guidebook T322, 28th International Geological Congress, American Geophysical Union, Washington, D.C., p. 1-6.

1989. Salt Lake City, Utah to Vernal, Utah; Thermopolis, Wyoming to Cody, Wyoming; Cody, Wyoming to Jordan, Montana, IN: J.J. Flynn (ed.), Mesozoic/Cenozoic Vertebrate Paleontology: Classic Localities, Contemporary Approaches, Field Trip Guidebook T322, 28th International Geological Congress, American Geophysical Union, Washington, D.C., p. 7, p. 45-46, p. 58-59.

1989. (with L. Grande) Vernal, Utah to Kemmerer, Wyoming, IN: J.J. Flynn (ed.), Mesozoic/Cenozoic Vertebrate Paleontology: Classic Localities, Contemporary Approaches, Field Trip Guidebook T322, 28th International Geological Congress, American Geophysical Union, Washington, D.C., p. 15-17.

1989. (with M.C. McKenna) Kemmerer, Wyoming to Thermopolis, Wyoming, IN: J.J. Flynn (ed.), Mesozoic/Cenozoic Vertebrate Paleontology: Classic Localities, Contemporary Approaches, Field Trip Guidebook T322, 28th International Geological Congress, American Geophysical Union, Washington, D.C., p. 29-33.

1989. (with R.M. Cipolletti, and M.J. Novacek) Paleontology and geochronology of Early Eocene marine and continental strata, Baja California, Mexico. *Geological Society of America Bulletin*, 101: 1182-1196.

1989. (with P.E. Olsen) Field guide to the vertebrate paleontology of Late Triassic rocks in the southwestern Newark Basin (Newark Supergroup, New Jersey and Pennsylvania). *The Mosasaur*, 4: 1-43.

1989. (with L. Marshall, and J. Guerrero) Constraints on the age of "Friasian" (Miocene) faunas. [Abstract] *Journal of Vertebrate Paleontology*, 8 (supplement to no. 3): 20A.

1989. Vertebrate paleontology and timescales. [Abstract] *Journal of Vertebrate Paleontology*, 8 (supplement to no. 3): 20A.

1989. (with R. Stucky, and L. Krishtalka) Paleontology and geochronology of Eocene strata, Wind River Basin, Wyoming. [Abstract] *Journal of Vertebrate Paleontology*, 8 (supplement to no. 3): 40A.

1989. (with L. Marshall, J. Guerrero, and P. Salinas) Geochronology of middle Miocene ("Friasian" Land Mammal Age) faunas from Chile and Colombia. *Abstracts with Programs*, Annual Meeting, Geological Society of America, 21(6): A133.

Catherine A. Forster

1989. (with Arthur E. Dunham, Karen L. Overall and Warren P. Porter) Implications of ecological energetics and biophysical and developmental constraints for life-history variation in dinosaurs. *Geological Society of America Special Paper* 238: 1-19.

Lance Grande

1989. Vicariance biogeography. In Briggs, D. E. G. and P. R. Crowther, eds., *Palaeobiology: a synthesis*. Blackwell Scientific Publications, Oxford.

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1989. (with J. J. Flynn). Vernal, Utah to Kemmerer, Wyoming. Pp. 15-17 In Flynn, J. ed., *Mesozoic/Cenozoic Vertebrate Paleontology: Classic Localities, Contemporary Approaches*. 28th International Geological Congress fieldtrip guidebook T322, pp. 1-77. American Geophysical Union.

1989. (with Eastman, J. T.) Evolution of the Antarctic fish fauna with emphasis on the Recent notothenioids. From Crame, J. A. (ed.), *Origins and Evolution of the Antarctic Biota*, Geological Society Special Publication No. 47, pp. 241-252.

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Scott Lidgard

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Matthew H. Nitecki

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Ed Olsen

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ZOOLOGY

Barry Chernoff

1989. Davis, Duckworth, Raven, Wilson, Hoaglund, and Chernoff (eds.) *Systematics Collections Resources for the 1990's*. The Association of Systematics Collections, Washington, D.C., 107 pp.

1989. (et al.) *Commentary on Systematics*. Association of Systematics Bulletin 1989 (1):1-2

Joel Cracraft

1989. (with D.P. Mindell) The early history of modern birds. In The Hierarchy of Life: Molecules and Morphology in Phylogenetic Analysis, Elsevier, pp. 389-403.

1989. Speciation and its ontology: the empirical consequences of alternative species concepts. In Speciation and Its Consequences, Elsevier, pp. 28-59.

1989. Species as entities of biological theory. In What the philosophy of biology is: the philosophy of David Hull, pp. 31-52.

Sharon B. Emerson

1989. (with S. J. Arnold) Intra-and Inter-specific relations between morphology, performance and fitness. In Complex Organismal Functions: Integration and Evolution Invertebrates, pp. 295-314. Eds. D. B. Wake and G. Roth.

Jack Fooden

1989. (with S.M. Lanyon) Blood-protein allele frequencies and phylogenetic relationships in Macaca: a review. *American Journal of Primatology*, 17(3):209-241.

Steven M. Goodman

1989 Predation by the Grey Leaf Langur (Presbytis hosei) on the contents of a bird's nest at Mt. Kinabalu Park, Sabah. Primates, 30:127-128.

1989. The occurence of Crocidura floweri in Wadi el Natrun, Egypt. Mammalia, 53:134-135.

1989. (With P. Gonzales). 1989. Seven bird species new to Catanduanes Island, Philippines. Bulletin of the British Ornithological Club, 109:48--50.

1989. (with C.V.Haynes). 1989. The distribution, breeding season and food habits of the Lanner from the Eastern Sahara. National Geographic Research 5:126-131.

1989. (with P.L. Meininger). 1989. The Birds of Egypt. Oxford University Press.

1989. (with P.L. Meininger). 1989. The discovery of the Arabian Warbler Syliva leucomelaena in southeastern Egypt. Courser 2:24-26.

David W. Greenfield

1989. Pirolepis dawsoni, n.sp. (Pisces: Gobiidae), a third Atlantic species of Pirolepis. *Copeia*, (2):397-401.

Lawrence R. Heaney

1989. (with P.D. Heideman, E.A. Rickart, R.B. Utzurrum and J.S.H. Klompen) Elevational zonation of mammals in the central Philippines. *Journal of Tropical Ecology*, 5:259-280.

1989. (with Richart, E.A. and M.J. Rosenfeld) Chromosomes of ten species of Philippine fruit bats (Chiroptera: Pteropodidat). *Proceedings of the Biological Society of Washington*, 520-531.

1989. (with Heideman, P.D.) Population biology of fruit bats (Pteropodidae) in Philippine submontane rainforest. *Journal of Zoology* (London), 218:565-586.

Robert F. Inger

1989. Four new species of frogs from Borneo. *Malayan Nature Journal*, 42:229-243.

1989. Zhao, E., G. Wu and R.F. Inger. 1989. Ecological and geographic distribution of the Amphibians of Sichuan, China. *Copeia* (3) 549-557.

Bruce C.Jayne

1989. The effect of tail morphology on locomotor performance of snakes: a comparison of experimental and correlative methods. *The Journal of Experimental Zoology*, 252:126-133.

W. B. Jeffries

1989. (with H.K. Voris and C.M. Yang) Observations of the incidence of the pedunculate barnacle, Octolasmsi warwickii (Gray, 1825) on horseshoe crabs (Xiphosura) in the seas adjacent to Singapore. *Raffles Bulletin of Zoology*, 37(1&2):57-61.

John Kethley

1989. Occurence of Pomerantzia kethleyi Price (Acari: Prostigmata: Pomerantziidae) in Illinois and Minnesota. *Great Lakes Entomologist*, 22(2):101.

1989. Proteonematalycidae, (Acari: Acariformes) A new mite family from fore-dune sand of Lake Michigan. *International Journal of Acarology*, 15:209-217.

1989. (with R.A. Norton, P.M. Bonamo and W.A. Shear). A terrestrial alicorhagiid mite (Acari: Acariformes) from the Devonian of New York. *Micropalentology*, 35(4):367-373.

John C. Murphy

1989. Musical amphibians of Chicagoland. In Field Museum of Natural History Bulletin, 60(4):18-27.

Harry Nelson

1989. Postelichus, a new genus of nearctic Dryopidae (Coleoptera). *Coleopterists Bulletin*, 43(1):19-24.

Alfred F. Newton

1989. (with D.S. Chandler). World catalog of the genera of Pselaphidae (Coleoptera). *Fieldiana: Zoology* (N.S.) 53:1-9.

1989. *Paralispinus mariae Hatch* (Coleoptera: Staphylinidae: Osoriinae) transferred to genus *Stictocranius* (Euaesthetinae). *Coleopterists Bulletin* 43:145-146.

1989. Review of *Dactylosternum* Wollaston species of Australia and New Zealand (Coleoptera: Hydrophilidae). *Australian Entomological Magazine*, 16:49-58.

Bruce Patterson

1989. Conservation of tropical diversity: the Field Museum connection. *Field Museum of Natural History Bulletin*, 60(3):18-28.

1989. Dominance of South American marsupials. *Nature*, 337:215.

1989. (with P.L. Meserve and B.K. Lang). Distribution and abundance of small mammals along an elevational transect in temperate rainforests of Chile. *Journal of Mammalogy*, 70(1):67-78.

1989. History and evolution. *Evolutionary Trends in Plants* 3(2).

H. Bradley Shaffer,

1989 (with F. Breeden) The relationship between allozyme variation and life history: non-transforming salamanders are less variable. *Copeia*, pp. 1016-1023.

G. Alan Solem

1989. Non-Camaenid Land Snails of the Kimberley and Northern Territory, Australia. I. Systematics, Affinities and Ranges. Invertebrate Taxonomy, 2(4):455-604, figs. 1-217.

1989. *Cristilabrum kessneri*, a new camaenid land snail from the Jeremiah Hills, Western Australia (Mollusca: Pulmonata: Camaenidae). *Journal of the Malacological Society of Australia*, 10:97-107, figs. 1-5, 2 tables.

Myriam and Donald Stewart

1989. Longtudinal zonation of sandy beach fishes in the Napa River Basin, Eastern Equador. *Copeia* (2):364-381.

Harold K. Voris

1989. (with Jeffries, W.B. and C.M. Yang). Observations on the incidence of the pedunculate barnacle, Octolasmis warwickii (Gray, 1825) on horseshoe crabs (Xiphosura) in the seas adjacent to Singapore. *Raffles Bulletin of Zoology*, 37(1&2):57-61.

Richard Wassersug

1989. Locomotion in Amphibian Larvae (or "Why aren't tadpoles built like fishes?"). *American Zoology*, 29:65-84.

COLLECTION AND RESEARCH

Current Active Grants

Anthropology

Bennett Bronson
Excavations at Ko Kho Khao, Southern Thailand. National Geographic Society. $12,400. November 1988-June 1990.

Robert Feldman
Cerro Baul: Chronology and Function at a Wari Frontier Settlement. Wenner Gren Foundation for Anthropological Research, Inc., $9,000. August 1989 - March 1990.

Jonathan Haas
Warfare and Disease in the Protohistoric Northern Rio Grande Region. H. F. Guggenheim Foundation, $50,398, 1988-1991. Co-PI Winifred Creamer.

Chui Mei Ho
Survey of Tang and Song Dynasty Kilns in Guangdong Province. Committee on Scholarly Communication with The People's Republic of China (National Academy of Sciences), $17,850. 1989-1990.

Catherine Sease
A New Means for Controlling Relative Humidity. National Endowment for the Arts, $20,000. April 1988 - March 1990. Co-PI Phillip Lewis

Botany

John J. Engel
Curatorial Support for the Field Museum Herbarium. National Science Foundation. BSR-8801197. $461,561.00. 1988-1991.

Botany Type Photo Treatment. Institute of Museum Services. $24,973.00. 1989-1990. Co-PI Christine Niezgoda.

Michael O. Dillon
Biogeography and Evolution of the Lomas Formations of Peru and Chile. National Science Foundation. $46,703, 1986-89.

Gregory M. Mueller
"Mushrooms and Other Fungi of Costa Rican Oak Forests." The John D. and Catherine T. MacArthur Foundation. $22,000. 1989-1991.

"Acquisition of New Scanning Electron Microscopy Facilities." National Science Foundation. $65,000. 1989. (Co-PI with P. Crane, J.S. Ashe, and C. Niezgoda).

"The agaric genus Laccaria in South America: A taxonomic and biological study." National Science Foundation. $44,568. 1986-1989.

"Mycota of the Leopold Reserve." Leopold Memorial Reserve Foundation. $18,000. 1986-1989. (Co-PI with H.H. Burdsall, D.A. Glawe, and A.D. Parker).

Geology

Peter Crane

Floral Structure and Systematics of Mid-Cretaceous Angiosperms. National Science Foundation, $110,00, 1987-1990.

Support for the Care and Use of the Systematic Collection of Mazon Creek Fauna and Flora. National Science Foundation, $152,995. Co-PIs Scott Lidgard and Matthew Nitecki.

Acquisition of New Scanning Electron Microscopy Facilities at Field Museum of Natural History. National Science Foundation, $60,000. Co-PIs Steven Ashe, Gregory Mueller and Christine Niezgoda.

Additional Support for Acquisition of New Scanning Electron Microscopy Facilities at Field Museum of Natural History. National Science Foundation, $5,000. Co-PIs Steven Ashe, Gregory Mueller, Christine Niezgoda.

John Flynn

"Paleontology and geochronology of the middle Miocene of South America". National Science Foundation, $32,363 subcontract to Flynn; 2 year subcontract. (PI on subcontract for paleomagnetic research, from R. Kay, Duke University; $384,806 total requested [grant awarded, but budget not yet finalized],).

"Acquisition of a video image analysis system". Philip M. McKenna Foundation, Inc., $11,000. December, 1989.

"Paleomagnetism laboratory equipment, Field Museum". Philip M. McKenna Foundation, Inc., $11,700. December, 1989.

Lance Grande

Systematics, osteology and historical biogeography of paddlefishes. National Science Foundation. $127,000.00. Co-PI William Bemis.

Zoology

Barry Chernoff

Development and Support for MUSE, a microcomputer-based System for Managing Natural History Collections. National Science Foundation, $153,252. 1988 to 1990.

Lawrence Heaney

"Computer Database Verification and Storage of Orphaned African Collection". National Science Foundation, $212,130. 1989-1992. BCoooo-PIs B. D. Patterson, L. R. Heaney, and J. Kerbis.

Robert Inger

Herpetofaunal communities in Borneo and effects of logging. National Geographic Society, $27,400. 1989-1990.

John Kethley

Support for the care and use of the collections of insects and other arthropods of the Field Museum of Natural History. National Science Foundation, $710,047. 1 June 1989 - 31 May 1994. Co-PI A.F. Newton, Jr.

Scott Lanyon

Collection computerization in the Division of Birds, FMNH. National Science Foundation, $140,057. 15 October 1987 - 31 March 1991

Phylogenetic affinities within the blackbird genus Agelaius (Icterinae). National Science Foundation, $118,974. 15 April 1987 - 30 September 1990

Alfred Newton

"Revision of New World *Platydracus* species". National Science Foundation, $89,009. 1989-1992.

"Support for collections of insects and other arthropods of FMNH". National Science Foundation, $710,047. 1989-1994. Co-PI J. B. Kethley).

Museum study trip to Europe. American Philosophical Society, $2,200, 1989.

Museum study trip to Europe. Ernst Mayr Grant (Harvard University), $1,500, 1989.

Bruce Patterson

"Facilities Support for the mammal collection, Field Museum of Natural History". National Science Foundation, $$203,714. 1989-1992. Co-PIs L. R. Heaney and J. C. Kerbis.

Herpetofaunal communities in Bornean rain forests and effects of logging. National Geographic Society, $27,400. 1989-90. Co-PI R. F. Inger.

Harold Voris

Herpetofaunal communities in Bornean rain forests and effects of logging. National Geographic Society, $27,400. 1989-90. Co-PI R. F. Inger.

Scientific Support Services

Photography

Preservation of the Photographic Collection. National Endowment for the Humanities, $184,000. 1989-1990.

COLLECTION AND RESEARCH

Scientific Travel

Anthropology

Bennet Bronson:	Thailand. December 1988-March 1989. Archeological fieldwork.
Glen Cole:	University Museum of Archaeology and Anthropology in Cambridge, England. April, 1989. Research on museum collections.
Jonathan Haas:	New Mexico, July, 1989. Archaeological fieldwork.
Catherine Sease:	Egypt, December 1988 - January 1989. Archaeological fieldwork.
Charles Stanish:	1989 Proyecto Juli. July-September, 1989. Peru. Archaeological fieldwork.
John Terrell:	Hawaii, August 1989. Archaeological fieldwork.
James VanStone:	Alaska, March-April , 1989. Archaeological fieldwork.

Botany

Michael Dillon:	University of British Columbia, Vancouver, B.C., Canada Smithsonian Institution, Washington, D.C. Research on museum collections.
Greg Mueller:	Central and Southern Costa Rica, 1-16 November. Leopold Memorial Reserve, Baraboo, WI, 12-13 May, 2-4 & 18 June, 20-21 September. Fieldwork and collection of mushrooms and other fungi.
Robert Stolze:	August, 1989. U.S. National Herbarium, Smithsonian Institution, Washington, D.C.October, 1989. Missouri Botanical Garden, St. Louis, MO. Research on museum collections.

Geology

John R. Bolt:	Oklahoma; England. Fieldwork.
Peter R. Crane:	Central Portugal. Fieldwork. University of Toronto, Canada; University of Aarhus, Denmark; University of Durham, U.K.; University of London, U.K. University of California, Berkeley, California; University of

	California, Davis, California; Harvard University, Cambridge, Massachusetts; Smith College, Northampton, Massachusetts; Ohio University, Athens, Ohio; Yale University, New Haven, Connecticut. Research on collections.
John J. Flynn:	American Museum of Natural History, New York; Texas Memorial Museum, Texas; Museo Argentino de Ciencias Naturales, Buenos Aires, Argentina; Museo de La Plata, La Plata, Argentina. Research on collections. Wyoming, Utah. Fieldwork. Chile. 2 independent projects.
Lance Grande:	Wyoming - 2 weeks field work in Kemmerer New York - 3 days at American Museum of Natural History Massachusetts - U. of Mass., Amherst, to work on paddlefish research project.
Scott Lidgard:	England, Massachusetts. Research on collections.
Matthew Nitecki:	Field work in the Great Basin.

Zoology

Barry Chernoff:	Cornell University, Ithaca, New York, January 1989 University of Michigan, Ann Arbor, Michigan, May 1989 Research on collections.
Lawrence Heaney:	Malaysia, Philippines. Fieldwork. Smithsonian Institution, University of Michigan. Research on collections.
Robert Inger:	Malaysia, June-August, 1989. Fieldwork. Washington, D.C., Dec. 18-20, research on collections.
John Kethley:	Georgia, Illinois, Texas. Fieldwork.
Alfred Newton:	Belgium, France, Spain, Switzeriand, Austria, E. Germany, Great Britain; Sept.-Oct.; studies of museum collections.
Bruce Patterson:	Brasil, Sao Paulo; Nov 2-Dec 21, 1989. Fieldwork. Research.
Alan Solem:	Australia. Fieldwork.
Harold Voris:	Malaysia, Sabah (Borneo), fieldwork.

FIELD MUSEUM LIBRARY

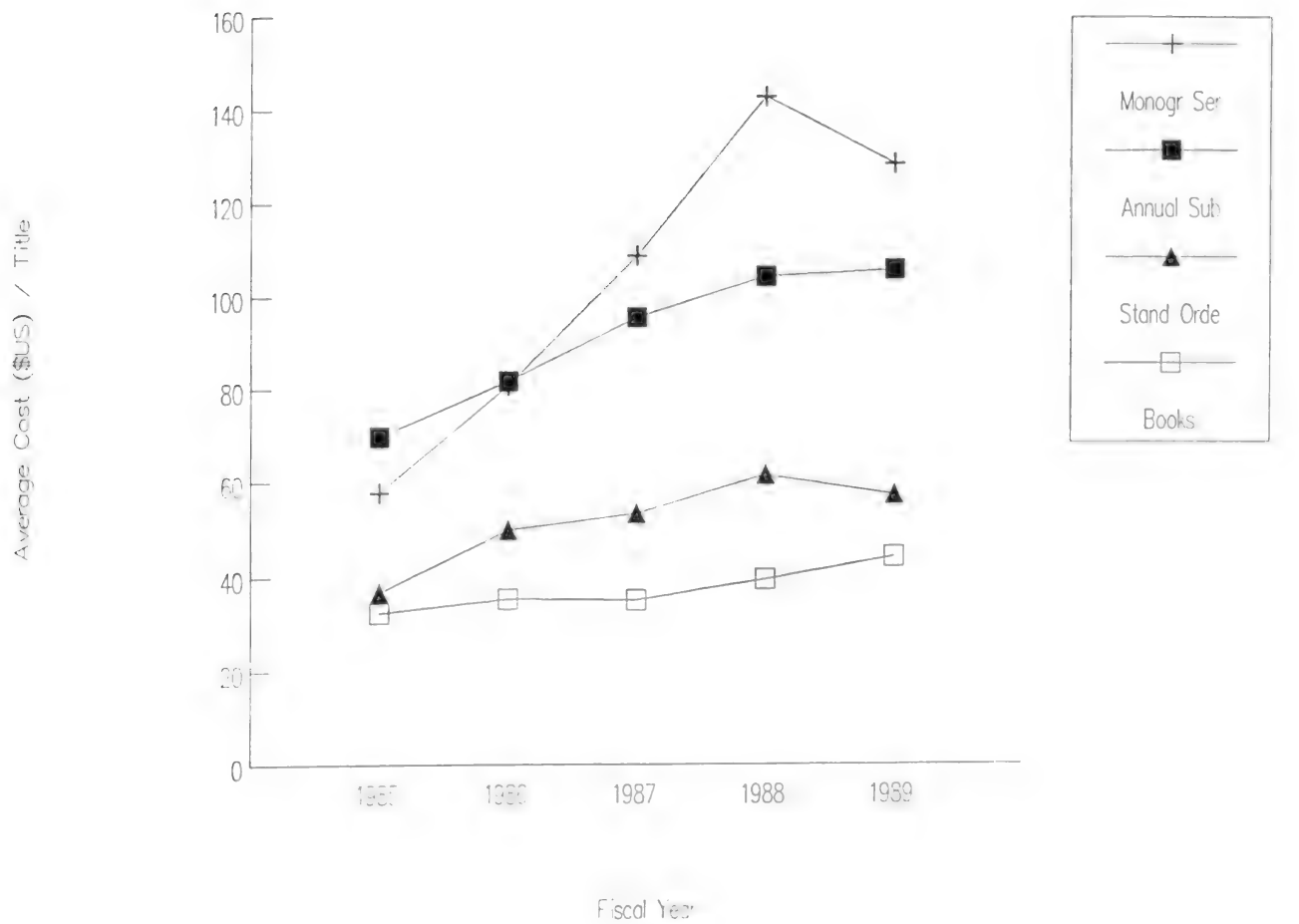
Field Museum Library maintains and builds collections of books, journals and other special materials that are essential to the Museum's research, exhibition, and educational programs. The Library serves a number of different publics, each with distinct needs, and strives to balance the requirements of all users in order to provide the best possible service. In addition to the services provided to Museum staff, volunteers, interns, visiting scientists, specialists and consultants, Library collections are available to the international community of natural science researchers through the Interlibrary Loan Program. Library resources are also offered to the public at large through the Library's Public Reading Room.

Research library collections in the United States have been undermined in the 1980's by two persistent problems: the weakness of the U.S. dollar against foreign currencies and the simultaneous emergence of aggressive pricing by a group of European publishers. Only recently have the relative strengthening of the dollar and the insistent lobbying of librarians and academics begun to allay these problems, but the damage to library research collections has been done.
Most libraries have been forced to drastically cut journal subscriptions while shifting funds at the same time from book acquisition to support remaining subscriptions. The accompanying graphs illustrate the problem of the escalating cost of research publications and the effect it has had on Field Museum Library's acquisition program.

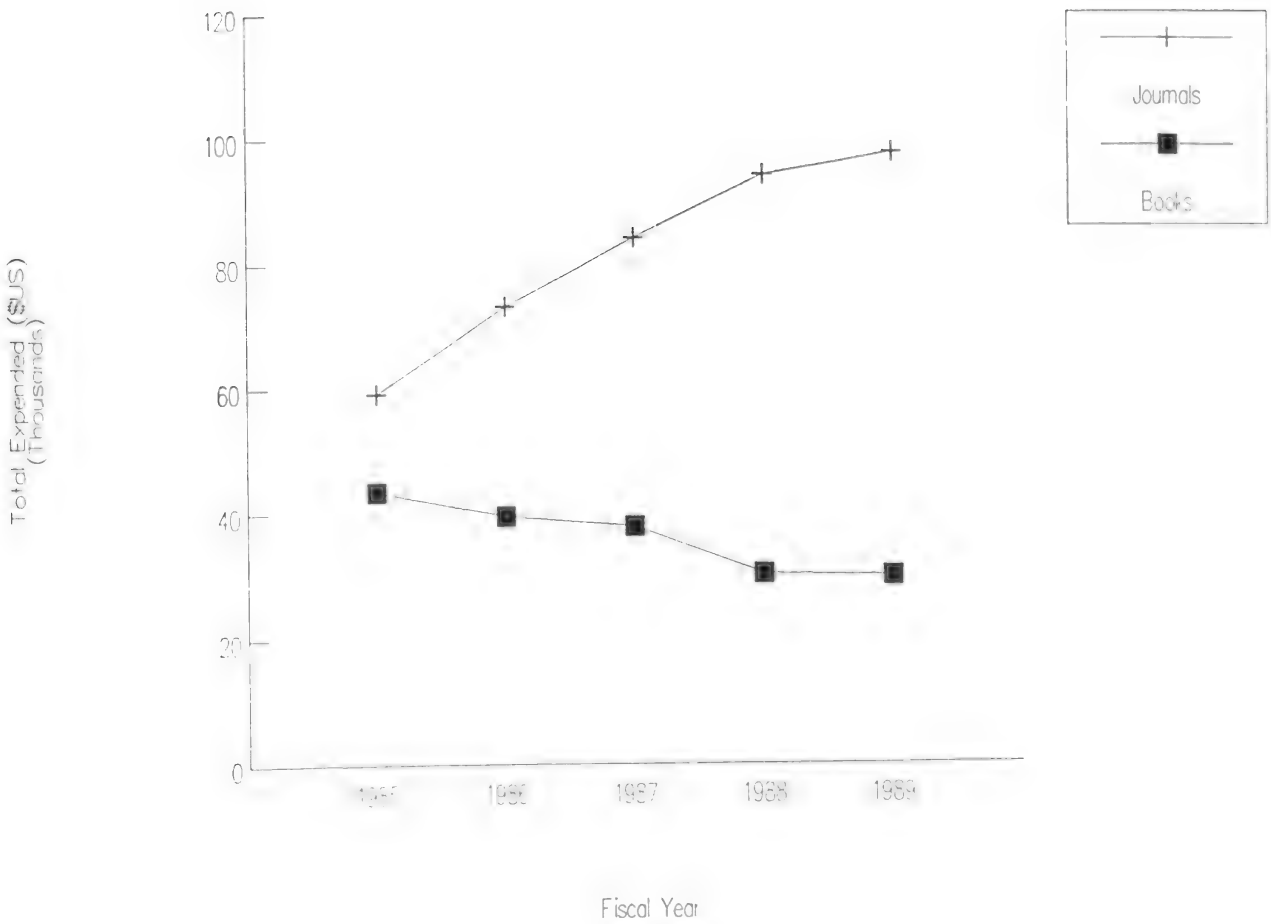
The overall cost of the Library's acquisitions were kept under control from 1985 through 1989 by cancellation of 55 journal subscriptions, among them some of the most expensive that had been maintained. Cost increases of the remaining journals (1223 titles currently) were covered during this period by a 50% reduction in the number of books purchased, and a concurrent lowering of the average price of books selected for purchase.
For the Library, the 1980's closed with the certain knowledge that a great research resource had suffered a stunted growth of several years' duration. The only bright spot during this period has been the relatively satisfactory manner in which the U.S. Interlibrary Loan network enabled libraries to meet research needs through sharing of existing resources.

A new source of support for the continuing development of the Library's collections may be found in the recently established Friends of Field Museum Library. The mission of the Friends will be the enhancement of all the Library's programs of collection building and service to the research community and the public. Support for acquisitions, and especially for the endangered journal collections, will be high on the Friends' list of priorities.

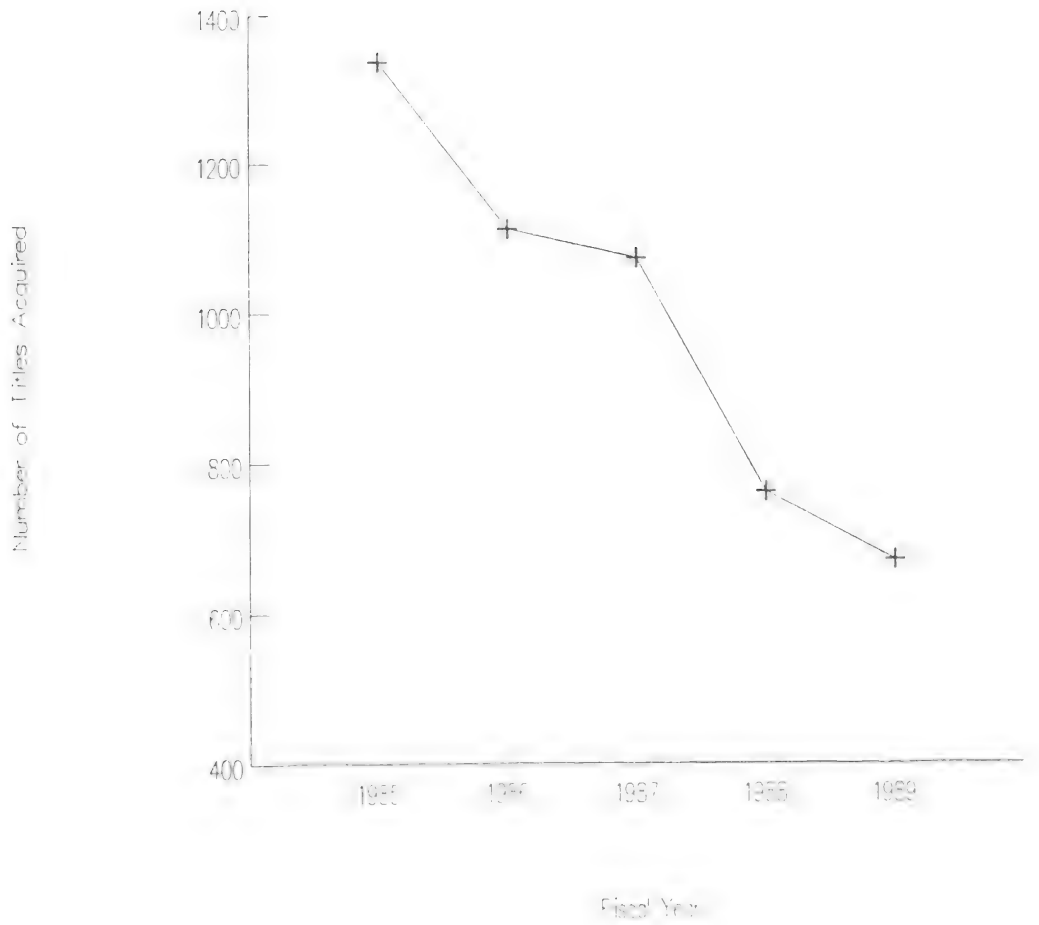
Average Costs of Library Acquisitions, 1985-1989 (By Type of Material)



Book and Journal Total Expenditures, 1985-1989



Decline in Book Purchases as Result of Shifting Funds to Journals



PROFILE OF FIELD MUSEUM LIBRARY
HOLDINGS AND COLLECTION ACTIVITY, 1989

SUMMARY TABLE

		VOLUMES ADDED					VOLUMES USED		
	VOLUMES HELD	BOOKS ACQUIRED BY:				VOLUMES HELD			INTER-LIBRARY
LIBRARY	12-31-88	PURCHASE	EXCHANGE	GIFT	JOURNALS	12-31-89	MUSEUM STAFF*	PUBLIC VISITORS	LOANS
GENERAL	100304	181	31	97	455	101068	1622	754	230
ANTHROPOLOGY	35112	221	43	41	125	35542	1029	779	126
BOTANY	29877	91	18	25	150	30161	349	141	86
GEOLOGY	34801	59	21	15	200	35096	315	117	63
ZOOLOGY:									
BIRDS	11111	49	6	8	34	11208	329	83	38
MAMMALS	3698	38	2	55	12	3805	186	91	31
INSECTS	13813	32	4	9	76	13934	107	77	25
INVERTS	3723	8	1	9	11	3752	30	19	9
FISHES	899	6	1	22	9	937	25	9	6
AMPH/REPTILES	1392	25	2	10	10	1439	30	45	34
ZOOLOGY TOTAL	34636	158	16	113	152	35075	707	324	143
TOTAL, ALL LIBRARIES	234730	710	129	291	1082	236942	4022	2115	648

*Figures for use of Library collections by Museum staff are derived from circulation charge forms filled out when staff take Library materials from the stacks to their offices. No figures are available for the amount of onsite use in the Libraries, incidental browsing at the shelves, or use of Library materials for photocopying.

PROFILE OF FIELD MUSEUM LIBRARY
HOLDINGS AND COLLECTION ACTIVITY, 1989

LIBRARY OF CONGRESS SUBJECT HEADING:	VOLUMES HELD 12-31-88	VOLUMES ADDED: BOOKS ACQUIRED BY: PURCHASE	EXCHANGE	GIFT	JOURNALS	VOLUMES HELD 12-31-89	VOLUMES USED: MUSEUM STAFF	PUBLIC VISITORS	INTER-LIBRARY LOANS
GENERAL WORKS									
COLLECTIONS. ENCYCLOPEDIAS. INDEXES (GENERAL)	1048					1048		2	
MUSEUMS									
PERIODICALS	402				5	407	18	5	4
GENERAL WORKS	79					79	5		3
MUSEOGRAPHY. INDIVIDUAL MUSEUMS	431	2			1	434	3	1	
MUSEOLOGY. MUSEUM METHODS, TECHNIQUES, ETC.	148	7			1	156	26	2	10
PERIODICALS (GENERAL)	675					675	3	3	
ACADEMIES & LEARNED SOCIETIES (GENERAL)	2215			1	6	2222	1	1	1
PHILOSOPHY. PSYCHOLOGY. RELIGION									
PHILOSOPHY. LOGIC. SPECULATIVE PHILOSOPHY	97			1		98	2		
PSYCHOLOGY	309	1			1	311	3	1	2
AESTHETICS. ETHICS	61	1				62	1		
RELIGION. MYTHOLOGY. PARTICULAR RELIGIONS	981	2	1	1		985	14	16	2
AUXILIARY SCIENCES OF HISTORY	458	1			1	460	9	3	1
HISTORY: GENERAL & OLD WORLD									
HISTORY (GENERAL)	183	1			1	185	4		
EUROPE	629		1	3	1	634	8	8	
ASIA	4334	4	1	3	8	4350	17	25	2
AFRICA	1342	1		4	2	1349	52	12	5
OCEANIA, AUSTRALIA, NEW ZEALAND	473	3			3	479	26	9	3
HISTORY: AMERICA									
UNITED STATES	1071	2		2	1	1076	6	12	1
UNITED STATES LOCAL HISTORY	1790	2		2	1	1795	5	5	1
BRITISH AMERICA. CANADA	122			1	1	124		3	1
MEXICO, CENTRAL AMERICA, WEST INDIES	927		1	3	3	934		12	
SOUTH AMERICA	1002	1	1	4	1	1009	6	16	1
GEOGRAPHY. ANTHROPOLOGY. RECREATION									
GEOGRAPHY	4083	14	1	4	11	4113	72	14	3
MATHEMATICAL & PHYSICAL GEOGRAPHY	436	1		2	2	441	4	2	1
OCEANOGRAPHY	838				10	848	4	8	
HUMAN ECOLOGY. ANTHROPOGEOGRAPHY	134	1		1		136	8	1	
ANTHROPOLOGY									
PERIODICALS									
GENERAL, INTERNATIONAL	1095				11	1106	48	44	1
SOCIETIES, INSTITUTIONS, ETC.									
AMERICA NORTH OF MEXICO	2917				16	2933	76	88	3
OTHER AMERICA (SO & CENT; MEXICO; ETC.)	435				1	436	4	5	1
EUROPE	3329				13	3342	22	22	5
ASIA	1158				7	1165		5	6
AFRICA	254				1	255			1
OCEANIA, AUSTRALIA, NEW ZEALAND	129				1	130	2	3	1
COLLECTIONS. GENERAL WORKS, METHODOLOGY, ETC.	581	4			4	589	22	6	1
PHYSICAL ANTHROPOLOGY	633	4	1		4	642	28	16	
ETHNOLOGY. SOCIAL & CULTURAL ANTHROPOLOGY									
GENERAL WORKS. SPECIAL ETHNOLOGIC GROUPS	240	4		2	1	247	27	1	
CUSTOMS & INSTITUTIONS	597	5			1	603	39	23	2
GEOGRAPHIC DIVISIONS									

	VOLUMES HELD 12-31-88	VOLUMES ADDED: BOOKS ACQUIRED BY: PURCHASE	EXCHANGE	GIFT	JOURNALS	VOLUMES HELD 12-31-89	VOLUMES USED: MUSEUM STAFF	PUBLIC VISITORS	INTER-LIBRARY LOANS
ANTHROPOLOGY									
ETHNOLOGY. SOCIAL & CULTURAL ANTHROPOLOGY									
GEOGRAPHIC DIVISIONS (CONTINUED)									
AMERICAS (GENERAL)	977	8			4	989	35	49	2
NORTH AMERICA									
ANTHROPOLOGY & ARCHAEOLOGY (GENERAL)	1036	16		5	3	1060	42	31	4
SPECIAL TOPICS	356	9	1	6		372	14	46	8
INDIANS OF N. AMER. BY TRIBE	748	13	7	3	1	772	38	47	5
INDIANS OF N. AMER. BY STATES & REGIONS	274	6	1	2	1	284	14	18	3
MEXICO, CENTRAL AMERICA, WEST INDIES	1044	22	4	1	1	1072	56	31	
SOUTH AMERICA	664	19	2		1	686	32	12	7
EUROPE	60					60	2	1	
ASIA	870	1	2		1	874	13	13	3
AFRICA	1808	6	13	1	4	1832	123	41	3
OCEANIA, AUSTRALIA, NEW ZEALAND	1433	23	2	7	2	1467	68	62	19
SPECIAL REGIONS & RACES	31	1				32	1	4	
ARCHEOLOGY									
PERIODICALS									
GENERAL; INTERNATIONAL	1085				7	1092	35	12	
AMERICA NORTH OF MEXICO	859				8	867	3	9	3
OTHER AMERICA (SOUTH & CENTRAL; MEXICO; ETC.)	54				1	55			2
EUROPE	1339				7	1346	5		4
ASIA	647				4	651	2	1	1
AFRICA	79				1	80	1		
OCEANIA, AUSTRALIA, NEW ZEALAND	79				2	81	5	2	
COLLECTIONS; GENERAL WORKS; METHODOLOGY	709	23		1	1	734	51	24	5
GEOGRAPHIC DIVISIONS									
EUROPE	480	2		2		484	10	8	5
ASIA	714	3	1		1	719	13	3	2
AFRICA	721	7		1	1	730	46	41	
OCEANIA, AUSTRALIA, NEW ZEALAND	253	4		1		258		5	
FOLKLORE	654	1			1	656	9	14	
MANNERS & CUSTOMS (GENERAL)	194	1		2	1	198	6	7	
RECREATION	126					126	3	1	1
SOCIAL SCIENCES	1477	4	1	6	1	1489	25	14	5
POLITICAL SCIENCE	242		1			243			
LAW	93	1		1		95	4	1	1
EDUCATION	182				1	183	2	2	
MUSIC	265	3			1	269	2	4	
FINE ARTS									
VISUAL ARTS (GENERAL)	1243	5	4	1	3	1256	37	11	5
ARCHITECTURE	126	2	1		1	130	7		2
SCULPTURE	126			1		127	2	2	
DRAWING; DESIGN; ILLUSTRATION	36					36		1	1
PAINTING	133	4		1		138	12	1	
PRINT MEDIA	40	1				41	3	1	
DECORATIVE ARTS; APPLIED ARTS	745	14	2	1	2	764	26	19	12
ARTS IN GENERAL	66				1	67	1	1	
LANGUAGE & LITERATURE									
PHILOLOGY & LINGUISTICS: CLASSICAL & MOD EUROPEAN	277	2			1	280	5	9	1
ROMANCE; GERMANIC; SLAVIC; FINNO-UGRIAN	414	1		1		416	4	2	
ORIENTAL LANGUAGES & LITERATURES	415				1	416	3	4	

LANGUAGE & LITERATURE (CONTINUED)	VOLUMES HELD 12-31-88	VOLUMES ADDED: BOOKS ACQUIRED BY: PURCHASE	EXCHANGE	GIFT	JOURNALS	VOLUMES HELD 12-31-89	VOLUMES USED: MUSEUM STAFF	PUBLIC VISITORS	INTER-LIBRARY LOANS
INDO-IRANIAN	146					146		1	
EASTERN ASIA; AFRICA; OCEANIA	963	2				965	5	3	2
AMERICAN INDIAN LANGUAGES	287	1	1		1	290	3	9	1
LITERATURE	228		1			229	7	1	1
SCIENCE									
PERIODICALS (GENERAL; INTERNATIONAL)	2482				19	2501	88	20	5
SOCIETIES (CHIEFLY PERIODICALS)									
AMERICA NORTH OF MEXICO	4672				22	4694	61	66	4
OTHER AMERICA (SOUTH & CENTRAL; MEXICO; ETC.)	570				5	575	2	1	
EUROPE	8183				20	8203	23	4	3
ASIA	1293				8	1301	11	1	
AFRICA	258				2	260		2	2
OCEANIA, AUSTRALIA, NEW ZEALAND	634				2	636	3	2	
COLLECTIONS; HISTORY OF SCIENCE	1218	5		1	1	1225	12	6	3
MATHEMATICS	98	2	1		1	102	3	4	1
ASTRONOMY	332	3				335	1	1	
PHYSICS	549	1		1		551	2	2	
CHEMISTRY	268	1	1		1	271	8		
GEOLOGY									
PERIODICALS (GENERAL & INTERNATIONAL)	1724			1	8	1733	14	4	
COLLECTED WORKS; GENERAL WORKS	1016	7	2	2	17	1044	4	3	4
PERIODICALS (SOCIETIES, INSTITUTIONS, ETC.)									
AMERICA NORTH OF MEXICO	1554				11	1565	29	16	1
OTHER AMERICA (SOUTH & CENTRAL; MEXICO; ETC.)	257				3	260	3	2	2
EUROPE	3896				35	3931	31	5	6
ASIA	541				8	549	1	1	2
AFRICA	129				1	130			
OCEANIA, AUSTRALIA, NEW ZEALAND	79					79			
GEOGRAPHICAL DIVISIONS									
AMERICA NORTH OF MEXICO	8533	4	1	1	44	8583	22	21	2
OTHER AMERICA (SOUTH & CENTRAL; MEXICO; ETC.)	263					263	1		
EUROPE	1331		3		3	1337	3		
ASIA	981				2	983		2	2
AFRICA	330				3	333	3		
OCEANIA, AUSTRALIA, NEW ZEALAND	540	2			2	544	3	1	1
MINERALOGY									
PERIODICALS	759				6	765	12		
GENERAL WORKS; SPECIAL TOPICS	252			1		253	1	1	1
SPECIAL GROUPS OF MINERALS	272	2		2	1	277	3	3	1
PETROLOGY									
PERIODICALS; GENERAL WORKS; SPECIAL TOPICS	245			1	3	249	3		2
IGNEOUS, SEDIMENTARY, METAMORPHIC ROCKS	172	3				175	1	1	
DYNAMIC & STRUCTURAL GEOLOGY	1673	11	1	1	5	1691	15	4	3
STRATIGRAPHY									
PERIODICALS; GENERAL WORKS; PRECAMBRIAN	192				1	193	1		
PALEOZOIC	169		1		1	171			1

SCIENCE	VOLUMES HELD	VOLUMES ADDED: BOOKS ACQUIRED BY:				VOLUMES HELD	VOLUMES USED:		
GEOLOGY									INTER-
STRATIGRAPHY (CONTINUED)	12-31-88	PURCHASE	EXCHANGE	GIFT	JOURNALS	12-31-89	MUSEUM STAFF	PUBLIC VISITORS	LIBRARY LOANS
MESOZOIC	36		1		1	38	2	1	
CENOZOIC	177				2	179	5	3	1
PALEONTOLOGY									
PERIODICALS									
GENERAL; INTERNATIONAL	467				3	470	9	6	1
AMERICA NORTH OF MEXICO	155				1	156	3	5	9
OTHER AMERICA (SO & CENT; MEXICO; ETC.)	54				1	55	1		2
EUROPE	1256				14	1270	31	1	
ASIA	108				2	110	1	2	1
AFRICA	28				1	29			
OCEANIA, AUSTRALIA, NEW ZEALAND	29				1	30	2	1	
COLLECTED WORKS; HISTORY; GENERAL WORKS	448	8	1	1	1	459	23	3	1
STRATIGRAPHIC DIVISIONS									
PALEOZOIC	61					61			
MESOZOIC	59					59	1	1	
CENOZOIC	99					99	4		2
GEOGRAPHICAL DIVISIONS	154		1		1	156	3	3	
PALEOZOOLOGY									
GENERAL WORKS; POPULAR WORKS	151				1	152	2		2
INVERTEBRATES	454	4	2	1	1	462	9	2	1
VERTEBRATES									
GENERAL WORKS; ICHNOLOGY	243	3			1	247	7	3	
FISHES	37					37	2		2
REPTILES	75	3	1			79	18	9	4
AMPHIBIANS, BATRACHIA	29					29			
BIRDS	31					31	2		
MAMMALS	141	2	5	1	1	150	5	4	3
FOSSILS OF DOUBTFUL AFFINITY OR ORIGIN	20	2				22	1		
PALEOBOTANY	488		1		5	494	18	1	1
NATURAL HISTORY									
PERIODICALS (GENERAL; INTERNATIONAL)	2170	1			11	2182	67	20	1
COLLECTIONS; HISTORY; GENERAL WORKS	880	5	2	2	4	893	9	5	5
PERIODICALS (SOCIETIES, INSTITUTIONS, ETC.)									
AMERICA NORTH OF MEXICO	2975	3			18	2996	94	73	3
OTHER AMERICA (SOUTH & CENTRAL; MEXICO; ETC.)	1047				5	1052	18	2	3
EUROPE	5244	2			36	5282	41	5	10
ASIA	1057				5	1062	8	7	8
AFRICA	976				6	982	14	11	10
OCEANIA, AUSTRALIA, NEW ZEALAND	954	1			8	963	33	12	
NATURE CONSERVATION	432	7	2	3	6	450	59	12	2
GEOGRAPHICAL DISTRIBUTION									
PHYSIOGRAPHIC DIVISIONS	1191	1	3		7	1202	14	7	
TOPOGRAPHICAL DIVISIONS									

SCIENCE / NATURAL HISTORY / GEOGRAPHICAL DISTRIBUTION / TOPOGRAPHICAL DIVISIONS (CONTINUED)	VOLUMES HELD 12-31-88	VOLUMES ADDED: BOOKS ACQUIRED BY: PURCHASE	EXCHANGE	GIFT	JOURNALS	VOLUMES HELD 12-31-89	VOLUMES USED: MUSEUM STAFF	PUBLIC VISITORS	INTER-LIBRARY LOANS
AMERICA NORTH OF MEXICO	182	2		5		189	5	2	
OTHER AMERICA (SO & CENT; MEXICO; ETC.)	213	3	2			218	6	10	1
EUROPE	134	1			1	136	2		1
ASIA	126	1				127		2	1
AFRICA	239			1	1	241	8	1	
INDIAN OCEAN & PACIFIC ISLANDS	161	1			1	163	13	3	1
ARCTIC & ANTARCTIC REGIONS	154				1	155	4		
MICROSCOPY	411				2	413	4	1	1
BIOLOGY									
PERIODICALS	1542				16	1558	73	20	6
GENERAL WORKS; HISTORY; RESEARCH METHODS	491	9	1		1	502	11	1	1
EVOLUTION; VARIATION; HYBRIDIZATION	420	20		1	1	442	32	6	7
HEREDITY	430	4			3	437	9	1	
REPRODUCTION & DEVELOPMENT	78	2			1	81	15		2
ECOLOGY	875	7	1	3	13	899	108	29	4
CYTOLOGY	120	2				122	10	1	
BOTANY									
PERIODICALS (GENERAL; INTERNATIONAL)	2253				13	2266	21	4	1
COLLECTED WORKS; POPULAR WORKS; HISTORY; ETC.	1549	8	4	2	3	1566	12	5	7
PERIODICALS (SOCIETIES; INSTITUTIONS; ETC.)									
AMERICA NORTH OF MEXICO	2161				16	2177	33	11	1
OTHER AMERICA (SO & CENT; MEXICO; ETC.)	372				5	377	4	1	
EUROPE	4441				41	4482	37	4	6
ASIA	602				8	610	11	5	6
AFRICA	183				3	186	3		1
OCEANIA, AUSTRALIA, NEW ZEALAND	137				4	141	7		2
PLANT-LORE; CLASSIFICATION; MEDICAL BOTANY	1321	7	1	2	2	1333	40	20	8
GEOGRAPHICAL DISTRIBUTION									
GENERAL WORKS; AQUATIC FLORA	216					216	2	1	
AMERICA NORTH OF MEXICO	1389	12	1	3	2	1407	19	6	2
OTHER AMERICA (SO & CENT; MEXICO; ETC.)	949	1	1	2	3	956	11	14	7
EUROPE	1013	6	2	2	2	1025			1
ASIA	670	3			1	674	1	9	1
AFRICA	542				2	544	9	14	1
OCEANIA, AUSTRALIA, NEW ZEALAND	230	4		2	2	238	14	2	3
SPERMATOPHYTA, PHANEROGAMS									
TREES & SHRUBS; GYMNOSPERMS	449	2		2	1	454	37	4	1
ANGIOSPERMS	2726	17		2	3	2748	14	18	6
CRYPTOGAMS									
GENERAL WORKS; LOCAL FLORAS	389	1			2	392			
PTERIDOPHYTA; BRYOPHYTA	236	3	2	1	2	244	1	1	2
MUSCI; HEPATICAE (MOSSES & LIVERWORTS)	671				2	673			1
ALGAE	632	2			2	636	2		2
LICHENS	243	3				246			
FUNGI	1506	3	3	2	11	1525	16	2	3
PLANT ANATOMY	323	1			1	325	10	2	2
PLANT PHYSIOLOGY	435	2			6	443		3	

SCIENCE / NATURAL HISTORY / BOTANY (CONTINUED)	VOLUMES HELD 12-31-88	VOLUMES ADDED: BOOKS ACQUIRED BY: PURCHASE	EXCHANGE	GIFT	JOURNALS	VOLUMES HELD 12-31-89	VOLUMES USED: MUSEUM STAFF	PUBLIC VISITORS	INTER-LIBRARY LOANS
PLANT ECOLOGY	492	7	2		2	503	16		3
ZOOLOGY									
PERIODICALS (GENERAL; INTERNATIONAL)	1777				9	1786	28	3	2
GENERAL WORKS; RESEARCH METHODS; ETC.	1609	3		1	2	1615	8	3	3
PERIODICALS (SOCIETIES, INSTITUTIONS, ETC)									
AMERICA NORTH OF MEXICO	1616				9	1625	40	47	4
OTHER AMERICA (SO & CENT; MEXICO; ETC.)	333				3	336	11	1	
EUROPE	3656	2			31	3689	71	41	10
ASIA	341				5	346	7		13
AFRICA	80				1	81	6	1	4
OCEANIA, AUSTRALIA, NEW ZEALAND	137				4	141	4	2	1
ZOOS; AQUARIA; SPECIAL TOPICS	185	1		1	3	190	15	16	10
GEOGRAPHICAL DISTRIBUTION									
GENERAL WORKS	89			1		90	2		
PHYSIOGRAPHIC DIVISIONS	253	4	1	1	2	261	6	5	1
TOPOGRAPHIC DIVISIONS									
AMERICA NORTH OF MEXICO	183	1				184	7	2	
OTHER AMERICA (SO & CENT; MEXICO; ETC.)	93				1	94		5	
EUROPE	567			1	2	570	1	2	
ASIA	194					194	2		3
AFRICA	240					240	2	1	
OCEANIA, AUSTRALIA, NEW ZEALAND	67					67	2	2	
CLASSIFICATION. SYSTEMATICS. NOMENCLATURE	241	1			1	243	2	1	
INVERTEBRATES									
PROTOZOA; PORIFERA; ECHINODERMATA	386	3			1	390	12	5	
WORMS; OTHER VERMIFORM; BRACHIOPODA; BRYOZOA	292	1			1	294	1	1	
MOLLUSCA									
PERIODICALS	1023				6	1029	7	1	6
GEOGRAPHIC DISTRIBUTION; SYSTEMATIC GROUPS	1650	4		4		1658	4	9	1
ARTHROPODA									
CRUSTACEA; MYRIAPODA, ETC.	372		1	5	3	381	6	3	2
ARACHNIDA	473	4		2	2	481	3	3	2
INSECTS									
PERIODICALS									
GENERAL; INTERNATIONAL	51	1				52	1		
AMERICA NORTH OF MEXICO	2083				23	2106	16	29	2
OTHER AMERICA (SO & CENT; MEXICO; ETC)	429				2	431		1	4
EUROPE	4723				25	4748	23	6	3
ASIA	491				4	495	3		7
AFRICA	156				1	157			
OCEANIA, AUSTRALIA, NEW ZEALAND	229				2	231	7	4	
GENERAL WORKS; METHODOLOGY	1251	4				1255	21	12	2
GEOGRAPHICAL DISTRIBUTION	394	1	1		3	399	9	1	
ANATOMY; PHYSIOLOGY; ETC.	225	1				226		1	
SYSTEMATIC DIVISIONS									
APTERA; ORTHOPTERA; NEUROPTERA; ETC.	307	5		2		314	2	1	2

SCIENCE / NATURAL HISTORY / ZOOLOGY / INVERTEBRATES / ARTHROPODA / INSECTS / SYSTEMATIC DIVISIONS (CONTINUED)	VOLUMES HELD 12-31-88	VOLUMES ADDED: BOOKS ACQUIRED BY: PURCHASE	EXCHANGE	GIFT	JOURNALS	VOLUMES HELD 12-31-89	VOLUMES USED: MUSEUM STAFF	PUBLIC VISITORS	INTER-LIBRARY LOANS
HEMIPTERA; HOMOPTERA	249		1	1	1	252			1
DIPTERA	468	2	1		4	475	1		
LEPIDOPTERA	811	7	1		5	824	2	16	
HYMENOPTERA	372	2				374	3		2
COLEOPTERA	1101	5		4	4	1114	16	3	
VERTEBRATES									
GENERAL WORKS; GEOGR DISTR; PROCHORDATA	71	2	1	4		78	4	1	
FISHES									
PERIODICALS	250	1			6	257	6	7	
GENERAL WORKS; CLASSIFICATION	185		1		1	187	2	1	1
GEOGRAPHIC DISTRIBUTION	255	2		1	2	260	14	1	2
SYSTEMATIC DIVISIONS	154	2		21		177	3		3
ANATOMY; PHYSIOLOGY; ETC.	55	1				56			
REPTILES & AMPHIBIANS									
PERIODICALS	191	1	1		4	197	2	12	4
GENERAL WORKS; CLASSIFICATION	221	2				223	2	2	5
GEOGRAPHIC DISTRIBUTION	474	9	1	3	2	489	8	12	14
SYSTEMATIC DIVISIONS	404	13		7	4	428	15	18	7
ANATOMY; PHYSIOLOGY; ETC.	102					102	3	1	4
BIRDS									
PERIODICALS									
GENERAL; INTERNATIONAL	52					52	4	1	2
AMERICA NORTH OF MEXICO	1708				8	1716	64	34	6
OTHER AMERICA (SO & CENT; MEXICO; ETC.)	28				1	29	2		1
EUROPE	2366				9	2375	41	11	2
ASIA	54				1	55		1	1
AFRICA	30				1	31	3	1	2
OCEANIA, AUSTRALIA, NEW ZEALAND	405				1	406	7	3	6
GENERAL WORKS; CLASSIFICATION	1503	7	1	2	9	1522	44	5	4
GEOGRAPHIC DISTRIBUTION									
AMERICA NORTH OF MEXICO	1197	11		2		1210	18	7	1
OTHER AMERICA (SO & CENT; MEXICO; ETC.)	342	5		2		349	35		1
EUROPE	1079	2	2		2	1085	2		
ASIA	450	3	1			454	5	2	
AFRICA	418	3		1		422	11		2
OCEANIA, AUSTRALIA, NEW ZEALAND	217	1				218	3		
ARCTIC; ANTARCTIC; TROPICAL	61					61	8		
SYSTEMATIC DIVISIONS	598	16	1	1		616	69	16	10
ANATOMY; PHYSIOLOGY; BEHAVIOR; ETC.	603	1	1		2	607	13	2	

	VOLUMES HELD 12-31-88	VOLUMES ADDED: BOOKS ACQUIRED BY: PURCHASE	EXCHANGE	GIFT	JOURNALS	VOLUMES HELD 12-31-89	VOLUMES USED: MUSEUM STAFF	PUBLIC VISITORS	INTER-LIBRARY LOANS
SCIENCE									
NATURAL HISTORY									
ZOOLOGY									
VERTEBRATES (CONTINUED)									
MAMMALS									
PERIODICALS	921	1			9	931	26	25	14
GENERAL WORKS; CLASSIFICATION	595	2		3		600	23	3	1
GEOGRAPHIC DISTRIBUTION	928	1		14	2	945	26	11	6
SYSTEMATIC DIVISIONS (EXCEPT PRIMATES)	535	22	2	38	1	598	79	40	6
PRIMATES	418	11				429	30	10	4
ANATOMY; PHYSIOLOGY; ETC.	301	1				302	2	2	
ANIMAL BEHAVIOR & PSYCHOLOGY	1332	3	2		12	1349	47	27	2
ANATOMY; EMBRYOLOGY	2380		1		12	2393	34	9	4
HUMAN ANATOMY	268				1	269	1	2	
PHYSIOLOGY	871	9	1		4	885	21	2	2
MICROBIOLOGY	91			1		92			
MEDICINE	605	5		4	5	619	4	10	13
AGRICULTURE									
AGRICULTURE (GENERAL)	4927	1		1	9	4938	19	1	2
PLANT CULTURE									
PERIODICALS	1017				4	1021	1		1
GENERAL WORKS	122					122		4	
ECONOMIC BOTANY	1008	2	2		3	1015	10	7	9
HORTICULTURE	845	7			3	855	9	1	8
GARDENING; LANDSCAPE GARDENING; ETC.	755			5	1	761	9	3	1
FORESTRY	716	2			1	719	5	7	1
ANIMAL CULTURE	422	3		2	1	428	1	14	7
FISHERIES	1559	2		1	10	1572	3	6	4
HUNTING. WILDLIFE MANAGEMENT	1079	1	1	3	6	1090	9	8	1
TECHNOLOGY									
TECHNOLOGY (GENERAL): ENVIRONMENTAL; ETC.	836	4		1	2	843	37	10	1
MINING; METALLURGY	3508	2			6	3516	1	3	4
CHEMICAL TECHNOLOGY; MANUFACTURES; HANDICRAFTS	620	3	3	4		630	33	14	4
MILITARY SCIENCE	59					59			
NAVAL SCIENCE	119					119		5	1
BIBLIOGRAPHY; LIBRARY SCIENCE									
BOOKS; BOOK INDUSTRIES & TRADE	191				1	192	1	1	2
LIBRARIES & LIBRARY SCIENCE	1940	8		8	10	1966	18	4	6
BIBLIOGRAPHY (NATIONAL; SUBJECT; PERSONAL; ETC.)	3761	3	1	12	22	3799	4	3	1
TOTALS:	234730	710	129	291	1082	236942	4022	2115	648

SCIENTIFIC

SUPPORT

STAFF

Biochemical Laboratories

During the last 20 years the biological sciences have experienced revolutionary technological growth, due in great part to major advances in biochemistry, protein chemistry, and molecular genetics. The consequences of these technological breakthroughs have now been felt not only in biology, but throughout society. Many of these techniques, some newly emerging and some well-established, have important applications to many disciplines in natural history. These applications derive from these technologies' capacity to define the genetic characteristics of organisms.

Some typical examples where such genetic information is useful are: 1) in systematics, where genealogical relationships within a group of organisms are inferred to determine how they might have descended from a presumed common ancestor; 2) in biogeography, as in the determination of genetic relationships among groups of populations, such as American Indians, to draw inferences about historical patterns of migration and settlement; 3) in the determination of the evolutionary relationships of humans with other primates; 4) in endangered species propagation programs at zoos, where molecular techniques are often used to infer the genetic health of captive populations; and 5) in the genetic characterization of extinct or endangered organisms from the genetic material still contained in dried skins and bone in museum collections.

The Biochemical Laboratories, a Field Museum research facility, recently began an expansion program to establish molecular biological techniques and procedures at the Field Museum as tools for research staff in their studies of long-standing problems in natural history. John G. Hall, Manager of the Biochemical Laboratories, is now coordinating the development and use of these facilities.

Starch gel electrophoresis of proteins, a technique that has been used for a number of years for biochemical systematics research, continues to be employed by Field Museum staff in their work. Scott Lanyon, curator of birds, continues his studies of blackbird relationships; Larry Heaney, curator of mammals, recently completed an electrophoretic study of Philippine fruit bats; and Town Peterson, graduate student at the University of Chicago, is finishing electrophoretic work in his study of geographical variation in jays. Other projects are planned. Because of the current demand for electrophoresis facilities, the Laboratories are currently being upgraded. This has included the purchase of a new refrigerator and power supplies, allowing the running of several workers' experiments at the same time.

With some startup funding from the Ellen Thorne Smith Fund and from Collections and Research, the Biochemical Laboratories are currently establishing a laboratory for the amplification and sequencing of specific genes or gene segments (DNA). The capability to target a specific sequence of DNA in the genome, amplify it, and study its properties--all in a test tube--is the result of the recent invention of a revolutionary technology, known as the polymerase chain reaction (PCR). PCR technology opens the door to the study of genes from organisms that were previously inaccessible to genetic study. It is now possible to amplify and study targeted genes from incredibly small pieces of tissue, including dried skins, bone, tissues stored in alcohol, single

hairs, and even single cells. The potential of PCR for exploiting the vast biological resources of the Field Museum in the study of central problems in the systematics and biogeography of many groups of organisms is enormous.

Computing Services

Computer Services is charged with responsibilities for supporting diverse computer related activities at Field Museum. During 1989 a large proportion of staff time was allocated to new initiatives in areas other than Research and Collections. Even so, in 1989 Computer Services maintained and improved existing collection management applications in the Mammals, Birds, Herpetology and Geology areas. Moreover, new database applications were designed and implemented for Anthropology, Invertebrates, and Insects. C/base, is the commercial database software used for all of the collection database applications. A menu driven interface allows access to a variety of screens, reports, and editing functions, loan management and label routines.

Computing hardware used to support research and collection activities consists of a Digital Equipment Corporation VAX 11/785, running Unix V.3, more than 100 personal computers and a network connecting the VAX and PCs together; these systems together with a wide range of peripherals such as printers, terminals, plotters, etc., comprise the equipment available to more than 150 researchers and staff.

The computer services department is managed by James Koeppl; Peter Lowther and Jin Jou Hwang are Computer Systems Specialists, and Julia Mirman and Wen Lii Liu are Computer Systems Assistants.

Field Museum Press

James Van Stone (1989) Scientific Editor
Harold K. Voris, (1990) Scientific Editor
Allen Press Inc., Managing Editor and Printer

Fieldiana is the scientific journal of Field Museum for publication of research by staff and research associates and for publication of information on the collections. Over the years, the journal has embraced many aspects of natural science, from collection catalogs to theoretical treatises. Fieldiana has reflected not only the growth and development of Field Museum, but the various sciences it encompasses. The series today is particularly suitable for the publication of monograph length papers that would be difficult to publish elsewhere.

To maintain standards of excellence, each manuscript submitted to Fieldiana is peer-reviewed by two or more outside reviewers. Although publication is generally limited to Field Museum staff and research associates, nonaffiliated authors may publish in the journal by invitation or when their works are based on Field Museum collections. Papers are submitted to the Scientific Editor, a member of the curatorial staff, who oversees the peer review process.

Before 1979 papers were published in volumes, but in 1979-1980 new series were implemented in which papers are numbered sequentially within each of the four disciplines. Beginning in 1984, the format of Fieldiana was changed from 6 x 9 inches with single columns to 7 x 10 inches with double columns. In 1989, under the scientific editorship of James VanStone, nine papers totaling 796 pages were published in all four scientific fields. Improvements in editing and printing procedures in 1990 should make it possible to increase this output.

Fieldiana in the past covered a wide variety of scientific works, from short papers to extensive monographs and books. Today the journal is intended primarily for the publication of scientific monographs. In fact, *Fieldiana* provides a vehicle for publication of longer papers at a time when many journals have set space limits that exclude such major works. In the 1990s the journal and its editors plan to continue to publish these major works but with an emphases on a synthetic approach. The scientific editor is also developing plans for a new Fieldiana series which would focus on interdisciplinary research on the evolution of living systems.

Fieldiana Publications - 1989

Anthropology

No. 12. Nunivak Island Eskimo (Yuit) Technology and Material Culture. By James W. VanStone; 1989. 108 pages, 107 illus., I table. $23.00 (Publ. No. 1398).

No. 13. Indian Trade Ornaments in the Collections of Field Museum of Natural History. By James W. VanStone; 1989. 40 pages, 32 illlus., $11.00 (Publ. No. 1404).

Botany

No. 20. Pteridophyta of Peru. Part I. I. Ophioglossaceae --12. Cyatheaceae. By Rolla M. Tryon and Robert G. Stolze; 1989. 145 pages, 24 illus. $27.00 (Publ. No. 1397)

No. 21. New Taxa and New Combinations of Agricales (Diagnoses Fungorum Nororum Agricalium IV). By Rolf Singer; 1989. 133 pages. $25.00 (Publ No. 1402).

No. 22. Pteridophyta of Peru. Part II. 13. Pteridaceae -- 15. Dennstaedtiaceae. By Rolla M. Tryon and Robert G. Stolze; 1989. 128 pages, 30 illus. $23.00. (Publ. No. 1403).

Geology

No. 17. The Mammalian Fauna of Madura Cave, Western Australia, Part VII: Macro podidae: Sthenurinae, Macropodinae, with a Review of the Marsupial Portion of the Fauna. By Ernest L. Lundelius, Jr. and William D. Turnbull; 1989. 71 pages, 21 illus., 21 tables. $15.00 (Publ. No. 1399).

No. 18. The Ear Region in Xenarthrans (= Edentata: Mammalia). Part I. Cingulates. By Bryan Patterson, Walter Segall, and William D. Turnbull; 1989. 46 pages, 17 illus. $13.00 (Publ. No. 1405).

Zoology

No. 53. World Catalog of the Genera of Pselaphidae (Coleoptera). By Alfred F. Ne wton, Jr. and Donald S. Chandler; 1989. 93 pages, 1 illus., 3 tables. $18.00 (Publ. No. 1400).

No. 54. Revision of the Species of *Pinophilus* Gravenhorst (Coleoptera: Staphylinidae) of America North of Mexico. By Neal Abarbanell and James S. Ashe; 1989. 32 pages, 47 illus., I table. $23.00 (Publ. No. 1401).

Photography

After 95 years as a Museum Service, the staff of the Photography Department was moved to the Collections and Research area in 1989. The staff photographers documented the completion of "Inside Ancient Egypt" and the construction and opening of "Traveling the Pacific." They shot photographs of museum events, activities, temporary exhibits, and made photographs that were used in curatorial publications and slide lectures. They also produced new photographs that were used nationally and internationally.

The Photographic Collection is currently estimated to contain over 1/2 million images, in black and white and color, dating from 1891 to the present. The Photo Researcher and her assistant identified and catalogued over 6,000 new photos and entered data into catalogues, and prepared order-lists of frequently requested images. The department was added to the VAX mainframe computer, and we began to enter the data of photographs of anthropology artifacts. We investigated other computerized systems to improve access to the collection and made plans for a more efficient physical arrangement of the negatives.

Through sales and exchange with museums and universities, Field Museum photographs appeared in over 200 publications, exhibit catalogues, postcards, and exhibits throughout the U.S., Canada, Europe, Africa and Australia.

Lab Services and Outside Sales

The photo lab staff processed over 900 requests for photographic services from museum staff and produced over 8,700 black and white prints; 4,937 black and white negatives; 3,509 35mm color slides; 767 large format color transparencies; 337 Polaroid prints; and over 100 Polaroid slides. These photographs were used for research and publicity, in exhibits, publications, and in a variety of fundraising proposals. Fieldiana, the *Bulletin* and the in-house newsletter, the *Natural News* published photos made by the staff photographers.

Income derived from over 350 outside sources for photographic services and publications' rights increased in 1989. Outside sales rose from $13,517 in 1987, to $20,609 in 1988, to $25,400 in 1989. This represents a near 100 percent increase over the past two years. Gratis permissions, worth $3,500.00 were granted to museums, universities, libraries, and secondary schools. The department received over 40 complimentary copies of books, magazines, videotapes, videodiscs, and posters that included Field Museum photos. These publications and videotapes are donated to the Field Museum Library. A new policy was instituted that required users of Field Museum photos to include the Negative Number of the image in the credit line. This way, when the photograph is published, the retrieval time for future requests of photographs is reduced by over 95 percent.

Grants and Photo Exhibits

The National Endowment for the Humanities made a grant of $184,000.00 toward the Preservation of the Photographic Collection. This two-year grant will enable the museum to preserve over 14,000 deteriorating negatives which document Museum expeditions, exhibits, and activities from 1920 through 1950. Additionally, a climate controlled environment will be built to store the entire collection of black and white and color images. In September, as Project Director, Nina Cummings began working with Massachusetts' based photo conservators from Chicago Albumen Works to coordinate the project.

"Charles Carpenter: Native American Portraits," opened in late 1989 in Webber Resource Center. Originally funded by the Union League Civic and Arts Foundation, and co-curated by Nina Cummings and Ron Testa, the exhibit contains 35 rare portraits taken of native American participants at the 1904 Louisiana Purchase Exposition held in St. Louis. Charles H. Carpenter, was Field Museum's staff photographer for almost 50 years.

Staff Activities

In August, Ron Testa, Department Head since 1975, resigned from the position to pursue a career in free-lance photography. In late October, John Weinstein joined the staff as Department Head. Mr. Weinstein's previous photographic work includes clients such as Zenith, Brunswick, Bell & Howell, United Airlines andMontgomery Ward's, among others.

Mr. Weinstein's published photography in 1989 included annual reports for FNW Bancorp and Stepan Chemical Company; advertising photography for Carnation, Sears and Zenith; and brochure photography for Bell & Howell, Zenith, and Columbia College. He oversaw a large mural project for Northwestern University, and had his photography sold in greeting cards, through Recycled Paper Product's California Dreamer's line. Mr. Weinstein was honored by his peers with cover and inside photography for the American Society of Magazine Photographers' Loupe magazine. In the fall, a page of his work was published in the Chicago Sourcebook directory.

Mr. Weinstein began working with Diane Alexander White, staff photographer, on projects including photographs of Native American masks, baskets, and other artifacts for use in the Smithsonian Press' *Handbook of North American Indians: Plains Volume*. A rare Chinese scroll was photographed for use in two pending publications by Textart, Inc. and ECAM Publications.

Mr. Weinstein and Mrs. White also worked on important photographic projects for two Geology department curators. Mr. Weinstein photographed a specimen of a fossil tetrapod for John Bolt, Curator of Fossil Reptiles and Amphibians. This photo will be published in Dr. Bolt's "Mississippian Vertebrates from Iowa," pending publication in National Geographic Research Magazine. Mr. Weinstein joined Mrs. White in photographing completing a project to photograph over 100 paddlefish for Dr. Lance Grande's monograph, to be published by the Journal of Vertebrate

Paleontology. Co- authored by Dr. William Bemis, *Systematics, Ontogeny, Osteology, and Historical Biogeography of Paddlefishes. Chondrostei; Polyodontidae* will be published in 1990.

Late in 1989, Mr. Weinstein assisted Mrs. White in producing promotional photography for the "Traveling the Pacific" exhibit for use in press kits, brochures, postcards, and for documentation. The 1990 Field Museum Women's Board Calendar was published and distributed at "One Enchanted Evening," the Women's Board Gala ball which coincided with the opening of the exhibit. Both Mr. Testa and Mrs. White's photographs appeared in the calendar. Mrs. White's photos of the ball appeared in the *Chicago Sun Time's, Skyline*, and *Spotlight Chicago*.

A selected list of recent outside publications and exhibit where Field Museum photographs appear is shown below:

Joseph Campbell's The Way of the Seeded Earth
Harper and Row, Publishers

Art of the Red Earth: Mesquakie of Iowa
University of Iowa--Exhibit and Catalogue

"Western Tradition" series
Public Broadcasting System

Lords of the Air
Smithsonian Press

Crow and *Comanche*
Chelsea House Publishers

Animal Navigation
Scientific American Books

Africa and the Renaissance: Art in Ivory

The Physicians and Surgeons Illustrated Desk Diary 1989-1990
Harry N. Abrams, Publishers

Scanning Electron Microscope

The Scanning Electron Microscope facility is a part of the Scientific Technical Services Department and serves as a multi-user area for the research staff. Acquisition of a new Scanning Electron Microscope (SEM), renovation of the facility, and employment of a new part-time SEM assistant (for coordinating the use of the facility along with providing routine maintenance and training of staff) has made this year an exciting one.

The SEM has been an invaluable scientific tool to Field Museum scientists in the anthropology, botany, geology and zoology departments since the establishing of the facility in 1973 with the original SEM. Over 65 scientists have used Field Museum's SEM facility to conduct research and more than 100 papers have been published using the microscope's data. Problems with the previous model such as major breakdowns and difficulty to obtain replacement parts had led to a steady decline in the numbers of users over the past few years.

With the installation of the new SEM last May, usage of the facility in the first 7 months has increased 54% over last year's and plans for many more research projects are underway. The newly acquired SEM has numerous technologically advanced features - some of which include the capacity to magnify at higher and lower levels, a large specimen chamber, dual magnification on a split screen, and the ability to project SEM images onto a TV screen. In addition the quality of results have improved. The upgrade of the SEM facility was possible due to support from the National Science Foundation and the Elizabeth F. Cheney Foundation. Field Museum's operating budget continues to support the ongoing maintenance and supplies for this facility.

Scientific Illustration

The four museum scientific illustrators are Zorica Dabich, B.F.A.; Zbigniew Jastrzebski, M.F.A.; Clara Richardson Simpson, M.S.; and Marlene Werner, B.S., A.A. Dr. John Engel supervises their activities. All of the illustrators are professional artists with a broad background in drawing and painting and many years of experience in both art and natural history illustration. They are charged with production of illustrations of various subjects, fulfilling the need for visual description of research material. The diversity of research interests of the curatorial staff is reflected in the wide variety of specimens and artifacts illustrated. Virtually all illustrations are produced from actual objects of scientific study, and include descriptive visual presentations, complicated reconstructions of artifacts, skeletal structures and fossil plants and animals. The illustrations are used as an explanatory supplement to the research conducted by the curatorial staff, and appear in various publications, including Fieldiana.

Each of the scientific illustrators is able to employ a broad range of techniques and media, and works with a diversity of subjects. However, each illustrator has refined a particular technique. For example, water color paintings of South American monkeys and drawings of botanical subjects utilizing crow quill are the specialities of Zorica Dabich. Clara Richardson Simpson excels in line and stipple representations of zoological and paleontological specimens. Marlene Werner excels in utilizing carbon dust and scratch board techniques of fossil and extant subjects. Zbigniew Jastrzebski has special expertise with pencil or pen and ink stipple rendering of skeletal structures as well as reconstructions of vessels for the anthropology staff.

Staff illustrators are involved in other activities relevant to their profession. Werner, Simpson and Dabich are involved in exchange of professional knowledge with the Guild of Natural Science Illustrators and the Chicago Artists Coalition. Dabich taught drawing classes as part of the Museum Adult Education series, and Jastrzebski taught night courses in scientific illustration at the Art Institute. Werner, Simpson and Jastrzebski have published numerous articles on drawing and painting techniques.

Scholarship Committee

The Field Museum supports the use of its collections and facilities by outside scholars and students. The Scholarship Committee is responsible for the review of applications and the disbursement of funds for visiting scientists, graduate fellowships and undergraduate internships who wish to work with the Museum's collections or collaborate with its scientists. The Scholarship Committee administers seven separate funds. These include: The Borg-Warner Visiting Scientist Fund, The Thomas J. Dee Fellowship Fund, The Louer Fund, The Schmidt Fund, The Rowley Fund, The Armour Fund and the Undergraduate Internship Fund.

During the 1988-89 year period, the Scholarship Committee, chaired by Charles Stanish, made awards to more than 75 individuals in each of the four scientific departments. Of these awards, approximately 1/3 were given to exceptional graduate or undergraduate students who have demonstrated a strong commitment to the study of natural history. The remaining awards were give to scientists from around the world, including scholars from Asia, South America, Europe, Australia and Africa as well as numerous scientists from the United States and Canada.

SCHOLARSHIPS AND INTERNSHIPS AWARDED 1989

Borg-Warner Roberto Bass Visiting Scientists
(For the support of visiting scientists)

Nils Spjeldnaes
Hesiquio Benitez Diaz
Clyde Barbour
Javier Guerrero-Diaz
James Penny
Miguel Lentino
Gregory Buckley
Bronslaw Woloszyn
Donald Gettinger
Jose Luis Navarrete-Heredia
Jeff Dodick
Pamela Willoughby

William A. and Stella M. Rowley Scholars
(For the education of worthwhile students in a field related to the purposes of the Museum)

Monica Listokin
Gregory Buckley

Karl P. Schmidt Scholars
(For the training of young scientists
who desire to study at the Museum)

Silva Botta
Joaquina A. Alban Castillo
Detlev Thies
Shun-Ichiro Naomi
Carolyn Renzulli Jaslow
Jeff Dodick
Clara Ines Orozco
Meriel Brooks

Thomas J. Dee Fellows
(For research and academic fellowships with priority given to younger, less well established research workers and to graduate students)

Ruth Utzurrum
Eric Rickart
Barbara Lundrigan
John Lundberg
Walter Carl Hartwig
Shelton Applegate
Asuncion Cano Echevarria
Richard Leschen
David McGinnis
Eric Findeis
Cleber Alho
David R. C. Prescott
Christopher J. Tribe
Charlotte Taylor
Patrick Carmichael
Timothy Killeen
Ann Schaffer Elder

Lester Armour Family Graduate Fellows
(Ensures the permanent support of at least one outstanding graduate student with preference given to qualified candidates in Ornithology)

Douglas Stotz
Monica Listokin

Rose M. Louer Fellow
(benefits the education of Illinois students or work by students in Illinois natural history of anthropology)

Connie Escobar

Internships

(Work experience whereby an undergraduate student gains hand-on training in his or her field of expertise for one or more semesters prior to graduation

Nancy Klehm
Mary Johnston
Rosalia Procelli
Lisa Park
Rebecca Johnston
Nayuta Yamashita

COLLECTIONS AND RESEARCH

VOLUNTEERS

Anthropology
Dee Aiana
Patinya Ambuel
Carole Anderson
Dodie Baumgarten
Garland Brown
Birdie Chang
Sol Century
Elizabeth Cheetham
Peter Coey
Jim Coplan
Ralph Cowan
Connie Crane
Jeannette DeLaney
Elizabeth Dinsmore
Pat Dodson
Andrew Fahlund
Josie Faulk
Mitzi Fine
Kirk Frye
Vesna Garber
Peter Gayford
Ann Gerber
Margaret Goes
Robert Gowland
Deborah Green
Rebecca Kammerer
Lisa Labiner
Jane Levin
Betty Lewis
Cecile Leroux
Andrew MacLeod
John MacDonald
Sam Mayo
Withrow Meeker
Carolyn Moore
George Morse
Mary Nelson
Louise Neuert
Herta Newton
Irmgard Nirschl-Rauch
Susan Parker
Dorothea Phipps-Cruz
Julie Pitzen
Marina Post
Michael Popowits
Carla Reiter
Robin Rinehart
Marea Sands
Lisa Shogren
Llois Stein
Theresa Williams
Wang-Fai Wong
Ed Yastrow

Botany
Virginia Beatty
Coleen Casey
Liz Farwell
Peter Fortsas
Daniel Goldfarb
Dennis Hall
Nancy Harlan
Sharon Kramer
Sandra Lee
Lillie Mannings
Margaret Martling
Sel Mather
Naomi Pruchnik
Joe Salzer
Martha Singer
Dan Snydacker
Randy Upton

Geology
Barbara Ballard
Irene Broede
Aldona Dziedzic
Jane Edmunds
Michael Henderson
Joseph Levin
John McConnell
Donald Newton
China Oughton
Susan Roop
Angie Shaw

Zoology
Neal Abarbanell
Paul Baker
Sophie Ann Brunner
Robert Cary
Sheila Demkovich
Stanley Dvorak
M. Alison Ebert
Ingrid Fauci
Joseph Fisher
Carlene Friedman
Ron Garner
Thomas Ghoske
Henry Greenwald
Dorothy Karall
Susan Knoll
Valerie Lewis
Janmet Madenberg
Larry Misialek
Susan Moy
Sheila Reynolds
Thomas Simon
Jack Sloan
Virginia Tune-Erfort
David Walker
Maxine Walter

Library
Arden Frederick
Ruth Howard
Mabel Johnson
Dorothy Oliver
Jim Reed
Marie Rosenthal
James Skorcz
Worthington Smith

FIELD MUSEUM OF NATURAL HISTORY
COLLECTION SIZE - 1989

Collection	Number of Specimens
ANTHROPOLOGY	
Central American Archaeology	11,724
Central American Ethnology	2,634
South American Archaeology	16,891
South American Ethnology	8,070
North American Archaeology	135,086
North American Ethnology	99,538
Osteological Collection	4,750
Polynesian Ethnology/Archaeology	5,271
Micronesian Ethnology/Archaeology	11,273
Asian Archaeology	1,196
Asian Ethnology	52,323
Near Eastern Archaeology	25,202
Near Eastern Ethnology	665
Old World Prehistory	161,257
Classical Archaeology	11,804
African and Madagascar Ethnology	16,518
Australian Ethnology	2,130
Melanesian Ethnology	36,151
Subtotal	602,483
BOTANY	
Algae	78,169
Fungi	83,528
Lichens	52,169
Bryophytes	165,203
Ferns	96,115
Seed Plants	2,021,255
Subtotal	2,496,439
GEOLOGY	
Physical Geology	62,889
Invertebrate and Plant Paleontology	397,257
Vertebrate Paleontology	132,789
Subtotal	592,935
ZOOLOGY	
Invertebrates	3,295,000
Insects	9,595,609
Fishes	1,718,300
Amphibians and Reptiles	236,232
Birds	385,000
Mammals	136,943
Subtotal	15,367,084
GRAND TOTAL	19,058,941

FIELD MUSEUM OF NATURAL HISTORY

COLLECTION GROWTH 1980-1989

	Anthro	Botany	Geology	Zoology	Total
1980	594,684	2,210,354	491,862	11,775,168	15,072,068
1989	602,483	2,496,439	592,935	15,356,775	19,048,632

USE OF COLLECTIONS BY LOAN
1989

Department	Year	Number of Loans	Specimens Loaned	Specimens Borrowed
Anthropology	1989	14	133	69
Botany	198	301	21,031	0
Geology	198	73	940	224
Zoology	198	352	26,311	24,359
Total		740	48,415	24,652
Net Loaned (Total loaned-borrowed)			23,763	

SCHOLARLY USE OF COLLECTIONS BY VISITORS
1989

Department	Year	Number of Professionals	Number of Students	Number of Others
Anthropologyu	1989	327	173	561
Botany	1989	158	24	7
Geology	1989	120	20	20
Zoology	1989	208	156	49
Total		813	373	637

1/30/90