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The Hunt Institute for Botanical Documentation, a research division of Carnegie Mellon University, specializes in the history of botany and all aspects of plant science and serves the international scientific community through research and documentation. To this end, the Institute acquires and maintains authoritative collections of books, plant images, manuscripts, portraits and data files, and provides publications and other modes of information service. The Institute meets the reference needs of botanists, biologists, historians, conservationists, librarians, bibliographers and the public at large, especially those concerned with any aspect of the North American flora.

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ARKANSAS ARCHEOLOGICAL SURVEY

DIRECTOR • CHARLES R. MCGIMSEY III
STATE ARCHEOLOGIST • HESTER A. DAVIS

Coordinating Office
University of Arkansas Museum
Fayetteville, Arkansas 72701

June 12, 1972

Dr. David Rogers
G.U.R.C.
NASA - MTF
Bay St. Louis, Miss. 39520

Dear Dr. Rogers:

The message which I received about your June 9 telephone call to Dr. Chenhall was somewhat garbled; accordingly, I am not entirely sure about just what information you have requested.

The proposed Museum Data Bank Coordinating Committee is a result of a meeting held in March of this year. Enclosed is a report of that meeting. If this is not what you require, please write or call me and I'll either send you the correct information or put you in touch with Dr. Chenhall. My telephone number at the Arkansas Archeological Survey is 501-575-3457.

I hope the enclosed information will be of use to you.

Sincerely,

Margaret J. Hoffman

cc: Robert G. Chenhall

enclosure

June 19, 1972

Dr. Robert G. Chenhall
University of Arkansas Museum
Fayetteville, Arkansas 72701

Dear Dr. Chenhall:

I recently received a copy of the report of the Hershey meeting of the Museum Data Bank Study Group, which I had requested from one of the secretaries of your museum during your absence. This is an interesting concept, and one in which I am naturally quite interested.

I was disappointed to see that there were no representatives at the meeting who could speak for TAXIR, although I noted that Dr. Kline did attend the meeting. I trust that this can be corrected in the future, particularly so since the TAXIR system has been greatly expanded, and is now being used in many applications on a greater set of problems than those represented just by museums. The above-named Consortium has adopted the systems, and under their contract with NASA- Mississippi Test Facility, has put a larger set of systems under the acronym ENVIR.

There are now a number of users of the ENVIR system, both in this organization and in several universities. There is a good chance, therefore, that the system will be a continuously expanding system operating on several of the larger computing machines (of several manufacturers) in this country and abroad.

I trust that you will keep me informed of further activities of your group, and look forward to communications with you. After July 1, I will be returning to the Univ. of Colorado, Dept. of Biology, in Boulder, Colo., 80302.

Sincerely yours,

David J. Rogers

June 19, 1972

Miss Margaret J. Hoffman
Coordinating Office
University of Arkansas Museum
Fayetteville, Arkansas 72701

Dear Miss Hoffman:

Thank you kindly for sending the report of the Museum Data Bank Study Group. This was essentially what I wanted to see.

I understand that Dr. Chenhall is out of the Museum until some time toward the end of this month. However, I will send him a separate letter to be on his desk when he arrives. I need more precise information about the activities of the group than that which is included in the report.

Sincerely yours,

David J. Rogers

MUSEUM DATA BANK STUDY GROUP

Report of Meeting at
Hershey, Pennsylvania
March 27-28, 1972

The idea of using a computer in place of a museum catalog card is scarcely more than five or six years old. However, at least five major information systems (see attached list) already have been developed to record museum data, and perhaps twenty or more institutions are now converting to computerized catalog systems. As a result of this proliferation of museum data banks, museum directors and curators contemplating the use of computers, either for collection management or for research purposes, are faced with a multiplicity of computer hardware and storage and retrieval systems which might fulfill their needs. In some cases there is an apparent competition between these systems, and there is a general lack of knowledge as to what each system will and will not do, the costs of operating under different systems, alternate methods of feeding data into the computers, and so on. There is at present no central office where a potential user can obtain objective and reliable information or assistance in getting started with a computerized museum data bank. Likewise, individuals actively working with data banks have found themselves constantly confronted with requests for information, ranging from the most elementary instructions on what a data bank will do to requests for free consulting services, and they have felt an increasing need for some kind of a centralized organization or office to coordinate their efforts and to prevent as much duplication of programing activities as possible. The Hershey Study Group meeting was organized in an effort to provide answers to these several needs.

The meeting at the Hotel Hershey was funded by the Office of Museum Programs of the Smithsonian Institution (Frederick Schmid, Director), and organized jointly by Drs. James F. Mello and Robert G. Chenhall. Participants were selected: (1) to include representation from each of the five major information systems; (2) to include persons from as many different disciplines as possible; and (3) to include only individuals who were actively working with and concerned about the future of museum data banks. The ten persons shown on the accompanying list of participants actively took part in the deliberations.

The general recommendation of the Hershey Study Group was that an organization should be created, with an executive office to serve as a central nerve center for the communication of data bank information to museums and a point of coordination among existing museum data banks. Some of the specific functions of this organization would be as follows:

1. To develop comparative descriptions of the general information systems that are presently available so that a potential new user would have an objective basis for deciding which system was most appropriate to his needs.

2. To serve as a clearing house of data categories and minimal standard recording conventions for all museum data banks, so that data recorded in one of the systems will be compatible with that recorded in other systems. This activity would be carried out by working with specialists from each discipline. Standard recording conventions would be recommended only for such categories as dates, proper names, etc., or when requested by a representative body of scholars from a particular discipline.

3. To coordinate and disseminate information to all interested parties concerning new developments in the use of museum data banks.

4. To supply information and (for a fee) consultants to work with potential new users.

5. To serve as a central point for the communication of information to and from other data bank organizations around the world.

6. To coordinate the development of programs for the conversion of data from one system to another and the collection of data that have been recorded in more than one of the five systems (the fact that such conversion is possible has now been demonstrated between the SELGEM and GRIPHOS systems).

7. To coordinate future system refinements, so that data recorded in any one of the systems can be processed substantially unchanged in any of the other systems.

8. At a later date, when sufficient information has been gathered in data banks across the country, to coordinate or contract for the synthesis of actual data for specific disciplines on a regional or national basis.

The name selected for the new organization is the Museum Data Bank Coordinating Committee. During the first two years from July 1, 1972, it was suggested that the organization should be free-floating--i.e., with the executive office located wherever the Executive Director may be situated rather than attached to any present organization or institution. Membership will be divided into two classes: (1) organizational representatives from the American Association of Museums, the American Association of State and Local History, the National Science Foundation Office of Science Information Services, the National Museum Act Program, the Directors of Systematic Collections, and other organizations which represent any large group of museums or museum-related disciplines; and (2) individual membership for any person who meets certain minimal requirements (essentially anyone working with or developing a museum data bank). The affairs of the Committee would be carried on by an Executive Board and an Executive Director. Initially, an Organizing Committee consisting of those who participated in or were invited to the Hershey Study Group meeting will function as the Executive Board. When the organization is better established, the Executive Board will be elected by the membership so as to represent a balance of the different computer systems, different disciplines and different kinds of museums located in different geographic areas. It is the intention of the Study Group that members of the Executive Board would serve as the points

of contact between the Executive Office and any discipline-related programs, so that the needs of particular disciplines would be protected but still integrated into the larger structure. The Executive Office initially will be staffed by the Executive Director and an administrative secretary. Computer consultants will be employed on a contract basis to carry out specific projects.

For the first two years Dr. Robert G. Chenhall has agreed to serve as Executive Director of the Museum Data Bank Coordinating Committee. He is located at the University of Arkansas and will prepare a grant request under the National Museum Act for the funding of the Committee's activities from July 1, 1972, to June 30, 1974. Any comments, suggestions or requests for information should be addressed to him at the University of Arkansas Museum, Fayetteville, Arkansas 72701.

GENERAL INFORMATION SYSTEMS CURRENTLY USED IN MUSEUM-RELATED ACTIVITIES*

GIPSY (General Information Processing System) - Developed by Dr. James Sweeney at the University of Oklahoma Computing Center. Used to record ethnographic museum specimens in Oklahoma, Missouri and Arizona.

GIS (General Information System) - Developed by the IBM Corporation. Used in the Flora North America Program, a large-scale, centralized data bank, designed to collect, analyze, maintain and disseminate diverse kinds of information about the plants of North America.

GRIPHOS (General Retrieval and Information Processing for Humanities Oriented Studies) - Developed by Dr. Jack Heller, SUNY at Stony Brook. Used by the Museum Computer Network, an organization of 15-20 museums and related organizations, primarily to record art objects and archaeological data.

SELGEM (SELF-Generating Master) - Developed by the Information Systems Division, Smithsonian Institution. Used to record specimen inventories of mammals, conodont types, foraminifera, nematodes, crustacea and other collections.

TAXIR (TAXonomic Information Retrieval) - Developed by Dr. David J. Rogers, University of Colorado. Used primarily for the storage and retrieval of biological specimen data.

*Several of the systems described here have also been used for the storage and retrieval of other types of data.

HERSHEY STUDY GROUP PARTICIPANTS

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University of Arkansas Museum
Fayetteville, Ark. 72701

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Dr. William Kline
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National Gallery of Art
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Mr. Stanwyn Shetler
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Washington, D.C. 20560

Mr. David Vance
Chairman, Administrative Committee
Museum Computer Network
11 W. 53rd St.
New York, N.Y. 10019

Others Invited to Participate

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Beltsville, Md. 20705

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Dept. of Computer Science
State University of New York
Stony Brook, N.Y. 11790



ARKANSAS ARCHEOLOGICAL SURVEY

DIRECTOR • CHARLES R. MCGIMSEY III
STATE ARCHEOLOGIST • HESTER A. DAVIS

Coordinating Office
University of Arkansas Museum
Fayetteville, Arkansas 72701

June 23, 1972

Dr. David J. Rogers
Dept. of Biology
University of Colorado
Boulder, Colo. 80302

Dear Dr. Rogers:

I was very pleased to receive your June 19 letter and to learn a little bit about the present status of TAXIR. A letter is not a substitute for personal conversation, but let me at least brief you on a couple of matters that I am sure will be of mutual interest.

The Study Group which met at Hershey, Pa. was organized quite rapidly, and I am sure there are a number of persons, including yourself, who could have made a worthwhile contribution to the discussions. As you suggest, this can and will be corrected in the future. I was not aware of the further applications that have been made of the TAXIR system, but as you can see we did include this in our list of viable systems that could be utilized in museum data bank activities, and if the Museum Data Bank Coordinating Committee becomes a reality I can assure you that both you and the TAXIR system will be an important part of it.

At the present time we are waiting for the next meeting of the National Museum Act Council to determine whether the funding will be made available to proceed as planned. The Council meeting is scheduled for August 8-9, and sometime prior to that I am to meet with a review committee to discuss some of the implications of such an organization. Once we get the go ahead, one of our first activities will be to develop adequate descriptions of the several extant data bank systems. This can be done, of course, only by working closely with those who are most deeply involved in each system.

Again let me express my appreciation for your letter, and assure you that I will be contacting you again, probably before the end of August.

Sincerely,

Robert G. Chenhall
Assistant Professor and
Survey Archeologist

RGC:mjh

NATIONAL SCIENCE FOUNDATION

WASHINGTON, D. C. 20550

Office of Science Information Service

MAR 5 1970

Ref: N-3311

VIA AIR MAIL

Dr. Hugo G. Rodeck
Director
University of Colorado Museum
Boulder, Colorado 80302

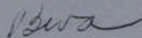
Dear Dr. Rodeck:

We regret to inform you that the National Science Foundation is unable to support your proposal for "Forging of a Data Retrieval System for the University of Colorado Museum."

In evaluating each proposal submitted to the Foundation, a number of factors are considered. They include the following: the scientific merit of the proposal and its merit in relation to other proposals received by the Foundation in the same general field of investigation; the distribution among fields of investigation within the program of the Foundation; the geographical distribution of support by the Foundation; and, finally, the funds available for the support of projects. Thus, many excellent proposals cannot be supported for reasons aside from intrinsic merit, although this is an important consideration.

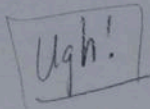
Even though we are unable to support this proposal, we would be pleased to consider other proposals which you might wish to submit.

Sincerely,



Burton W. Adkinson
Head

cc: Dr. David J. Rogers ✓
Mr. Thurston E. Menning



A Proposal to the
National Science Foundation
for

FORGING OF A DATA RETRIEVAL SYSTEM FOR THE
UNIVERSITY OF COLORADO MUSEUM

Name and Address of Institution: The Regents of the
University of Colorado
Boulder, Colorado 80302

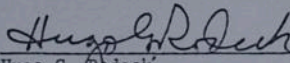
Desired Starting Date: September 1, 1969

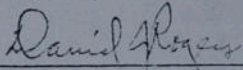
Amount Requested from NSF: \$532,850

Time Period for which Support is Requested: Four Years

Co-Principal Investigators: Hugo G. Rodeck
Director and Professor of
Natural History,
University of Colorado Museum
Boulder, Colorado 80302
Telephone: (303) 443-2211, Ext. 6165

David J. Rogers
Associate Curator of Botany,
University of Colorado Museum;
Professor of Biology;
Director, Taximetrics Laboratory
University of Colorado
Boulder, Colorado 80302
Telephone: (303) 443-2211, Ext. 6712


Hugo G. Rodeck
Co-Principal Investigator


David J. Rogers
Co-Principal Investigator

I certify that the distribution of costs between the direct and indirect categories as shown in the proposal conforms to the usual accounting practices of the institution and to the distribution used by the cognizant Federal audit agency.

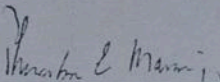

Thurston E. Manning
Vice President for Academic Affairs

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I. DESCRIPTION OF PROPOSED RESEARCH

a. ABSTRACT

The University of Colorado Museum has collections of sufficient scientific importance to justify better access to the information they contain. To provide this improved information management, the University Museum is applying an automated data retrieval system to its collections. The system, TAXIR, developed by the Taximetrics Laboratory of the University of Colorado, has been designed specifically for use by museum personnel to provide improved information retrieval. Use of TAXIR permits retrieval of information arranged in a variety of ways, none of which is dependent upon the order in which the specimens are arranged physically in the museum collection. Thus, for the first time, a museum can determine how many specimens of a given group or geographic location (or any other sorting factor) are in its collections and also where those specimens are located in the museum. It is difficult to over-estimate the usefulness of having museum collection data available for use in more flexible and easily retrievable form than has been possible to date. Students and faculty of the University, our scientific colleagues here and abroad, and the public in general then will have access to information about our environment and cultural development which has heretofore been unavailable for lack of the hundreds of thousands of man-hours required to assemble it from the collections.

To facilitate understanding of how the University of Colorado Museum contributes to the educational program of the University, as well as its participation in the scientific world, (at local, regional, national and international levels) the staff of the Museum has prepared a description of its history, collections, procedures, and activities which is included in this grant proposal.

b. OBJECTIVES

1). To install a computer-assisted information management and retrieval system for the collections contained in the University of Colorado Museum.

a). To make the abundance of knowledge existing in those collections available to: 1. the scientific world, 2. regional scientists (those residing and working in the Rocky Mountain area), 3. instructors and their students at all academic levels, 4. regional public planners, and 5. the general public.

b). To strengthen the Museum's central role as a disseminator of knowledge primarily about the Rocky Mountain area and southwestern United States.

c). To facilitate scientific research in all areas of the Museum's holdings.

2). To demonstrate the ability of a well-constructed retrieval system to free the information contained in museum collections from the physical arrangement of the collections, and as a demonstration of the significance and applicability of computers for biologists, anthropologists, and geologists in the University of Colorado Museum.

3). To make a more precise Cost/Effectiveness analysis* of the work of the University of Colorado Museum for the purpose of insuring better information for future planning, programming, and budgeting.

4). To free the Curators from operations that can be better performed by the TAXIR system so that the Curators may attend the problem of scientific administration of collections.

5). To facilitate the process of keeping track of materials sent on loan and received on loan.

6). To provide a demonstration of information management and retrieval as installed in the University of Colorado Museum to other museums and their personnel.

7). To train students of the University of Colorado (at the undergraduate, graduate, and postdoctoral levels) in modern museum techniques.

c. EXPECTED SIGNIFICANCE

The most valuable stores of information in the world exist in libraries and museums. In the museum, what is known of our tangible environment is more complete and is found in a better organized manner than anywhere else. The University of Colorado Museum is a complete natural history museum incorporating teaching, research, and exhibition collections in the fields of anthropology, botany, geology, and zoology into one administrative unit. We recognize that there are individual collections of plants, animals, anthropological and archeological artifacts or geological materials of greater extent in other locations in the Rocky Mountains, and one may recognize that, for example, the Rocky Mountain Herbarium at the University of Wyoming, Laramie, is an historical collection of plant materials from this region far surpassing any other such

*See Appendix I, "Systems Analysis: Cost/Effectiveness."

collection, and so forth. However, by our own desires and initiative we have integrated activities of each of the areas of a natural history museum better than any other existing museum in the Rocky Mountain region.

Museums, whose functions are collection and preservation, basic research, and education are being inundated with new materials and are rapidly falling behind in the tasks for which they have long been responsible. At the University of Colorado Museum, the acquisition rates of new specimens and rate of use of the collections of the Herbarium, Zoology, Geology, and Anthropology Sections are constantly increasing. More and more time of the scientific personnel is taken up with routine processing in which they act essentially as inventory clerks. The professional staff of the Museum recognizes this problem and is united in its desire to use uniform computer-assisted techniques to replace manual procedures no longer adequate.

Museums throughout the country are trying to adapt data retrieval systems for their use. Located on the campus of the University of Colorado is the Taximetrics Laboratory, a group of investigators who have developed a system for computer-assisted data management and retrieval specifically designed for use in museum operations. This system, TAXIR, seems by far to be the most appropriate and carefully designed to provide the improved information retrieval needed at this Museum. With the application of TAXIR, much of the inventory effort can be automated, thus permitting the professional personnel to concentrate their efforts on the scientific aspects of curatorship and research for which they were trained.

The University Administration supports the efforts of the Museum to provide improved management of its collections data and accordingly has authorized the staff of the Museum to implement application of the TAXIR system to its collections. The University's contribution in terms of Museum professional and administrative staff salaries is listed in the budget. In addition the University's budget request includes support for a Data Systems Manager, key tape machine rental, and computer time to continue operation of TAXIR at the end of the grant period.

Automation within the Museum falls into the following categories:

- 1). Maintenance, clerical handling, and administration of specimens or collections;
- 2). Scientific information processing and dissemination;
- 3). Museum administration, including curation.

1). Data about the collections are processed from the moment of gathering the specimens in the field to final deposit in the Museum collections and thereafter as research progresses. Such effort, now largely accomplished by hand, can be done by machines, with instant recall of the information. The knowledge of the physical contents of the Museum is thus improved, giving the Curators a much more intimate knowledge about what materials they have. This allows more meaningful administration of the Museum's holdings.

2). The significance of the collected specimens and knowledge of them can be more readily disseminated. Consider the daily task of answering questions commonly demanded of Curators for information from other scientists and from the public. Consider also the Curator's own desire to produce scientific knowledge. To make scientific evaluations about the natural and man-made products of the Rocky Mountain region, the Curators must refer to the collections and much time is consumed in physically searching for the specimens.

3). The availability of information concerning the Museum's holdings, the Museum's operating systems, the needs of those communities served by the Museum, and the rate of the Museum's growth is currently limited. Yet this information is necessary for efficient planning, programming, and budgeting of Museum operations to perform its services effectively. The TAXIR system will provide the information necessary for such planning, programming, and budgeting.

d. RELATION TO PRESENT STATE OF KNOWLEDGE IN THE FIELD

Much of the need in a museum for the use of computers is related to its most basic activity, namely, inventory. Inventory processes are the principal objectives of many computing programs. There are presently a number of museums where such efforts are in progress. See, for example, "Scientific Documentation," a mimeographed paper prepared by E. Ellin, Director of the Museum Computer Network, New York City. The University of California at Berkeley has a computerized system for fossil animals. The fixed field format of the Berkeley system is a very limiting factor, and makes future data input and modifications of the system extremely difficult. The American Museum of Natural History has an inventory utilizing a machine system known as TERMATREX. This is not a computer system in the usual sense because of the limited set of functions performed, but the method of data formatting is similar to that for a computer. The Smithsonian Institution has a large staff of computer

experts working with the various curators in a pilot project to inventory their massive collections. Many other efforts could be cited of which the ones mentioned above are outstanding examples.

The major difficulty as we see the systems presently working is that the developers of the systems have not combined scientific studies of basic information flow as it already exists with the mathematical skills required to discover the logic of the information flow and unite with these the necessary expertise for computer use. In most of the examples mentioned there has not been a sufficient amount of attention paid to the accomplishments of standard museum operations already in practice, and the use of these standards operating procedures as inspiration for the development of an appropriate scheme to direct the programs (software) which in turn make the most efficient use of computing machinery.

To our knowledge, there is no information retrieval system, other than TAXIR, which allows the printing of hierarchical, in-depth listings, answers queries, verifies data, and allows updating all under a unified set of programs. Furthermore, we know of no other system with the approach to data storage and retrieval, where the system is independent of the information content. A user's information is restructured internally, such that it reflects basic set theoretic notions. Thus information retrieval is effected through restructuring and not the semantic content; and we are able to say that we have a complete Boolean system. Because information is stored and retrieved in accordance with its internal restructuring, we effectively and efficiently calculate rather than search for information.

The TAXIR system has been consistently developed by the staff of the Taximetrics Laboratory with the needs of museum curation and research uppermost in mind, combining these needs with mathematical and programming skills of a high order. Biologists with long training in large museum endeavors have worked side-by-side with mathematicians, computer programmers, and operations research analysts in one integrated effort. The goal has been to forge computer-assisted systems which work for the museum scientist and administrator.

e. RELATION TO PREVIOUS WORK DONE ON THIS PROJECT

The University of Colorado Museum in cooperation with the Taximetrics Laboratory has undertaken a preliminary investigation of collection automation using the TAXIR system. The work was done on a section of the Museum's

bryophyte collection in order to determine the problems involved and to solve these problems effectively.

Extensive conferences between the Curator, Dr. William Weber, and the Taximetrics Laboratory staff were held. A list of 32 descriptors -- information preserved for each item (specimen) in the order they were to be entered -- was developed.

The Taximetrics Laboratory staff and the Curator then began the training of a Data Systems Manager who had had no previous training in botany nor in the use of input devices.

Labels pasted externally on specimen packets contained the information to be abstracted in random order, puzzling or cryptic to a non-botanist. Thus the training process included systems to enable the Data Systems Manager to identify descriptors. Processes of scanning the label for the desired information and recording it on coding sheets first (to gain facility) were carefully timed per item. Errors and questions were noted and timed. Data from the specimen label were punched onto IBM cards. At a later stage a more efficient procedure was adopted -- transcribing the data directly onto magnetic tape by a key-tape machine. Through further testing and timing, standards of expected accuracy and speed were set, types and frequencies of mistakes were analysed, and correction methods streamlined.

The Data Systems Manager, in turn, trained another input operator with a college degree in anthropology and technical typing experience with the Institute of Arctic and Alpine Research. To date, about 3,000 items have been fully recorded, verified, and mounted in the Bryophyte Data Bank.

These items can now be "queried" -- that is, specific questions can be addressed to the data bank when it is in the ACCESSIONER module, such as: "List all items collected in Colorado or New Mexico with substrate rock and altitude 8,000 feet." Queries are formatted in a natural language similar to English, using a few basic rules discussed in "The TAXIR PRIMER - a Manual for Users" now being prepared for publication. The result is a print-out listing all the items and information requested.

Or the items can be printed in the BOOK module. The BOOK module rearranges the whole collection into desired hierarchical order without touching the physical collection. Thus, although the herbarium collection may be arranged alphabetically by genus, a BOOK could print the same collection arranged by country, with subsequent sub-division such as state, collector,

and so forth. Any descriptor entry which lends itself to a hierarchical order could thereby be classified and arranged in the BOOK module. The result is a whole reference system of BOOKS, each describing the collection according to a desired arrangement: by country, or collector, or date of collection, or altitude, or genus, etc.

As stated, work is still in progress, and the search continues for efficient and economical methods and systems of operation, training personnel, and determining the optimal input devices.

The test case used in developing the TAXIR system was the description of the world's collection of Manihot (Euphorbiaceae). The Manihot data (descriptors included in Appendix I) were divided into two broad categories: curatorial data (extrinsic descriptions to locate and inventory the specimen) and research data (more detailed information for classification and other research purposes). The descriptors and sample BOOKS of the bryophyte collection are also contained in Appendix I.

The project director for TAXIR has been either curator or student in two of this country's leading herbaria. This experience, plus that of collaborating curators in many varied institutions, has brought strength and perspective to the TAXIR system, gearing it for museum needs and use.

f. BIBLIOGRAPHY OF PERTINENT LITERATURE

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g. GENERAL PLAN OF THE WORK

Both narrative descriptions and flow charts are provided to indicate how the work will be accomplished. The work will proceed with each of the major collections (see accompanying document describing the Museum). The Curators of the collections designated the order (or priority) and the information about their collections (descriptors) for inclusion in the information bank.

(A listing of these descriptors is given in Appendix II.) These descriptors are sufficiently well defined for the work to be turned over to input operators who will enter the data directly onto magnetic tapes via the Honeywell 700 key-tape machine.

The majority of the information put into machine-readable format will go into the BOOK module of the TAXIR system (See Appendix I, "An Introduction to TAXIR"). This module has the capacity to produce hard copy indexes, catalogues, or listings of the items in the Museum collections in any desirable format. Its advantage is that it provides the Curator with a desk-top reference system without going to the computer for each query. Several types of BOOKS from each of the major data banks will be produced by the BOOK module of the TAXIR system, giving the Curator a set of references describing his collections in several different output formats (see Appendix I for sample BOOKS). These BOOKS will be used to inventory the collections, maintain them, update the collected materials, assist in the distribution of work load of the Curators, provide knowledge of the collections to visiting investigators, and give the Museum Director an up-to-the-minute knowledge of each of the curatorial banks in the Museum.

Selected portions of the most intensely used collections in each of the Museum's Sections will be placed in the ACCESSIONER module of the TAXIR system for immediate querying by interested personnel.

The training of the Data Systems Manager will continue. At the end of the grant period he will be competent to 1) maintain the TAXIR operating system for the Museum; 2) continue to make Cost/Effectiveness analyses; 3) interpret the TAXIR system to Curators and other users; and 4) update data banks.

Personnel Selection and Training

A definite part of the intended work includes an experimental approach to the employment of personnel for the tasks involved in preparation for input to an information retrieval system and maintaining the operating systems. It is intended that at the lowest level ("Scan and Record" on the flow chart) an individual be employed who can read and type but who has no other special training. Such persons will be given jobs which do not require interpretive decisions, but as they become familiar with the work, they will be observed and tested by the Taximetrics Laboratory staff for their capability to move up the ladder of the decision-making process as far as they can go.

Part of the desired work in this investigation is to discover means and methods of education in museum data-gathering processes and to discover what levels of individuals may be employed for various tasks. Eventually we anticipate bringing into this type of training program people from disadvantaged levels who have very little previous formal education. By a step-wise process of training and education again these individuals may be raised to higher levels of skills. This type of effort fits well with the Museum's technical course (see accompanying Museum document).

Work Program

The work program follows in three parts.

1. A verbal summary of the work flow.
2. The work-time distribution commentary denotes when a work procedure begins and how long it will take to do.
3. The flow charts for the work flow. These are annotated by pathway codes (dots, dashes, etc.). These codes denote what work is to be done in this project.

Verbal Summary of Work Flow - Work Program

For those interested in determining procedures step-by-step, detailed methods of establishing problems and their solutions have been analyzed in the following flow charts.

A brief interpretation of these flow-charts in narrative summary and status of work is presented:

I. PROBLEM IDENTIFICATION

The Research Staff of the Taximetrics Laboratory and the Museum Curators determine together the nature of the Museum's problems, and whether the computer programs answer the needs expressed.

Status: essentially completed.

II. RESEARCH, SYSTEMS DEVELOPMENT, AND TESTING

Problems relating to research, research methods, and information to be preserved are analyzed as to Cost/Effectiveness (C/E), a model of the machine system solution constructed to operate at optimal effectiveness at lowest cost.

Problems relating to present operating system are analyzed, redesigned, and tested with a pilot model; new personnel are trained, and C/E analysis made for the new system.

If the machine system devised is not acceptable to the museum, changes are made to meet the needs.

Status: pilot project completed - most work yet to be done.

III. REVIEW OF TAXIR AND RESEARCH

Can TAXIR fulfill the needs of the institution? The current information system as to Cost/Effectiveness is analyzed to determine if the TAXIR system is necessary.

What changes are needed? Is TAXIR feasible? If so, models are built to test the C/E of TAXIR system. If acceptable, TAXIR is integrated into the Museum's work procedure.

Status: pilot study partially completed.

IV. IMPLEMENT

In order to mount the data, users are instructed in the various concepts of TAXIR, such as determining descriptors and their order for each item to be recorded, the process of scanning and recording the data, and verifying and correcting of errors.

Further, operators may be trained to call TAXIR on the computer, write the necessary control statement, and to run the data on the computer, thus building and storing BOOK or ACCESSIONER modules of the data bank, to be printed or queried as needed.

Status: to be done when funds are available.

Sub-Program for Training

One important aspect for implementing TAXIR is the actual training of personnel. This includes the Data Systems Manager and all operators.

The Data Systems Manager is coordinator with the Taximetrics Laboratory in every aspect of the work program. He is trained in operating TAXIR, in C/E analytic methods, in instructional methods for other personnel (operators), and administrative techniques.

Specifically, the Data Systems Manager instructs operators in purpose and methods of data input and operation of input machine, assigns work commensurate with operator's ability, and supervises progress.

Status: Procedures for training already available.

Sub-Program for Scan and Record

Mounting of the data involves the following considerations: Sources of information for data input, (e.g., specimen, label, catalogs, etc.); scanning for ease of descriptor entry (are descriptor states and order of entry easily located on information source?); is a coding sheet a necessary intermediary before input to the machine?; type of input machine to be used; and process of verification and correction of errors.

Status: Some of the data formatting procedures are established. A list of the descriptors most likely to be employed for each of the museum's sections are given in Appendix II.

Work-Time Distribution

Work Plan

I. Analysis of Museum Operating Procedures and Installation of TAXIR System

<u>Years</u>	<u>Code</u>	
1 → 2	-----	Train Data Systems Manager and input staff
	-----	Make a complete Cost/Effectiveness analysis of the Museum's operating procedures
	-----	Install TAXIR system to integrate with Museum's operating procedures
	-----	Curator work-up of Entomology and Arachnid collections; make Cost/Effectiveness analysis of methods used.
2 → 4	-----	Re-evaluate Museum operating systems with TAXIR installed

II. Mounting Extant Collections

1	-----	Collections listed in Priority Block 1 *
2	-----	Collections listed in Priority Block 2 *
3	-----	Collections listed in Priority Block 3 *
4	-----	Collections listed in Priority Block 4 *
		* See following pages

The updating of collections will be done as necessary after extant specimen information has been put into TAXIR. For specific procedure on how this work will be done, see following flow charts and commentary.

Museum Collections Listed in Priority Order¹

Pri- ority*	Collections	Number of File Records	Number of Descriptors	Source of Information	Order of Source Information	Estimate Man-weeks Needed to Process Information
1	Bryophytes	35,000	32	Spec. Label	Random	100
	Reptiles	36,500	18	Catalogue	Random	50
	Amphibians	4,000	18	Catalogue	Random	6
	Southwestern Archeology	14,750	25	Card File**	Random	20
	Ethnographic materials	4,100	25	Card File**	Random	6
	Paleo-Indian materials	1,500	25	Card File**	Random	3
	Fossil Vertebrates	12,000	34	Catalogues, Field notebooks	Random	30
						Total 215
2	Lichens	50,000	32	Spec. Label	Random	125
	Arachnids	2,000	18	Spec. Label	Random	5
	Entomology	12,000	18	Spec. Label	Random	25
	Mammals	11,450	18	Catalogue, Spec. Label	Random	20
	Aves	7,750	18	Catalogue	Random	10
	Fossil Invertebrates	20,000	34	Catalogues, Field note- books, Publications	Random	45
	All other Anthropology collections	30,090	25	Card File**	Random	40
						Total 270

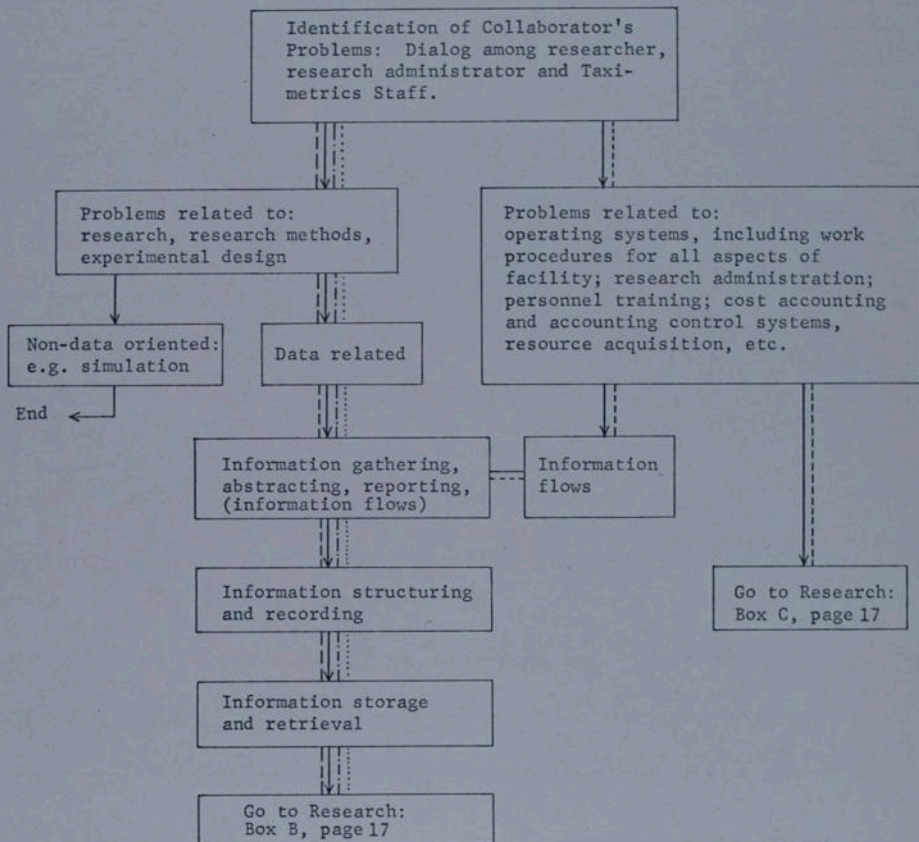
Priority*	Collections	Number of File Records	Number of Descriptors	Source of Information	Order of Source Information	Estimate Man-weeks Needed to Process Information
3	Phanerogams	127,000	32	Spec. Labels	Random	280
	Fossil plants	1,000	34	Catalogues, Field note- books	Random	5
						Total 285
15 4	Conchology	26,400	18	Catalogues	Random	30
	Minerals and rocks	3,700	25	Catalogues, Spec. Labels	Random	7
	INSTAAR herbarium	1,500	32	Spec. Labels	Random	4
	Dept. Biology herbarium	3,000	32	Spec. Labels	Random	9
	Fungi	10,000	32	Spec. Labels	Random	25
	Algae	5,000	32	Spec. Labels	Random	13
						Total 795

*Priority is between groups of collections; collections in priority group equal in priority.

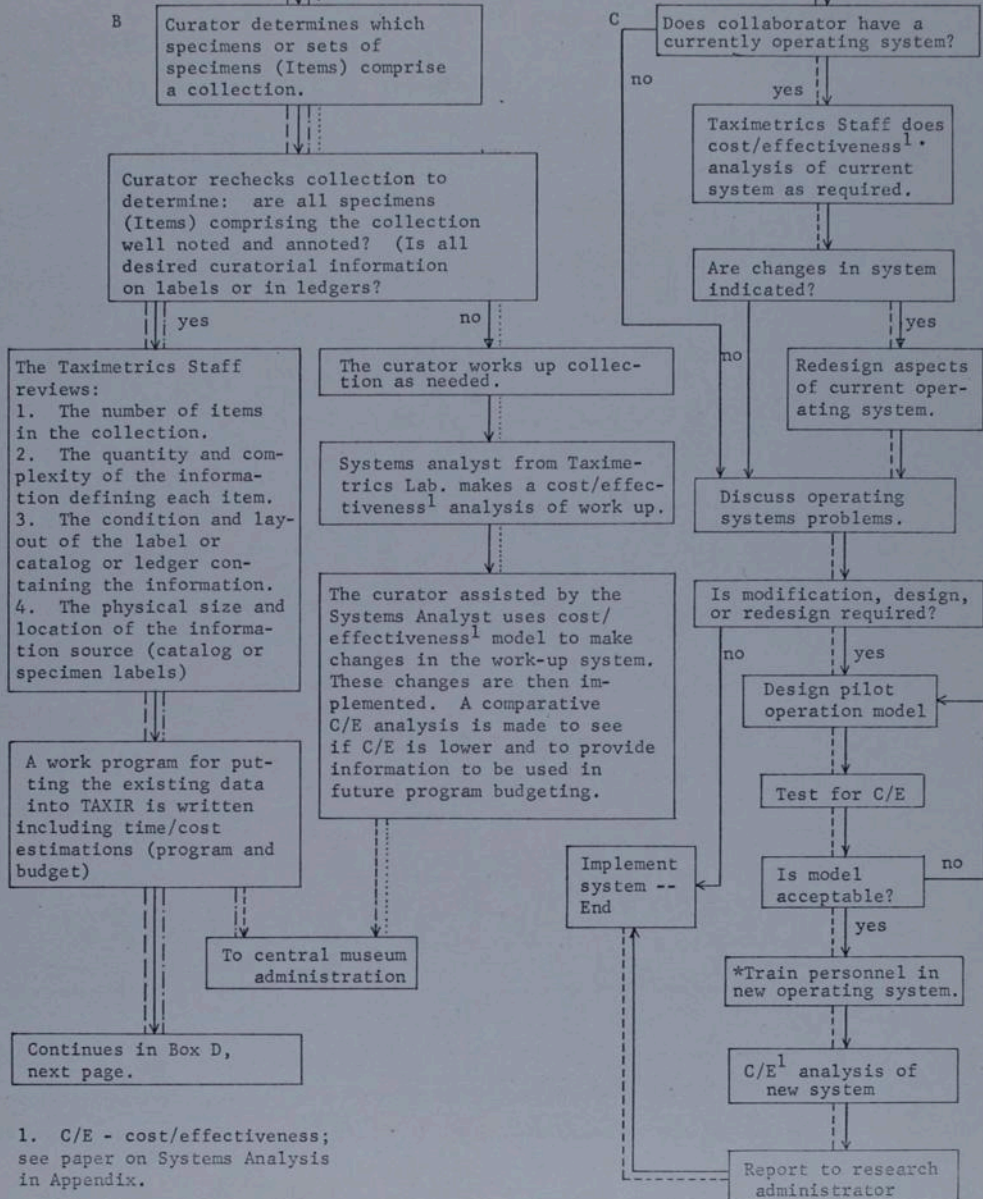
**Basic data from card; additional information may be added from other sources such as atlas, list of measurements, etc. at a later date.

¹These pages contain the information needed to make estimates of data mounting costs. The relationship among "Number of File Records," "Number of Descriptors," "Source of Information," and "Order of Source of Information" was determined by the Taximetrics Laboratory. The estimated man-weeks needed take into account time loss due to sick leave, vacation, training time, machine down time, etc.

I. Problem Identification

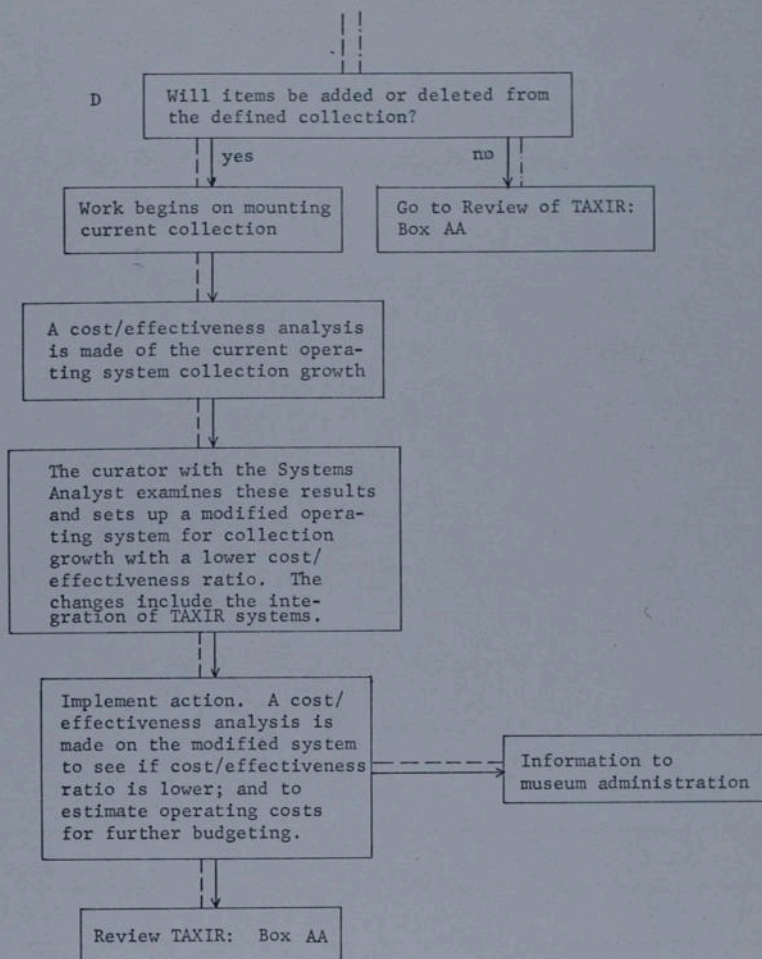


RESEARCH, SYSTEMS DEVELOPMENT
AND TESTING

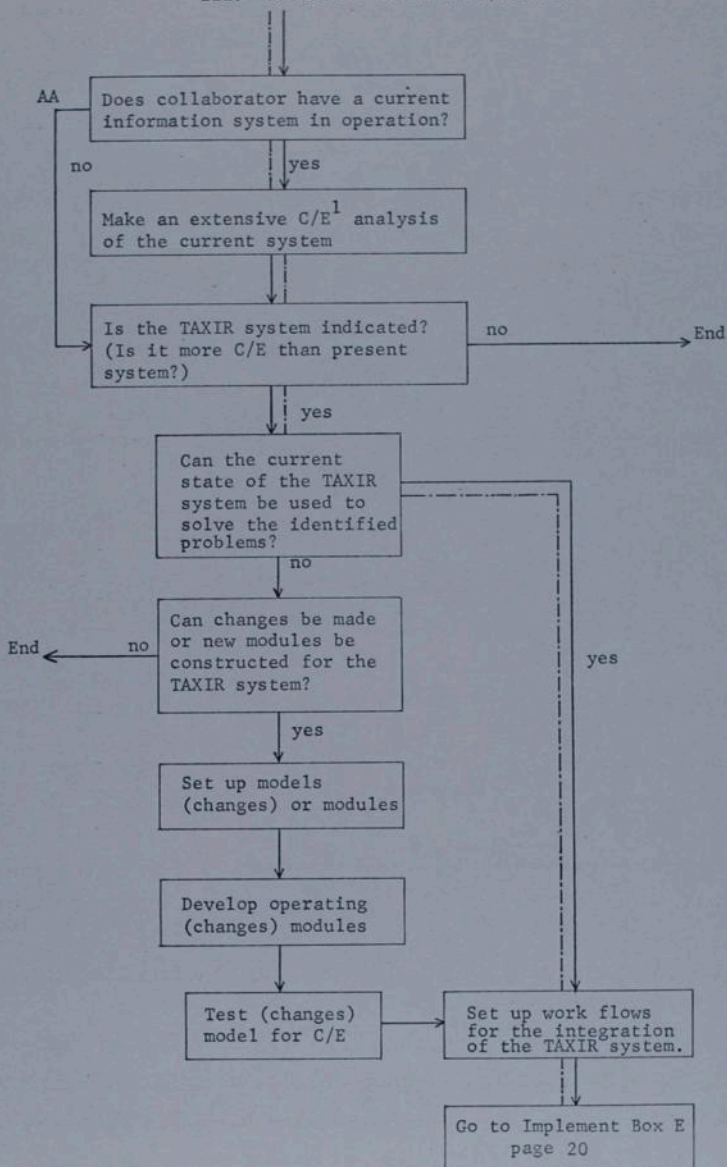


1. C/E - cost/effectiveness;
see paper on Systems Analysis
in Appendix.

*See subprogram TRAIN

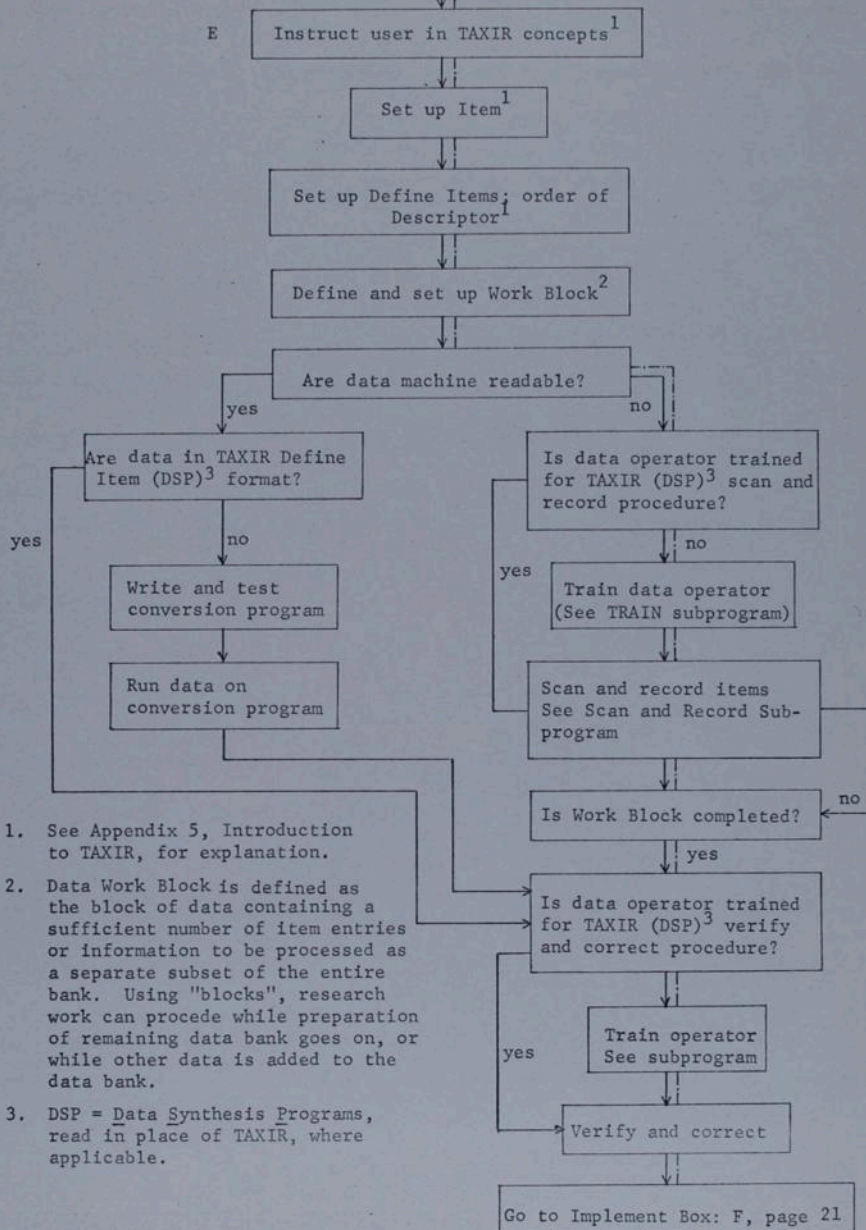


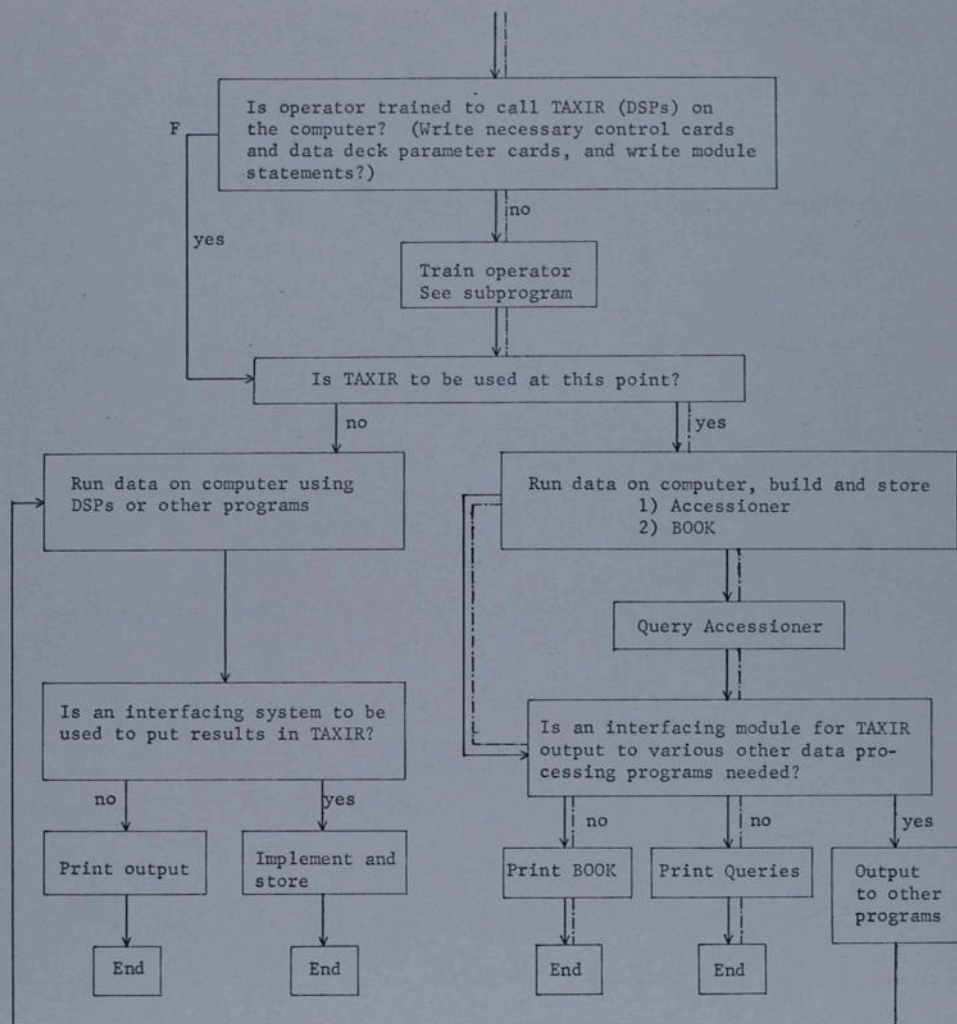
III. Review of TAXIR and Research



1. C/E = cost/effectiveness

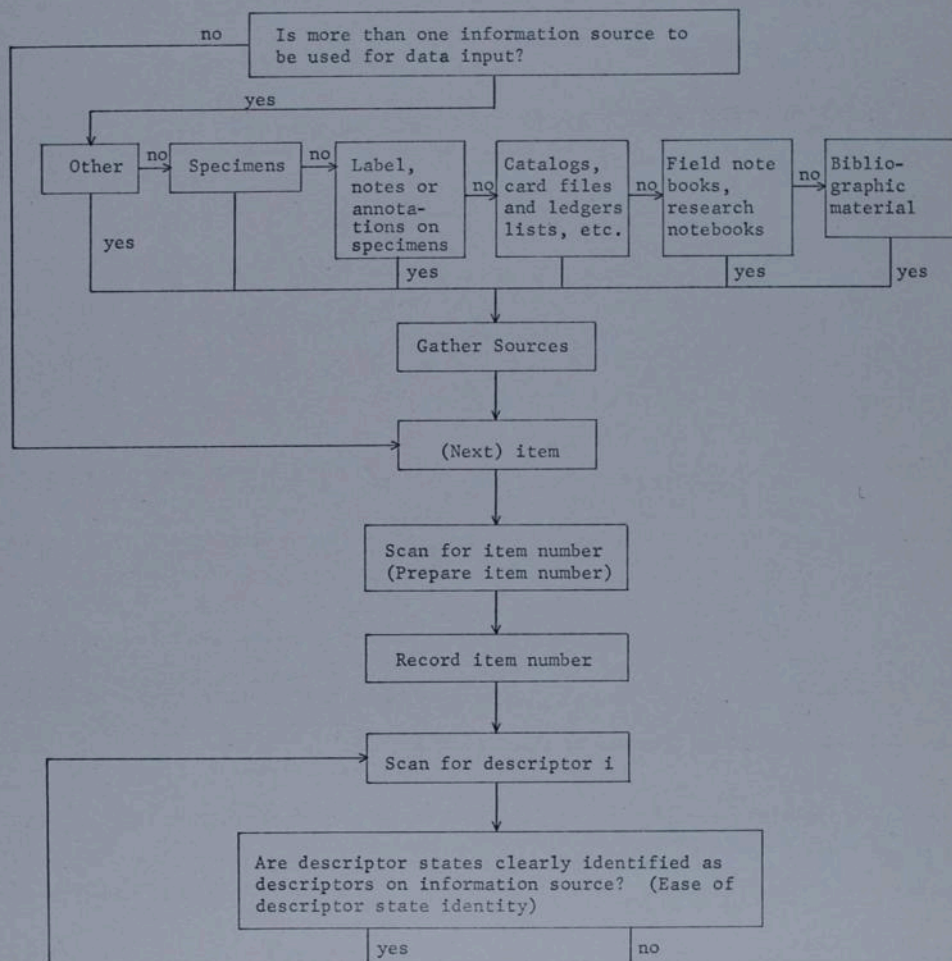
IV. Implement

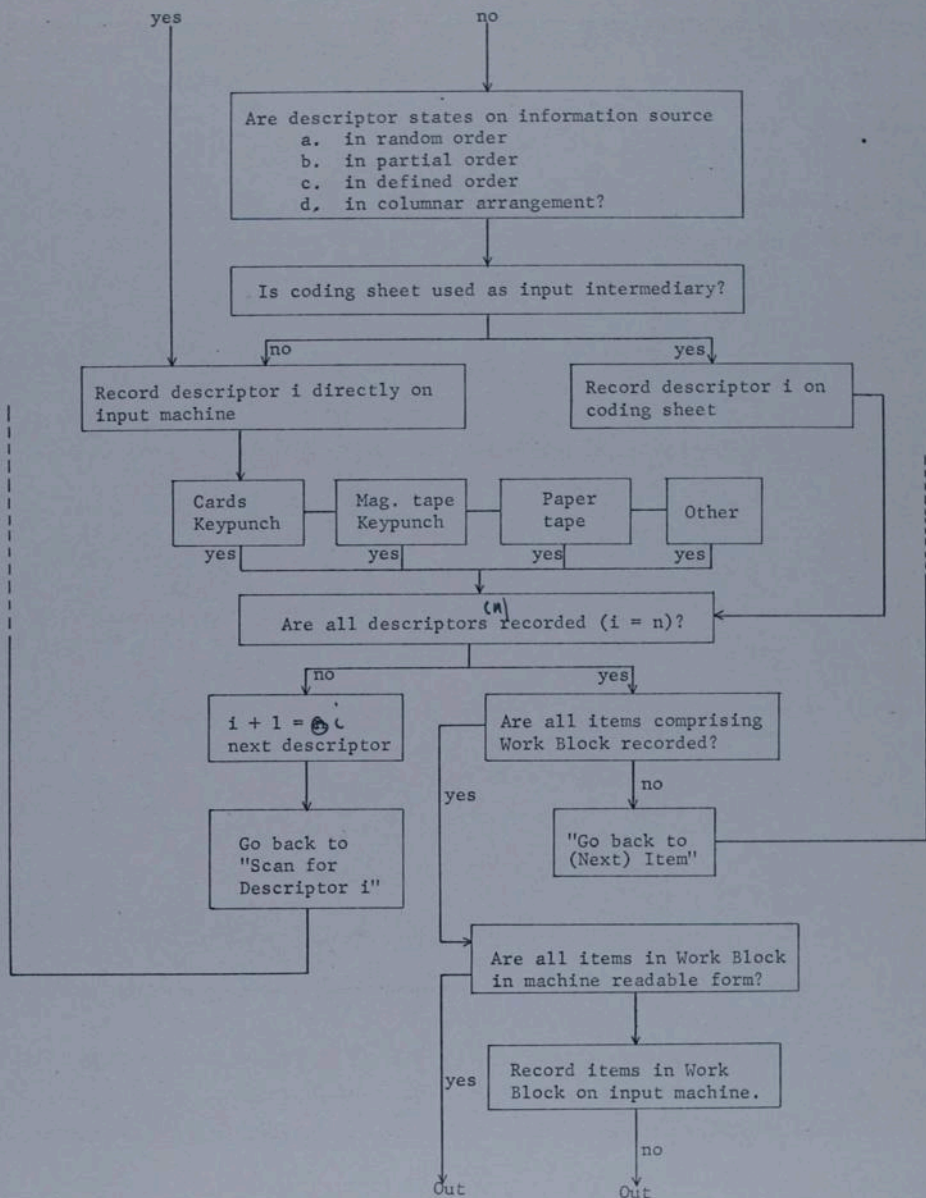




SUB-PROGRAM FOR SCAN AND RECORD

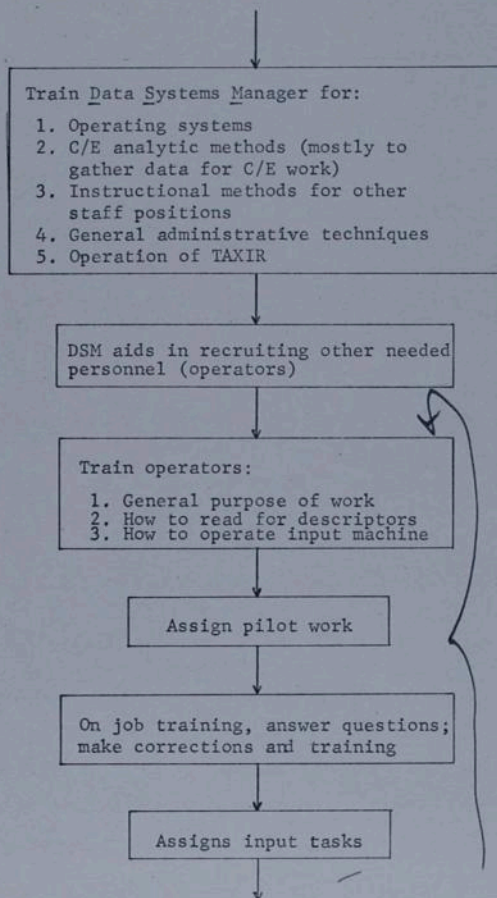
This sub-program is of special importance for mounting data. From the flow charts can be seen the steps necessary for preparing input to TAXIR. Each of these steps also indicates a certain cost. Estimates of data mounting costs, then, come from these specific flows. These were developed from actual work done on four Data Banks.

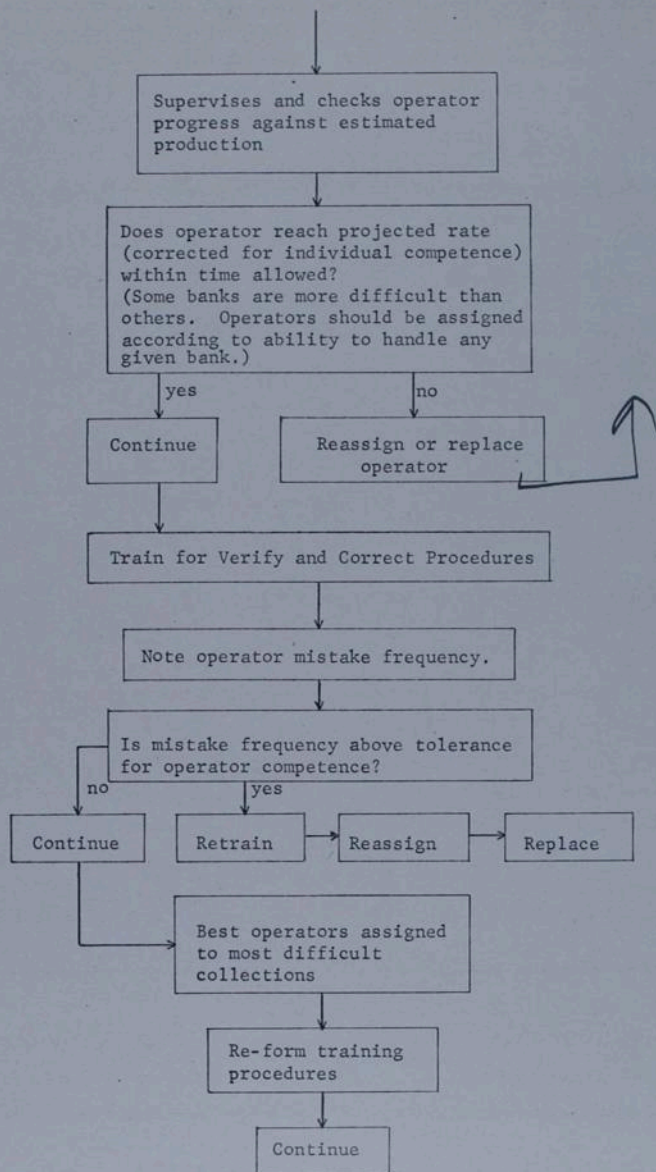




SUB-PROGRAM FOR TRAINING

Essential to the integration of any program is the training of personnel. The general approach taken here is to train fully one key person who is an employee of the collaborator (Museum). This position is called "Data Systems Manager." The person filling this position works as coordinator with Taximetrics Laboratory staff for all work aspects. (Note: These systems call for complete operator training and evaluation. No prior experience is needed. Pay rates will fluctuate with proven operator competence.)





TRAINING PROCESS

- | | |
|---|----------|
| 1. Introduction to machine; putting tape onto machine | 1/2 hour |
| a. tape and protector | |
| b. drive mechanism | |
| c. head | |
| d. how information is stored on tape | |
| e. window and vacuum explanations | |
| 2. Introduction to keyboard and switches; explanation of interrelations between switches and operational buttons | 1/2 hour |
| 3. Further explanation of keyboard; display board | 1/2 hour |
| 4. Trainee allowed to experiment with keyboard and to become somewhat familiar with display coding, typing information on to tape, etc. | 1 hour |
| 5. Instructed experiment period for trainee to become familiar with locating various areas on tape (backing up several lines, correcting procedures, more complex functions of dials and buttons) | 1 hour |
| 6. Trainee allowed to type material into keyboard with minimal instruction (very simple text suggested) and to correct and check her operating procedures. Instructor on hand to offer suggestions or answer questions. | 1 hour |

Optional:

- | | |
|--|--------|
| 7. Familiarize and discuss the nature of the data to be entered onto the machine (form, field separators, format for each item and coded form, etc.) | 1 hour |
| 8. Explain programming concept and coding for programming machine | 1 hour |
| 9. Give trainee a "problem" in programming the machine for a fixed format (may be obtained from manual) | 1 hour |
| 10. Correct trainee's program | |
| 11. Go over printout with trainee and assist in correction procedures | 1 hour |

II. FACILITIES

Please see the accompanying document, The Significance and Value of the University of Colorado Museum, which describes the facilities of the Museum.

The Graduate School Computing Center provides a CDC 6400 64K 60 bit-word machine. Charges for the machine are \$300 per hour for Central Processing (\$450 for the second half of core) and \$60 per hour for Peripheral Processing (\$90 for the second half of core). Operators and program advisers are available without charge.

Four Honeywell 700 key-tape machine, one for each of the Sections of the Museum, are required. These devices provide the most rapid, accurate means for capturing data from the collections. Considerable investigation has determined that this machine has the required speed, accuracy, and flexibility for the purpose of this activity. The advantage of the key-tape machine is that the data are put directly into a form that can be used by the computer. In contrast, such devices as the Flexowriter (punched paper tape output) require considerable programming to convert the data output to magnetic tape format. An IBM 026 keypunch machine will be used to do the necessary programming and debugging for the Museum project.

One IBM Selectric typewriter will be needed for administrative use.

III. PERSONNEL

a. Co-principal Investigators

Name: Hugo G. Rodeck

Academic Title: Director of Museum: Professor of Natural History

Percent of Time on this Project: 20% (calendar year)

Date and Place of Birth: 1902, Marion, New Jersey

Education: A.B., B.E., 1928; M.A., 1929, University of Colorado
(Biology, Psychology, Education)
Ph.D. 1944, University of Minnesota
(Entomology, Ecology)

Employment: Graduate Assistant in Biology, 1928-29;

Instructor in Biology, 1929-30;

Assistant in Museum, 1932-33;

Curator and successively Assistant, Associate,

and full Professor of Natural History;

Title of Director of the Museum established in 1939;
University of Colorado, Boulder, Colorado

Field Experience: Colorado, the Rocky Mountain region from Canada to Mexico; in Mexico and Yucatan, Europe, North Africa.

Grants: Viking Fund, for prehistoric Mimbres paleoethnology
Frick Fund for subrecent cave excavations in Wyoming
University of Colorado Council on Research and Creative
Work, for cave deposit studies.

Professional Societies:

Membership: Sigma Xi

Fellow, Entomological Society of America

Life Member, American Society of Mammalogists

Society for Systematic Zoology

Colorado-Wyoming Academy of Science

American Association of Museums

International Council of Museums

Association of Science Museum Directors

Conference of Directors of Systematic

Collections

Offices Held: President, Secretary of Colorado

Chapter of Sigma Xi

President, Secretary of Colorado-Wyoming

Academy of Science

Vice-President (for Science Museums) and

two-term Council member, American Association
of Museums.

Secretary, now Vice-President

Committee No. 2 (Natural History) of

International Council of Museums;

Secretary-Treasurer, United States Committee,

International Council of Museums.

Recent Publications:

See Museum Bibliography

Name: David J. Rogers

Academic Title: Professor of Biology; Associate Curator of Botany
(Museum): Director, Taximetrics Laboratory;
University of Colorado

Percent of Time on this Project: 20% (Academic Year); 100% (2 mos., Summer)

Date and Place of Birth: 1918, deFuniak Springs, Florida

Education: B.S., University of Florida, Gainesville, 1941.

M.A., Ph.D., Washington University, St. Louis, 1949, 1951.

Employment: Assistant and Associate Professor, Allegheny College, 1951-57.
Curator, New York Botanical Garden, 1957-65.

Professor of Botany, Colorado State University, 1965-67.

Professor of Biology, University of Colorado, 1967-present.

Associate Curator of Botany (Museum); Director Taximetrics
Laboratory, University of Colorado, 1967-present.

Travel: United Kingdom, France, West Indies, Mexico, Central America,
Brazil, Bolivia, Peru.

Grants: American Philosophical Society
Allegheny Faculty Grant
National Science Foundation
Office of Naval Research
National Institutes of Health
International Business Machines
United States Department of Agriculture

Professional Societies:

American Association for the Advancement of Science
Sigma Xi
Botanical Society of America
American Society of Plant Taxonomy
Society for Economic Botany
Torrey Botanical Club
International Association of Plant Taxonomy
Society for Computing Machinery
Society for Systematics (British)
Classification Society (North American Branch)
AIBS

Recent Publications:

See "Publications from Taximetrics Laboratory" in Appendix I.

b. Faculty Associates

Name: T. Paul Maslin

Academic Title: Professor of Natural History, Curator of Zoology,
University of Colorado

Percent of Time on this Project: 25% (calendar year)

Date and Place of Birth: 1909, Hankow, Hupeh, China

Education: B.A., M.A., University of California, 1933, 1941.

Ph.D. Stanford University, 1945.

Employment: Acting Instructor, Stanford University, Summer 1943.

Assistant Professor, Colorado State University, 1945-47.

Assistant Professor of Biology, University of Colorado, 1949-53.

Associate Professor of Biology, University of Colorado, 1953-60.

Professor of Biology, University of Colorado, 1960-66.

Curator of Herpetology, University of Colorado Museum, 1949-66.

Professor of Natural History, University of Colorado, 1966-
present.

Curator of Zoology, University of Colorado Museum, 1966-present.

Recent Expeditions:

(Major only)

Yucatan Peninsula. Summer 1959.

University of Colorado 1961 Expedition to Yucatan, Mexico,
Summer 1961.

Durango, Mexico, and Chihuahua Mountains, Summer 1963.

University of Colorado 1964 Expedition to Yucatan Mexico,
Summer 1964.

Gulf of Mexico Expedition, August 1964.

Canada, British Columbia, August 1965.

Second Gulf of California Expedition, July-August 1966.

Third Gulf of California Expedition, July 1967.

Seven expeditions of from 3 to 10 days in Texas, New
Mexico, Arizona, and Colorado, Summer 1968.

Fifth University of Colorado Tunisian Expedition, January-May 1969.

Grants:

1947-1962 Numerous grants from Council on Research and
Creative Work, University of Colorado; usually
\$200-\$350.

1961-1962 NSF Grant G-16244 "An investigation of the all-
female species of the lizard genus Cnemidophorus
(Teiidae). " \$9,600 - 1 year

1962-1964 NSF Grant G-21903 "Further studies of the lizard
genus Cnemidophorus. " \$18,400 - 2 years.

1963-1965 NSF Grant GB 1813 "Systematic studies of the lizard
genus Cnemidophorus. " \$31,300 - 2 years.

1964 NSF Grant GB 2362 as Associate Investigator,
"Biology of the insular lizards of the Gulf of
California." \$5,958 - 3 weeks.

Grants: (Cont'd)

1965-1968 NSF Grant GB 4628 "Further experimental systematic studies of the lizard genus Cnemidophorus."
\$28,000 - 2 years.

Fellowships:

1958 Spring To Study Amphibians and Reptiles of Colorado.

1966-1967 To study parthenogenesis in lizards and examine type specimens at major museums in the U.S. and abroad. University of Colorado Council on Research and Creative Work.

Professional Societies:

American Association for the Advancement of Science
Amer. Soc. Ich. Herp.
Herp. League
Brit. Herp. Soc.
Soc. Study Evolution
Soc. Syst. Zool.
Southwestern Association of Naturalists
Colorado-Wyoming Academy of Science
Phi Sigma Society
Sigma Xi
AIBS

Selected Publications:

See Museum Bibliography.

Name: Peter Robinson
Academic Title: Associate Professor of Natural History; Curator of Geology,
University of Colorado Museum, University of Colorado.
Percent of Time on this Project: 25% (calendar year)
Date and Place of Birth: 1932, New York City, New York.
Education: B.S., 1954, Yale University
M.S., 1958, Yale University
Ph.D., 1960, Yale University
Employment: Instructor of Geology, Harpur College, S.U.N.Y. 1955-57.
Research Associate, Yale Peabody Museum, 1960-61.
Assistant Professor of Natural History and Curator of
Geology, University of Colorado, 1961-67.
Associate Professor of Natural History, Curator of
Geology, University of Colorado, 1967-present.

Field Experience:

Field Assistant, Yale Peabody Museum, 1949-1950.
American Museum of Natural History, 1952, 1954, 1955. .
Princeton University, 1961.
Project Director, Yale Peabody Museum, 1959-60.
University of Colorado Museum, 1962-68, western United States.
Field Associate, University of Colorado Nubian Expedition,
1962-63; co-investigator, 1964-65.
Deputy Administrator Nubian Project, 1964-present.
Field work: Tunisia, Winter 1967; Winter-Spring 1968;
Winter-Spring 1969.
Director, University of Colorado Tunisian Expedition, 1967-present.

Grants:

- 1960 Studies on Eocene Insectivores, National Science Foundation
GL4255 - \$11,300
- 1961- Numerous grants from the Council on Research and Creative Work,
University of Colorado, totaling \$6,809.
- 1962 Cenozoic Microfauna; Committee on Coordination of Research,
University of Colorado - \$4,606.
- 1965 Paleontological equipment; Research Capital Support grant,
University of Colorado, \$3,725.
- 1966 Pliocene Fossils, Educational Experimentation Fund, University
of Colorado - \$1,000.
- 1968 Co-investigator: "Continuation of Archeological excavations of
the ancient settlement remains of the Second-Fourth Cataract area,
Republic of Sudan, NSF GS-557, and subsequent amendments, \$98,000.
- 1967- Archeological and paleontological research in Tunisia, NSF GS-1607,
69 \$26,700 - Co-investigator.
- 1967 Excavation at Oued el Akarit, (with Hewes, Wheat) SFCP-26
\$62,090.

Grants: (Cont'd)

- 1968 Miocene Microfaunas, Private Funds, \$2,784.
- 1968 Educational Experimentation Fund, Miocene fossils, \$700.
- 1968 Paleontologic Research in Tunisia, Smithsonian SFC-8-7011, \$23,165 (dinars) Amendment: \$1,196 (dinars).
- 1969 Paleontological investigations in Tunisia, Smithsonian SFC-9-7011 - \$24,828 (dinars).

Professional Societies:

Society of Vertebrate Paleontology
Australian Mammal Society
Sigma Xi
American Association for the Advancement of Science
Colorado Scientific Society

Recent Publications:

See Museum Bibliography.

Name: William A. Weber
Academic Title: Professor of Natural History, Curator of the Herbarium,
University of Colorado
Percent of Time on this Project: 25% (calendar year)
Date and Place of Birth: 1918, New York City
Education: B.S., 1940; Iowa State College; M.S., 1942.
Ph.D., 1946, Washington State College (Botany).
Employment: Herbarium Assistant, 1938-40, Iowa State College; 1941-45
Washington State College
Instructor, Department of Biology, University of Colorado, 1946-50
Assistant Professor, 1950-56
Associate Professor, 1956-62
Professor of Natural History and Curator of the Herbarium,
University of Colorado Museum, 1962-present

Field Experience:

Scripps Expedition to Guadalupe Island, Mexico, 1963
Scandinavia, 1957-1958, 61.
Western Europe and Alps, Pyrenees, 1966
Arctic Canada, Alaska, United States
Galapagos Islands, Cocos I., Mexico, 1964
Australia, New Guinea, 1967-68

Fellowships:

National Science Senior Postdoctoral Fellowship (Sweden, 1957-58)
Research Fellow, Australian National University; CRCW FF, 1967-68

Grants:

1960-63 Taxonomic and Phytogeographic Studies on the Lichens of Western
North America (NSF-G-9840) \$25,000.
1962 Herbarium Cabinets (NSF-G-20865) \$15,000.
1962 Cockerell Bibliography, Council on Research and Creative Work,
University of Colorado, \$550.
1963-66 Taxonomic and Phytogeographic Studies on Lichens of Western
North America (NSF-GB-1538) \$28,600.
1963 Taxonomy of Rocky Mountain Plants, Council on Research and
Creative Work, University of Colorado, \$888.
1965 Cockerell Bibliography, Council on Research and Creative Work,
University of Colorado, \$2,322.
1967 Australian National University Fellow, \$3,800

Professional Societies:

American Society of Plant Taxonomists
International Association for Plant Taxonomy
California Botanical Society
American Institute of Biological Sciences
American Bryological Society
Botanical Society of Lund
Society for Tropical Biology
Society for Study of Evolution
Swedish Botanical Society
Southwestern Association of Naturalists

Recent Publications:

See Museum Bibliography.

Name: Joe Ben Wheat

Academic Title: Professor of Natural History, Curator of Anthropology,
University of Colorado

Percent of Time on this Project: 25% (calendar year)

Date and Place of Birth: 1916, Van Horn, Texas

Education: B.A., University of California (Berkeley), 1937

M.A., Ph.D. (Anthropology), University of Arizona, 1949, 1953.

Employment: Field Director, Texas Technological College, WPA Archaeological
Project, 1939-41.

Archaeologist, River Basins Survey, Smithsonian Institution, 1947.

Graduate Fellow, Department of Anthropology, University of
Arizona, 1947-48.

Instructor 1948-50, 1951-52, University of Arizona,
Dept. of Anthropology.

Field Foreman, University of Arizona Summer Field School in
Archaeology 1949-51.

Ranger-Archaeologist, Grand Canyon National Park, Summers 1952-53.

Assistant Professor of Natural History, University of Colorado
Museum, 1953-59; Associate Professor 1959-62; Professor, 1962-
present; Curator of Anthropology, University of Colorado Museum,
1953-present.

Field Experience:

Archeological Field Assistant, University of California,
summers 1936-38.

Director, University of Colorado Nubian Upper Paleolithic
Project, 1963-65.

Survey and Evaluation of Paleolithic Sites in Tunisia, 1966.

Numerous site excavations during summers 1954-present.

Fellowships:

Ford Foundation Fellowship 1952-53.

Grants:

1961 Preparation of reports on the unpublished archeological remains
excavated by Earl H. Morris (NSF-G-18570) \$8,500.

1962 Earl H. Morris Papers (NSF-GS-11) \$9,300.

1962 Excavations at Yellow Jacket, Colorado. Council on Research
and Creative Work, University of Colorado, \$1,058.

1963 Ethnographic illustrations, Council on Research and Creative
Work, University of Colorado, \$500.

1964 Earl H. Morris Papers (NSF-GS-467), \$13,900.

1967-68 Excavations of the Prehistoric Site and Oued El Akarit, Tunisia,
Smithsonian Institution (SFCP-26) (with Hewes, Robinson)
\$62,090 dinars.

Grants: (Cont'd)

- 1967-69 Excavations at L'Oued el Akarit (NSF-GS-1607) \$26,700.
1968 Research in Northeastern Colorado (NSF-GS-2073) \$14,900.
1968 Curatorial Furniture, NSF, \$11,600.

Professional Societies

American Association for the Advancement of Science Fellow
American Anthropological Association, Fellow
American Ethnological Society
Society of the Sigma Xi
Secretary, Society for American Archaeology, 1960-64
President, Society for American Archaeology, 1966-67

Recent Publications:

See Museum Bibliography.

Name: Henry S. Fleming, Jr.

Academic Title: Associate Curator of Entomology, University of Colorado Museum

Percent of Time on this Project: 80% (calendar year)

Date and Place of Birth: 1913, Brooklyn, New York

Education: New York University, 1932-35

Employment: Entomologist, New York Zoological Society, 1942-61

Research Associate in Taximetrics, New York Botanical Garden,
1961-65

Associate Professor of Botany, Colorado State University
1965-67.

Research Botanist III, Taximetrics Laboratory, University of
Colorado, 1967-present.

Associate Curator of Botany, University of Colorado Museum,
1967-69

Associate Curator of Entomology, University of Colorado Museum
1969-present

Field Experience:

20 years of scientific expeditions in South America

Professional Societies:

Fellow, New York Zoological Society
Sigma Xi

Publications:

- 1945 with William Beebe. The Sphingidae (moths) of Kartabo, British Guiana and Caripito, Venezuela Zoologica, 30: 1-6.
- 1945 The Saturnioidae (moths) of Kartabo, British Guiana and Caripito, Venezuela. Zoologica, 30: 73-80.
- 1945 The Meliponidae (stingless bees) of Caripito, northeastern Venezuela. Zoologica, 30: 267.
- 1947 Sphingidae (moths) of Rancho Grande, north central Venezuela. Zoologica, 32: 133-145.
- 1948 A new genus and species of Orneodidae (moths) from Rancho Grande, north central Venezuela. Zoologica, 33: 39-42.
- 1949 The Pericopidae (moths) of Kartabo, British Guiana and Caripito, Venezuela. Zoologica, 34: 19-20.
- 1951 with William Beebe. Migration of day-flying moths through Portachuelo Pass, Rancho Grande, north central Venezuela. Zoologica, 36: 243-254.
- 1952 The Saturnioidae (moths) of Rancho Grande, north central Venezuela. Zoologica, 37: 203-207.

- 1953 with Jocelyn Crane, Construction and operation of butterfly insectaries in the tropics. *Zoologica*, 38: 161-172.
- 1957 The Ctenuchidae (moths) of Trinidad, British West Indies. Part I. *Euchromiinae*. *Zoologica*, 42: 105-130.
- 1959 The Ctenuchidae (moths) of Trinidad, British West Indies, Part II. *Ctenuchinae*. *Zoologica*, 44: 85-104.
- 1960 The external morphology and chaetotaxy of first instar larvae of the *Heliconiinae* of Trinidad, W.I. *Zoologica*, 45: 91-110.
- 1960 with William Beebe, J. Crane. Comparison of eggs larvae and pupae in 14 species of *Heliconiinae* (butterflies) of Trinidad, W.I. *Zoologica*, 45: 111-154.
- 1963 with D. Rogers, Data Recording: an inexpensive and efficient method. *AIBS Bull.* 13(2): 42.
- 1964 with D. Rogers. A computer program for classifying plants II. A numerical handling of non-numerical data. *BioScience* 14 (9): 15-28.

BUDGET EXPLANATION

I. The following budget aggregates the personnel time and other resources necessary to carry out the work as defined in the flow charts describing the Work Program. (That is, the budget justification will be found in the Work Program Section.) The cost for mounting data is estimated from the pilot study of the bryophyte collection.

II. The budget is arranged in a four-year sequence. The first two years constitute a minimal program. Each additional year is a self-contained unit. For funding consideration then, the first two years should be treated as a block, and depending upon the availability of funds, the third and fourth year support could be considered at a later time.

III. In order to separate the costs of the Taximetrics Laboratory's services from other direct costs (e.g., museum personnel salary expenses), the total costs of the Taximetrics Laboratory services are listed under budget item C.1. as "Other Costs." A detailed cost breakdown for this expense is given in the attached budget addendum. Because the Taximetrics Laboratory is located on the Boulder campus and their personnel have regular University staff and faculty appointments, fringe benefits at 7% of salaries and indirect costs based on the present on-campus overhead rate of 45% have been included in the total costs of the Taximetrics Laboratory services. (See page 47).

NATIONAL SCIENCE FOUNDATION

Institution: The Regents of the
University of Colorado
Boulder, Colorado 80302

Title: Forging of a Data Retrieval System for the
University of Colorado Museum

Co-Principal Investigators: Hugo Rodeck
David Rogers

Starting Date & Duration: September 1, 1969 (4 years)

A. Salaries & Wages

Senior Personnel

Co-Principal Investigator: Dr. H.G. Rodeck
20% time 12 mos.

\$ 4,100 (2MM)

\$ 4,430 (2MM)

Co-Principal Investigator: Dr. D.J. Rogers
25% time 9 mos. AY
100% time 2 mos. summer

4,425 (2MM)

4,780 (2MM)

\$ 3,930 (2MM)

\$ 4,245 (2MM)

Faculty Associate: Dr. T.P. Maslin
25% time 12 mos.

5,075 (3MM)

5,480 (3MM)

Faculty Associate: Dr. P. Robinson
25% time 12 mos.

3,690 (3MM)

3,985 (3MM)

Faculty Associate: Dr. W. Weber
25% time 12 mos.

4,465 (3MM)

4,820 (3MM)

Faculty Associate: Dr. J.B. Wheat
25% time 12 mos.

4,340 (3MM)

4,685 (3MM)

Research Associate: H.S. Fleming
80% time 12 mos.

12,815 (10MM)

13,585 (10MM)

Other Personnel:

Administrative Assistant
30% time 12 mos.

2,590 (4MM)

2,745 (4MM)

Museum Data Systems Manager
100% time 12 mos.

8,000 (12MM)

8,480 (12MM)

Research Technician
100% time 12 mos.

5,220 (12MM)

5,535 (12MM)

Secretary
10% time 12 mos.

575 (1MM)

610 (1MM)

Input Operators

One @ 40% time 12 mos.

1,665 (5MM)

1,765 (5MM)

Four @ 100% time 12 mos.

16,640

Five @ 100% time 12 mos.

22,050 (60MM)

One @ 70% time 12 mos.

Two @ 100% time 12 mos.

CU Proposal No. 69.5.233
Budget Cont'd

	1st Yr.		2nd Yr.	
	NSF	CU	NSF	CU
A. <u>Salaries & Wages</u> (cont'd)				
Graduate Research Assts. (three)				
50% time 9 months AY	\$ 8,550 (14MM)	\$ 1,410*	\$ 9,000 (14MM)	\$ 1,410*
100% time 3 months summer	5,670 (9MM)		5,985 (9MM)	
Total Salaries & Wages	\$62,490	\$30,670	\$70,645	\$32,945
B. <u>Fringe Benefits</u>				
TIAA and PERA - 7% of faculty & staff salaries	3,380	2,050	3,895	2,205
C. <u>Permanent Equipment</u>				
Tape file cabinets (6-10 drawer)	300			
Card storage cabinets (5-50 tapes)	300			
Print out storage cabinets (10-data stacks)	300			
Total Permanent Equipment	900		-0-	
D. <u>Expendable Supplies & Equipment</u>				
Magnetic tapes	600		1,050	
IBM tab cards	50		100	
Consumable supplies	500		500	
Total Expendable Supplies & Equipment	1,150		1,650	
E. <u>Travel</u>				
Domestic: Four rd. tps. by Co-P.I.'s to Washington, D.C. for participation in Smithsonian conferences on museum systems and/or NSF consultations.	350		350	
F. <u>Publication Costs</u>				
Report preparation, page costs, reprints	500		1,000	

	1st Yr.		2nd Yr.	
	NSF	CU	NSF	CU
G. <u>Other Costs</u>				
1. Taximetrics Laboratory Services (see budget addendum for detailed cost breakdown)			\$16,740	
2. Computer time (CDC 6400 @\$300/hr.)	\$15,970		6,000	
3. Equipment Rental**				
Honeywell 200 Key Tape Machine @ \$1,800 each per year	5,400		7,200	
One IBM Key Punch .026 @ \$670/yr.	670		670	
One IBM Selectric Typewriter @ \$145/yr.	145		145	
4. Communications				
Postage	25		150	
Toll charges	50		50	
Total Other Costs	\$27,260		\$30,955	
H. <u>Total Direct Costs</u>	\$96,030	\$32,720	\$108,495	\$35,150
I. <u>Indirect Costs</u>				
On campus: 45% of S & W	28,120	13,165	31,790	14,190
J. <u>Total Costs</u>	\$124,150	\$45,885	\$140,285	\$49,340

REQUESTED FROM NSF FOR FIRST TWO YEARS: \$264,435

*The University waives the difference between out-of-state and in-state tuition for research assistants. The average cost of such waivers for all research assistants is \$470 per research assistant per year which is shown as a University contribution. This amount will be adjusted periodically to reflect actual experience.

**Costs shown include service contract expense where applicable.

A. Salaries & Wages

Senior Personnel

	3rd Yr.		4th Yr.	
	NSF	CU	NSF	CU
Co-Principal Investigator: Dr. H.G. Rodeck 20% time 12 mos.		\$ 4,785(2MM)		\$ 5,170(2MM)
Co-Principal Investigator: Dr. D.J. Rogers 25% time 9 mos. AY		5,160(2MM)		5,575(2MM)
100% time 2 mos. summer	\$ 4,585(2MM)		\$ 4,950(2MM)	
Faculty Associate: Dr. T.P. Maslin 25% time 12 mos.		5,920(3MM)		6,395(3MM)
Faculty Associate: Dr. P. Robinson 25% time 12 mos.		4,305(3MM)		4,650(3MM)
Faculty Associate: Dr. W. Weber 25% time 12 mos.		5,205(3MM)		5,620(3MM)
Faculty Associate: Dr. J.B. Wheat 25% time 12 mos.		5,060(3MM)		5,465(3MM)
Research Associate: H.S. Fleming 80% time 12 mos.	14,400(10MM)		15,265(10MM)	

Other Personnel:

Administrative Assistant 30% time 12 mos.		2,910(4MM)		3,085(4MM)
Museum Data Systems Manager 100% time 12 mos.	8,990(12MM)		9,530(12MM)	
Research Technician 100% time 12 mos.	5,865(12MM)		6,215(12MM)	
Secretary 10% time 12 mos.		645(1MM)		685(1MM)
Input Operators				
One @ 40% time 12 mos.				
Four @ 100% time 12 mos.				
Five @ 100% time 12 mos.	23,375(60MM)			
One @ 70% time 12 mos.	3,275(8MM)			
Two @ 100% time 12 mos.			9,910(24MM)	
Graduate Research Assts. (three)				
50% time 9 mos. AY	9,450(14MM)	1,410*	9,900(14MM)	1,410*
100% time 3 months summer	6,300(9MM)		6,615(9MM)	

Total Salaries & Wages	\$76,240	\$35,400	\$62,385	\$38,055
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CU Proposal No. 69.5.233
Budget Cont'd

	3rd Yr.		4th Yr.	
	NSF	CU	NSF	CU
B. <u>Fringe Benefits</u>				
TIAA and PERA - @ 7% of faculty & staff salaries	\$ 4,235	\$ 2,380	\$ 3,210	\$ 2,565
C. <u>Permanent Equipment</u>	-0-		-0-	
D. <u>Expendable Supplies & Equipment</u>				
Magnetic tapes	1,050		150	
IBM tab cards	100		25	
Consumable supplies	500		500	
Total Expendable Supplies & Equipment	1,650		675	
E. <u>Travel</u>				
Domestic: Four rd. tps. by Co-P.I.'s to Washington, D.C. for participation in Smithsonian conferences on museum systems and/or NSF consultations.	350		350	
F. <u>Publication Costs</u>				
Report preparation, page costs, reprints	1,000		2,000	
G. <u>Other Costs</u>				
1. Taximetries Laboratory Services (see budget addendum for detailed cost breakdown)	17,695		6,560	
2. Computer time (CDC 6400 @ \$300/hr.)	8,600		10,000	
3. Equipment Rental**				
Honeywell 200 Key Tape Machines @ \$1,800 each per year	7,200		1,800	
One IBM Key Punch .026 @ \$670/yr.	670		670	
One IBM Selectric Typewriter @ \$145/yr.	145		145	
4. Communications				
Postage	150		200	
Toll charges	50		50	
Total Other Costs	\$34,510		\$19,425	

CU Proposal No. 69.5.233
Budget Cont'd

	3rd Yr.		4th Yr.	
	NSF	CU	NSF	CU
H. <u>Total Direct Costs</u>	\$117,985	\$ 37,780	\$ 88,045	\$ 40,620
I. <u>Indirect Costs</u>				
On campus: 45% of S & W	<u>34,310</u>	<u>15,295</u>	<u>28, 075</u>	<u>16,475</u>
J. <u>Total Costs</u>	\$152,295	\$ 53,075	\$116,120	\$ 57,095

TOTAL REQUESTED FROM NSF FOR FOUR YEARS: \$532,850

BUDGET ADDENDUM

Detailed Cost Breakdown of Taximetrics Laboratory Services

	<u>1st Year</u>	<u>2nd Year</u>	<u>3rd Year</u>	<u>4th Year</u>
1. <u>Salaries</u>				
*Operations Research Systems				
Analyst II				
60% time 12 months	\$ 6,300	\$ 6,615	\$ 7,045	
20% time 12 months				\$ 2,430
**TAXIR Systems Programmer II				
30% time 12 months	3,780	3,970	4,170	
10% time 12 months				1,460
Total Salaries	<u>\$10,080</u>	<u>\$10,585</u>	<u>\$11,215</u>	<u>\$ 3,890</u>
2. <u>Fringe Benefits</u>				
PERA - @ 7% of staff salaries	705	740	785	270
3. <u>Indirect Costs</u>				
On Campus: 45% of salaries	<u>4,535</u>	<u>4,765</u>	<u>5,045</u>	<u>1,750</u>
4. <u>Expendable Supplies & Materials</u>	650	650	650	650
5. <u>Total Costs</u>	<u>\$15,970</u>	<u>\$16,740</u>	<u>\$17,695</u>	<u>\$ 6,560</u>
(as shown in budget item G.1.)				

*The amount of time needed for consultation is derived from the work program flow charts. It is estimated that at least 1230 man-hours of an Operations Research Analyst's time will be needed.

**The TAXIR Systems Programmer will be needed at least 625 man-hours to instruct in the use of TAXIR -- and to see that the programs run properly.

The Significance and Value
of the
University of Colorado Museum

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THE UNIVERSITY OF COLORADO MUSEUM

INTRODUCTION

The University of Colorado Museum was established to develop a better understanding of the natural features, resources of fauna and flora, and ecology of the Rocky Mountain region through the accumulation of systematic collections for research, exhibition, and the training of professional specialists in the branches of natural history. Originally including the fields of mineralogy, paleontology, zoology, and archeology, its responsibilities in the ensuing years have been extended to include geology, botany, anthropology, ethnology, history, and the arts.

It is in fact, although not in the statutes, the State Natural History Museum of Colorado since it is the only comprehensive museum in Colorado attached to a State institution. As a division of the University of Colorado, the Museum is the custodian of all gifts in kind to the University which do not more logically fall within the responsibility of the Library or the various departments. Furthermore, it is the only legitimate custodian of such collections on the campus. Private collections exist to some extent among the faculty, but research collections not considered to be private are the property of the Museum which has in its responsibilities their curatorship and availability to the departments and to the public. Whereas in most American universities the museum function is divided among the academic departments which maintain their separate collections (especially herbaria), this Museum has from its inception worked towards centralization of collections in order to 1) provide continuing curatorial care unaffected by changes in academic faculty over the years 2) safeguard the collections against attrition which often occurs when research materials are housed in "teaching" departments, and 3) provide all of the typical museum services to the institution and to its sister institutions and research colleagues in a manner which is simply not possible in departments where the major responsibilities lie in quite another direction. Thus the Museum can provide special teaching tools in the form of small representative teaching collections which are relatively expendable, and at the same time provide research collections of specimens adequate to the most sophisticated professional requirements.

The Museum's original emphasis on the Rocky Mountain region remains, but the need for comparative materials from other areas and the enlarging research horizons of the University's faculty and students has caused the scope of the Museum's operation to encompass the world. The Museum's expeditions to North Africa, the European Alps, Mexico, Central and South America, Australia, western United States, the American Arctic, Canada, and the Hawaiian Islands have contributed to a priceless scientific resource of collections. Additional information concerning each Section's collections is given in following discussions, but the holdings of the Museum as of December 1968 are approximately as follows:

	Number of Specimens
Minerals, rocks, and geological specimens	5,000
Fossils	350,000
Plants	222,300*

	Number of Specimens
Recent invertebrates (except insects)	490,000
Arachnids	20,000
Insects (approximate)	121,000
Fishes, amphibians, and reptiles	41,000
Birds and mammals	19,200
Anthropological and historical specimens	58,988*
Kodachrome slides, lantern slides	<u>11,000</u>
Total	1,338,488

*Number of accessions, not specimens.

In addition, the scientific reprint collection of the Museum numbers about 60,000.

ORGANIZATION (Please refer to organizational chart on page 55)

In 1902 Professor Junius Henderson (1865-1937) was appointed Curator of the Museum, without salary, and charged by President Sewall with the responsibility of developing the disparate collections of the University into the Museum. The Museum at that time consisted of a few fossils and mollusk shells, a small collection of rocks and minerals, and several mounted birds and mammals, the specimens all separated from the labels. These and others were assembled by Professor Henderson and were housed in a room in the upper story of the Hale Building. There was no regular appropriation for Museum purposes, but occasional allowances were made from time to time for short collecting trips. From this source, supplemented by gifts from friends of the University, considerable material was accumulated in a few years.

In 1909 Professor Henderson was placed on salary, given full professorial rank, and became full-time Curator, an unusual procedure for an educational institution only thirty-two years old. The Museum was made a separate department of the University, a status similar to that of the Library, with sectional curatorial and inter-departmental cooperative functions as contrasted to teaching functions. Since that time, increasing appropriations have been set aside each year for general Museum purposes, in addition to research support from federal agencies, University sources, and private gifts.

Professor Henderson, with the volunteer services of students and members of the faculty, succeeded in producing an astonishing amount of scientific work and in adding a great quantity of valuable material to the collections.

Upon the completion of the west wing of the Hale Building in 1910, the Museum moved into the main floor portion. In 1922 Mrs. Elberta Smith was appointed part-time Assistant to help care for the collections. In 1933, upon the retirement of Professor Henderson after 30 years of activity, the present Director was appointed Curator.

Since 1909 the University of Colorado Museum has been in the charge of a full-time, professional, and academically-qualified Curator (the title was amended to that of Director in 1939). The Director of the Museum is classified administratively with deans of schools and colleges and the Director of Libraries. He is responsible administratively to the Vice President for Academic Affairs. His responsibility is exclusively the Museum on a full-time basis.

In addition to the Director, who is also Curator of Museology and of Exhibits, the Museum faculty includes full-time Curators of Anthropology, Botany, Geology, and Zoology. These faculty members hold academic rank as Professors of Natural History or in the case of the Curator of Geology, Associate Professor, and are full-time faculty members of the University on a fiscal year basis. A full-time Senior Instructor of Natural History who teaches museum techniques is also on the faculty of the Museum.

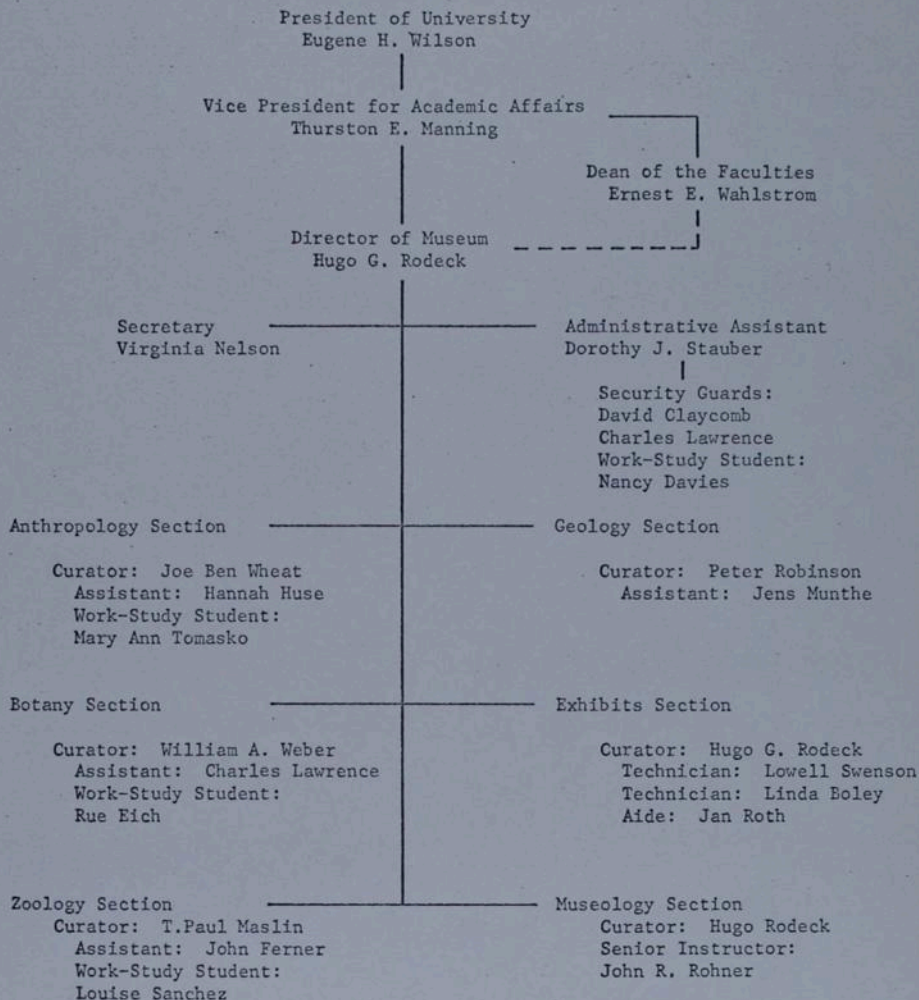
The Museum employs student Assistants in the fields of anthropology, botany, geology, zoology, and exhibits. Currently there are five such Assistants. Each Assistant has as his primary duty routine curatorship in the respective fields under the supervision of the Curator. These positions are comparable to assistantships in departments, pay the same stipend, and have the same academic qualifications. Persons so employed are almost always those anticipating future curatorial careers.

Full-time staff members of the Museum include a secretary, an administrative assistant-registrar, and two technicians who assist in the development and construction of exhibits.

In addition to the personnel mentioned above, the Museum collections are supervised and used by another group of individuals affiliated officially with the Museum. Those in the employ of the University as faculty or research staff members in departments related to the fields represented in the Museum are designated as Associate Curators. Those not in the employ of the University are designated Associates. These individuals are scholars who are affiliated in their professional capacity with the Museum and who participate in Museum-sponsored expeditions and other research programs. They are also available for consultation and assist in the curation of the collections.

The Museum's collections, now numbering more than a million and one third accessioned specimens, are located in the Henderson, Hellems, Macky, and Fine Arts buildings. The Henderson building was erected in 1937 under the auspices of the Works Progress Administration and was built specifically to house the Museum. This building comprises three floors approximately 50 x 150 feet, and an attic. Two floors are occupied by exhibit halls entitled, respectively, the Halls of Earth, Life, Man, and Art. The remaining building space is used for curatorial, shop, and administrative operations. Expansion of Museum activities has made use of other buildings necessary, and approximately 4295 square feet in the Hellems building, 2186 square feet in the Fine Arts building, and 1000 square feet in the Macky Building are used for Museum operations.

ORGANIZATION CHART



UNIVERSITY OF COLORADO MUSEUM ASSOCIATE CURATORS

Name	Museum Title	University of Colorado Department Position
Alice M. Brues	Associate Curator of Physical Anthropology	Professor of Anthropology
B. John Chronic	Associate Curator of Invertebrate Paleontology	Professor of Geological Sciences
Don L. Eicher	Associate Curator of Micropaleontology	Associate Professor of Geological Sciences
Henry S. Fleming	Associate Curator of Botany and Entomology	Research Botanist, Department of Biology
Gordon W. Hewes	Associate Curator of African Anthropology	Professor of Anthropology
Urless N. Lanham	Associate Curator of Entomology	Assistant Professor of Biophysics
Leonard Lewin	Associate Curator of Entomology	Professor of Electrical Engineering
Robert Lister	Associate Curator of Archeology	Professor of Anthropology
Askill Löve	Associate Curator of Phanerogams	Professor of Biology
Doris Löve	Associate Curator of Plant Geography	Research Associate, Department of Biology, Associate Professor of Geography
John W. Marr	Associate Curator of Ecology	Professor of Biology
David J. Rogers	Associate Curator of Botany	Professor of Biology
Hobart M. Smith	Associate Curator of Herpetology	Professor of Biology

UNIVERSITY OF COLORADO MUSEUM ASSOCIATES

Name	Museum Title	Position and Institution
Craig C. Black	Associate in Vertebrate Paleontology	Curator of Vertebrate Fossils, Carnegie Museum, Pittsburgh
Mary R. Dawson	Associate in Vertebrate Paleontology	Associate Curator of Vertebrate Fossils, Carnegie Museum, Pittsburgh
Dale L. Denham	Associate in Botany	Pharmacist, Boulder Medical Center
Edwin S. Licht	Associate in Microscopy and Araneology	Owner, E. Licht Co., Denver
Malcolm C. McKenna	Associate in Vertebrate Paleontology	Frick Associate Curator of Fossil Mammals, American Museum of Natural History, New York
John T. Polhemus	Associate in Entomology	Electronics Engineer, Martin Marietta Corporation, Denver
Harry Taylor	Associate in Herpetology	Department of Biology, Regis College, Denver
H. Marie Wormington Volk	Associate in Paleo-Indian Archeology	Visiting Professor in Anthropology, Arizona State University, Tempe
James M. Walker	Associate in Herpetology	Assistant Professor of Zoology, University of Arkansas, Fayetteville

UNIVERSITY OF COLORADO MUSEUM BUDGET ALLOCATIONS*

	<u>1962-63</u>	<u>1963-64</u>	<u>1964-65</u>	<u>1965-66</u>	<u>1966-67</u>	<u>1967-68</u>	<u>1968-69</u>
Code 1: Academic Salaries	\$51,832	\$53,132	\$51,262	\$58,230	\$78,580	\$86,550	\$97,250
Code 2: Assistants Salaries	12,757	10,920	12,540	11,500	11,500	12,500	12,500
Code 3: Staff Salaries	13,110	14,378	16,677	18,070	23,240	26,160	26,820
Code 4: Hourly Wages	1,180	1,180	4,788	1,180	1,180	1,180	1,180
Code 5: Supplies and Expense	6,323	5,790	6,679	4,296	6,296	6,296	7,415
Code 6: Special Items	250	250	250	250	250	250	250
Code 8: Equipment	Unknown	Unknown	4,012	3,000	1,000	2,000	None
Development Foundation Allocations	1,000	1,000	1,135	1,650	330	1,000	6,300

*Buildings, utilities, repairs, and maintenance are furnished by the University and are in addition to these figures.

MUSEUM SERVICES

On the Campus of the University of Colorado

1. The Campus Exhibit Program. In order to bring exhibits to the University community in a more frequent and visible manner the Museum has established temporary exhibits in several campus buildings (Biology, Chemistry, Geology, and the University Memorial Center) and plans to extend this program to the housing units and student centers.

Curators also work in liaison with departments in developing special teaching exhibits. For example, the Curator of Geology and the Geological Sciences Department are currently planning an exhibit on seismology, illustrating among other things, the earthquakes near Derby, Colorado, to supplement the existing mineral, atomic structure, and topographic map displays prepared by the Museum at the Department's request and located in the main hall of the Geology Building.

2. The Teaching Collections. The teaching collections maintained by the Museum are utilized by undergraduate and graduate students and faculty. For example, the Herbarium maintains two separate teaching collections, one in the Department of Biology, containing a representative collection of the Colorado flora, and one in the Institute of Arctic and Alpine Research laboratory building at its Mountain Research Station northwest of Nederland, Colorado. This herbarium contains a representation of the local alpine and subalpine flora. Loan of more exotic material from the main herbarium is easily arranged. Plans are under way for the establishment of a teaching herbarium at the Colorado Springs Center of the University which will provide a representative collection of Colorado Springs area flora conveniently available for classes at the Center.

Specimens from other Museum collections are also available to University departments for teaching purposes. Minerals, rocks, and fossils are loaned to the Departments of Geological Sciences and Anthropology for class use each semester. Anthropological materials, particularly pottery, textiles, wood and stone artifacts, as well as skeletal material are loaned for use by classes in Southwestern archeology, ethnology, research methods, and comparative textile arts. The mammalogy collections are used by classes in mammalogy as the basis for laboratory studies, and reptiles from Museum collections are used in herpetology classes. Skeletal materials are loaned for use in mammalogy, herpetology, and comparative anatomy classes, and birds from Museum collections are loaned for use in ornithology classes.

Curators also identify materials for students, and, as more often is the case, introduce students to the collections so that they can learn to identify the material themselves.

Specimens from all Museum sections are loaned for student research projects ranging from term papers to Ph.D. theses.

3. Museum Exhibits. The Museum's exhibits in the Museum building are an integral part of the instructional program at the University. Introductory classes in biological sciences and earth sciences study exhibits in the Halls

of Life and Earth as a part of regular assignments. Field Botany classes use the ecology exhibits as guides in their study of habitat development. The introductory physical sciences course requires study of exhibits in the Hall of Earth, and the students in Mountain Geography and Primitive Arts and Industries are regular visitors to the Museum as a part of their classwork. Other classes use the Museum exhibits in their assignments as well.

4. Direct Teaching. The Curators teach courses in their specialties in related teaching departments as well as direct independent study projects and graduate theses.

5. Special Teaching. The Museum faculty performs special teaching services such as giving lectures in courses directed by their colleagues in related departments and providing demonstrations in special museum techniques. For example, the Curator of Geology lectures in geology and anthropology classes, giving information about the collections -- methods of obtaining material, preparation, identification and cataloguing. The Instructor in Museum Techniques gives demonstrations of modeling and casting techniques for various media, and restoration and facsimile reproduction of fossils, coins, and archeological materials for classes in historical geology, paleobiology, jewelry design, and sculpture. A Museum technician demonstrates methods of preparation of mammal and bird study skins for mammalogy classes.

The Curators also conduct field trips for classes taught by their colleagues in related departments.

6. On-campus Research Use. Museum collections provide information for faculty and students on their research projects. For example, Professor David Coffey of the Chemistry Department is interested in developing structural formulas for the lichenic acids. The Herbarium is able to provide authentically determined material which can be used for his work and to verify the identity of specimens which he uses in his work. Professor Askell Löve of the Biology Department uses the Herbarium as a resource not only for the geographical distribution and variation patterns of the plants of the region, but he documents his chromosome count studies by specimens which he deposits in the Herbarium for future reference. Professor Erik Bonde and his students in their work on physiological plant ecology in the alpine have used the Herbarium for identification of materials and also for documentation purposes in their research.

Richard G. Baker of the Geological Sciences Department is not only utilizing the Herbarium for his studies of macrofossils in the Pleistocene deposits of Yellowstone Park and vicinity, but at the same time he is building for the Museum a reference seed collection of materials which are applicable to such studies. This seed collection, of course, can be made the basis of a general seed collection should the need arise. Dr. Estella Leopold of the United States Geological Survey, Federal Center, Denver, has utilized the Herbarium extensively during the past few years to obtain voucher material of pollen grains for their modern and fossil slide collection. Dr. Leopold and her assistants are broadening their program and have been analyzing and taking material of bryophyte spores in the event that these may be stratigraphically important. Dr. James B. Benedict of the Institute of Arctic and Alpine Research used the Herbarium as a basic resource for his glacier moraine dating studies in the Colorado Front Range, using lichenometric techniques.

7. Documentation of University Research. The Museum serves as the repository for thesis collections. All thesis collections of fossils made by students receiving Master's and Ph.D. degrees at the University are accessioned for permanent record in the Geology Section of the Museum. Other related departments are urged to deposit thesis or other documentary collections in the Museum for permanent safekeeping and availability. The Museum is the repository for mammal collections made by personnel of the University's Institute of Arctic and Alpine Research.

8. Cooperative Research. Curators take part in research participation programs of the Institute of Arctic and Alpine Research and research projects of other related departments.

The Curators serve as coordinators of research programs involving the Museum and related departments, thus freeing teaching faculty from the necessity of managing such programs as the University's Tunisian and Nubian Expeditions.

9. In-house Publications. Museum leaflets, extended labels, and guidebooks written by Museum staff serve as text resources and they supplement exhibits in the Museum's Halls.

10. The Technical Training Program. The technical training program designed to provide training in all aspects of museum and exhibit techniques is described in the section on museology.

In the State of Colorado

1. Traveling exhibits. Traveling exhibits of Colorado birds and mammals are a well-developed phase of our service for area school systems. These exhibits are mounted in portable exhibit cases so that there is negligible danger to the specimens.

2. Public Lectures. Public lectures by the faculty serve to extend the University to the immediate environs of the campus (the Museum Summer Lecture Series is in its 13th consecutive year) and to the State at large. Lectures are given through the University Extension Division and by other arrangements and are dovetailed into field work in areas where contact with Museum faculty is desired. Visitations are made to Colorado junior colleges, and field trips are led by Museum faculty in connection with courses in progress there. A special short course in grass identification held at Western State College, Gunnison, attracted not only students but Forest Service personnel as well. At the request of the University of Colorado School of Medicine, a short course in allergenic plants has been given by the Curator of Botany.

3. Tours. The Museum staff gives guided tours through the Museum for elementary and secondary school classes. In addition, the area's public schools schedule unguided class visits to the Museum, and hardly a week goes by during the year without at least one such visit.

Classes from Metropolitan State College in Denver as well as Brownie, Girl Scout, Blue Bird, Boy and Cub Scout troops, science clubs and other groups visit the Museum throughout the year.

4. Identification of Specimens. Identification of specimens and artifacts is a continuous service. Identifications of plants are requested for medical and legal purposes (poisonous plants, hay-fever allergens, edible plants) as well as for other scientific, hobby and gardening requirements. Human skeletal remains, fossil mammoths, insects, spiders, snakes, small mammals, and archeological remains are typical of the materials submitted for identification, a daily part of the Museum's services. The staffs of the Boulder Medical Center, the Denver Museum of Natural History, the Denver Botanical Garden, and other area organizations regularly request specimen identifications.

5. State Repository for Scientific Specimens. The Museum is the repository for all thesis collections of mammals made by students at Colorado State University in Fort Collins.

The Museum is the repository for natural history collections of other State institutions and museums which can no longer provide safekeeping for them. For example, the Colorado College Museum was disbanded in 1960 and the entire Aiken Collection of Colorado birds as well as the Warren Mammal Collection was transferred to the University of Colorado Museum. In 1929 the natural history collections of the Colorado State Historical Society were transferred to the University of Colorado Museum. The Denver Museum of Natural History has turned over to the University Museum its remaining collections of preserved animal specimens.

The Museum is a repository for gifts and bequests. Significant contributions to Museum collections have been made by State residents who seek a permanent home for their private collections. The McKenna collection of Oriental and European ivory carvings, snuff bottles, and a variety of other small objects; the Walker Van Riper collection of reptile photographs; the Roberts kodachrome collection of wildflowers (which the New York Botanical Garden is using for color plates in its Wildflowers of the United States, edited by H.W. Rickett); and the Donald Eff Butterfly collection are examples of gifts and bequests to the Museum by area residents.

6. Off-Campus Exhibits. In addition to exhibits located on the campus, the Museum maintains exhibits for interpretation of specimens to the general public in the windows of downtown Boulder buildings. The National State Bank, on a continuing basis, and occasionally the Tri State Finance Company make exhibit space available for Museum displays. Exhibits in these locations have included jewelry from around the world; a pottery vessel retrieved from the Aegean Sea, demonstrating archeological salvage and restoration techniques; description and materials of the University's Nubian Expedition; an exhibit describing how mollusks vary and how they affect our lives; masks of North American Indians; Navajo silversmithing tools; and bead and quill work of Plains Indians, among others.

7. Conservation Programs. The Museum is active in conservation programs in Colorado furnishing professional advice regarding natural areas and resources. It has been instrumental in establishing the Summit Lake, Mount Evans, Natural History Landmark. It is also called upon to perform salvage operations in archeology and paleontology.

8. Public Relations. Significant good-will for the University is generated with educators, students, ranchers, and townspeople in the State through Curator and staff contacts.

In the United States

1. Exchanges and Loans. The Museum is a significant source of information and collections for other institutions through its exchange and loan programs. Requests for loans from throughout the U.S. and abroad are received regularly.

2. Visiting Scholars. The Museum is a resource for scholars from other institutions directly, providing opportunity for residence in the departments as NSF Postdoctoral Fellows or Visiting Curators, and acting as host for scholars on short-term research study visits.

3. National Collections. The Herbarium acts as the repository for the lichen herbarium belonging to the American Bryological Society. This represents a collection on indefinite loan from the Society, and the Curator is responsible for maintaining it and making it available on loan to research workers.

4. Identification Services. Identification of specimens is an important part of our service in the United States because of our specialists. For example, in the taxonomy of crustose lichens, we provide one of the few such resources in the country, and provide identification for graduate students and research workers for whom lichenology is a major or peripheral portion of their projects. This is particularly vital for ecologists, but we have had requests from geologists (desert varnish problems) and the National Aeronautics and Space Administration (simulated moon environment work). Identification requests for fossils, human artifacts, insects, plant diseases, possible poisonous plants, weeds, snakes, etc., are a part of the daily routine.

Requests for information about the natural history of the Rocky Mountain area are also received.

5. Meetings. The Museum hosts national meetings of museum organizations, and often assists in planning for more general scientific meetings held at the University. Most recently, the Museum was host to the 15th Annual Mountain-Plains Museums Conference held September 5-7, 1968. Eighty-nine persons representing 57 museums from 11 states, the American Museum of Natural History in New York, and the American Association of Museums in Washington, D.C., attended the three-day conference.

In the Spring of 1970 the Conference of Directors of Systematic Collections is expected to meet at the Museum. In 1971 the Museum will host the Association of Science Museum Directors, preceding the national meetings of the American Association of Museums in Denver.

The Museum is host to field conferences in fields related to its endeavors. In August 1968 the Museum sponsored the Conference on High Altitude and Mountain Basin Deposits of Miocene Age in Wyoming and Colorado. This conference is briefly described in the section on the Geology Section of the Museum page 74.

6. Traveling Exhibits. Certain Museum collections, such as the Ida Hrubesky Pemberton Plant Portraits and the SuZan Noguchi Swain Insect Portraits have long been available as traveling exhibits under the Museum's auspices as well as those of the Smithsonian Institution, under whose direction the exhibits have been shown from coast to coast, and in Canada.

7. Professional Services. The Curators serve on evaluation boards for panels, such as NSF, and on governing boards, or as officers, of national organizations.

Internationally

The Curators of the Museum maintain strong contacts with their scientific colleagues throughout the world. Foreign exchanges and loans as well as international organizations and meetings are supported just as are comparable domestic activities. NSF Senior Foreign Scientists and other scholars make use of the Museum's resources just as do U.S. scientists. Examples to show the kind of participation in which the Museum is involved internationally are given below. This is not nor is it intended to be a complete statement of the Museum's international affiliations.

Research

In 1957-58 the Curator of Botany worked in the Naturhistoriska Riksmuseum in Stockholm as an NSF Senior Postdoctoral Fellow studying the lichen flora of alpine, arctic, and desert regions. While there he made study visits to Oslo, Helsinki, Lund, and the British Museum and gave public lectures to the Swedish Botanical Society, the Botanical Society of Lund, and at the University of Helsinki and the Universities of Edinburgh, Glasgow, and St. Andrews on topics in lichenology and plant geography.

In 1964 at the invitation of the Charles Darwin Foundation Dr. Weber participated in the Galapagos International Scientific Project as lichenologist-bryologist for the expedition. The results were published in the symposium volume The Galapagos, published by the University of California Press at Berkeley.

On the invitation of the Australian National University, Dr. Weber spent the 1967-68 year in Australia, cooperating with Professor Donald McVean in studies of the vegetation of high-altitude Australia and Australian New Guinea. The Australian National University awarded him a fellowship which provided transportation and field support, and the University of Colorado Council on Research and Creative Work awarded a Faculty Fellowship which provided replacement funds for an Acting Curator of Botany during Dr. Weber's absence. The Museum was thus able to invite Dr. Olaf Rønning of Trondheim Museum, Norway, to the University for the year. During his stay here Dr. Rønning taught a course in Arctic-Alpine Ecology and Phytogeography for the Department of Biology, gave several seminars on arctic ecology, and cooperated with scientists of the Institute of Arctic and Alpine Research in their studies of the relationship between permafrost and vegetation at the Niwot Ridge field station. Dr. Rønning also used the Herbarium to continue his research on Svalbard botany, the genus Rorippa in the Rocky Mountains, and the ecology of arctic plants. He completed a preliminary manuscript on the genus Rorippa and continued work on one on the ecology of arctic plants.

Thus, by his tenure in the Museum, Dr. Rønning contributed to the graduate program of the Department of Biology, the research activities of the Institute of Arctic and Alpine Research, and was able to collect new specimens for his own institution in Norway as well as to complete some of his own research projects and manuscripts using Herbarium collections. All this was in addition to the normal curatorship of the Herbarium.

Dr. Weber was able to assist Australian botanists in their problems concerning cryptogams and make extensive collections for the University of Colorado Museum during his research year in Australia. Part of the material collected is being used in the exchange program described later in this section.

In 1962 the Museum and the Department of Anthropology jointly undertook salvage operations in the Sudan as part of the international program in the area being flooded by the lake of Aswan Dam. A large number of specimens ranging in time from some 40,000 years ago to ca. A.D. 1200 have been excavated. Chipped implements of paleolithic and mesolithic age, and later materials such as pottery vessels, sherds from various periods, beads and other ornaments, textile fragments, various minerals, stone objects, and large series of skeletons and other physical anthropology specimens are among materials recovered. Study of these specimens has resulted in publications by Dr. Gordon W. Hewes, Mrs. Robert Lister, Mr. Henry T.J. Irwin and others describing the excavations and their significance.

In 1966 a 30-day survey of archeological sites in Tunisia opened another area to long-range study and in 1967 investigation of the Mousterian cultural tradition and its environmental setting in Tunisia was begun by Museum, Department of Anthropology, and Department of Geological Sciences personnel. Work was transferred to Nigeria during the 1967-68 field season due to the Arab-Israeli war. The 1968-69 season has just been completed in Nigeria.

Paleontological excavations are underway by the Museum in cooperation with the University of Helsinki, the University of Barcelona, and the Geological Survey of Tunisia. Information resulting from these excavations indicates that a significant local change in ecology, from grassland to forest, occurred during the late Miocene-early Pliocene epochs. New distributional information about many taxa of fossil mammals has also been accumulated.

Studies of soil samples taken by expedition personnel reveal kaolinite to be a major clay mineral in all Tunisian soils. This fact may have important implications regarding Pleistocene climates and further study of bedrock samples is underway.

Completion of archeological, paleontological and geological studies in the Sudan and Tunisia by Museum and other University personnel is expected to increase significantly the understanding of climate, fauna, and ecology of the Miocene, Pliocene, and Pleistocene as well as to clarify cultural development during the Middle Paleolithic in this part of Africa. The projects have provided research materials for several master's and doctoral theses for students at the University of Colorado as well as for in-depth studies by Museum faculty members. The exchange program with the Sabadell Museum in Spain is a direct result of contacts established during the Nubian-Tunisian expedition.

Foreign Visitors to the Museum

The stature of the Museum's collections has attracted numerous research workers, who, whether coming to the University under the direct auspices of the Museum or through arrangements in departments or institutes, have spent considerable time in the Museum working on their research. The following is a partial list of foreign specialists who have visited the Museum to study collections during the past eight years.

Name	Affiliation	Research Problem
Dr. Teuvo Ahti	University of Helsinki	Taxonomy of the lichen genus <u>Cladonia</u>
Dr. D.D. Awasthi	University of Lucknow	Lichens of India
Dr. Bernard Boivin	Institute Botanique, Ministry of Agriculture, Ottawa, Canada	Studies of <u>Lycopodium</u>
Professor Francois Bordes	Laboratoire d'Prehistoire, Bordeaux University, France	Lithic technology; survey of Paleo-Indian sites
Professor Percy M. Butler	University of London	Research in vertebrate paleontology
*Professor Eilif Dahl	Agricultural College, Vollebekk, Norway	Taxonomy, ecology, and plant geography of tundra plants
Dr. Hans de Bruijn	University of Utrecht	Fossil rodents of Europe
Mr. Edet Essang	Benin Museum, Benin, Nigeria	Use of anthropological materials in museum exhibits
Dr. Ann-Marie Forstén	University of Helsinki	Fossil horses
Mr. Don Gregg	Canterbury Museum, Christchurch, New Zealand	Volcanic rocks
Dr. Genevieve Guichard	Musée, Les Eyzies, France	Technology of paleolithic instruments
Dr. Jean Guichard	Musée, Les Eyzies, France	Technology of paleolithic instruments
Dr. Rene Hantke	Department of Geology, Eidg. Tech. Hochschule, Zurich, Switzerland	Palynological studies in modern and Tertiary floras of America and Europe
Dr. Dirk Hellenius	Royal Museum of Amsterdam, Holland	Plains herpetological fauna
Dr. Aino Henssen	University of Marburg, West Germany	Taxonomy of lichen families Ephebaceae and Lichinaceae

Name	Affiliation	Research Problem
Dr. Dirk Hooijer	Rijksmuseum, Leiden, Holland	Research in vertebrate paleontology
Professor Eric Hultén	Riksmuseum, Stockholm, Sweden	Studies of distribution and taxonomy of the Circumpolar Flora
Dr. Kuldip R. Khanna	National Botanical Garden, Lucknow	Cytological studies on Rocky Mountain mosses
Dr. Ilkka Kukkonen	University of Turku, Finland	Parasitic fungi of the northern regions
Dr. Donald McVean	Australian National University, Canberra	Lichens and bryophytes of New Guinea and Australia
Mr. Nathaniel Mudoga	Ministry of Natural Resources, Nairobi, Kenya	Nubian Archeological Expedition materials
Dr. William Mullenders	University of Louvain, Belgium	Pollen morphology of Rocky Mountain plants
Dr. Yoshihisa Ohta	Fukuoka University, Japan	Cretaceous mollusks
Dr. John Packer	University of Alberta, Edmonton, Canada	Cytological studies of the boreal flora
Dr. Roland Paepe	Service Geologique, Brussels, Belgium	Environmental studies of paleolithic time; history of the Nile River Valley
Dr. Herman Persson	Riksmuseum, Stockholm, Sweden	Studies on the bryophytes of Alaska. (See bibliography, Persson and Weber, Bryophytes of Mt. McKinley National Park)
Dr. J.A. Rattenbury	University of Auckland, New Zealand	Studies of natural hybrids in plants
Dr. Olaf Rønning	Trondheim Museum, Norway	(Acting Curator of Herbarium 1967-68) Ecology of arctic and alpine phanerogams; studies of the genus <u>Rorippa</u>
Dr. Rolf Santesson	University of Uppsala	Joint studies, with Curator, of the lichens of southern California

Name	Affiliation	Research Problem
Mr. Charles Sekintu	Director, Uganda Museum, Kampala, Uganda	Use of anthropological materials in museum exhibits
Dr. Norman Tindale	South Australia Museum, Adelaide, Australia	Lithic studies of tools, particularly mastic materials; fossil insects
*Dr. Antero Vaarama	University of Turku, Finland	Taxonomic and cytological investigation on Rocky Mountain bryophytes

*NSF Senior Foreign Scientists who came to the University of Colorado in part because of the Museum's Herbarium facility.

Exchange Program

Through the medium of exchange of duplicate specimens the Museum is able to provide more cosmopolitan comparison material for study and research than otherwise would be possible.

During the past five years the Geology Section of the Museum has engaged in an intensive exchange program with the following institutions abroad:

The University of Witwatersrand, Johannesburg, South Africa

The University of Lyon, France

The University of Ferrara, Italy

The Sabadell Museum near Barcelona, Spain.

As a result the Museum has acquired excellent material of mammal-like reptiles and small Pleistocene mammals from Africa; Oligocene and Miocene mammals from France; Pleistocene material from Italy; and Oligocene, Miocene, Pliocene, and Pleistocene specimens from Spain.

The Herbarium carries on active exchanges with over 100 institutions including most of the major herbaria in the world. In this way institutions receive material of interest to them and are made aware of interests common to both them and ourselves. The following is a list of foreign institutions with which exchanges are in progress. Additional private individuals are also sent exchange specimens.

Fundacion Miguel Lillo, Tucuman, Argentina

Commonwealth Scientific and Industrial Organization, Plant

Industry Herbarium, Canberra, Australia

National Herbarium of Victoria, South Yarra, Victoria, Australia

Royal Botanic Gardens and National Herbarium, Sydney, New South

Wales, Australia

Naturhistorisches Museum, Vienna, Austria

Institute de Morphologie Végétale, Cryptogamie, Liege, Belgium

University of Alberta, Calgary, Canada

Montreal Botanical Garden, Montreal, Canada

National Research Council, Atlantic Regional Laboratory, Halifax,

Nova Scotia, Canada

Plant Research Institute, Ottawa, Canada

National Museum of Canada, Ottawa, Canada

University of Saskatchewan, Saskatoon, Canada

University of Sherbrooke, Sherbrooke, Quebec, Canada

University of Toronto, Toronto, Canada

University of British Columbia, Vancouver, B.C., Canada

Slovak National Museum, Bratislava, Czechoslovakia

Moravského Museo v Brne, Brno, Czechoslovakia

Czechoslovakian Academy of Science, Brno, Czechoslovakia

Narodné Muzeum v Praze, Prague, Czechoslovakia

Botanical Institute, University of Aarhus, Denmark

Botanical Museum, University of Copenhagen, Denmark

British Museum (Natural History), London, England
 Botanical Museum, University of Helsinki, Finland
 University of Oulu, Oulu, Finland
 Kuopio Museum, Kuopio, Finland
 University of Turku, Turku, Finland
 Université de Rennes, Rennes, France
 Botanisches Garten und Museum, Berlin-Dahlem
 Botanische Staatssammlung, München, West Germany
 University College, Galway, Ireland
 University of Tel-Aviv, Israel
 Hattori Botanical Laboratory, Nichinan, Japan
 National Science Museum, Tokyo, Japan
 Instituto de Biología, Mexico City, Mexico
 Rijksherbarium, Leiden, Netherlands
 University of Otago, Dunedin, New Zealand
 University of Bergen, Bergen, Norway
 Botanical Museum, University of Oslo, Oslo, Norway
 University of Krakow, Krakow, Poland
 Universidad de Lisboa, Lisbon, Portugal
 Royal Botanical Gardens, Edinburgh, Scotland
 Institute for Systematic Botany, University of Göteborg,
 Göteborg, Sweden
 Botanical Museum, University of Lund, Lund, Sweden
 Naturhistoriska Riksmuseet, Stockholm, Sweden
 Institute for Systematic Botany, University of Uppsala, Uppsala,
 Sweden
 Conservatoire et Jardin Botanique, Geneva, Switzerland
 Botanical Institute, Akad. Nauk Kazakhstan SSR, Alma Ata,
 Kazakhstan, U.S.S.R.
 Komarov Botanical Institute, Leningrad, U.S.S.R.
 Botanic Garden, University of Moscow, Moscow, U.S.S.R.
 National Museum of Wales, Cardiff, Wales

The Herbarium also helps foreign botanists in several other ways: it pays the annual dues to the American Bryological Society for a Czech botanist and receives in exchange collections of bryophytes not otherwise available. The Herbarium also sends bryological books to a scholar in Kazakhstan and receives in return difficult-to-obtain literature from the local Akademia Nauk.

In addition to exchange of specimens each Museum Section has an exchange program for reprints. By distributing copies of Museum faculty publications to interested colleagues and institutions abroad, the Museum receives in exchange publications of foreign scientists which would be too expensive to acquire through purchase. The reprint collections are basic research tools for faculty, students, and other scholars who use Museum collections.

Information on techniques of making facsimile reproductions of artifacts, coins, and fossils has been distributed to institutions abroad upon request as have photographs and other information on specific exhibits on display in the Museum.

During travel abroad to meetings or on expeditions Museum personnel visit their foreign colleagues and establish contacts for additional exchange programs.

Professional International Meetings and Organizations

International Botanical Congress

The Curator of the Herbarium has been active in these meetings for many years. For example, in 1959 he was co-leader of the Canadian Rocky Mountain Field Trip for the 9th International Botanical Congress and participated in the Arctic Excursion of the Congress. In 1969 he is the leader of a 23-day field trip (August 1-23) for participants in the 11th International Botanical Congress. This field trip is the most extensive of the entire Congress meeting and will give participants a view in depth of the vegetation of the southwestern United States. The schedule of stops includes Mount Evans, Gothic, Mesa Verde National Park, Monument Valley, Grand Canyon (North and South rims), Zion National Park, the ancient bristlecone pine colony in the White Mountains of California, Yosemite National Park, Golden Gate Park in San Francisco, Redwood National Park, Crater Lake, and the Columbia River Gorge. There will be 42 participants on the field trip. In preparation for this trip Dr. Weber is writing a trip log for use by participants and for the Congress' proceedings which will then be available to other interested persons.

International Association for Quaternary Research

The VIIth International Congress of this organization was held at the University of Colorado in August 1965. The Curator of Anthropology served on the local arrangements committee and was in charge of all exhibits, both commercial and non-commercial, for the meeting. He also organized and chaired the symposium on Nile Valley Archeology.

The Curator of the Herbarium wrote the chapter "Plant Geography in the Southern Rocky Mountains" for the Quaternary of the United States; A review volume for the VII Congress of the International Association for Quaternary Research, edited by H.E. Wright, Jr. and David G. Frey. In addition he led the field trip to Mount Evans and was one of the leaders of the Northern Rocky Mountains field trip.

Professor Robinson, Curator of Geology, led a one-day field trip to Middle Park, Colorado to show visitors fossil-bearing beds of Miocene age.

International Council of Museums

The International Council of Museums (ICOM) is a professional organization created in 1946 to facilitate museum cooperation and exchange of ideas and information throughout the world. It works in close collaboration with UNESCO from which it receives financial support. National committees of ICOM have been established in the following 42 countries:

Australia	Denmark	Japan	Portugal
Austria	Ecuador	Lebanon	Spain
Belgium	Egypt	Mexico	Sweden
Bolivia	Finland	Netherlands	Switzerland
Brazil	France	New Zealand	Syria
Canada	Germany	Norway	Thailand
Ceylon	Greece	Pakistan	Turkey
Columbia	Haiti	Peru	Union of S. Africa
Cuba	India	Philippines	United Kingdom
Czechoslovakia	Iraq	Poland	United States of America
	Italy		Yugoslavia

International committees of ICOM have special functions and responsibilities. The Director of the University of Colorado Museum has been a member of the United States Committee of ICOM since its inception in 1952 and Treasurer since 1959. The Director is also Vice President of ICOM International Committee No. 2, the Committee on Natural History Museums. This committee is currently compiling an International Directory of Natural History Museums. Correspondence and manuscript preparation for the Directory are being carried forward by the University of Colorado Museum. The Directory is expected to be published in the near future.

A General Conference is held every three years, to which all members and others interested in the organization's work are invited. The main business of this Triennial Conference of ICOM is to assess the achievements of different countries in the field of museum knowledge and activities. The most recent of these Conferences was held in Germany during July and August 1968. At this 8th General Conference, Dr. Rodeck gave an invited paper on "University Museums."

These meetings provide opportunities for personal contact with many foreign scientists and museologists who, through this means, have been introduced to the Museum and its collections.

Museology Program

The Museum's Technical Training Program is known abroad, and a number of students from foreign countries have enrolled in the course. Upon completion of their studies these students return to their own country to continue the professional development of museums and the preservation of the cultural heritage of their people. One such student from Nairobi has just completed writing Kenya's Antiquities Act and will become head of the newly-created Antiquities Department in that country's government. Another student, from Uganda, was sent by his government to learn professional museum techniques; upon return to his country he became Director of the Uganda Museum at Kampala.

During 1968-69 the Tanzanian government, in cooperation with the U.S. Departments of State, Interior, and Agriculture and the University of Colorado Museum, sent one of its game wardens to the United States for on-the-job training in park and wildlife conservation and management, and museum techniques. Upon his return to Tanzania, this individual will join the faculty of the College of African Wildlife Management at Mweka to provide training to his fellow countrymen for positions in these fields.

Museologists from abroad visit this museum to observe the Technical Training Program and the academic museology program in operation. Just recently Dr. S.M. Nair of the Department of Museology at the University of Baroda, India, was here for this purpose and to discuss his publication series, Studies in Museology. The museology program at Baroda has been patterned in part after the program here at the University of Colorado Museum. Over the years the University of Colorado Museum has assisted many museums and educational institutions in the setting up of their own museology training programs.

Thus the University of Colorado Museum not only assists foreign countries in developing more effective use of their educational, manpower, and wild-life resources but also encourages the preservation, exhibition, and study of their culture's tangible materials in their own countries.

GEOLOGY SECTION

Historical Development

The first Curator of the Museum, Junius Henderson, who was a member of the University Museum faculty from 1902 to 1933, became a paleontologist early in his Museum career. Although the Section as such was not then established, the collections of geological importance began through his interests and with the assistance of Russell D. George, Head of the Department of Geology, other faculty members, and students. From 1933 until 1961 there was no full-time Curator of Geology in the Museum. However, a number of University of Colorado geologists on the faculty of the Department of Geological Sciences, such as John Clark, Robert Wilson, John Chronic, and Don Eicher, have contributed to the collections over the years and have been associated with the Museum as Associate Curators.

In 1961 the present Curator, Dr. Peter Robinson, joined the Museum faculty. The addition of a full-time geologist has resulted in significant increase in Museum holdings, particularly vertebrate fossils. Subsequent to Dr. Robinson's arrival, scientists in other institutions were added to the faculty of the Museum as Associates, and they have contributed significantly to the collections. Dr. Malcolm McKenna has contributed great quantities of late Cretaceous and early Cenozoic materials, and Dr. E.C. Galbreath has contributed a large portion of his career collection of Oligocene fossils.

Research activities since 1961 have included the Cretaceous foraminifera studies of Dr. Eicher and his students, which have resulted in clarification of the changes in marine ecology which took place in the western interior seaway then in existence; and Dr. Robinson's studies of Tertiary microfauna, particularly in Miocene deposits, of the Western Great Plains and the Rocky Mountain basins. These studies have demonstrated that Tertiary deposits in some of the montane basins are unique in their animal species and that the animals must have evolved for some time in isolation from their close relatives. Other research, on Tunisian Tertiary deposits, has been carried on by the Curator and Associated faculty of the Geology Section.

Continuing support for Museum-sponsored research programs has been forthcoming from both non-University and University sources. The National

Science Foundation provided \$7000 in 1962 for a study on the evolution of fossil tortoises. The Council on Research and Creative Work of the University of Colorado has provided seven grants totaling \$6779 over the past seven years for research on Tertiary mammals. The Smithsonian Institution has awarded four grants totaling \$53,639 through the Public Law 480 program for geological and paleontological research on Tertiary mammals in Tunisia, and additional joint grants include archeological excavation in Tunisia.

In August 1968 the Museum sponsored a Conference on High Altitude and Mountain Basin Deposits of Miocene Age in Wyoming and Colorado. This Conference was organized by the Curator, Dr. Peter Robinson; Dr. Craig Black of the Carnegie Museum, and Dr. Malcolm McKenna of the American Museum of Natural History, both University of Colorado Museum Associates; and was supported by the Faculty Improvement Fund of the University of Colorado. The Conference was well attended and brought together scientists from throughout the United States and England who are working on problems in Miocene age deposits in Wyoming and Colorado. The Conference provided the first opportunity for these scientists, who represented a variety of fields, to see and discuss current research problems of mutual concern.

Current Museum holdings in geology are as follows:

	<u>No. Specimens</u>	<u>No. Catalogue Items</u>
Minerals, rocks	5,000	3,700
Paleobotany	5,000	2,000
Invertebrate fossils	330,000	20,000
Vertebrate fossils	<u>15,000</u>	<u>15,000</u>
Total	355,000	40,700

Importance of Collections

The geological collections of the Museum cover four areas: mineralogy and petrology, paleobotany, invertebrate paleontology, and vertebrate paleontology.

The mineral collection was based on the very early acquisition of the Guggenheim Collection of more than a thousand specimens. It now includes a good representation for Colorado and some material from scattered localities throughout the world. The Museum does not have a mineralogist on its staff and recent improvement of the mineral collection has come primarily through the efforts of Mr. David Seaman. Over the years Mr. Seaman has donated almost 500 specimens of his career collection to the Museum. These specimens have all been of fine quality.

The petrology collection is poor in coverage and quality.

Holdings in paleobotany, while few in number, are important for Colorado and consist of Eocene material from the Green River formation and Oligocene material from Creede and Florissant, Colorado.

The invertebrate fossil holdings from the Rocky Mountain area are excellent, being one of the best regional coverages in any museum in the world. The mollusk material is particularly strong. Since 1958 significant, stratigraphically important Rocky Mountain and western United States foraminifer specimens have been acquired through the research activities of Dr. Don Eicher of the Department of Geological Sciences and his graduate students.

In vertebrate fossil holdings, the Museum rates about 15th in university collections and 20th in the United States generally in volume and quality of material. The Tertiary microfauna collection is excellent and the Miocene small vertebrate material is possibly the best in North America. Tertiary collections have been augmented by donation of a significant portion of the career collection of Dr. Edwin C. Galbreath, a geologist at Southern Illinois University who has done most of his research on northeastern Colorado deposits.

The Museum also has 500 fossil holotypes, mostly insects and plants of Oligocene age from Florissant, Colorado.

Improvement in the collections of the Geology Section has meant that numerous scientists from outside the University of Colorado and from overseas have come here for research on particular fossil groups. These visits last from less than one day to as much as a year. The greater number of these scholars are vertebrate paleontologists. Some recent regular visitors to the Museum are: Dr. Craig Black, of the Carnegie Museum; Dr. Mary Dawson, Carnegie Museum; Dr. E.C. Galbreath, Southern Illinois University; Dr. G. Edward Lewis from the United States Geological Survey; Dr. Paul McGrew of the University of Wyoming; and Dr. Malcolm McKenna, American Museum of Natural History.

Foreign visitors include Professor Percy Butler of the University of London; Dr. Hans Debruijn of the University of Utrecht; Mr. Don Gregg of the Canterbury Museum, Christchurch, New Zealand; Dr. Yoshihisa Ohta, Fukuoka University, Fukuoka, Japan, who spent a full year here studying Cretaceous mollusks; and Dr. Ann Forstén of the University of Helsinki, who as a Visiting Curator in the Museum during 1968-69, worked on fossil horses.

GEOLOGY SECTION PERSONNEL

Curator: Dr. Peter Robinson

Assistant: Jens Munthe

Associated Faculty:

Dr. John Chronic, Associate Curator of Invertebrate
Paleontology

Dr. Don L. Eicher, Associate Curator of Micropaleontology

Dr. Craig Black, Associate in Vertebrate Paleontology

Dr. Mary Dawson, Associate in Vertebrate Paleontology

Dr. Malcolm McKenna, Associate in Vertebrate Paleontology

SECTION ACTIVITIES

Curator of Geology

Museum Assistant or equivalent

Process Material
Separate concentrate
from fossils
Catalogue specimens
Place specimens in
collection
Return used material to
collections
Research

Work-Study Students

Sort material by size
Separate fossils from
concentrate
Prepare fossils
Clerical work
Collect specimens

Curation of Collection

Accessions
Loans
Exchanges
Visitors: scientific, general
Public lectures, consultation
Identification of specimens
Care, maintenance of collections,
arrangement of collections
Correspondence
Extension Division travel, field
trips, lectures, consultation
Monthly reports
Publication: guides, leaflets
Supervision of assistants and
Work-Study students
Exhibits development: department,
Museum
Annual report to Director

Professional Activities

Meetings
Attendance
Officer positions
Committee service
Professional papers
Field conferences

Grants Proposals

Preparation
Reports
Financial records

Research

Travel, collecting
Reading
Publication

Other University Responsibilities

Teaching: courses, graduate thesis
direction; independent study
Committees
Faculty, staff meetings
Annual Faculty Service Report

GEOLOGY SECTION COLLECTIONS

Mineralogy
and
Petrology
(5,000 specimens,
3,700 accessions)

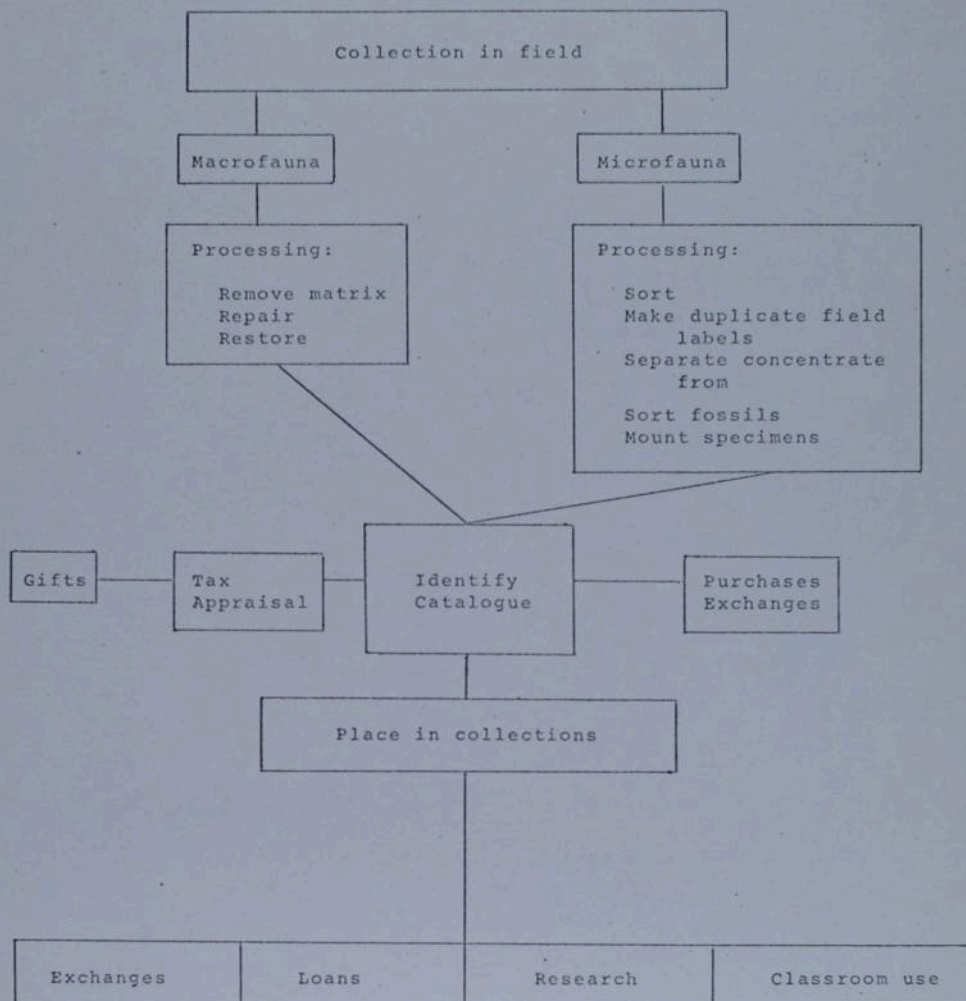
Reprints
(9,000
accessions)

Paleobotany
(5,000 specimens,
2,000 accessions)

Vertebrate
Paleontology
(15,000 specimens
and accessions)

Invertebrate
Paleontology
(330,000 specimens,
20,000 accessions)

Flow Chart for Vertebrate Fossil Specimens



BOTANY SECTION

Historical Development

The University of Colorado Herbarium originated in about 1890 with a collection of plants by Professor I.J. McFarland, mostly without accurate locality data, from "Boulder County." The first significant contribution to the Herbarium came in 1929 when the botanical collections of the State Historical Society in Denver were dispersed to the existing universities in Colorado. The University of Colorado asked for and received the valuable pioneer collections of Alice Eastwood who taught high school in Denver before moving to California where she became one of America's famous botanists. This early Eastwood collection is evidently a unicate set not represented elsewhere and contains many type specimens.

The Herbarium grew only slightly under the curatorship of Mr. Joseph A. Ewan (1937-1944), the most notable acquisition being the very fine collection of the genus Delphinium, upon which Ewan's monograph (1945) was based. Mr. Ewan, because the Herbarium at that time was not a part of the Museum and its future in considerable doubt, maintained a large private herbarium which he took with him when he left the University.

The Herbarium, although it has been housed by the University Museum since 1937, was until 1948 the property of the Department of Biology. Curatorship was a spare-time activity, depending upon the Curator's generosity in time and effort. The value in terms of continuous curatorship, budgetary support, safety, and availability of the collections, of the Herbarium in a central museum, was demonstrated to the Department of Biology by the present Curator, then a member of the Department's faculty, and in 1948, the Herbarium became part of the Museum, thereby rounding out its coverage to include all branches of natural history. At this time a collection documenting the ecological work of Professor Francis Ramaley and his students at the University of Colorado was incorporated into the new Herbarium of the Museum.

The phanerogamic herbarium has been developed and expanded first of all because of the need for development of local teaching tools in taxonomy which depend upon an exhaustive exploration of the region. The field program resulted in a mimeographed treatment of the flora of the Boulder area. This was later developed into the Handbook of Plants of the Colorado Front Range, editions 1 and 2. Recently this work was expanded to form the illustrated handbook, Rocky Mountain Flora. This text is used in colleges and universities as well as in amateur and professional studies for the region from northern New Mexico to southern Wyoming. Furthermore, the field program has attempted a thorough coverage of the Colorado flora inasmuch as during the historical period the type specimens and other important voucher specimens usually became part of large eastern herbaria. Because the Rocky Mountain flora lies on a pathway of plant migration involving the northern hemisphere in its larger aspect, particularly north and westward, special attention has been given to acquiring through field and exchange programs collections of arctic, northern European, and central Asiatic specimens.

The cryptogamic herbarium has been activated only within the past 15 years. A mycological herbarium, privately maintained by Dr. Paul Shope, was

salvaged from the hallways of the bacteriology building where it had gathered dust and dermestids for some years. It has been thoroughly renovated and now is in excellent condition. The bryophyte collections, begun in 1946 by Dr. Geneva Sayre as a graduate student at the University of Colorado, numbered about 2,000 specimens at that time and documents her unpublished thesis, The Moss Flora of Colorado. Since 1946 the collection and exchange programs have built this to a major bryophyte herbarium of over 30,000 specimens. The lichen herbarium was started in 1951 by the present Curator, and in the past decade has grown to be the fifth or sixth largest active collection on the continent. A small but adequate collection of myxomycetes has been accumulated by collection and by gifts from the New York Botanical Garden and the University of Iowa. Through purchases, the herbarium acquired the private herbaria of several French cryptogamists, namely Abbé F. Hy, Abbé Letacq, Eugene Ripart and E. Monguillon. The Ripart and Hy herbaria contain an important and rich collection of marine and fresh-water algae, including many type specimens.

The present Curator, Dr. William A. Weber, joined the faculty of the Department of Biology in 1946 as instructor, under the same relationship to the Museum as the previous Curator, carrying a full teaching load in the Department and performing Museum service in his spare time. In 1962 he joined the faculty of the Museum as Professor of Natural History on a full-time, fiscal year basis.

Research activities have stressed taxonomic and phytogeographic studies of lichens of western North America and support from the National Science Foundation has greatly aided this work. In addition, in 1962 NSF funds provided for modern storage cabinets for the phanerogam, fungi, and algae collections. During 1967-68 the Curator was on a Faculty Fellowship awarded by the University of Colorado for taxonomic and phytogeographic studies of cryptogams of Australia and New Guinea. Approximately 55,000 specimens, including duplicates, were collected.

Importance of the Collections

The Herbarium is now the most complete and comprehensive in the State of Colorado. Phanerogamic holdings are particularly strong in material from the American arctic, European arctic and alpine, with representative holdings from South America, Australia, and Central Asia. The Herbarium is among the top ten American cryptogamic herbaria and it has the finest collection of Colorado cryptogams in the world. It is the only comprehensive cryptogamic herbarium between St. Louis and the Pacific Coast. Coverage of mosses and lichens is world wide and of international significance. In addition to exsiccati sets, recent acquisitions to the Herbarium include collections made by the Curator during the last 12 years in the Galapagos, the American Arctic, the European alps, Scandinavia, Australia, and New Guinea.

Since 1960 over 52 papers have been published based on the Herbarium's collections. Authors include the Curator of the Herbarium, graduate students at the University of Colorado, faculty of this University and other institutions, and other scholars. In addition, fascicles 1-7 of Lichenes Exsiccati which contain 280 numbers totaling 16,800 specimens, have been distributed to 60 institutions and museums throughout the world.

Growth of the Herbarium collections is indicated below:

	1948	1958	1968
Phanerogams, ferns, and vascular cryptogams	52,000	90,000	127,000
Lichens	0	27,000	50,000
Bryophytes	2,000	12,000	30,000
Fungi	0	10,000	10,000
Algae	0	5,000	5,000
Myxomycetes	0	300	300
Total	54,000	144,300	222,300

Important Collections in the Herbarium

Phanerogam, Fern, and Vascular Cryptogam Collections

Early Colorado collections (unicates) of Alice Eastwood, circa 1890.

Early historic collections of Colorado plants from the herbarium of the Academy of Natural Sciences of Philadelphia.

Francis Ramaley Herbarium

Abbé Letacq Herbarium

Delphinium Herbarium of Joseph A. Ewan (monographer of the genus)

William A. Weber Herbarium, 1936-68 (including special collections in Compositae)

Exsiccati

- Plantae Pyreneennes (Zetterstedt)
- Flora Jutlandica Exsiccata (Copenhagen Museum)
- Plantae Vasculares Groenlandicae
- Plantae Exsiccati Polonicae
- Plantae Exsiccatae Grayanae
- Plantae Groenlandicae Exsiccatae
- Plantae Suecicae Exsiccatae (Samuelsson)
- Plantae Mexicanae (Pringle)

Lichen Collections

William A. Weber Herbarium, 1951-68

Lichen Herbarium of Abbé F. Hy, Anjou, France (major lichenologist)

Exsiccati

Abbeyes, Lichens Armorici Spectabiles
Almborn, Lichenes Africani
Clements, Crypt. Format. Coloradensium
Cummings, et al., Lichenes Boreali-Americani
Cummings, et al., Decades of N. Amer. Lichens
Elenkin, Lichenes Florae Rossiae et Regionum Confinium
Orientalium
Farlow, Reliquiae Farlowianae
Godron, Flora Cryptogamica Nanceiensis Exsiccata
Hale, Lichenes Americani Exsiccati
Havaas, Lichenes Norvegiae Occid. Exsiccati
Kryptogamae Exsiccatae Vindobonensis
Lojka, Lichenes Regni Hungarica
Magnusson, Lichenes Selecti Scand. Exsiccati
Malme, Lichenes Suecici Exsiccati
Mereschkowsky, Lichenes Rossiae Exsiccati
Merrill, Lichenes Exsiccati
Mougeot, Nestler et Schimper, Stirpes Cryptogamae Vogeso-
Rhenanae
Poelt, Lichenes Alpium
Rabenhorst, Lichenes Europaei Exsiccati
Räsänen, Lichenotheca Fennica
Savicz, Lichenotheca Rossica
Stenhammar, Lichenes Suecici Exsiccati
Suza, Lichenes Bohemoslovakiae Exsiccati
Tavares, Lichenes Lusitaniae Selectae Exsiccati
Thomson, Lichenes Wisconsinensis Exsiccati
Thomson, Lichenes Arctici
Tobolewski, Lichenotheca Polonica
Tuckerman, Reliquiae Tuckermanianae
Vezda, Lichenes Bohemoslovakiae Exsiccati
Vezda, Lichenes Selecti Exsiccati
Weber, Lichenes Exsiccati, Univ. Colorado

Bryophyte Collections

Bryophyte Herbaria of E. Monguillon, Geneva Sayre

Exsiccati

Allorge, Bryotheca Iberica
Allorge, Bryophyta Azorica
Grout, N. Amer. Musci Perfecti
Hattori, Hepaticae Japonicae Exsiccatae
Holzinger, Musci Acrocarpi Boreali-Americani
Kryptogamae Exsiccati Vindobonensis
Noguchi, Musci Japonici Exsiccatae
Schiffner, Hepaticae Europaeae Exsiccatae

Sullivant, N. Amer. Musci
Sullivant and Lesquereux, Musci Boreali-Americani
Hartmann, Bryaceae Scandinaviae Exsiccatae
Bauer, Musci Europaei Exsiccata
Sillén, Musci Suecicae
Bryophyta Danica Exsiccata

Fungi Collections

Mycological Herbarium of Paul Shope

Exsiccati

Bartholomew, Fungi Columbiani
Bonar, California Fungi
Clements, Cryptogamae Formationum Coloradensium
Ellis and Everhart, North American Fungi
Ellis, North American Fungi
Garrett, Fungi Utahenses
Seymour and Earle, Economic Fungi
Solheim, Mycoflora Saximontanensis Exsiccata
Sydow, Mycotheca Germanica
Kryptogamae Exsiccatae Vindobonensis

Algae Collections

Algal Herbarium of M. Ripart, France (major algologist)

Exsiccati

LeJolis, Algues Marines de Cherbourg
Rabenhorst, Algen Europas
Tilden, American Algae
Kryptogamae Exsiccatae Vindobonensis

BOTANY SECTION PERSONNEL

Curator: Dr. William A. Weber

Assistant: Mr. Charles Lawrence

Work-Study Student: Miss Rue Eich

Associated Faculty:

Mr. Henry S. Fleming, Associate Curator of Botany

Dr. Askeell Löve, Associate Curator of Phanerogams

Dr. Doris Löve, Associate Curator of Plant Geography

Dr. John W. Marr, Associate Curator of Ecology

Dr. David J. Rogers, Associate Curator of Botany

Mr. Dale Denham, Associate in Botany

Graduate Student Use of Collections

Below is given a partial listing of graduate students who in the past ten years have used Museum collections in their thesis or other research. This list is by no means complete and is intended to serve as an example of the use made of the collections in the graduate program of the University.

Name of Student	Thesis Title or Research Project	Thesis Advisor	Degree	Date of Degree
Ralph D. Amen	Germination and dormancy in two species of alpine <u>Carex</u> from the Colorado Front Range.	Erik Bonde	Ph.D.	1962
Clifford C. Amundsen	The subalpine forest of Wild Basin, Front Range, Colorado.	John Marr	Ph.D.	1967
Elaine Anderson	The mammalian fauna of Little Box Elder Cave, Converse County, Wyoming, with a special study of the Carnivora.	Hugo G. Rodeck	M.A.	1965
Roger Anderson	The lichen flora of the Dakota Sandstone in the northern Front Range foothills of Colorado.	Sam Shushan	M.A.	1962
Roger Anderson	The genus <u>Lecidea</u> (lichenized fungi) in Rocky Mountain National Park, Colorado.	William Weber	Ph.D.	1964
George J. Armelagos	Paleopathology of three archological populations from Sudanese Nubia.	A.J. Kelso	Ph.D.	1968
L. Clair Armin	A study of the family Carabidae (Coleoptera) of Boulder County, Colorado.	R.E. Gregg	Ph.D.	1963
Dharani D. Awasthi	Contributions to the lichen flora of India with special reference to micro-lichens.	William Weber	Ph.D.	1962

Name of Student	Thesis Title or Research Project	Thesis Advisor	Degree	Date of Degree
Gerald Baier	Research on Claypool Site excavations.	--	--	--
Richard Baker	Late Pleistocene pollen and seed diagrams from Yellowstone National Park.	William Bradley	Ph.D.	In prog.
Peter N. Bartlett	The energy budget of a lizard on a tree trunk.	T. Paul Maslin	M.A.	1966
Kathleen Beargie	Cranial anatomy of the teiid lizard <u>Cnemidophorus</u> .	T. Paul Maslin	Ph.D.	In prog.
Maynard C. Bowers	A cytotaxonomic study of the genus <u>Mnium</u> in Colorado.	William Weber	Ph.D.	1966
Richard Brooks	Archeological survey of the Chihuahua and Durango districts, Mexico.			
George Bryce	Ecology of Colorado mollusks with special reference to shell morphology.	Robert W. Pennak	Ph.D.	In prog.
William G. Buckles	Study of early neolithic site materials from Nubia.	--	--	--
Douglas Bucy	Lithic technology; casting of Olsen-Chubbuck Site materials.	--	--	--
James Campbell	Ecology and high altitude populations of <u>Bufo boreas boreas</u> in the Front Range of Colorado.	T. Paul Maslin	Ph.D.	In prog.
John Cruzan	Ecological distributions and interactions of four species of <u>Microtus</u> in Colorado.	Olwen Williams	Ph.D.	1968
Orlando Cuellar	Cytology of oogenesis in a triploid parthenogenetic teiid lizard.	T. Paul Maslin	Ph.D.	In prog.

Name of Student	Thesis Title or Research Project	Thesis Advisor	Degree	Date of Degree
Alvin Earle	The middle ear of the sand lizard.	T. Paul Maslin	Ph.D.	1962
Frank Eddy	Study of pottery design changes through time.	--	--	--
James A. Erdman	Ecology of the Pinyon-Juniper woodland of Wetherill Mesa, Mesa Verde National Park, Colorado.	John Marr	M.A.	1962
	Pinyon-Juniper succession after fires on residual soils of the Mesa Verde, Colorado.	John Marr	Ph.D.	1969
George Ewing	Physical anthropology of Nubian materials.	A.J. Kelso	Ph.D.	In prog.
Sue Fairer	Pueblo ethnographic materials.	--	--	--
Barbara Finney	Re-examination of small mammal populations in Moon Gulch, Gilpin County, Colorado.	Olwen Williams	M.A.	1962
	Small mammal populations in the Capitan Mountains, New Mexico.	Olwen Williams	Ph.D.	1966
E. Maxine Foreman	Growth and flowering in some arctic and alpine grasses.	Erik Bonde	Ph.D.	1969
Jean W. Foss	Study of Yellow Jacket, Colorado, materials.	--	--	--
Harold J. Grant, Jr.	A revision of the subfamily Batrachideinae (Orthoptera: Tettigoniidae).	R. E. Gregg	Ph.D.	1962
David L. Greene	Dentition and the taxonomy of Meroitic, X-Group and Christian populations from Wadi Halfa, Republic of the Sudan.	A.J. Kelso	Ph.D.	1965
Kathleen Greene	Study of textiles from Christian graves in Nubia.	--	--	--

Name of Student	Thesis Title or Research Project	Thesis Advisor	Degree	Date Degree
Neil Hadley	Microenvironmental factors influencing nesting sites of some Colorado subalpine Fringillidae.	Gordon Alexander	Ph.D.	1966
Diane K. Halleck	The biological status of <u>Claytonia rosea</u> .	Delbert Wiens	M.S.	1963
Dexter Hess	Ecological studies of the growth of ponderosa pine on the east slope of the Rocky Mountain Front Range in Boulder County, Colorado.	John Marr	Ph.D.	1959
Richard Holland	A comparative study of morphology and plasma proteins of the blood in the lizard species <u>Cnemidophorus tesselatus</u> Say - Reptilia Teiidae - from Colorado and New Mexico.	T. Paul Maslin	M.A.	1965
Hannah Huse	Classification of Southwestern pottery from the Earl Morris Collection.	--	--	--
Wilfred Husted	A proposed archeological chronology for Rocky Mountain National Park based on projectile points and pottery.	Robert Lister	M.A.	1962
Veryl Keen	A comparison of five <u>Peromyscus</u> populations in north central Colorado.	Olwen Williams	M.A.	1962
Garry Knopf	Reproductive behavior and ecology of the unisexual lizard, <u>Cnemidophorus tesselatus</u> Say.	T. Paul Maslin	Ph.D.	1966
Harry Robert Krear	An ecological and ethological study of the pika (<u>Ochotona princeps saxatilis</u> Bangs) in the Front Range of Colorado.	Margaret Altmann	Ph.D.	1965
Larry Leach	The archeology of Boundary Village	D. Breternitz	M.A.	1965

Name of Student	Thesis Title or Research Project	Thesis Advisor	Degree	Date of Degree
Kathryn E. Lichty	Small mammal populations in the San Juan Mountains of Colorado.	Olwen Williams	M.A.	1962
Clarence J. McCoy, Jr.	Life history and ecology of <u>Cnemidophorus tigris septentrionalis</u> .	T. Paul Maslin	Ph.D.	1965
M. Joan Michener	The high altitude vegetation of the Needle Mountains in southwestern Colorado.	William Weber	M.A.	1964
Philip C. Miller	Factors influencing the vegetation pattern on the White River Plateau in northwestern Colorado.	John Marr	Ph.D.	1964
Robert C. Mills	A study of near climax conditions in a spruce-fir ecosystem.	John Marr	M.S.	1962
Nathanial Mudoga	Research on Nubian materials and in exhibition technique and theory.	--	--	--
David Murray	Taxonomy of the southern Rocky Mountain Atratae, genus <u>Carex</u> , with comments on some related species in North America.	William Weber	Ph.D.	1966
Karl Robert Newman	Micropaleontology and stratigraphy of late Cretaceous and Paleocene formations, northwestern Colorado.	Don Eicher	Ph.D.	1961
William Osburn, Jr.	Ecology of winter snow-free areas of the alpine tundra of Niwot Ridge, Boulder County, Colorado.	John Marr	Ph.D.	1958
Markley W. Paddock	The food habits of the pika, <u>Ochotona princeps saxatilis</u> Bangs.	Olwen Williams	M.A.	1961

Name of Student	Thesis Title or Research Project	Thesis Advisor	Degree	Date of Degree
William Page	Late Pleistocene geology of Oued Akarit area, Tunisia.	William Bradley	Ph.D.	In prog.
Giorgio Pannella	Palynology of the Dakota group and Graneros shale of the Denver Basin.	Don Eicher	Ph.D.	1966
Lewis Pennock	A karyotype study of parthenogenetic species in the teiid lizard genus <i>Cnemidophorus</i> from southwestern United States.	T. Paul Maslin	Ph.D.	1966
Bruce Petersen	Pollination of some tundra plants with miniature flowers on Niwot Ridge in Boulder County, Colorado.	Hugo G. Rodeck	Ph.D.	1968
Robert W. Reese	Taxonomy and ecology of the tiger salamander (<i>Ambystoma tigrinum</i>) of Colorado.	T. Paul Maslin	Ph.D.	In prog.
92 Curtiss Schaafsma	Study of Olsen-Chubbuck Site material.	--	--	--
Pauline Schaafsma	Study of Olsen-Chubbuck Site material.	--	--	--
Ronald R. Schmoller	Ecology of alpine tundra Arachnida and Carabidae (Coleoptera) in Colorado.	Gordon Alexander	Ph.D.	1968
Diane Secoy	The myology of <i>Sceloporus clarki</i> <i>clarki</i> Baird and Girard (Reptilia: Iguanidae).	T. Paul Maslin	Ph.D.	1968
Donald A. Spencer	Porcupine population fluctuations in the past centuries revealed by dendrochronology.	Hugo G. Rodeck	Ph.D.	1958
Alan Swedlund	Human skeletal material from the Yellowjacket Canyon area, southwestern Colorado.	Alice Brues	M.A.	1969

Name of Student	Thesis Title or Research Project	Thesis Advisor	Degree	Date of Degree
Harry L. Taylor	Morphological variation in selected populations of the teiid lizards <u>Cnemidophorus velox</u> and <u>Cnemidophorus inornatus</u> .	T. Paul Maslin	M.A.	1965
Larry L. Tieszen	Photosynthetic adaptations to light intensity in arctic and alpine populations of <u>Deschampsia caespitosa</u> .	Erik Bonde	Ph.D.	1965
Donald Van Horn	Variations in populations of the grasshopper <u>Melanoplus dodgei</u> (Thomas) from the Front Range of Colorado.	Gordon Alexander	Ph.D.	1961
Eleanor N. Viereck	Small mammal populations in Mount McKinley National Park, Alaska.	Olwen Williams	Ph.D.	1959
63 Leslie Viereck	Plant succession and soil development on gravel outwash of the Muldrow Glacier, Alaska.	John Marr	Ph.D.	1962
James M. Walker	Morphological variation in the teiid lizard <u>Cnemidophorus gularis</u> .	T. Paul Maslin	Ph.D.	1966
Richard G. Walter	The vascular flora of the north end of South Park.	William Weber	M.A.	1963
George H. Waring	Sounds and communications of the yellow-bellied marmot.	Hugo G. Rodeck	M.A.	1964
Robert J. Werth	The ecology of four sympatric lizards.	T. Paul Maslin	Ph.D.	In prog.
Beatrice E. Willard	Phytosociology of the alpine tundra of Trail Ridge, Rocky Mountain National Park, Colorado.	John Marr	Ph.D.	1963
John Woods	Archeology of northeastern Colorado.	D. Breternitz	Ph.D.	In prog.

SECTION ACTIVITIES

Curator of Botany

Museum Assistant(s)

Accessions
Exchanges
Loans
Exsiccati preparation
Care, maintenance of collections
Monthly reports
Staff meetings

Work-Study Students

Accessions
Staff meetings

Curation of Herbarium Collections

Accessions
Loans
Exchanges
Exsiccati preparation
Teaching herbaria
Visitors: scientific, general
Public lectures, consultation
Identification of specimens
Care, maintenance, arrangement
of collections
Correspondence
Monthly reports
Publication: guides, leaflets
Annual report to Director
Supervise assistants and
students

Professional Activities

Meetings
Attendance
Officer positions
Committee service
Professional papers

Grant Proposals

Preparation
Reports
Financial records

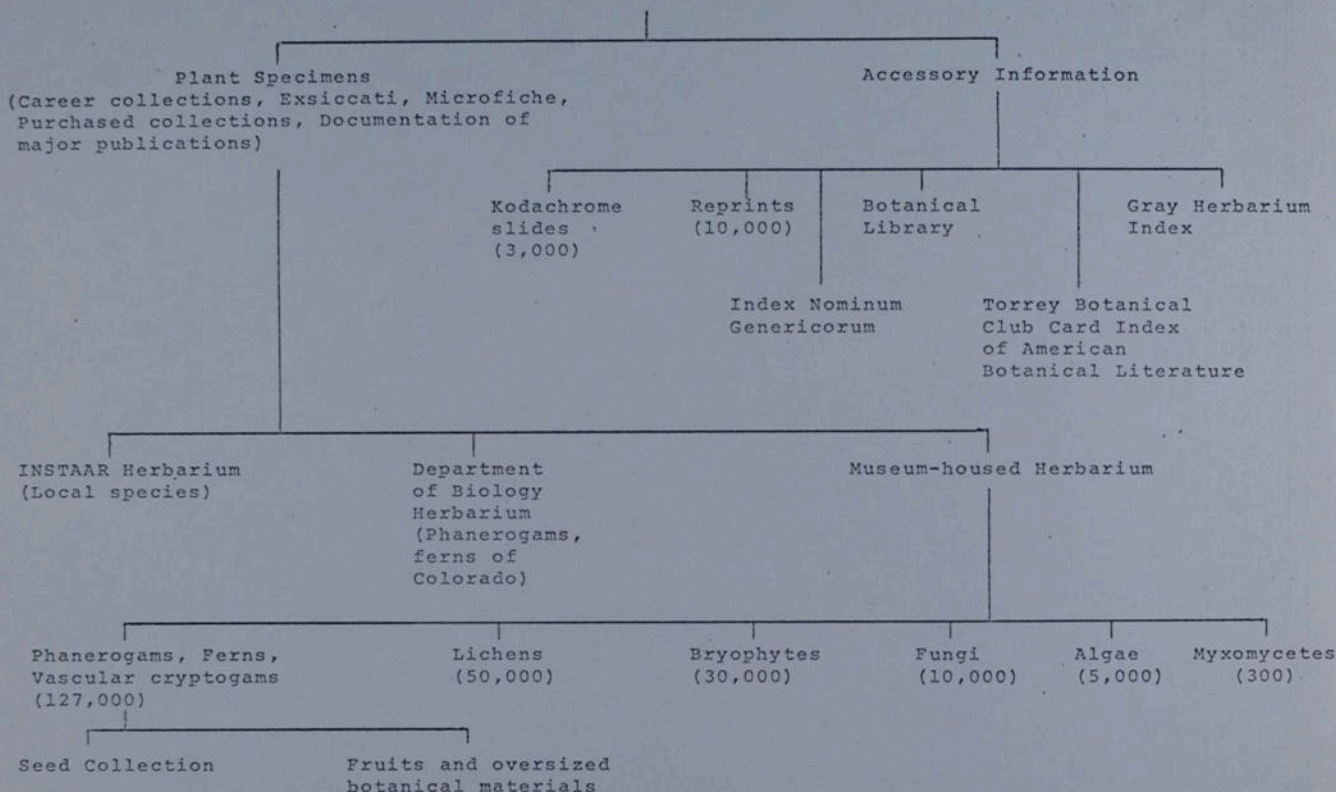
Research

Travel, collecting
Reading
Publication

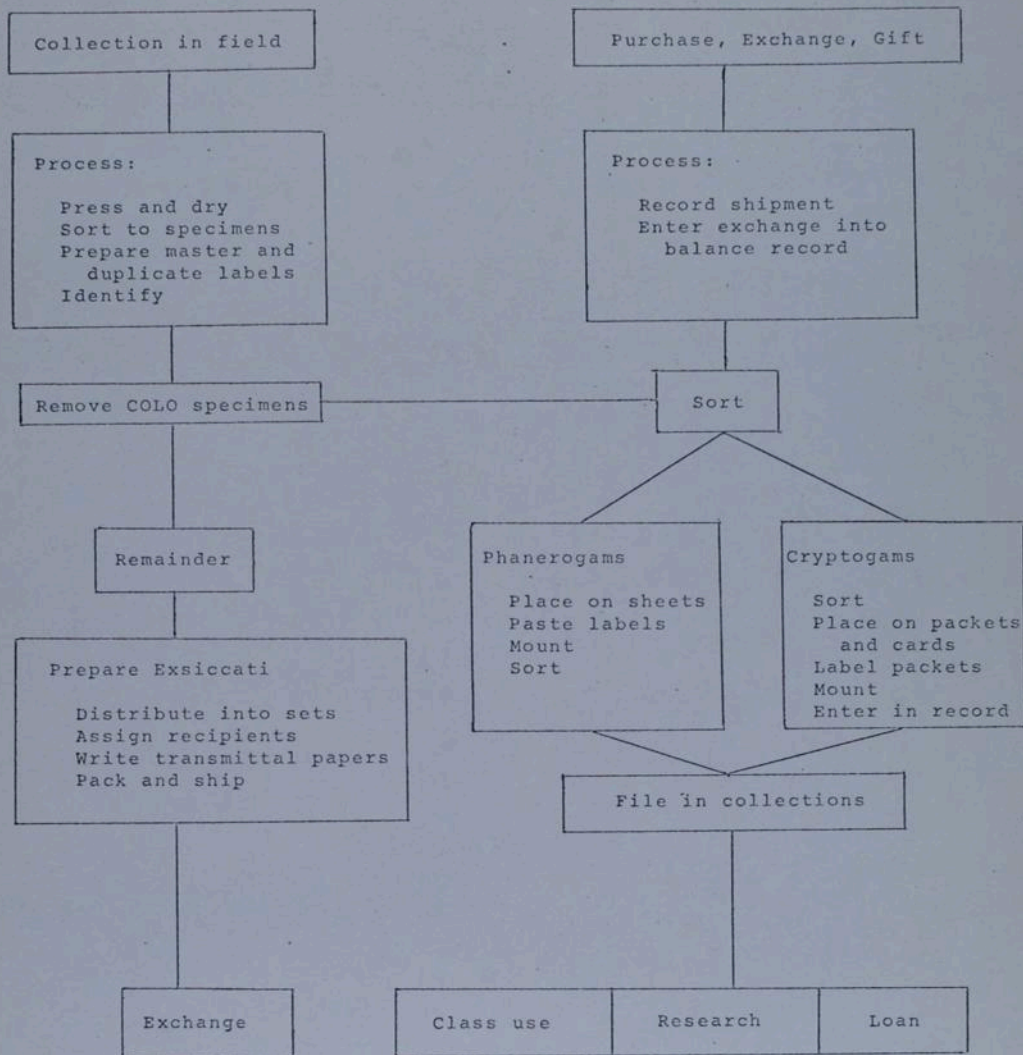
Other University Responsibilities

Teaching: courses, graduate theses
Committees, University Senate
Faculty, staff meetings
Annual Faculty Service Report

BOTANY SECTION COLLECTIONS



Flow Chart for Botany Specimens



ZOOLOGY SECTION

Historical Development

The first collections of the Museum were largely zoological materials and the vigorous and continuing efforts of the Museum's first Curator, Professor Henderson, and his colleague in the Biology Department, Theodore D.A. Cockerell, resulted in the accumulation of extensive collections, particularly of birds and mollusks during the first 30 years of the Museum's existence.

Invertebrates, except Insecta

Of the invertebrates, the mollusk collection is by far the largest and most extensive in regional representation. Most specimens were collected by Professor Henderson during his curatorship of the Museum. Some additions have been made to the collection since his death, but the collection in general is inactive due to lack of a curator. However, it is used for identification purposes, serving as a resource for research of Museum faculty and other scholars, and the material is available to interested research workers. Numerous scholars have visited the Museum to study the collection.

Other invertebrate groups are represented in the collections, but again, due to lack of a curator, few additions are currently being made in this area of the zoological collections.

Entomology

The systematic insect collection was established by Hugo G. Rodeck in the 1930's, with elements of the private collection of T.D.A. Cockerell serving as the effective nucleus. This collection was augmented by material collected by students of Cockerell, such as Hugo G. Rodeck, M.T. James, and C. Hicks. During 1936-40, U.N. Lanham was Curator of the collection, and added to it by field work, particularly in the western part of the State.

Although there was no Curator of Entomology in the Museum between 1940 and 1961, the collection continued to grow, partly as a result of continued collecting by members of the Museum staff, and partly from gifts from collectors in the region.

In July 1961, the entomological collections of the Museum totaled about 42,000 specimens. In 1961 the Museum received two important collections of Lepidoptera: the F. Martin Brown collection of about 16,000 specimens, mostly from the Rocky Mountain region, and the W.N. Burdick collection comprising about 20,000 specimens from western North America.

U.N. Lanham was appointed Visiting Curator of Entomology for the summers of 1961 and 1962 and for the academic year 1962-63. Field work during these two summers added about 17,000 specimens to the collection. A relatively complete collection of the insect fauna of the Alpine Zone of Niwot Ridge, in western Boulder County, was assembled with the aid of grants from the Society of the Sigma Xi and the Institute of Arctic and Alpine Research.

Dr. Gordon Alexander has deposited specimens accumulated from his long-term studies of Colorado Orthoptera, and John Polhemus, who has one of the largest collections of North America Saldidae, has contributed sets of species of this and other hemipterous families. F.C. Harmston is doing the same for the Dolichopodidae and certain other dipterous families. The entomology collections of the Museum now total approximately 121,000 specimens.

Arachnids

Emphasis on arachnids is a relatively recent activity. In 1960 upon the death of Mr. Walker van Riper of Denver, his natural history library, photographs, and arachnid collection were given to the Museum. The library provides the Museum with important scientific and general reference materials, particularly on arachnids. From 1960 to 1963 Miss Beatrice Vogel, a graduate student in the Department of Biology, concentrated on the collecting and identification of Rocky Mountain spiders and contributed approximately 3,000 specimens to the collection. Mr. Edwin Licht of Denver, who is Museum Associate in Microscopy and Araneology, currently is working on the collections.

Along with the entomology materials, the collection is a steadily growing resource, although curatorship is on a part-time basis by Museum Associates and Associate Curators.

Fishes

The collection of fishes numbers about 4,000 specimens at this time. Most of the collection was acquired by Dr. Max Ellis during the first 20 years of the Museum's existence and formed the basis of a still-definitive monograph on the fishes of Colorado. Although additions are made occasionally, this collection is largely inactive due to lack of a curator.

Amphibians and Reptiles

The early collections were mostly by Max Ellis and Junius Henderson and while not numerous, were significant for Colorado. Their "Amphibia and Reptilia of Colorado" is still basic for our state and region. After the Second World War Dr. Rodeck made a concentrated effort to build up the herpetological collections, and by 1949 there were approximately 600 specimens in the collections. Subsequently the Denver Museum of Natural History transferred to the Museum the remainder of its scientific collections of this group.

The present Curator of the Zoological Collections, Dr. T. Paul Maslin, in the 20 years since then, has devoted much of his time to the study and collection of reptiles, particularly lizards, and there are now 37,000 specimens in the herpetological collections. About 4,000 specimens a year are added.

Current research of the Curator and his students is primarily concerned with the systematics of lizards, but ecological work is being carried on also. As a direct result of curatorial activities, parthenogenesis in teiid lizards was discovered by Dr. Maslin, and experimental taxonomic work involving skin graft techniques to establish the degree of genetic similarity among

research is being undertaken. Other research has resulted in formulation of criteria of phylogeny based on morphology, as well as the discovery that salamanders produce a variety of sounds.

Birds and Mammals

One of the early collections of 570 birds' nests and eggs of the Denis Gale collection was purchased with a \$500 contribution from Senator Simon Guggenheim. Another early collection of birds' eggs acquired by the Museum was that of Fred M. Dille about 1915. In 1923 Dr. Leonard Freeman gave the Museum his extensive collection (644 specimens) of Ohio Valley birds, and in 1924 Dr. W.H. Bergtold contributed 620 specimens of North American birds. In 1928 the Colorado State Historical and Natural History Society disbanded its natural history collections and 140 specimens of Colorado mammals and birds were transferred to the Museum. From 1936-39 the Denver Post paid a bounty to hunters for mountain lions and the skulls of the animals were given to the Museum. As a result, nearly 100 skulls of Colorado mountain lions, representing a wide variety of ages and from locations throughout the state are a part of the Museum's collections. This is probably the most extensive collection of mountain lion skulls from any limited geographic area to be found in any museum.

One of the few purchased collections is the Kjell von Sneidern collection of over 100 specimens of Colombian birds which was acquired in 1943.

In 1952-53 over 400 specimens of Colorado chipmunks were added to the collections by Dallas Sutton, whose Ph.D. thesis was written on the chipmunks of Colorado. Other thesis voucher collections of birds and mammals have been included in the Museum's collections over the years.

Other contributors to the zoological collections include E.R. Kalmbach, who gave the Museum 235 specimens of birds in 1959; and Donald Spencer, of the U.S. Fish and Wildlife Service, who built up a collection of mammals in conjunction with a re-forestation program under the auspices of the U.S. Forest Service, and presented his collection of 1,000 specimens to the Museum in 1962. Gregor Rohrer has collected widely in several parts of the United States, and his collections, by gift and purchase, widen the representation of the zoological collections.

In 1963 the Museum of Colorado College was disbanded and the Warren Collection of 4,000 specimens of Colorado mammals and the Aiken Collection of 3,000 specimens of Colorado birds were transferred to this Museum. Recently, in 1968, Dr. Ligon Price of Aspen, Colorado, gave the Museum a fine collection of 99 specimens of mounted birds and mammals, including most species of North American deer.

In addition to the steady accumulation of birds and mammals from private contributors, the Museum's faculty and staff, as well as graduate students at the University, have made significant and large additions to the collections. In particular, staff members Donald J. Magoon (1941-44), Lowell Swenson (1944-present), and Sylvia Sutton (1960-66) have collected and prepared many hundreds of specimens from throughout the United States for Museum exhibition and study collections.

The mammal collections include study-skins, mounted specimens, and skeletal materials. The osteology unit, including specimens from all North American mammal groups, has been supplemented by scores of specimens of African and Asiatic mammal skeletons donated by Colomon Jonas of Jonas Brothers, Denver. This collection provides a basic reference for comparison and identification purposes in paleontology and archeology.

Importance of the Collections

With the exception of the conchological collections, the zoological collections of the Museum are primarily regional and are being developed to the point where they are becoming the most extensive and representative collections available anywhere. By maintaining such extensive regional collections, institutions elsewhere need house no more than reference materials from our region. In this way we are a member of a loosely affiliated company of museums which collectively acts as a super museum.

Mollusks and Other Invertebrates

The study collection of mollusks is one of the largest of its kind in the western United States. There are mollusks from over 600 Rocky Mountain localities which formed the basis of Professor Henderson's illustrated report on the "Mollusca of Colorado, Utah, Montana, Idaho, and Wyoming" and its supplement. Some of the other regions represented in the collection are the Pacific Coast from Alaska to Mexico, the Hawaiian Islands, and the Atlantic Coast from New England to South America. Gifts and exchanges have provided shells from every major political division of the world.

The other invertebrates, from protozoa to insects, are also represented in the collections, sometimes in long series. For example, about half of the known species of living brachiopods are represented. The insect collection is especially rich in Hymenoptera.

The arachnid collection, although small, provides good regional representation and is particularly important because of its emphasis on high altitude-dwelling species of the Rocky Mountain area.

Fishes and Amphibians

The Rocky Mountain fish collection, obtained chiefly by Dr. Max M. Ellis, who collected intensively in Colorado and northern New Mexico, is the basis for Dr. Ellis' report on the "Fishes of Colorado." Many of the amphibians discussed in Ellis' and Henderson's "Amphibia and Reptilia of Colorado" are in the Museum collections. Fishes and amphibians from other regions have been obtained by exchange or gift, including a series from British Guiana.

Herpetology Collections

The early collections of Max M. Ellis and Junius Henderson along with a larger collection at Greeley formed the basis of Ellis' and Henderson's The Amphibia and Reptilia of Colorado published in 1913. Large and important collections of lizards have been made from the Yucatan Peninsula and the islands of the Gulf of California in the last decade or so. The significance of these collections is in part reflected by the grants made to the Curator and the use other institutions have made of our collections. The American Museum of Natural History and the University of Michigan are only two examples.

Ornithology Collection

The birds in the collection are largely from Colorado and include a number of specimens of particular significance. Other regions of North America are also represented as are tropical species. There are good series from Central America and Japan. The Leonard Freeman collection, from the Ohio Valley, is especially rich in warblers, illustrating plumage variation.

Mammalogy Collection

The mammal collection includes the Warren and Aiken collections, both extensive and including representatives of all of the mammals found in Colorado. The Warren collection is the basis for Warren's Mammals of Colorado, published in 1910 and revised in 1942. This was the first definitive work on Colorado mammals and is still the basic reference for mammalogists.

The osteology material is of fundamental importance to research in archeology and paleontology. For example, the Pleistocene mammal bones from Little Box Elder Cave, Wyoming, collected by Museum field parties during 1949-63, were identified in large part by comparison with known material in the osteology collection. This project was the subject of a master's thesis and resulted in publication in 1968 of Fauna of the Little Box Elder Cave, Converse County, Wyoming, University of Colorado Studies, Series in Earth Sciences, No. 6: The Carnivora, by Elaine Anderson; and Pleistocene Zoogeography of the Lemming Dicrostonyx, by John E. Guilday. Discovered as a result of this work is the first known record of Equus conversidens Owen from Wyoming, published in the Journal of Mammalogy, Vol. 48, No. 4, November 1967, by Elaine Anderson, of the University of Colorado Museum. The osteology material is used by archeologists to identify bones found during excavation of sites as well as those brought in by ranchers or other persons seeking the identity of skeletal remains.

ZOOLOGY SECTION PERSONNEL

Curator: Dr. T. Paul Maslin

Assistant: Mr. John Ferner

Work-Study: Miss Louise Sanchez

Associated Faculty:

Mr. Henry S. Fleming, Associate Curator of Entomology

Dr. Urless N. Lanham, Associate Curator of Entomology

Dr. Leonard Lewin, Associate Curator of Entomology

Dr. Hobart M. Smith, Associate Curator of Herpetology

Mr. Edwin S. Licht, Associate in Microscopy and Araneology

Mr. John Polhemus, Associate in Entomology

Mr. Harry Taylor, Associate in Herpetology

Mr. James M. Walker, Associate in Herpetology

SECTION ACTIVITIES

Curator of Zoology

Curation of Collections

Museum Assistant

Collect specimens
Process materials
Catalogue specimens
Place specimens in
collections
Return used material
to collections
Research

Accessions

Loans

Exchanges

Visitors: scientists, general

Public lectures, consultation

Identification of specimens

Care, maintenance of collection,

arrangement of collections

Correspondence

Extension Division travel, field

trips, lectures, consultation

Monthly reports

Publications: guides, leaflets

Supervise assistants and

Work-Study students

Annual report to Director

Work-Study Students

Prepare and
preserve
specimens
Catalogue specimens
Catalogue reprints
Prepare cross-
reference cards
Prepare bibliographies

Professional Activities

Meetings

Attendance

Officer positions

Committee service

Professional papers

Field conferences

Grants

Preparation

Reports

Financial records

Research

Travel, collecting

Reading

Publication

Other University Responsibilities

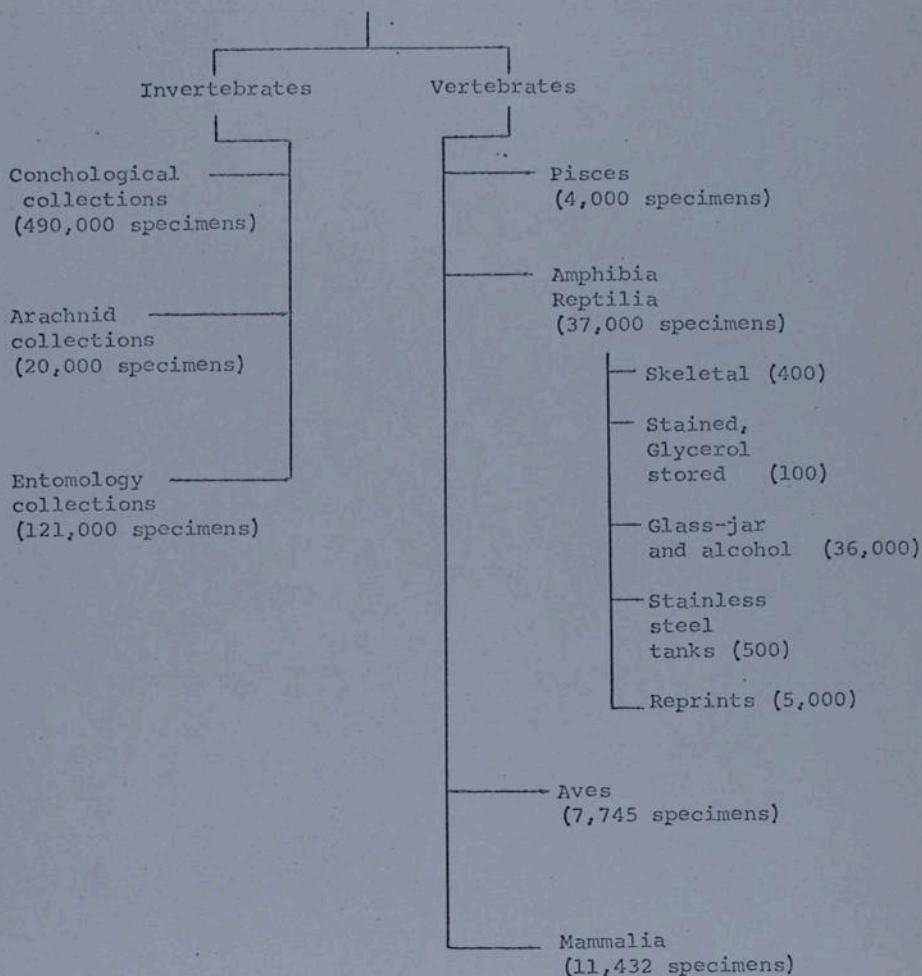
Teaching: courses, graduate thesis
direction, independent study,
seminars

Committees

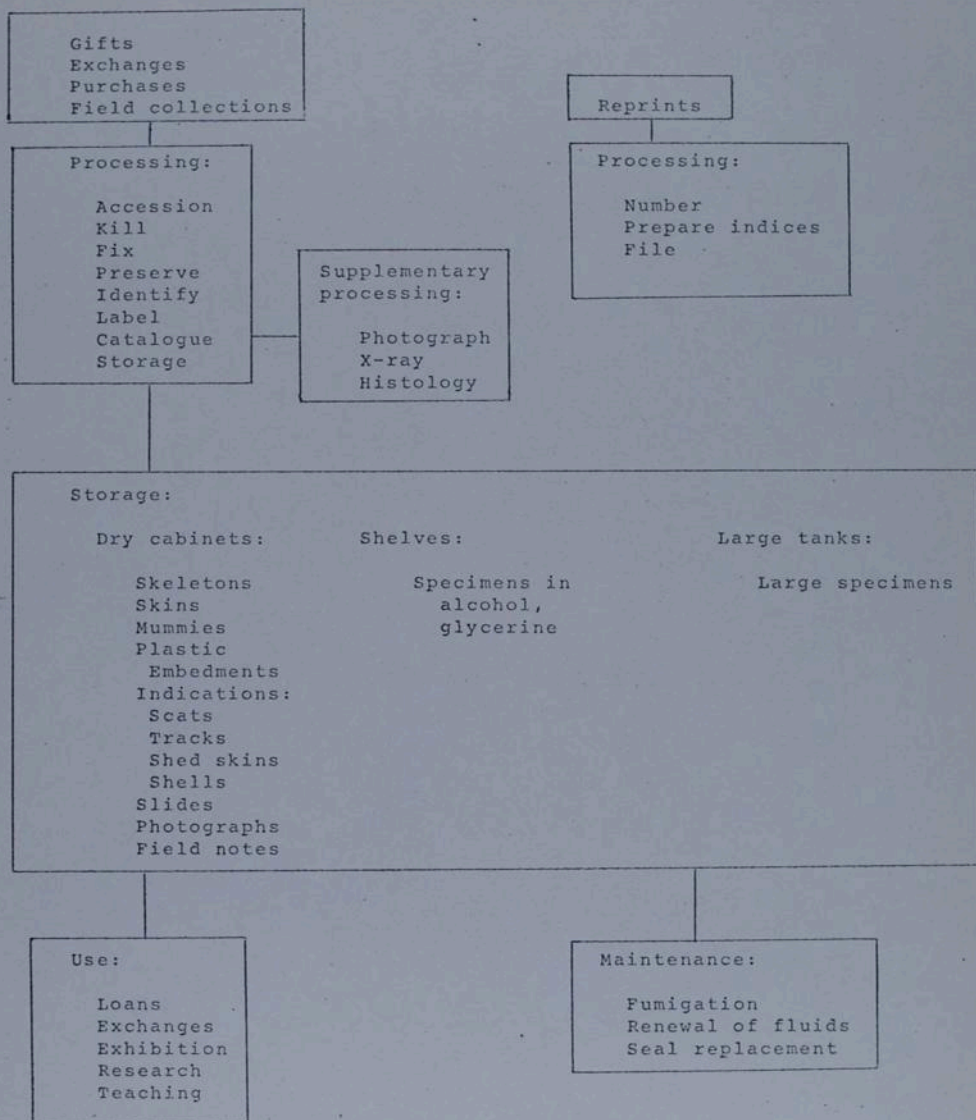
Faculty, staff meetings

Annual Faculty Service Report

ZOOLOGICAL SECTION COLLECTIONS



Flow Chart for Herpetology Specimens



ANTHROPOLOGY SECTION

Historical Development

While Professor Junius Henderson, the Museum's first Curator, was primarily a naturalist he was also concerned with anthropology and published in that field. Joint work with the School of American Research and the Bureau of American Ethnology of the Smithsonian Institution resulted in the association of such men as Edgar L. Hewett, Sylvanus G. Morley, and John P. Harrington with the Museum and collections made by them are part of the permanent collections.

Henderson's activities also brought into Museum association such men as Dean C. Worcester, former Governor of the Philippine Islands, Dr. J.H. Todd and Dr. Leonard Freeman whose ethnographic and archeological collections are housed in the Anthropology Section of the Museum.

During the early years of the Museum, the eminent anthropologist Livingston Farrand was President of the University and instrumental in furthering its activities.

In 1913, the first organized work in archeology was begun for the Museum by the late Earl H. Morris, who became one of the pre-eminent archeologists of both the southwestern United States and Mexico. Morris' association with the Museum continued in one capacity or another until his death in 1956. During those years the collections made by him built the Anthropology Section of the Museum into one of the major American resources in Southwestern Archeology. The collections include not only those made by Morris while working for the University of Colorado but a major part of the Southwest collections made for the Carnegie Institution of Washington. Dr. A.V. Kidder, Director of the History and Anthropology Division of the Carnegie Institution, through Morris, also maintained a close association with the Museum and was ultimately responsible for the Carnegie collections becoming a part of the University of Colorado Museum holdings.

Morris also undertook joint field work with Harry Shapiro of the American Museum of Natural History, resulting in the collection of major skeletal series now at the Peabody Museum at Harvard University, whose staff undertook analysis of the material.

Morris' southwestern work resulted in the monumental monographs Archeological Studies in the La Plata District; Anasazi Basketry; and Basket Maker II Sites near Durango, Colorado, all published by the Carnegie Institution and based on collections now in the University of Colorado Museum. He was a pioneer in developing theories on Anasazi culture, as well as an innovator in excavation techniques developing more exacting and efficient methods of removing material, as exemplified by his work at the Temple of the Warriors at Chichen Itzá, Yucatan. Later work by Morris resulted in the discovery of the first habitation sites of the Basketmaker culture near Durango, Colorado. Morris lived to describe and publish only a part of his excavations. Subsequently, through a series of grants from the National Science Foundation with Dr. Joe Ben Wheat as principal investigator and Dr. Roy L. Carlson as associate, the publications of Morris' work continued. Two monographs and several articles have been published and other works are in various stages of completion.

For some time prior to World War II Charles R. Scoggin served as Assistant in the Museum directing his work principally toward excavations in Dinosaur National Monument. Later work in that area was carried on by Robert F. Burgh, long associated with Earl Morris and who succeeded Scoggin at the Museum, and Robert H. Lister. Both Scoggin and Burgh made major discoveries on Fremont culture in this work. At about the same time Leonard L. Leh, of the Anthropology Department, excavated the Monument Ruins in southeastern Utah and contributed his collections to the Museum.

Following World War II Herbert C. Dick followed Burgh as Assistant to the Director of the Museum. During his tenure, Dick, together with Robert H. Lister, carried on excavations at Glade Park in west central Colorado and at Hell's Midden in Dinosaur National Monument. He also excavated the Paleo-Indian Claypool Site in eastern Colorado.

In 1953 the position of Curator of Anthropology was established in the Museum and filled by Dr. Joe Ben Wheat. Wheat's research has been directed to excavation of a series of Basket Maker and Pueblo Sites in southwestern Colorado, and the Olsen-Chubbuck and Jurgens Paleo-Indian Sites in eastern Colorado.

Archeological salvage work initiated by the Museum in cooperation with the Department of Anthropology resulted in five seasons of excavation and reconnaissance as well as small scale surveys and test excavations in the Republic of the Sudan on the Nile River and in Tunisia. The result was the opening of a new field which, while greatly enriching the Museum's collections, also provided the opportunity and material for a number of master's and doctoral theses. Support for these activities has come from grants by the National Science Foundation, the U.S. State Department, Smithsonian Institution, and the University of Colorado's Council on Research and Creative Work.

Other projects carried out are a computerized study of pottery from the Yellow Jacket area of Colorado; a study of Paleo-Indian material from Museum excavations in western Texas; analysis and publication of the stone, pottery, and physical anthropology collections from the Sudan; physical anthropology of the Yellow Jacket area; and studies on Plains Indian and Navajo material culture.

Importance of the Collections

Prior to 1953 the emphasis in the Anthropology Section of the Museum was directed toward Southwestern Archeology. Since that time there has been an organized effort to provide a more balanced approach, and the Section now contains major collections in archeology, ethnology, and physical anthropology. In addition there are minor collections of historical material and numismatics.

As a final result of Morris' work the University of Colorado houses what A.V. Kidder once described as "not the largest, but the finest collection of Southwestern Archaeology in existence." It includes materials from nearly every part of the Southwest and from every time period. With Morris' numerous publications and those resulting from Carlson's work, it is also one of the best documented.

Other important holdings in American archeology include Paleo-Indian material, numerous artifacts from the eastern United States, from Alaska, and lesser series from other parts of North, Central, and South America. Holdings in Old World archeology include some 10,000 specimens derived from the University of Colorado Museum Expedition to the Sudan, and over 2,000 artifacts from western Europe.

Ethnology collections reflect the continuing emphasis on regional problems of the Southwest and the High Plains, but provide comparative materials on a world-wide basis, including a major collection from Melanesia.

Physical anthropology collections derive mainly from Museum expeditions to the southwestern United States and from Sudanese Nubia with minor increments from other sources.

Wide use made of the collections in formal courses given by the Department of Anthropology as well as loan of materials to other museums and institutions for research and exhibition testify to the well-rounded nature of the present collections.

Scholars from other institutions who have used collections in the past ten years include:

George Armelagos, University of Utah
Roy L. Carlson, Simon Fraser University
Jennifer Chatfield, American Museum of Natural History
Don Crabtree, Idaho State University
Herbert Dick, Adams State College
Charles C. DiPeso, The Amerind Foundation
George Ewing, Museum of New Mexico
David Greene, University of Wyoming
James Hester, Museum of New Mexico
Henry T. Irwin, Washington State University
Cynthia Irwin-Williams, Eastern New Mexico University
Armintha Neal, Denver Museum of Natural History
Carolyn Osborne, Wetherill Mesa Project of the U.S. National
Park Service and National Geographic Society
Charles A. Reed, Peabody Museum of Natural History,
Yale University
Charles Sekintu, National Museum of Uganda
Anna O. Shepard, Carnegie Institution of Washington
Richard Schutler, University of Nevada

ANTHROPOLOGY SECTION PERSONNEL

Curator: Dr. Joe Ben Wheat

Assistant: Miss Hannah Huse

Work-Study Student: Miss Mary Ann Tomasko

Associated Faculty:

Dr. Alice M. Brues, Associate Curator of Physical Anthropology

Dr. Gordon W. Hewes, Associate Curator of African Anthropology

Dr. Robert Lister, Associate Curator of Archeology

Dr. H. Marie Wormington Volk, Associate in Paleo-Indian Archeology

SECTION ACTIVITIES

Curator of Anthropology

Curation of Collections

Accessions
Loans
Exchanges
Visitors: scientists, general
Public lectures, consultation
Identification of specimens
Care, maintenance of collections,
 arrangement of collections
Correspondence
Monthly reports
Publications: guides, leaflets
Supervise assistants, Work-Study students
Exhibits development
Annual report to Director

Professional Activities

Meetings
 Attendance
 Officer positions
 Committee service
Professional papers

Grant Proposals
 Preparation
 Reports
Financial records

Research
 Travel, collecting
 Site excavations
Publication

Other University Responsibilities

Teaching: courses, graduate thesis
 direction, independent study
 direction, seminars

Committees
Faculty, staff meetings
Annual Faculty Service Report

Museum Assistant

Process material,
 repair, clean specimens
Catalogue specimens
Place specimens in
 collections
Loans
Return used material
 to collections

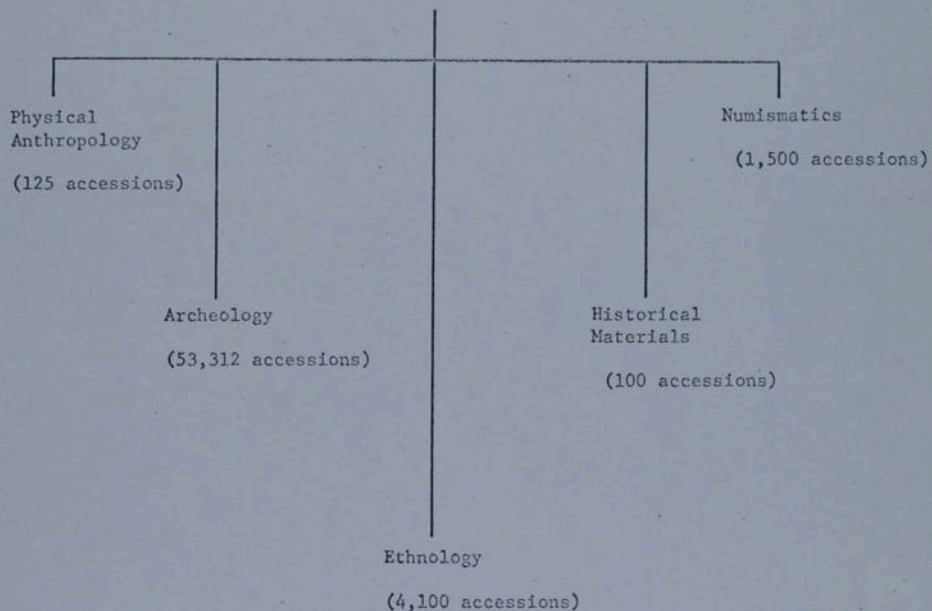
Work-Study Students

Repair, clean
 specimens
Catalogue
 specimens

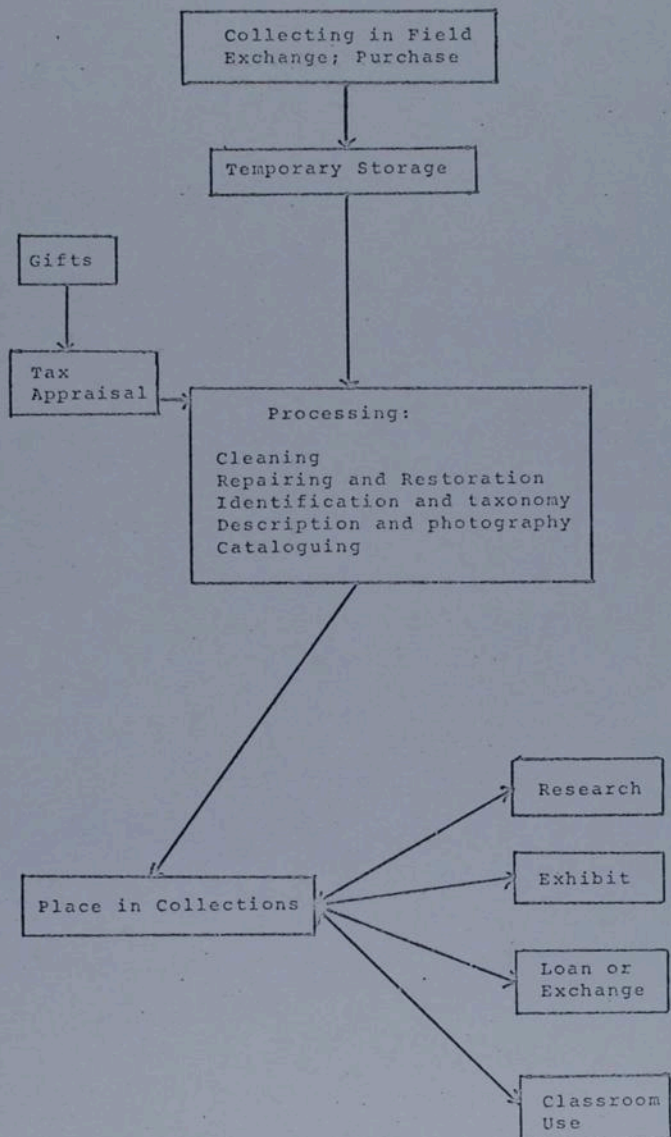
Volunteers

Repair specimens

ANTHROPOLOGY SECTION COLLECTIONS



Flow Chart for Anthropology Specimens



EXHIBITS SECTION

Exhibition has been one of the objectives of the Museum since its inception. Collections of minerals, fossils, as well as biological and anthropological materials were on display from the beginning in the Hale Building, the first location of the Museum. In 1937 when the Museum moved to the newly completed Henderson Building, four exhibition halls were opened: the Hall of Earth, Hall of Life, Hall of Man, and Hall of Art. The Hall of Art is operated by the Fine Arts Department under an agreement made when funds for the building were acquired.

The other three Halls provide display of selections from Museum collections, with emphasis on the Rocky Mountain area and the southwestern United States.

The Hall of Earth

The Hall of Earth contains the Guggenheim Collection, a classified collection of minerals arranged according to the Dana System. Other cases show large and spectacular mineral specimens, crystals, and crystal groups; semi-precious and decorative stones, both cut and in the rough; a representative group of meteorites; visual explanations of what is a mineral, and the properties of crystals. Wall cases present groups of minerals and ores classified according to their metallic constituents, from iron to gold and silver. One of the most complete collections of radioactive minerals in the United States is displayed along with explanatory radioactivity and fluorescence demonstrations.

Exhibits distinguish between fossils and pseudo-fossils as a beginning to the paleontological exhibits. Dioramas illustrate the evolution and development of dominant life forms from the Cambrian to the Permian, and a large (8 by 12 feet) multicolored wall chart summarizes the information presented in the dioramas. Additional dioramas of later periods are being developed.

Displays of flora and fauna of important Tertiary deposits in Colorado, the Florissant, Creede, and Green River beds, are located in floor cases, as is a selection of Mesozoic mollusks of the world, especially of western North American forms.

Fossil vertebrates, from fishes to mammals, are shown in a series of wall cases. These exhibits include actual specimens, pictures of restorations, and other descriptive information about each group and the species represented. A block of the Brule formation from the Badlands of South Dakota contains the first discovered complete skeletons of *Hypertragulus calcaratus*, a primitive deer-like mammal from the Oligocene. Large slabs showing tracks of extinct amphibians and birds are also on display. Also in the Hall is a very fine exhibit outlining the evolution of mammalian molar teeth. A generalized cross-section through the Boulder area foothills shows the formations and fossils found along the Front Range in Colorado.

Also located in the Hall of Earth for lack of more appropriate space is the very fine McKenna Collection of ivory and other carvings. This collection includes Oriental and European art works in ivory, stone, ceramic, and metal.

The Hall of Life

The primary purpose of these exhibits is to illustrate some of the basic concepts of biology, such as adaptive radiation, geographic distribution, taxonomy, mimicry, and migration.

Synoptic collections of Colorado butterflies, birds, and mammals of the Rocky Mountains and the Southwest are displayed for the use of visitors who wish to study local specimens for purposes of identification as well as to learn about ecology and faunal development. A small live reptile exhibit shows examples of common species found in the Southwest.

The range of variation in living organisms is illustrated by representative specimens of invertebrates and vertebrates from throughout the world. An extensive collection of mollusks, with examples of how they affect human life and culture, is a recent addition to the Hall. Tropical butterflies, other insects, and birds are displayed along with exotic species from Australia, New Zealand, and South America.

Just outside the Hall of Life is an exhibit of organisms in a drop of pond water. This is a favorite exhibit of youngsters who are just getting interested in the natural world around them.

Exhibits showing Rocky Mountain area ecological relationships are located in the second floor corridor as is an exhibit showing development and variation in antlers and horns. Heads of large Rocky Mountain mammals are mounted on the walls along the hall, correlating with the miniature ecological dioramas beneath.

The Hall of Man

The Hall of Man presents exhibits showing the three main facets of Anthropology:

1. Man as an animal (physical anthropology)
2. Man develops a culture (archeology)
3. Man has many ways of life (ethnology)

That man is an animal is shown by a human skeleton and an exhibit showing evolution of his brain size, muzzle decrease, and upright posture.

Measuring time, Old World Prehistory, and the migration of man to the New World exhibits introduce the development of the culture theme. Emphasis is on how a culture evolves and changes to fulfill the changing needs of a people, using the archeology of the southwestern United States as the example. Exhibits in historical sequence show the development of a culture through time. Displays of clothing, jewelry, tools, pottery, art objects, and musical instruments are supplemented by miniature dioramas showing the habitat, architecture, and activities of each of the periods. The Muriel Sibell Wolle Katchina Doll Collection exhibit was completed and installed during 1968. This is one of the world's major Katchina Doll collections. One case contains an accurately reconstructed Pueblo burial and shows what the archeologist finds in his excavations, illustrating the conditions under which many of the artifacts on display in the Hall were found.

Other exhibits in the Hall illustrate cultures (ethnology) of Africa, the South Pacific, Western Pacific, South America, Mexico, the Far North, Northwest Coast, and the Western Plains. An exhibit of Navajo jewelry and the design and making of Indian pottery are also featured.

Additional exhibits feature Museum expeditions to Nubia, and pottery vessels salvaged from the Aegean Sea demonstrate techniques used in restoring archeological materials long buried in the sea.

Other Exhibits

The lobby exhibit in the Museum building is temporary and changed periodically. Recent displays include: a one-third scale model of the Apollo Command Module on loan from NASA, "Objets d'Art"; "Nigeria"; "Contemporary Korea"; and Makonde sculpture from East Africa. Currently, a Koala mother and baby are on exhibit in the lobby.

Traveling exhibits of Colorado birds and mammals, and the Ida Hrubesky Pemberton Plant Portraits and SuZan Noguchi Swain Insect Portraits are described under Museum Services, as are the exhibits designed and maintained by the Museum in other University buildings and in downtown Boulder.

Specimens are loaned for display at other institutions and public schools. Among those which frequently use Museum materials for exhibition are the annual Colorado State Fair, the Denver Museum of Natural History, the Denver Art Museum, the State Historical Society Museum, the Museum of Modern Art, the Laboratory of Anthropology in Santa Fé; the Museum of New Mexico; Trinidad Junior College; Mesa Verde National Park Museum, Canyon de Chelly National Monument Museum; Dinosaur National Park Museum; Oakland Public Museum; Ball State University; and school systems in the Denver-Boulder area. As one example, items from the Anthropology Section are currently on display under the auspices of the Museum of New Mexico's Indian Culture Education Program in a traveling van exhibit which will visit the Navajo Reservation in Arizona and New Mexico.

Although major renovation of the Halls has not been possible because of limited funds and personnel, new exhibits and modification of long-standing exhibits are a part of each year's program. Since July of 1962, 68 permanent exhibits and 75 temporary exhibits have been designed, built, and put on display.

EXHIBIT SECTION PERSONNEL

Curator: Dr. Hugo G. Rodeck

Technician: Mr. Lowell Swenson

Technician: Miss Linda Boley

Aide: Mr. Jan Roth

MUSEOLOGY

Academic Program

The Museum provides courses in professional museology as a part of the University's academic instructional program. These courses have, for many years, been given as independent study in the various departments. However, the College of Arts and Sciences and the Graduate School now have approved the listing of the following courses offered by the Museum faculty with Museum designations. Although no major is offered in museum studies at this time, courses listed below, may, with the approval of the student's major department, be taken.

Museum 401-3. Introduction to Museology. (Spring, even-numbered years.) Especially for students majoring in the Departments of Anthropology, Biology, Fine Arts, Geological Sciences, History, or other museum-related subjects. Background in history and literature of museums, their objectives and methods. Laboratory exercises in curatorship, exhibition theory, and administration.

Museum 402-4. Principles and Practice of Museology. (Fall, even-numbered years.) Professional-level study of philosophy of museums. Thorough review of museological literature. Techniques of museology in all fields; special concentration in field of student's choice.

Museum 403-4. Principles and Practice of Museology. (Spring, odd-numbered years.) Continuation of Museum 402.

Plans to initiate additional, in depth, internship courses in each of the Museum's activities are underway. Graduates of the academic museum program are now employed in museums from coast to coast.

Technical Training Program

A non-academic two-year course in museum techniques has been offered by the Museum since June 1966. This is a program designed to provide training in all aspects of museum and exhibit techniques and leads to a certificate issued by the Museum. Since the program's initiation, eight government-sponsored American Indian students have attended full-time and other students enrolled have come from the Museum of New Mexico; Washington State Historical Museum; Ball State University; Nigerian National Museum at Lagos; Union of South Africa; College of African Wildlife Management Tanzania; and the Department of Antiquities, Kenya.

Two recent graduates of the course, a Pueblo Indian and a Spokane Indian, have been appointed, respectively, Curator of Indian Exhibits at the St. Joseph Museum, St. Joseph, Missouri; and Artist-Technician at the Heard Museum, Phoenix, Arizona.

Facsimile Reproduction

The University has supported research and development of techniques for facsimile reproduction of geological, archeological, and zoological specimens, and as a result of these activities, the Museum is asked by numerous institutions, both in the United States and abroad, to prepare facsimile reproductions of fossils, coins, and artifacts for their collections and for exhibition.

MUSEOLOGY SECTION PERSONNEL

Curator: Dr. Hugo G. Rodeck

Faculty: Mr. John R. Rohner, Senior Instructor

The following contribute to the Museology courses
for a few weeks during each semester:

Dr. T. Paul Maslin, Professor

Dr. Peter Robinson, Associate Professor

Dr. William A. Weber, Professor

Dr. Joe Ben Wheat, Professor

Summary of Research and Equipment grants made to the University of Colorado Museum since 1960.

Geology Section

Beginning Date of Grant	Duration of Grant	Title of Grant	Granting Agency	Amount of Grant
6-61	1 year	Paleontological Research	Council on Research and Creative Work	\$ 450
11-61	1 year	Microscope for paleontological research	Council on Research and Creative Work	1,379
5-1-62	1 year	Evolution of Fossil Tortoises (NSF-G-23562)	NSF	7,000
7-62	1 year	Cenozoic Microfauna: microscopes and illustrations	Committee on Coordination of Research	4,606
7-63	1 year	Late Eocene Faunas in Wyoming and Colorado	Council on Research and Creative Work	1,535
10-63	1 year	Insectivore studies: illustrations	Council on Research and Creative Work	1,200
8-64	1 year	Paleontological Research	Council on Research and Creative Work	400
6-65	1 year	Xeroxing of reprints	University Libraries	369
7-65	1 year	Paleontological equipment	Research Capital Support Grant	3,725
7-65	1 year	Paleontological Research: illustrations	Council on Research and Creative Work	1,145
6-66	1 year	Paleontological Research: illustrations	Council on Research and Creative Work	700
6-66	1 year	Xeroxing of reprints, microfilming of catalogues	University Libraries	300
6-66	1 year	Collecting of Pliocene Fossils for teaching	Educational Experimentation Fund	1,000
6-67		See grants to Anthropology Section		
6-67	1 year	Xeroxing of reprints	University Libraries	100
1-68	1 year	Paleontological Research in Tunisia (SFC-8-7011)	Smithsonian Institution	23,165 (paid in Dinars)

Beginning Date of Grant	Duration of Grant	Title of Grant	Grant Agency	Amount of Grant
1-68	1 year	Paleontological Research in Tunisia (Amendment to SFC-8-7011)	Smithsonian Institution	\$ 1,196 (paid in Dinars)
5-68	No Exp.	Miocene Research	Private Funds	2,764
6-68	1 year	Miocene Research: guidebook, field trip, fossil collecting, preparation of fossils	Faculty Improve- ment Fund	475
6-68	1 year	Xeroxing of reprints, microfilming of catalogues	University Libraries	100
7-68	1 year	Fossil Collecting	Educational Experimentation Fund	700
1-69	1 year	Paleontological Investigations in Tunisia (SFC-9-7011)	Smithsonian Institution	24,828 (paid in Dinars)
<u>Botany Section</u>				
9-60	3 years	Taxonomic and Phytogeographic Studies on the Lichens of Western North America (NSF-G-9840)	NSF	25,000
1-62	1 year	Herbarium Cabinets (NSF-G-20865)	NSF	15,000
9-62	1 year	Taxonomic Study of Lichens of India (NSF-GB-199)	NSF	7,500
10-62	1 year	Cockerell Bibliography	Council on Research and Creative Work	550
9-63	3 years	Taxonomic and Phytogeographic Studies on Lichens of Western North America (NSF-GB-1538)	NSF	28,600
10-63	1 year	Taxonomy of Rocky Mountain Plants	Council on Research and Creative Work	888
9-65	1 year	Cockerell Bibliography	Council on Research and Creative Work	2,322
9-67	1 year	Faculty Fellowship for full-time study on Taxonomic and Phytogeographic Studies of Cryptogams of Australia and New Guinea	Council on Research and Creative Work	Full Salary

Beginning Date of Grant	Duration of Grant	Title of Grant	Granting Agency	Amount of Grant
<u>Zoology Section</u>				
1-61	1 year	Possible Parthenogenesis (NSF-G-16244)	NSF	\$ 9,600
2-62	2 years	An Investigation of the All-female Species of the Lizard Genus <u>Cnemidophorus</u> (NSF-G-21930)	NSF	18,400
3-63	1 year	Entomological Research	Council on Research and Creative Work	245
12-63	2 years	Experimental Systematic Studies of the Lizard Genus <u>Cnemidophorus</u> (NSF-BG-1813)	NSF	31,300
8-64	3 weeks	Biology of Insular Lizards of the Gulf of California (NSF-CB-2362)	NSF	5,958
1-66	2 years	Further Experimental Systematic Studies of the Lizard Genus <u>Cnemidophorus</u> (NSF-CB-4628)	NSF	28,000
2-66	1 year	Entomology cabinet drawers	Research Capital Support Grant	1,430
9-66	9 months	Faculty Fellowship to study parthenogenesis in lizards and examine type specimens at major museums in the United States	Council on Research and Creative Work	Full Salary
7-69	1 year	Storage cabinets and Lane cases for mammalogy collections	Development Fund	4,000
<u>Anthropology Section</u>				
8-61	1 year	Earl Morris Papers (NSF-G-18570)	NSF	8,500
2-62	1 year	Excavations at Yellow Jacket, Colorado	Council on Research and Creative Work	1,058
6-62	2 years	Archeological Salvage in the Sudan	UNESCO	62,499 Sudan pounds
8-62	33 months	Archeological Salvage in the Sudan (NSF-GS-7)	NSF	35,000
9-62	1 year	Earl Morris Papers (NSF-GS-11)	NSF	9,300
10-63	1 year	Archeological Salvage in the Sudan (NSF-GS-286)	NSF	40,300

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Beginning Date of Grant	Duration of Grant	Title of Grant	Granting Agency	Amount of Grant
10-63	1 year	Ethnographic illustrations	Council on Research and Creative Work	\$ 500
8-64	1 year	Earl Morris Papers (NSF-GS-467)	NSF	13,900
8-64	2 years	Archeological Excavations at the Ancient Settlement Remains of the Second-Fourth Cataract Area, Republic of Sudan (NSF-GS-557)	NSF	53,800
		Archeological Excavations in the Republic of the Sudan (Amendment to NSF-GS-557)	NSF	44,200
5-66	1 year	Computer Study of Pottery	Council on Research and Creative Work	350
10-66	1 month	Archeological Survey in Tunisia	Smithsonian Institution	3,500 (paid in Dinars)
5-67	1 year	Paleo-Indian Research	Council on Research and Creative Work	1,136
6-67	2 years	Archeological and Paleontological Research in Tunisia (NSF-GS-1607)	NSF	26,700
6-67	1 year	Excavations of the Prehistoric Site at Oued el Akarit, Tunisia (SFCP-26)	Smithsonian Institution	62,090 (paid in Dinars)
6-67	1 year	Amendment to SFCP-26	Smithsonian Institution	19,806 (paid in Dinars)
6-68	1 year	Research in Northeastern Colorado: Archeological Excavation at Jurgen's Site	NSF	14,900
7-68	1 year	Equipment: Equipto Storage units	NSF	11,600

SUMMARY

The foregoing analysis of the organization, operations and services of the University of Colorado Museum demonstrates both the legitimate and vital place a museum occupies in the life of a major university, and the great potential it and similar museums have in facilitating not only research in museum-related fields here and abroad, but in filling the developing urgent need for information on regional and world natural resources for ecological use. The values accruing to studies on human ecology, air and water pollution, resource depletion, and to the International Biological Program, as the result of active museum operations, and hopefully, of advanced data retrieval systems in these museums, should be obvious.

University museums are prone to be viewed incorrectly as research institutions and its professors as privileged research professors. The analysis given here, however, shows that the museum operation penetrates deeply and continuously into the teaching and public information function of the university. Moreover, while the museum staff may itself conduct research, this is a responsibility which belongs to all faculty members of the university. In fact, the museum's operation facilitates the research of faculty and students on the campus in museum-related fields and serves as an information bank for scholars in all parts of the world.

University museums of the scope of the University of Colorado Museum are relatively uncommon in America. The collection of museum materials in most universities is carried on by separate collections maintained by the various teaching departments. The assumption by a centralized museum of these curatorial affairs which are vital to the research work of the academic departments represents a significant release to those departments of budgetary burdens, to say nothing of the released time for their faculties.

We believe that a thorough analysis such as we have given here might profitably be undertaken by university museums wherever they may be, for such self-studies should serve to educate administrators, the public, state legislators, and federal agencies on the importance of continuing and supporting more strongly the ongoing museum activities of universities. To allow the burden of systematic collection accumulation and study to fall by default into the hands of a shrinking and increasingly centralized federally-supported operation is to ignore the actual and potential vitality of regional museums as educational and scientific resources for the future.

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