PROCEEDINGS

of the

NINTH PACIFIC SCIENCE CONGRESS

of the

PACIFIC SCIENCE ASSOCIATION

1957

VOLUME

MUSEUMS

Published by the

SECRETARIAT, NINTH PACIFIC SCIENCE CONGRESS

DEPARTMENT OF SCIENCE
BANGKOK, THAILAND

1958

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EDITOR'S NOTE

At the meeting of the Committee on Publications of the Ninth Pacific Science Congress, it was agreed that the increasing number of communications and papers presented at each Congress has become a very difficult problem for the Publication Committee and the editorial staff to cope with and that too much time is required to complete the publication of the Proceedings; therefore, it was recommended that the following principles governing publication be followed:

a. That invited contributions to the scheduled symposium be published in full;

b. That reports of the Standing Committees be published in full;

c. That other papers submitted to the Congress during its sessions be published in abstract only, the abstract not to exceed 500 words;

d. That papers which, though listed on the program or included in the pre-Congress abstracts published in advance but not actually submitted to the Congress at its sessions, should be disregarded;

e. That authors be asked to indicate by a definite and early date[1] whether they prefer to publish their papers in sources other than the Congress Proceedings; that if this is done, the Congress should be acknowledged;

f. That all proof reading be the responsibility of the editorial committee, and that this committee shall consider the manuscripts in their hands by a definite date as final;[2]

g. That authors be held responsible for submitting their material in good English;

h. That on matters arising during the course of publication and not specifically covered in the statement of policy the editorial committee is empowered to act.

In accordance with the resolutions of the Committee, the editorial board has edited the reports and manuscripts where necessary to bring uniformity and consistency to the format. Typographical and grammatical errors as well as errors in phraseology, spelling, or technical terms have been corrected, wherever possible, but in cases where the exact meaning of the original copy was not clear, the text has been left as submitted by the author.

In order to reduce the cost and bulk of the publication, appendices, illustrations, and exhibits whenever considered not vital to the text have been eliminated.

If an author requested to publish elsewhere, his paper has been mentioned in the footnote under the respective titles, but if an author who presented a paper at the Congress failed to submit his manuscript either in full or in abstract, his paper and the discussions thereon have been eliminated entirely.

It was also decided that, in order to complete the publication of the Proceedings as soon as possible, each division be published in a separate volume. Short volumes or the ones that do not require too much editorial work will be released first. Therefore, among the twenty volumes planned, any volume may appear first. They will not appear in consecutive order.

The editorial board wishes to thank all authors who were prompt in submitting their revised manuscripts in good form and, in particular, members of the Standing and Organizing Committees, too numerous to be named, who have helped in collecting the manuscripts pertaining to their respective divisions.

The Board wishes in particular to thank Dr. F. Raymond Fosberg for going over and correcti
the Special Symposium on *Climate, Vegetation, and Rational Land Utilization in the Humid T*
under Unesco;

Mr. Saman Buravas of the Royal Mines Department for helping by redrawin
in order that they might reproduce clearly when printed:

Mr. J. Alan Tubb of the FAO Regional Office, for his assistance in g
of the papers in the Fisheries and Oceanography volumes and in tra

[1] January 1, 1958, in the case of the Ninth Congress.
[2] March 1, 1958, in the case of the Ninth Congress.

Dr. Pradisth Cheosakul of the Department of Science for editing the Chemistry in the Development of Natural Resources volume;

Last but not least, the Board wishes to thank the *Thai Watana Panich Press* for their cooperative efforts, far beyond the requirement of the contract, in devoting all their resources to printing these volumes.

ABBREVIATIONS

APFC	— Asia-Pacific Forestry Commission
CAA	— Civil Air Administration
CSIRO	— Commonwealth Scientific and Industrial Research Organization (Australia)
ECAFE	— Economic Commission for Asia and the Far East
EQUAPAC	— Equatorial Pacific (oceanographic survey)
FAO	— Food and Agriculture Organization
IACOMS	— International Advisory Committee on Marine Sciences
ICA	— International Cooperation Administration
ICAO	— International Civil Aviation Organization
ICSU	— International Council of Scientific Unions
IGY	— International Geophysical Year
IPFC	— Indo-Pacific Fishery Commission
IRC	— International Rice Commission (FAO)
JCRR	— Joint Commission on Rural Reconstruction (Taiwan, China)
NORPAC	— North Pacific (oceanographic survey)
PHILCUSA	— Philippine Council for United States Aid
PIOSA	— Pan-Indian Ocean Scientific Association
SEATO	— South-East Asia Treaty Organization
SPC	— South Pacific Commission
UN	— United Nations
UNESCO	— United Nations Educational, Scientific and Cultural Organization
UNICEF	— United Nations International Children's Emergency Fund
USDA	— United States Department of Agriculture
USIS	— United States Information Service
USOM	— United States of America Operations Mission
WHO	— World Health Organization
WMO	— World Meteorology Organization

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MUSEUMS

Standing Committee Chairman: ROBERT C. MILLER
Organizing Committee Chairman: BOONSONG LEKAGUL

Standing Committee Report

REPORT OF THE CHAIRMAN OF THE STANDING COMMITTEE ON MUSEUMS IN PACIFIC RESEARCH

ROBERT C. MILLER

California Academy of Sciences, San Francisco, California, U.S.A.

By action taken at the Seventh Pacific Science Congress (New Zealand, 1949) the Committee on Museums in Pacific Research was established as one of the Standing Committees of the Pacific Science Association. This action was taken in recognition of a definite need, pointed out independently by two different groups. The Committee on Organization of Research adopted the following resolution:

> Whereas further taxonomic work, particularly on collections from relatively little explored areas in the Pacific, is badly needed as a basis for all studies dealing with biological data, and, since large and still undescribed collections have accumulated in various repositories, it is recommended that fuller recognition be given to museums in their capacity as research institutions and depositories of reference collections in such branches of science as zoology, botany, and geology; that the attention of governments and other institutions that support museums be drawn to the serious understaffing of many of them, which leads to inadequate systematic and curatorial attention being paid to such collections; that encouragement be given to students to embrace taxonomy and museum and herbarium work as a career; and that sponsors of expeditions be encouraged to make financial provision for the preparation and preservation of collections that they have procured for scientific museums.

The Division of Zoology adopted, in the same vein, a briefer but more specific resolution:

> That, in view of the problems common to scientific museums with collections from the Pacific area, and the essential part that they must play in systematic research in the fields of natural science, a *Standing Committee on Museums* be established.

Pursuant to the action taken at that Congress, the President of the Congress, Dr. R.A. Falla, appointed Dr. Robert Cushman Murphy as chairman of the newly authorized Committee, with the request that he select other members to serve with him as he might choose. This was a highly felicitious selection for a number of reasons, one of them being that most of us currently serving on this Committee began our service under his appointment. I am pleased to report that all of Dr. Murphy's original appointees have accepted reappointment, insofar as they were available to serve. Dr. M.F.W. Tweedie has retired from the directorship of the Raffles Museum, and Dr. T. Nakai has died. Four new members have been added to the Committee, having accepted appointment at my request: Dr. Yo K. Okada, Director of the National Science Museum, Tokyo, Japan; Dr. Eduardo Quisumbing, Director of the National Museum, Manila, Philippines; Dr. Roland W. Force, Curator of Oceanic Archaeology and Ethnology, Chicago Natural History Museum, U.S.A.; and Dr. Boonsong Lekagul, President of the Association for the Conservation of Wildlife, Bangkok, and Organizing Chairman of the Museums Section of this Congress.

I express my thanks to them for their willingness to serve, because each is able to make a particular contribution in his special field.

around to members of the Committee for comment and criticism, then rewrote before the Eighth Congress. It is a *magnum opus* in a very real sense—not Dr. Murphy's *magnum opus*, because he has many to his credit that are *maior*—but a *magnum opus* in the sense that it represents the approach to a new endeavor of a man who has spent his entire life in the museum field, still loves it, and still enjoys new challenges.

I have used Dr. Murphy's report as the basis of my own, and I think it will long be used as a model by future chairmen of this Committee.

With this preamble I shall proceed to report on the problems facing this committee as I see them, the progress that has been made toward their solution, and the further steps that need to be taken to make the Standing Committee on Museums in Pacific Research an increasingly effective body for the energetic furtherance of the proper aims both of museums as institutions, and of the research programs that revolve around them.

WHAT IS A MUSEUM?

This question apparently given encyclopedists and lexicographers some trouble. The Encyclopedia Britannica points out that the original meaning of the word was "a temple of the Muses," a derivation in which all other learned works concur. Webster, in the only edition available to me at this writing, defines a museum as "a repository or a collection of natural, scientific or literary *curiosities* (italics mine) or objects of interest, or of works of art." Funk and Wagnalls' College Standard Dictionary defines it somewhat vaguely as "a place" where such objects are kept. The Century Dictionary, with what some of us feel is almost painful literalness, defines a museum as "a building or *part of a building* (italics again mine) appropriated as a repository of things . . . ."

The New International Encyclopedia defines a museum briefly and with some approach to accuracy as "an institution for the preservation, study, and exhibition of objects of art or those of natural origin." This definition is good in that it points out the three-fold function of museums, preservation, study (that is, research), and exhibition (in the broader sense, education). In one respect this definition goes too far; there are numerous museums—especially in universities—that exist solely for research and have no exhibition whatever. In another respect it does not go far enough, because the educational program of museums today goes far beyond the exhibition of objects, and includes instruction through publications, lectures, and the use of radio and television.

Having criticized other definitions, I am perhaps now obligated to give my own, and render it likewise vulnerable to criticism. A museum, in my belief, is an institution of learning whose special functions are the collection, preservation, study and interpretation of objects of scientific, historical or artistic interest.

I toyed with the idea of including in this definition objects of "literary" interest, but that would be trespass on the domain of libraries. I do not know where the dividing line between libraries and museums lies. All large museums have important libraries, and even the smallest museum will have a collection of books, be it only a five-foot shelf above the curator's desk. On the other hand, many libraries perform museum functions. A good example is the Huntington Library and Museum at Pasadena. Another is the Library of Congress, which exhibits in its public halls some of the rarest of American historical documents.

The most famous museum of antiquity, that established at Alexandria by Ptolemy Soter about the beginning of the 3rd century B.C., (often erroneously attributed to Alexander the Great who established the city but not the museum), was much more a library than a museum. In fact, it was a good deal like a university—a center of study and research in various fields of human knowledge—and to that extent perhaps the forerunner of some of our great museums of today.

But by and large there is a recognized difference between the functions of museums and libraries; and it would be fruitless and confusing to define museums in such a way that libraries would automatically be included.

You will note that in my definition I have added the function of collection to those of preservation, study, and interpretation. A museum is not merely a storehouse, accepting and caring for such things as come to it. It must have an active program of searching out and acquiring the objects deemed worthy of preservation and study. In museums of natural history, anthropology, and archaeology, this involves a more or less continuous program of work in the field, which is a vital aspect of modern museology.

THE IMPORTANCE OF MUSEUMS

The world at large does not automatically, spontaneously, and universally regard museums

as important. The average citizen can probably be persuaded to admit that *some* museums are important. He probably has learned somewhere along the line that the *Mona Lisa* is in the Louvre. He has a vague notion that the Metropolitan Museum of Art is something that would rate a visit if he ever gets to New York. He has likely heard about the British Museum and the American Museum of Natural History. He is slightly confused about the U.S. National Museum and the Smithsonian Institution — which is which?

He probably knows the names of any museums in his own city — not accurately, but well enough to find them when entertaining visitors from out of town. It is sad but true that the average citizen regards his cultural institutions as something to show off to outsiders rather than as something he himself should repeatedly visit and enjoy. I am speaking now of the average American — the individual we refer to as "the man in the street" — but I suspect the man in the street is pretty much the same the world over; and the conditions I describe are doubtless true in most cities around the Pacific rim.

Museums have traditionally been regarded as dusty, musty, fusty places, filled with — as Webster has it — "curiosities." The phrase "museum piece" is often used in an uncomplimentary sense to refer to objects or even individuals that are felt no longer to serve any useful purpose.

Unfortunately this concept of museums has in the past too often been accurate. Fortunately it is not the case today. Museum methods and techniques have undergone a greater revolution in the past thirty years than in the previous three hundred. Gone is the old curiosity shop type of museum. The contemporary museum is a stream-lined educational institution, in which every exhibit is organized to give a maximum of information in a manner that can be readily absorbed. It still uses two-dimensional or three-dimensional objects, but its purpose is not to exhibit "things" but *ideas*.

Along with this change in museum techniques has come a growing sense of the importance of museums as institutions. The man in the street, when he visits the museum, finds something he didn't expect. This is more interesting than he thought it would be. In fact, it is rather exciting. He decides that maybe he ought to come back and bring the children.

Along with this change in the museum "front" has come a change behind the scenes that, from the standpoint of the advancement of learning, is even more important. Things have been changing in the curatorial department. A curator was once — as Dr. Murphy has said — a "caretaker," the root meaning of the word. Then he became a collector. The larger museums have for many years been sending their curators into the field — often on long expeditions to distant parts of the world — to add to the museum's collections. Then he became a scholar, because of the necessity of studying the collections he had made and relating them to other collections and to the whole body of knowledge in the field of his interest.

Today a curator in any major museum is a man of outstanding scholarship in the field of his competence — a man who could easily command, and frequently does hold, a university professorship — and is highly regarded by knowledgeable persons in his field throughout the world.

Moreover, another change has come about, particularly in the field of taxonomy. This was ably discussed by Dr. Murphy in his previous report, under the head of "Modern Taxonomy." I cannot improve on that discussion, but I take this opportunity to endorse it. I will quote from a lecture I used to give to students at the University of Washington:

"The taxonomist used to be regarded, and frequently was, a narrow specialist. One entomologist I knew told me he had no interest in insects as long as they were running around on the ground. His interest only began when they were impaled on a pin in his collection.

"But taxonomy, as we understand it today, is something quite different from this. A species is not an insect impaled on a pin, nor a specimen in a bottle of alcohol. A species is a group of organisms living in a particular environment; it has certain morphological characteristics by which it is ordinarily described; it has also certain physiological characteristics which are just as important, and certain genetic characters which it will pass on to future generations; it impinges on other species, with which it lives in a cooperative, competitive, or a merely interlocking status; its ecological relations are just as important as its morphological features, or even more so. This is what we mean by a species—a whole organism, living among and reacting with other organisms. The entire natural history of an organism is in a very real sense a proper part of the description of the species."

Taxonomy, viewed in this light, leaves its dry-as-dust confines and becomes as exciting as the whole world of nature. And this is the way that taxonomy is coming more and more to be viewed. Modern taxonomy takes in all of the disciplines relating to the study of organisms. Far from being a narrow field, it becomes one of the broadest and at the same time one of the most exacting disciplines in the world. And the museums are the institutions best suited to pursue it.

THE MUSEUM AND ITS PUBLIC

Museums have traditionally been simply places to which people may come. Here are the exhibits, here is the information. Take it or leave it. And all too generally the public has left it.

The modern museum goes out seeking its public. It does this openly, and through a variety of means.

First there is the press release. Newspapers play an extraordinary role in contemporary life. With his morning coffee the reader should find — along with the latest murder, the latest catastrophe, the latest impasse in international relations, the latest political malfeasance or misfeasance in office — an account of the newest exhibit in his local museum.

Numerous museums — indeed, most museums — have their own program of publication. This begins with guide books and museum leaflets, and may eventuate in scientific publications or in journals of popular science, such as *Natural History* or *Pacific Discovery*. This phase of museum activity will be covered in a separate paper to be given at a subsequent session of this Division.

There is in many museums an active program of cooperation with the schools. Sometimes this is assisted by the local school board, sometimes by private philanthropy. The program of the N. W. Harris Public School Extension at the Chicago Natural History Museum is an outstanding example of what can be accomplished by private philanthropy in meeting a need of the public schools.

Radio has long been used as a medium of communication between museums and the public. This writer recalls participating in such a radio program as early as 1922, when commercial broadcasting was still in its infancy.

Television is in most respects a more satisfactory medium because it is easier and more meaningful to display museum materials than merely to describe them over the air. When color television becomes more widely prevalent the situation, museum-wise, will be even better, because so many natural objects — birds, butterflies, tropical fish, gem minerals, to cite a few examples — depend so much on color for their impact on the viewer.

I should, however, warn out of a not inconsiderable experience — the museum I represent has had an educational television program on the air for eight years, and is now producing two such programs a week — television is an exacting medium. To produce a half hour of good television, with appropriate visual materials, takes long and careful preparation. No museum should venture into the television field unless it has adequate resources of material, personnel and — last but not least, — funds. Television is expensive. But properly used, it is a very effective means of museum education. Only a few museums have an attendance as large as one million persons a year, but a single television program may be seen by several million viewers.

Another means by which the museum may reach a larger public is through traveling exhibits. Many museums have found it worthwhile to equip a truck in such a way that it becomes a small museum that can be quickly and easily moved from place to place. Since a paper to be read on a later program of this gathering deals at some length with traveling museums, I shall mention them only in passing. I would like to point out that they constitute a particularly effective method of teaching rural health and sanitation.

MUSEUMS AS AN EDUCATIONAL FORCE

It is worth our while to consider the opinions of the value of museum work held by persons outside of the museum field. In this connection I should like to refer to a paper on "Museums and Education" by Salvador de Madariaga, which was published in *The Museums Journal*[1] a few years ago. Says Señor de Madariaga in part:

"... in the matter of museums I am a mere member of the public, and as such I entertain strong views about the importance—the really paramount importance—of museums for education, and particularly at the present day more than ever. You will forgive me for saying that in spite of the victory in the battlefield I am not exhilarated with optimism about the future of the world, and the reason for this is that I feel, as many of you, that we are, if not at the beginning of an era, threatened by the possibility of an era dominated by mass and matter instead of by spirit and quality.... In this fight, for it is going to be a fight,... the museums have a tremendous share to take, bigger than the schools, and for this reason: that, as I see it, the schools stand for *instruction* and the museums stand for *education*, and it is not the same thing.... In museums we can gather the contrast between quantity and quality, and the importance of quality as against quantity.

"The second point is complexity versus simplicity.... Things must be clear... but they are not simple. The respect for the complexity of things must be kept going... not by arguing with people, because they will argue back... but by telling them why, by merely showing them why, and letting them think it over, and realize the complexity of things."

[1] *Museums Journal*, **45**: 135-137, 1945.

Thus Señor de Madariaga. It affords no small degree of inspiration to persons working in the museum field to learn that an outsider looking in —the outsider in this case a distinguished scholar and man of letters—finds in museums a real civilizing force, a force for education in the broadest sense. It is important that museum staffs, museum administrators, boards of trustees, and persons in a position to contribute financially or otherwise to a museum program, be deeply aware both of the opportunity that is theirs and of the responsibility involved.

The recent spectacular Russian successes in launching satellites into space have increased public interest in science, and awareness of its impact on our lives. Museums are one of the sources to which people turn for information when their interest has been aroused. Most adults cannot go back to school when events impress upon them the increasing complexities of a technological civilization. But they can and do come to museums. There has been a noticeable increase in museum attendance since the launching of Sputniks I and II—especially in those museums which have the additional facility of a planetarium.

Museums can do much to point out the essential unity of science. We do not have German science and British science, American science and Russian science, occidental science and Asian science. Advances may be made now in one country, now in another. But the whole body of scientific information is one.

We have in our museum in San Francisco at the present time an exhibit, originally produced in the Los Angeles County Museum, designed to show the oneness of the human race. It points out that there is no distinction of blood types among the various peoples of the world—the same blood types are found among all. It illustrates, by a series of carefully selected photographs, the difficulty of even telling a person's ancestry by his appearance.

Thus museums are—or can be—a unifying influence in the world.

There is a saying often repeated among museum workers—repeated so often that no one knows who first said it: *A museum is a university of the people.* This is what our museums must in fact be.

RESEARCH AS A MUSEUM FUNCTION

If I have seemed to emphasize the educational function of museums, I would like now to place fully as much emphasis on their function in advancing the frontiers of science. This is one of the activities of museums least understood by the general public, and one of which it needs to be made increasingly aware.

The late Frank Tose, long the wise and able head of our Department of Exhibits at the California Academy of Sciences used to remark: "Museum exhibits are like the show windows of a store. Their purpose is to show the public a few attractive samples of the vast stores of merchandise you have on your shelves."

The public should realize that the materials on exhibit represent only a very small fraction of the museums' collections. It is the "merchandise on the shelves," the study collections in drawers and cabinets, that are the solid core of any good museum.

Some small museums may and do have no other purpose than that of displaying things to the public. But a museum is unlikely to serve this function well unless it is staffed by one or more persons who are experts in the field covered. An expert is a scholar, and a scholar is almost by definition a research man. Thus even a good small museum is likely to be, to a limited extent, a research institution.

Certainly research is one of the primary objectives of any large museum. Many kinds of research are carried on by museums, and there are in fact certain types of fundamental research that can be carried on only with the facilities a large museum can provide. One of these is systematic biology, which is basic to all other lines of biological research.

I have already mentioned the modern concept of taxonomy and do not wish to repeat. What I want to emphasize here is the importance—the indispensibility—of sound taxonomic research.

This has been eloquently pointed up by Ernst Mayr and Richard Goodwin in a recent publication entitled "Biological Materials, Part I, Preserved Materials and Museum Collections," Publication 399 of the National Academy of Sciences—National Research Council (U.S.A.). These authors state in part (pp. 4-5):

"Systematic biology has a purely practical significance in that the precise identification of organisms is of crucial importance in many applied fields, such as preventive medicine, agriculture, forestry, and geology. Many branches of pure biology as well, e.g., marine biology, ecology, population genetics, and the study of animal behavior, are dependent on the accurate identification of their study material, as are all other branches of biology that deal with specific properties of species. A deplorably large amount of published material is worthless because of a failure to recognize the need for correct identification.

"The importance of systematic biology, however, extends far beyond these purely practical aims. Various legitimate branches of biology, namely biogeography and much of evolution and ecology, are the specific preoccupation of systematists. Some of the best work done in these fields is done by systematists and is the result of painstaking taxonomic analyses. Yet the importance of systematics goes beyond even this expanded sphere of influence. One of the most important concepts of modern biology, the population concept, now widely accepted in genetics and ecology, was developed by taxonomists, as can be demonstrated historically. The approach of the systematist, who deals with evolutionary and population phenomena, is so radically different from that of the physiologist, who deals with functional phenomena, that a continued co-existence of both is necessary for mutual stimulation and to broaden the conceptual basis of biology. Just as cellular and molecular biologists need electron microscopes, Warburg apparatuses, centrifuges, and other expensive types of laboratory equipment and chemicals, so the systematic biologist needs collections. Those who are concerned with the cost of maintaining taxonomic collections should be reminded of the enormous savings, dollar-wise, which taxonomic work has made possible in the fields of agriculture, preventive medicine, fisheries, engineering and industry."

I commend this report of Mayr and Goodwin to your attention as a significant document which should be in the library of every museum dealing with natural history or systematic biology, and which should be studied by museum directors and museum personnel.

Museum research of course does not stop with systematic biology. Field natural history, ecology and animal behavior are logical areas of research for museum personnel. Comparative anatomy and morphology are traditional fields of museum research. Experimental biology is not excluded. One never can tell where a problem is going to lead.

A classical example is Herbert Friedmann's study of the wax-eating habits of the African birds known as honey-guides. Finding by an ingenious line of experimentation that they were able to digest wax with the assistance of certain microscopic organisms, he arrived at the thought that these same micro-organisms might be able to digest the waxy coating of the tubercle bacillus, and thus be useful in the treatment of tuberculosis.

Thus we find the Curator of Birds in the U.S. National Museum led by a study of an obscure group of African birds into the field of experimental biology and medicine. What could be better illustrative of the essential unity of science, and of the scope of museum research?

THE NEED FOR A MUSEUM ROSTER

Dr. Murphy in his report four years ago commented on the need for a roster of museums engaged in research in the Pacific area, or having significant collections therefrom. This need still exists.

Your chairman optimistically set out to compile such a roster. It proved to be, to quote Dr. Murphy's exact words, a "relatively formidable task." I prepared and sent out a three-page questionnaire to a list of 63 museums. To date 34 of the questionnaires have been returned — almost exactly 50 per cent. I am now in a position to compile a roster of half the museums engaged in Pacific research, or presumed to be so engaged; but I do not feel that such a document would be of very much use.

I am not able to be very bitter about this situation. While I was mulling over the failure of museum directors to fill out questionnaires, I received a communication from the Academy Conference of the American Association for the Advancement of Science. It was a roster of Academies of Science and their officers. Near the top of the list, which was alphabetical, I found California Academy of Sciences with an asterisk and a footnote reading "Questionnaire not returned."

With half of the returns in from Pacific museums I am encouraged to pursue this matter further, and will attempt to prepare and circulate in the relatively near future a roster as complete as I can make it.

The difficulty I had in merely compiling a list of addresses to which to send questionnaires emphasizes the need for such a roster.

TRAINING OF MUSEUM PERSONNEL

This is suggested as a new topic for consideration by the Standing Committee. It was broached by Dr. Murphy at the Manila Congress in his Statement:

"Museums have lagged behind the universities with regard to formalized plans corresponding with exchange or visiting professorships and fellowships available to competent graduate students. The established relationship between Yale University and the Bishop Museum has set a shining example. In the past few years several larger museums in the United States have also served as hosts and supervisors of young research workers whose travel and living expenses were defrayed by foreign museums, universities, or governments, or by grants from the great educational foundations. All such incipient movements are worthy of forceful encouragement."

I am sorry to say that little progress has been made toward implementing this suggested program of increased exchange of museum personnel

across the Pacific. I have approached two philanthropic foundations, both of which considered this particular matter outside of their prescribed fields. As a matter of fact, there is apparently no large foundation that considers museums its special province. Of course, many foundations have supported individual museum projects, sometimes quite handsomely. But I think most museum directors will agree with me that, when it comes to approaching large foundations for funds, museums are "hard to sell."

Here is a field to which private philanthropy could be well directed. Some captain of finance, wondering how to dispose of his fortune for the public good, could set up a foundation specifically to assist museums in their well-thought-out and generally not improper aims. Large sums of money have been left to much vaguer projects than those of museums, whose staffs usually know what they want to do and how to do it—also how much it will cost.

Doubtless it is wishful thinking to dream of a large foundation with its resources primarily devoted to the interests of museums. But there is no harm in trying. In the meantime, we have to accept conditions as they are. We have our museums and their problems, which have to be solved on an individual basis.

The crying need of many museums in the Pacific area today is to obtain adequate training for the younger members of their staffs. I know from correspondence and from his public utterances at the Annual Meeting of the Museums Association in Bristol last July[2] that Dr. Tom Harrisson of the Sarawak Museum feels this strongly. I have no doubt that other museum directors with similar problems are similarly concerned.

We must explore every avenue to get these young men the training by which they can most profit, and which will enable them to serve their highest function in the museum field. In most cases this will involve bringing them to one of the larger museum centers, and this at once involves a question of finance. In a very few cases Fulbright funds may be available; as a rule these provide only transportation, and must be supplemented from other sources if the young man is to continue eating while he pursues his education. Generally private philanthropy has to be invoked.

I recommend to the Resolutions Committee of this Museums Division the framing of a strong resolution on the subject of bringing our best young men from museums in the Pacific area to centers of museum teaching and research for periods of several months to a year or more of special training. Such a resolution will be helpful to those of us who are seeking funds from foundations for this important purpose. Twenty years hence the young men we are training now will be directing our Pacific museums.

[2] *Museums Journal*, **57**: 134 ff., 1957.

Symposium: *Museum Projects Relating to the Pacific Area*

THE PACIFIC RESEARCH LABORATORY AT CHICAGO NATURAL HISTORY MUSEUM

ROLAND W. FORCE

Chicago Natural History Museum, Chicago, Illinois, U.S.A.

A primary function of an anthropological museum is the care of specimens. No less important a function is the provision of means which insure the availability of specimens to the professional scholar who wishes to study them.

Unfortunately, very few museums manage to perform these basic functions at optimum level. The chief reason for the shortcoming is the failure to provide adequate facilities. In most museums the restrictions imposed by outmoded physical plants coupled with a steadily increasing volume of materials result in situations in which space is at a premium. Consequently, ethnological and archaeological materials are crowded together in makeshift fashion and are neither safe from damage nor readily accessible to the scholar.

If materials are to be well-cared for and protected from damage, adequate space must be provided for their housing. Likewise, if the full scientific worth of materials is to be realized, they must be arranged in such a way as to permit examination and study. This, too, requires space as well as special facilities. The nature of ethnological and some archaeological materials is such that there is no uniformity of size or shape. Special arrangements which are adaptable to awkward shapes and non-uniform specimen dimensions should be provided. The generally crowded conditions and absence of adaptable facilities in most museum storage rooms defeat the two primary functions a museum should provide, namely, the safe-guarding and ready accessibility of specimens.

Several years ago, in dual recognition of the excellent quality of its oceanic materials and the inadequate facilities for their storage and study, Chicago Natural History Museum (formerly Field Museum of Natural History) embarked upon a program of establishing a center for Pacific research. Up to this time, most materials in oceanic exhibits were crowded together in displays which were ineffective both from the standpoint of the ordinary museum visitor and the professional scholar. The casual visitor soon lost whatever interest he may have brought with him because he was bombarded with too many stimuli at one time. He soon became saturated by the vast array of materials ranged in uninteresting row after uninteresting row in exhibit cases. The scholar, on the other hand, was constantly tantalized by viewing materials he could not examine. Any extensive study of materials he might wish to make required the dismantling of exhibits and, of course, beyond a point, he could not be accommodated.

Chicago Natural History Museum, however, had an advantage in solving some of its space problems because of the extraordinary amount of floor space which originally had been devoted to exhibit halls. By sacrificing a relatively small percentage of this extensive area, extremely valuable space for storage was gained. Exhibit space was not unduly restricted in this process. For institutions less well provided with exhibit hall space, an expansion of study-storage facilities such as was undertaken at Chicago would have been impossible.

In order better to satisfy both lay and professional audiences, two main and coordinated tasks were undertaken simultaneously. One was to reduce the number of materials on exhibit, thereby making displays far less crowded and therefore more effective. The other was to combine materials retired from display with those in several small and vastly overcrowded storage rooms and house them in a new and spacious study-storage facility, conceived of as a Pacific Research Laboratory.

In addition to the recognized need for better study-storage accommodations for oceanic materials which would make them, in fact, reference collections, there was also recognized the fact that in order to carry out a much needed renovation of outmoded and overcrowded "open storage" exhibits, great numbers of specimens on display would have to be retired from case exhibition. In order to retire these specimens, space had to be secured for them to be stored. There was none. Indeed, the existing storage rooms were so

crowded and cramped that not only could no further specimens be introduced, but those specimens already contained were in no way accessible.

In these storage rooms, shelves and racks were crowded to the extent that many materials were hidden either underneath or behind others. Cramped space between shelves and racks permitted little room to withdraw and examine materials. No work space had been allowed in the old storerooms. Many materials were piled on the floor or were leaned against the walls. Of course the danger of specimen damage was great and collections could not properly be used for reference purposes. No drawer space for small and delicate specimens was provided in these storerooms, and often in order to secure a given specimen from storage it was necessary to remove and replace many others with consequent delays, waste of labor, and possible damage to materials. Study and research were impeded under this arrangement and inventory was impossible.

As a panacea for these several problems, an oceanic exhibit hall was closed off and display cases were removed. This area of over 3,000 square feet was then fitted with specially designed stacks of steel shelving and built-in drawers of shallow depth. A portion of the area was devoted to a large, airtight, two-level room in which materials subject to insect damage could be stored under poison. A work room with over a thousand square feet of floor space comprises one end of the now completed laboratory. Specially built 9 feet by 5 feet bins 14 feet high designed to contain bulky objects line one wall of the main room. There are about 500 square feet of bin storage space in all.

The 14 feet 5 inches height of the main storage room is split into an upper and a lower level. This main room is 182 feet long and 46 feet wide. In it, adjustable steel shelves allow nearly half an acre of storage space. The main arrangement of shelf stacks is accessible from two aisles. A dumbwaiter allows heavy objects and a specimen cart to be raised or lowered from the upper level. Multi-hole supporting steel members permit shelves to be raised or lowered as necessary and the installation of racks for long objects between shelves.

High-capacity fans regulate ventilation, allow the poison room to be cleared quickly, and assure that only filtered air enters the laboratory. In this way dust accumulation is avoided. Many other special features have been installed. For example, special racks were constructed for the storage of out-size materials such as drums, ladders, bowls, and house members. A hoist was installed for the raising of awkward and heavy specimens. Panels of hardware cloth are provided in some bins so that carved masks and other fragile materials may be suspended apart from each other.

Lighting is provided by over 200 flourescent units and a sink and drain board was installed in the work room for washing specimens. Large work tables are provided so that materials under study may be spread out.

Guiding principles in the planning and development of the Pacific Research Laboratory were adaptibility of fittings, optimum utilization of space, easy accessibility of specimens, and safety of materials. Both care of materials and the needs of the scholar were prime considerations throughout the planning and execution of the laboratory which now houses collections from Polynesia, Micronesia, Melanesia, Indonesia, Southeast Asia, the Philippine Islands, Australia, and Madagascar. A complete catalogue card file of specimens has been installed in the work room and individual typed labels designating material proveniences appear on each shelf.

On the order of 100,000 specimens are now housed in the Pacific Research Laboratory. Many of these rank with the finest from Oceania. Particularly extensive are the collections from Melanesia and the Philippines. The Sepik River materials from northern New Guinea are outstanding as are some of the items from Papua and the Massim area. Melanesian islands such as the Admiralties, New Britain, and New Ireland are strongly represented. Philippine Highland materials comprise what is probably the finest collection of artifacts from this locale anywhere extant. The Melanesian and Philippine collections are unique from both the standpoint of quality and quantity. The great majority of the specimens contained in the laboratory were acquired half a century or more ago from areas where similar collections can not be made today due to the general changes in the cultures of the regions and the consequent alterations in material culture content.

The special research aids which complement the materials contained in the laboratory contribute to the general research value of the collections. For example, through a microfilming process, the main card catalogue of the Department of Anthropology was reproduced insofar as it pertained to Oceania. Over 50,000 catalogue cards were so duplicated. This means that there is contained within the laboratory itself a complete record of the catalogue information relating to

member specimens. The convenience of this arrangement to the researcher can not be overstated. In addition to this very complete research tool, there is also in the Department of Anthropology a subject-index file in which specimens from the various areas of the world are segregated according to their nature. Cards describing specimens of similar kinds are grouped together so that, for instance, a student of Micronesian basketry will find filed together cards for all specimens in which he is interested for that area. If he wishes to make a comparison with similar materials from another part of the world, he has but to consult another drawer where a similar grouping of cards relating to such materials may be found. So it is with other categories of material culture. A convenient unmerical key enables the scholar to use this file quickly and efficiently.

Also there are available to the research scholar a series of excellent photographs of specimens in the cultural contexts from which they were derived. Most of these photographs were secured by field expeditions of the Museum, many of them when collections now housed in the Pacific Research Laboratory were being collected. The photographs are easily accessible since they are contained in albums which are arranged by area. Albums from Melanesia and the Philippine Islands are particularly outstanding.

The estimated total cost of constructing and fitting the laboratory approximates 50,000 dollars. The Museum received financial assistance in the development of the facility from both the Philippine Studies Program of the University of Chicago (supported by a grant from the Carnegie Corporation of New York) and the Wenner-Gren Foundation for Anthropological Research.

A large share of the credit for the initial planning of this study-storage facility is due Dr. Alexander Spoehr, the present Director of the Bernice P. Bishop Museum in Honolulu and former Curator of Oceanic Ethnology at Chicago Natural History Museum. Mr. Evett D. Hester, Associate Director of the Philippine Studies Program and Thomas J. Dee, Museum Fellow, was responsible for general supervision of the project. Generous support and interest in the project was provided by Mr. Stanley Field, President of the Museum Board of Trustees; Dr. C. C. Gregg, Museum Director; Dr. Donald Collier, Curator of South American Archaeology and Ethnology; and other members of the curatorial staff of the department.

The actual construction of the Pacific Research Laboratory took approximately two years to complete, but planning and installation of materials each extended the over-all conversion to a six-year span.

The time required for the completion of the laboratory was extended by at least two years because of the associated program of case exhibit renovation. As materials were retired to the new study-storage facility, the exhibits from which they were drawn had to be reorganized. Moreover, new hall case arrangements were executed and cases were modernized to the extent that they were painted and relighted. The labor involved in this general hall revision of course was considerable and the final result was a much more extended project than would have been the case if no such program of exhibit hall renovation had been necessary.

The laboratory now stands as undoubtedly the largest and most adequately equipped facility of its kind in the world. Museum collections of Pacific materials are now safely cared for and at the same time are readily accessible for reference and study by members of the Museum curatorial staff and by visiting research scholars.

A SCIENTIFIC INVESTIGATION FOR THE AUTHORIZED CITY OF REFUGE NATIONAL MONUMENT, HONAUNAU

G.C. RUHLE

Hawaii National Park, Hawaii.

(Abstract)

In the ethnology of a race or racial group, significant traits, customs, and institutions may evolve that give it distinction above the commonplace that is the mere product of environment or satisfaction of basic drives such as hunger and vanity. The institution of sanctuary that existed in Hawaii 200 years ago is in this category. In a framework of tyranny and fear, havens developed to which helpless and oppressed could flee for assured relief and safety. A similitude existed among the ancient Greeks, the Hebrews of the Old Testament, and in Polynesia, as in Tonga and Samoa.

The concept of a place of refuge is so singularly impressive that the National Park Service has determined to reconstruct and preserve the picture of the culture of ancient Hawaii about it. Of the several typical sites, that at Honaunau has been selected as the best suited for the purpose. This location also contained the depository of the bones of Hawaii's kings and was an important center of Hawaiian life and recent history. Consequently the Congress of the United States authorized in 1955 the establishment of a City of Refuge National Historical Park at that place. Only the acquisition and transfer of title of 180 acres of land by the territory must be consummated before material operations can be started.

While the territory is carrying out its task, the National Park Service has drawn up a contract with the Bishop Museum for a detailed surface and subsurface ethnological and historical survey of the area. No other institution or group of scientists is better qualified to undertake the study, of which the first phase has been completed and will be the subject of two volumes now being processed. The findings will constitute the basis for all future planning, development, operation, maintenance, and interpretation of the area.

It is anticipated that the National Park Service will restore the picture as it existed at some date, say 1750. To this end, all exotics must be eradicated and subsequent changes obliterated as are feasible. Landscaping will be tailored appropriately. In operational development for visiting guests, only picnic grounds are contemplated. Interpretation should include an expository museum, study collections, naturalist guides, talks, explanatory markers, self-guiding trails, and literature. Native living may be demonstrated in the fashion effectively used elsewhere in portraying colonial, ante-bellum, and Indian life. Study of adjacent, related areas is being included so that the territory may be encouraged to preserve such sites as Keei Battlefield and Kealakekua Bay. Their integration with the story of the City of Refuge will be mutually beneficial. Contemporary Hawaiian usage of the park such as swimming, canooing, and fishing will be encouraged to the extent that augments and is not incompatible with the primitive picture.

The most significant feature of the project is the fact that this is the first instance in which thorough study and investigation precedes any planning and development, even before the area becomes a part of the National Park System. It should thus prove to be a model of sound, intelligent procedure.

ARCHAEOLOGICAL MUSEUMS IN THAILAND

CHIN YOU-DI

National Museum, Bangkok, Thailand.

Recent discoveries of antiquities of various types and periods under stupas and prangs reveal that collections of archaeological artifacts in Thailand began early in the fourteenth century, A.D.

The origin of the museum movement in this kingdom is traced to King Mongkut's collection displayed in the Ratcharudi Hall, where Sir John Bowring, the British Ambassador, was received in audience by the King (1852-1869). Later on he built one more building named Praps-phiphithaphan to house his growing collection. In 1874, a public museum was founded in the Concordia Hall (now known as the Sahathai Hall) by King Chulalongkorn, his son and successor. This museum comprised two sections, one archaeological and ethnological and the other geological and zoological. It remained there for thirteen years until, on the death of the last Prince-Successor and the abolition of the office of the Prince-Successor, his palace became vacant. So King Chulalongkorn had the museum moved into the front part of the Prince-Successor's palace. During that time it was under the direction of the Ministry of the Royal Household. In 1926 King Prachathipok graciously made over the whole palace of the Prince-Successor to the museum. By Royal Command, Prince Damrong Rachanuphab reorganized the museum. Its exhibits were then comprised only of items of archaeological and ethnological interest. Through the Prince's indefatigable work the museum came to possess a rich archaeological collection which has since been Thailand's pride. The museum was designated the National Museum and is now attached to the Fine Arts Department. Though it lacks a laboratory, a lecture room, a library and much necessary equipment, its staff has been trying to offer museum-services to the public. In the museum-shop are some publications both in Thai and in English, some picture-postcards, and small guidebooks for sale. School children are guided through the museum, so that they can derive more benefits from the visit. It is worth noticing that during the last decade the number of visitors has doubled, i.e., in 1947 there were 89,847 visitors; and in 1958 the number rose to 192,147.

The greatest impetus for the museum development was furnished by the personal enthusiasm and inexhaustible efforts of Prince Damrong. While serving his country as Minister of Interior he encouraged lord-lieutenants, governors, district officers, and abbots to collect antiquities found in their respective areas and have them housed either in town halls or in temples or sent to the Ministry of Interior. The year 1902 saw the establishment of government museums in the Provinces of Ayutthaya, Lop Buri, Nakhon Si-thammrat, Nakhon Pathom, Phitsanulok, and Lam Phun.

Another important phase of museum growth is the rise of small but interesting museums in large temples. Six small archaeological museums have been started since 1935, i.e., in 1935 at Wat Mahathat, Chaiya District, Surat Thani Province, and at Wat Mahathat, Phet Buri Province; in 1953 at Wat Bot, In Buri District, Sing Buri Province and at Wat Ratchathani, Sukho Thai Province; and in 1956 at Wat Suthichinda, Nakhon Ratchasima Province.

Today we have three archaeological museums in Bangkok and twelve more in twelve provinces.

Symposium: ***Museum Functions and Methods***

THE HERBARIUM AS A RESEARCH MUSEUM

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The discussions at the Seventh Pacific Science Congress which led to the establishment of the Standing Committee on Museums in Pacific Research were initiated by a paper entitled Museums in Pacific Research (Fosberg, *Proc. 7th Pac. Sci. Congr.* **1**: 91-93, 1951). This paper was first written about herbaria, but later was changed to include the general subject of museums because the basic problems facing all types of research museums are essentially similar.

Even during the initial discussions there was a tendency to ignore herbaria, and since then not too much attention to herbarium problems has been manifested by the committee. Hence it seems appropriate to offer a brief discussion of the nature and use of the herbarium to make possible a comparison with other types of research museums, and, for the benefit of those who may have charge of herbaria, a description of certain recently evolved techniques and ideas that broaden their usefulness.

A herbarium is essentially a collection of pressed and dried specimens of plants (just as an insect collection is an aggregation of dried and pinned or preserved insects). Because most plants lend themselves very well to this method of preservation, and because, thus preserved, they may be stored indefinitely with considerable economy of space, certain more or less standard techniques for handling them have developed. The plants are commonly mounted on sheets of heavy ledger paper, approximately $11\frac{1}{2} \times 16\frac{1}{2}$ inches (28×41 cm.), with glue, drops of plastic, or gummed strips. Thus mounted, the specimens may be handled, sorted, and studied without damage. There is no known limit to the time they will stay in good condition if they are protected from insects and moisture.

A label with the original data, any amount of information about the plant and its occurrence that the collector thought worth recording, is pasted on the lower right corner of each mounting sheet. The remainder of the blank part of the sheet is available for critical observations or subsequent reidentifications by those who study the specimen. These sheets are sorted by species, filed flat in heavy folders of manila paper in special cases with tight doors and pigeon holes 12 inches (30 cm.) wide, 6 inches (15 cm.) high, and 18 inches (45 cm.) deep. With them, in many modern herbaria, are filed photographs, drawings, and other illustrations, clippings with descriptions, keys, and critical notes and any other pertinent material that lends itself to this method of preservation and filing. The object is to have as complete a representation as possible of each plant, its morphology, variation, phenology, and its distribution in space and even in time, brought together in one place where it will be available for use when the plant is studied. Large series of specimens of a species are accumulated, giving an accurate picture of its total variation in relation to geographic distribution. This material is gathered from many sources. A world-wide system of exchanges of herbarium specimens has existed for many years. This exchange not only broadens the representation of species in the collections, but it also brings together for comparison the ideas of many specialists because critical identifications go with many of the specimens.

In a large herbarium, in the case of a few species at least, a large enough sample of the total population of a species is available for examination so that even statistical methods can be used to gain a better idea of the significance of variation. To make the herbarium an even more effective tool for botanical research, two new methods have been introduced during the last 25 years, both by the gifted Edgar Anderson. One is the technique of mass collection. This method increases the statistical basis for studies of variation by collecting large series in a single population, taking only the particular part of the plant where the variation occurs. It is thus possible to get a single flower, leaf, or other organ from each of a hundred or more individuals and mount them all on a single sheet or two, thus benefiting from a hundred individuals while using the space normally occupied by one or two.

The other idea introduced by Dr. Anderson is called by him "the inclusive herbarium." It is a means of getting more adequate representation of large plants of which normally only a fragment or two are preserved. An inclusive herbarium specimen may occupy several to many sheets, each part of the plant being carefully selected, dried, and arranged for mounting with ample notes on the parts and their appearance and arrangement in living condition. Many economic plants that do not lend themselves to adequate representation by ordinary dried specimens are at last being effectively studied by this method.

In addition to the obvious function of bringing together sufficient specimens of a species, species of a genus, and genera of a family for adequate study, the herbarium performs various other important functions. It provides a representation of the flora of a region adequate to form the basis of a manual or book on the flora. It provides for the permanent preservation and availability of the type material or original specimens on which new species are founded and names based. It preserves vouchers for the identifications of plants on which chromosome counts have been made, physiological, morphological, or genetical work has been done, or for any published data dealing with particular plants. And last, but scarcely least, the large body of specimens provides a means for quick and reliable identification of unknown specimens by comparison with those already identified.

The foregoing is only a brief outline of some of the basic methods and techniques of assembling and utilizing herbarium collections. Details of practical procedure can be learned by reading longer articles or books on the subject, but it is much better to learn by visiting and actually working in a number of large herbaria. Methods vary enough so that more than one institution should be studied to see what is really best under different sets of circumstances, and how to accomplish different purposes.

The problems confronting herbaria are essentially those bothering other types of museums. Lack of adequate space to house growing collections is one. Another is lack of sufficient botanists and clerical help to take care of the collections and provide the service that is expected by the public, scientific and otherwise, in the form of identifications and answers to a vast volume of questions about plants—some of them truly astonishing. The protection of the specimens against insect pests, fungi, dust, and dampness is a constant problem. Lack of public appreciation of the need for large study collections as a base for research and service and consequent inadequate financial support are discouraging difficulties. Carelessness on the part of those who utilize the collections for study is a problem that is serious, though it should not even exist.

It will be seen from this discussion that in every respect, the herbarium is the exact equivalent of research museums dealing with other categories of scientific material. The name "herbarium" goes back to the days when most such collections were the hobbies of people interested in plants. Perhaps botanical museum would be better, but herbarium will doubtless persist.

A substantial number of important herbaria are located in the Pacific Basin. Also a number of the great herbaria of the world—those in Leiden, Paris, British Museum, Kew, Edinburgh, Geneva, Florence, Gothenburg, Washington, Harvard, Chicago, and others, have substantial Pacific collections and are centers of active work on Pacific plants. A list is being distributed at this congress that names between 500 and 1,000 botanists who are interested in and working on Pacific plants in one way or another. *Index Herbariorum*, a list of all herbaria with some description of their contents, is available from the International Association for Plant Taxonomy, Utrecht, Netherlands. In view of this interest and of the importance of plants in the natural scene as well as in man's economic system in the Pacific, it is hoped that the Standing Committee on Museums in Pacific Research will give herbaria and their problems an adequate share of attention.

THE PROBLEMS OF AN ALL-ROUND MUSEUM IN A SMALL COUNTRY

TOM HARRISSON

Sarawak Museum, Kuching, Sarawak.

I speak as the Curator of a museum in one of the smallest countries in Asia: the Sarawak Museum at Kuching, capital of Sarawak in West Borneo. Sarawak has a population of 500,000 people, scattered over a large country. The other three Borneo territories, including Indonesian Borneo with several million people, have no museum at all. One immediate problem the author feels, is that as the only museum on a huge island, Sarawak Museum should attempt to serve the interests of science of the whole island.

The Sarawak Museum was started by the second White Rajah, Sir Charles Brooke, a most enlightened ruler, more than 50 years ago. The third rajah kept up this interest; and since the Japanese War, successive governors of Sarawak (notably Sir Anthony Abell, K.C.M.G.) have encouraged and expanded the scope of the Museum's activities. Sarawak is now proud of owning this show-place, one of the best of its kind to be found in any small country in the world. It now has the finest Borneo collections in the world, and attracts not only swarms of daily visitors from inside Sarawak but also students from as far afield as U.S.A., Holland, Hawaii, Australia and Formosa. Its function is to be an all-round Museum: that is, to collect everything — plants and birds and snakes, as well as arts and crafts and antiques. This may seem to be a tall order, and in some ways it is. But by confining the collections strictly to things (living or dead) found *inside* Borneo, the scope is more limited and easily understood by all.

Even so, one of the worst headaches in running such a museum is the range of questions one is expected to answer. And the public is entitled to have any and every question answered, however seemingly absurd or trivial. That is one of a local museum's jobs — and one of the best ways of winning public good will and support.

I would like to define the main functions of an all-round museum in a small country like Sarawak. There are seven points of priority:

1. To present a well-selected display of exhibits, so arranged that even illiterate people — a large part of the population — can enjoy the museum.
2. To keep the atmosphere of the museum informal, airy and cool, so that even people from the far interior in loin cloths can feel relaxed — and stay in the place all day if they like (as some do).
3. To keep changing exhibits and having special displays, especially topical ones; never to let the Museum get static or stale. In a small country, a museum must be a "living" museum — or everyone will feel they *know* it, and it is done with.
4. To explain the museum's collections and work as widely as possible, to give lectures, school and radio talks, write articles, publish popular accounts, and so on.
5. To separate the selected — and not *too* numerous — display materials from duplicate reference and study collections intended for advanced students, specialists and visiting experts.
6. To encourage outside persons to come and study the reference collections; and at the same time get these outsiders to talk, teach and interest local people in their special subjects.
7. At all times, to interpret the museum's functions liberally and alertly, avoiding complacency or pedantry at all costs.

This is a fairly tough set of criteria. It demands a lot of the small staff of a small museum. And, therefore, the absolute preessential in any all-round museum in a small country is a staff who are not time-servers or clock-watchers or pension waiters, but genuinely keen, enthusiastic fellows, with a sympathy for the people, a ceaseless curiosity about the country and a restless urge to keep on learning as well as teaching. Fortunately, a small but significant minority of Asian intellectuals have these capacities to a high degree. And there is a widespread understanding of nature and of art in Southeast Asian countries, where these things are much closer to everyone everyday than in the west. So it is relatively easy to get people to collect or study animals, plants and so on. Otherwise all would be of no avail! For an outsider can only guide and direct and train the local inhabitants. The real drive and interest MUST come from *within* the country.

There are also *technical* problems of a small all-round museum. In the tropical climate of an equatorial country like Sarawak, constant vigilance is needed to offset the ravages of dampness, white ants, cockroaches, bleaching, fungus infections on textiles, and much else. Fortunately new chemicals and air-conditioning greatly simplify this problem. Close attention should also be paid to damp-causing and sealing of *buildings*. It is no good turning any old shack into a museum — as has been done in several Asian countries recently. In any *new* museum project, first attention should be paid to design and construction. In this, the Sarawak Museum has been rather fortunate in obtaining special funds to erect a new building especially to house reference collections, reference library archives and offices. This is now completed and includes space for research workers and visiting scientists.

The problem of helping to promote research, both indoors on existing collections and outdoors in subjects like archaeology, is also likely to require attention in such a Museum. A curator can make himself helpful to the administration as a whole, and thus further justify his existence. For instance, in Sarawak the curator is also, in effect:

Keeper of Ancient Monuments; Keeper of the State Archives; Editor of the *Sarawak Museum Journal* (with world-wide circulation); Government Ethnologist (part of his official title); Controller of the Edible Birds' Nest Industry (the most expensive food on earth); Superintendent of the local zoo; Vice-Chairman of the National Parks Board; Executive Officer of the Turtle Board (selling up to 2,000,000 turtle's eggs a year).

Such are the duties embraced by the term "All-round Museum" in a small but progressive and intellectually alive country like Sarawak.

MUSEUM EXTENSION SERVICE THROUGH TRAVELING MUSEUMS

ARNOLD B. GROBMAN

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(Abstract)

Traveling museums, that carry a series of displays in automotive vehicles are discussed. Some details are given of the unit operated in Florida with a briefer discussion of the traveling museums of Illinois, Wisconsin, Virginia, Tennessee, New York, Nevada, Poland and France.

Traveling museums have a number of advantages. (1) They bring museum displays to many persons who would not, otherwise, have an opportunity for such an experience. (2) They cost less to operate, per visitor, than a central museum building. (3) They increase the citizen's interest in museums. (4) They are an especially valuable educational and enrichment source for rural residents or those living remote from the more metropolitan areas.

There seems to be considerable applicability to the Thailand situation. A traveling museum could be of great service before, as well as after, the National Museum is constructed.

The exhibit content of existing traveling museums in the United States covers the fields of art, science, history, and technology. Average costs for operating the traveling museums in America approximate seven cents per visitor.

PUBLICATION AS A MUSEUM FUNCTION

DON GREAME KELLEY

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The first order of business of a newly formed human society, however small and insignificant, is to put itself on record. Minutes are kept in minutest detail. No time is lost in formulating—and publishing—a constitution and by-laws. If the society is a learned one, especially if its purposes are scientific, it will, it must—having survived and duly recorded the throes and pangs of its birth—rush with all possible haste into print. For although the body's elan vital was immediately that of mutual interest—the joint and several investigation of physical phenomena—its *raison d'être* is inevitably to Contribute to the Literature. Its members will at first have to "cross file" (borrowing a California political term for party fence-jumping) in the journals of established societies; but academic prestige requires that it beg, borrow, or appropriate from dues, at the earliest date, to launch its own Proceedings, Bulletin, Journal, or what have you. In time, the new society's age and stature will be measured—as trees are by seasonal growth rings—through the annual increment on library shelves of its published footage. Variable factors are, of course, the productivity—and the prolixity—of contributors (a certain Dr. Ayres, eagle-eyed watcher of fish market stalls, almost single-handed kept things proceeding voluminously during the first year or so of the California Academy of Sciences, with his descriptions of new ichthyological species).

In this paper I intend to outline somewhat informally the publishing history of the California Academy of Sciences, then look for suggestion there as to the growth and evolution of the society itself, stressing its relation to the general public which surrounds and in good part supports it. I will try to show how its course of development naturally led the Academy into the popular publishing field, with particular reference to its bi-monthly non-technical magazine *Pacific Discovery*, with the history of which I have been rather intimately connected from Volume I, Number 1 to the present. Finally I will venture into some ideas on possible future trends in the publishing program which may be read partly from trends within the Academy as a whole. Appended will be a brief statement on present policies guiding the Academy's technical publications, by their editor, Dr. Edward L. Kessel. Any generalizations applicable to similar institutions, which may seem evident to some one or another of my hearers, are his own: beyond my opening paragraph I make no attempt to generalize on museum publishing, leaving that to persons familiar with the publishing histories of many such institutions.

Cities give birth to institutions, usually in maturity. Parturition of the "first academy of sciences west of the Atlantic seaboard," however, occurred in defiance of biological custom during San Francisco's Gargantuan infancy. How the gold of 1848 and '49 and the silver of the next decade transmuted a sleepy Mexican village of 800 or so into a roistering town and city of thousands, is a story heard round the world — and often; I'll not retell it. It was a *new* city, this San Francisco — even to the name (the Mexican village was Yerba Buena until 1847) — and to its growing pains it added schizoid tendencies. Gargantua was monstrous; he was also a humanist. This was a city of cutthroats (585 homicides in 1855); it had also, correlatively, a quantity of doctors. Whether the medicos came to stitch the Argonauts' throats or — as present-day income tax returns might suggest — to dig the gold from their pockets, they came endowed with the general scientific knowledge of the day. With them came other men of letters — and printers. Here, then, in the city's infancy, were the makings both of a learned society and of its inevitable issue, a new stream of scientific literature.

On the evening of April 4, 1853, five physicians, San Francisco's first superintendent of schools, and a real estate broker met by candle-light in the latter's office, and founded the California Academy of Natural Sciences. They elected officers, appointed committees, drew up constitution and by-laws, and kept minutes of their weekly meetings. And with dignified, certainly not undue, haste they looked up a printer.

"It was early recognized by members of the Academy that publication was an indispensable function of a scientific organization," the present director, Dr. Robert C. Miller, wrote in *Pacific Discovery* (March-April, 1953), on the occasion of the Academy's centennial. "But how to publish their findings was a serious problem. Communication with the eastern United States was poor. Railroads were non-existent, and even the Pony Express was still seven years in the future.

"At the Academy meeting of March 27, 1854, it was '*Resolved*, that in view of the isolated condition of the Academy from other societies we will regard every publication of new species which has been or may be made through the daily papers of this city as substantial evidence of priority of discovery.'" The Corresponding Secretary was instructed to notify other scientific bodies of this resolution.

"Very shortly, however," quoting Dr. Miller again, "... arrangement was made with a weekly magazine, the *Pacific*, to publish the Proceedings of the Academy in such form that they could be reprinted as separates from the same type, at very small expense, and subsequently bound into volumes. The first number of the Proceedings was published thus in September, 1854, and the first volume, consisting of 126 pages and 6 plates, was completed in January, 1858. From this small beginning grew the Academy's 'ten-foot shelf of books'—Proceedings, Occasional Papers, Memoirs, and special publications—numbering about one hundred volumes, containing original contributions in almost every field of science and found today in every important library in the world."

I found it extremely interesting to look into these first printed pages from Western America's first scientific institution. They truly reflected the state of knowledge of the new West a century ago — practically everything was new, even the fish you brought home from market for your dinner! The Academy made no grandiose entrance into the stream of scientific literature. In almost a backyard nature-notes vein, by modern standards, begins Book One, Chapter One:

The observant and meticulous Dr. Ayres then proceeded to back up this note on ecology and common name with erudite description in proper technical style, two and a half fine-print columns' worth. The California Academy of Natural Sciences was Contributing!

Publishing of the Academy's Proceedings took second order of business in the second of meetings thus recorded, September 11th, 1854:

Dr. Kellogg in the chair.

The Committee on Botanical Garden reported progress and was continued.

Mr. L.W. Sloat exhibited a proof-sheet of the proceedings of the last meeting, (taken from the columns of the *Pacific*) as a specimen of the manner in which the proceedings of the Academy may be published in a permanent form, and at a trifling expense.

On motion of Dr. W.P. Gibbons, it was

Resolved, That the publishing Committee be directed to publish 250 copies of the Proceedings of the Academy, (in the form exhibited by Mr. S.) and that the subscription of the same be three dollars a year.

The Academy thereupon proceeded, looking at a drawing of the *chia* plant, a curiosity from Los Angeles, and, among other things, listening to another two-and-a-half column "communication" in which the ichthyophilous and, I trust, ichthyophagous Dr. Ayres described two more new fishes he had collected in the local markets. Proceedings then abruptly ended with a motion by the good doctor, apparently anxious to insure his descriptions reaching posterity:

Resolved, That the Recording Secretary be directed to publish the proceedings of each meeting of the Academy in the *Pacific*, as soon after the meeting as practicable.

PROCEEDINGS OF THE CALIFORNIA ACADEMY OF NATURAL SCIENCES.
(Taken from the Society's Records.)
Vol. I. San Francisco. 1854

Sept. 4th, 1954.

DR. A. KELLOGG in the Chair:

Mr. W. J. Steene, by the Ed. of the *Pacific*, presented a curious specimen of cabbage, grown on the Sacramento bottoms, which, instead of a head formed of leaves in the usual manner, has a globular head formed by an enlargement of the top of the main stock ....

Dr. Kellogg exhibited a drawing and specimen of a plant from the sea shore and salt marshes of the Bay of San Francisco, the *Frankenia grandifolia*. The plant is often coated with crystals of salt, which has given it the common name of Salt-weed ....

Dr. Ayres presented descriptions of the following species of fish, believed to be new:
Labrus pulcher.—Ayres. This species, one of the finest of our fishes, makes its appearance in the market about the first of August, and continues in season till nearly the close of February. They are sold by the fishermen under the name of Blackfish, and are also not unfrequently (sic) called. Sheepshead ....

After its first two meetings, the Academy had moved, lock, stock, and specimen Cabinet, from Mr. Sloat's office to that of School Superintendent Nevins. Appended to the Proceedings of September 11, 1854, we find this eleemosynary note:

Omitted in Proceedings of Sept. 4th.—Col. Nevins presented to the Academy a receipt in full for the rent of his office and furniture, which have been used by the Academy from the 18th of April, 1853, to the last day of July, 1854, for its weekly meetings, and for storing its Library and Specimens, and for the stationery used for its minutes, and other purposes; being a donation to the Academy worth at least three hundred dollars. Whereupon it was, on motion,

Resolved, That the thanks of the Academy be tendered to Mr. Nevins, for his liberal donation, above specified.

October 16, 1854, is the date of the Academy's first recorded interest in popular education, though we fail to find a follow-up note on subsequent action. Proceedings records a motion which just might bear some relationship to the note of September 11:

On motion of Mr. Nevins,

Resolved, That the Curators examine and report at their earliest convenience whether there are in the Cabinet any surplus specimens which can be spared as donations to a Cabinet for the Public School at "North Beach", in this city.

Does the absence of a published report from the Curators show a lapse on the Recording Secretary's part, or is it silent testimony to curatorial parsimony?—curators were ever loath to part with specimens. The record also fails to reveal whether the worthy Colonel Nevins was in turn indebted to the city fathers with respect to the premises from which he presumably conducted his superintendency of schools, leaving us with the impertinent thought that his zealous motion in behalf of the "North Beach" school might possibly have been guided by conscience on two different levels. Be that as it may, the Academy takes much pride today in the heavy use made of all its facilities and many of its publications by the great modern San Francisco City and County Unified School District. If the city did have a silent share in his generosity to the Academy a hundred years ago, Colonel Nevins has been vindicated and redeemed, many times over.

It was said of early San Francisco that every tenth resident was a Frenchman, and many a Gallic name turns up on Academy membership rolls. Perhaps they all could read their science in English. At any rate, the Academy's first publishing in a foreign language seems to have been for the benefit of another group also well represented in California in those days. In this same Volume I appears the motion: "That copies of the Proceedings of the Academy be furnished to the San Francisco Journal, to be published in the German language." (Could it have looked ahead a full century to the present august gathering in this much older city of Krung Thep, with the Academy represented by its admiral and one sideboy, the then Committee of Publication might well have provided for translation into Thai. I beg indulgence for the omission—San Francisco's Far Eastern constituency of the time was largely Chinese and chiefly engaged in more practical pursuits than that of pure science.)

In 1863, Volume II issued from the Excelsior Steam Printing Office in its own proper format: Volume I was reprinted in 1873, in a conforming page size, the type reset smaller than that of the *Pacific* but in the magazine's two-column page style. From here on the Academy recorded less routine business in Proceedings until, with the Third Series beginning 1898, such matters ceased to appear. The Proceedings as published became strictly contributions to the literature. Longer works came out as Occasional Papers, Volume I in 1890. Certain Memoirs have been presented, as *to* the Academy, in more elaborate and costly format — five volumes so far, from 1868 to 1905, monographic in treatment of their widely varied subjects.

Now I am going to risk some hasty interpretations of the meanings of change as I see them. While they appeared in the public print during the Academy's formative years, the Proceedings served the secondary but vital purpose of bringing the young society to public notice, thus gaining membership, sufficient at the outset to insure its growth and continuance. When at length they were issued in their own format, they reflected the coming of age of the institution, and they entered directly into the main stream of science for scientists as it coursed through established channels around the world. During this maturing period the Academy was enabled through benefactions to shift the burden of its invasion of popular awareness to the weapons of museum exhibits, public lectures, noteworthy expeditions, and so forth — all the things that attract the public. It needed no general following of its literature in the public press; and, moreover, its publishing program was increasingly for specialists in the various scientific disciplines. Thus the Academy grew, serving science through collections and

publications, and meeting the public in its museum halls which, as they stand today, many-faceted, in San Francisco's world famous Golden Gate Park are one of the major scientific cultural centers of western North America.

For these very museum halls and others like them the world around—showplaces of the earth's natural wonders—have helped create a larger popular appreciation, a more intense and intelligent general interest, and consequently an unprecedented demand for descriptive and interpretive literature. Publishing houses have risen to this demand with the greatest array ever seen of attractive and readable books about all aspects of the natural world and universe. Many science museums have also accepted the challenge. The Handbook Series of the American Museum of Natural History is designed to carry one deeper into the subjects portrayed in the vast New York exhibition plant and beyond museum walls (Number 11 in the Series, Mead's *Old Civilizations of Inca Land*, was my principal text in an undergraduate anthropology course at the University of California, to give one example). The California Academy of Sciences has long recognized the need for something to carry away from cases, mounts, and dioramas besides fast-fading, and incomplete recollections. Descriptive brochures were issued for each of the new buildings in Golden Gate Park and were quickly run out of print. At the Alexander F. Morrison Planetarium desk, low-priced pamphlets on the sun, moon, planets, and stars sell in quantity. In the last few years the Academy has adventitiously published several popular books, and its editorial cooperation is frequently sought by magazine and trade book houses. While Proceedings perenially proceed from the rootstock, a new branch is flourishing upon the Academy's literary tree.

Ten years ago, perhaps emboldened by the rather spectacular success of the American Museum's *Natural History*, the Academy decided to launch a popular magazine of its own. Your speaker was hired to get the idea into print. *Pacific Discovery* has become well established on the planes of science and literature, if not yet on that of profit to the publisher. As editor, I have come this far on a six months' tour of the Pacific which has as its final objective the development of *Pacific Discovery* into a major magazine of the Pacific world in the fields of natural and human history, geography, anthropology, and related sciences. (I am happy here to acknowledge my indebtedness to the John Simon Guggenheim Memorial Foundation, The San Francisco Foundation, and certain persons whose liberal recognition of the merit of this purpose has made my tour of the Pacific possible.) It is the Academy's hope, and mine, that *Pacific Discovery* will in the future throw some weight towards understanding, friendship, and cultural interchange among all Pacific peoples—ideals which are already in full working force among their scientific representatives as the spirit and tangible results of these Pacific Science Congresses abundantly show. If *Pacific Discovery* can help strengthen this spirit and contribute to its results in cultural gains among plain people of the Pacific, then indeed the California Academy of Sciences will be proceeding in new directions to larger goals.

The Academy was born of the need of cultured men in a cultural desert to seek each other's company in a society whose common interest was to investigate, discourse upon, and describe to the world all natural aspects of a region still new to civilized man. The society they founded helped very considerably to bring broader cultural values to a new and rawly materialistic frontier community. Growing with the community, it outgrew the status of coterie and reached into ever broader strata of community interest, appealing to each on its appropriate level. Drawing upon an increasing fund of public support, the firmly established Academy has repaid through continuously augmented public services. In its publishing program this is evident in its recognition of new demands and its making use of new channels for the spread of knowledge it receives and creates. It has thus become a cultural asset to a larger community at every level—that of the school child, the man in the street, the specialized scientist, or of any recognizable group which the Academy can reach through diverse means of communication. The Academy hopes, through its efforts to report, interpret, and integrate knowledge of the natural world, by exhibition, instruction, and publication, to be of some lasting benefit to all men, everywhere.

APPENDIX I

PROCESSES AND OCCASIONS—THE ACADEMY'S TECHNICAL PAPERS

EDWARD L. KESSEL

Editor

The Academy's publication program is well balanced, seeking to serve the cause of technical science on the one hand, and the educational needs of the general public on the other. Even our technical series, Proceedings, Occasional Papers, and Memoirs, participate in this program of wider appeal. While these publications stress the strictly technical aspect of the Academy's program in that they are made up mostly of reports on the research of our staff members and of others, based to a great extent on studies in the Academy's own collections, they do include some papers of much broader interest. For example, the Occasional Papers series has contained two recent contributions of this type, "The Discovery of Wrangel Island" by S.L. Hooper, and "A Geological Reconnaissance of Panama" by R. A. Terry. The Proceedings has shared in this wider appeal with a symposium of four papers on conservation. These were "Population Growth in the West and Its Impact on Natural Resources" by Varden Fuller; "Water Resources of the West, Today and Tomorrow" by Martin R. Huberty; "Forests for the Future" by Stephen N. Wyckoff; and "The Conservation and Future Development of West Coast Marine Resources" by Richard Van Cleve.

Although contributions from many different sources are published by the Academy, our budget does not begin to permit the acceptance of all the many manuscripts submitted. These are carefully screened by the members of the Editorial Committee, and the more desirable ones are sent on to the Council with the recommendations of the Committee (the Council is the governing body of the Academy.—D.G.K.). Only papers which are approved by the Council are passed back to the editor for publication. Yet it is sometimes necessary to reject acceptable manuscripts because of lack of funds. Therefore two priorities have been established. First priority is given papers by staff members. This is operative in regard both to acceptance of manuscripts and to sequence of publication. Second priority is reserved for papers dealing with material in the Academy's collections but written by persons not on the Academy staff. With funds permitting, other papers are selected for publication on the bases of unusual interest or importance or of relativity to the Academy's own fields of operation and research programs.

A recent non-serial publication, which yet has much in common with the series just mentioned, is an 800-page book entitled *A Century of Progress in the Natural Sciences*, 1859-1953, "published in celebration of the centennial of the California Academy of Sciences" (San Francisco, 1955). This historical symposium leads off with Professor Joseph Ewan's essay on "San Francisco as a Mecca for Nineteenth Century Naturalists" which, quite appropriately mentioned in connection with Mr. Kelley's paper, inevitably embraces a vital and lively part of the Academy's own early history. "A Century of Astronomy and Geodesy in California" by Professor Erwin G. Gudde, and "The Contribution of Natural History to Human Progress" by Professor G.F. Ferris complete the introductory part of the book. The essays that follow, by leading American and European authorities, "attempt to review the progress made during the past century in the classification of organisms," and conclude with four essays not unrelated to the group— "one on invertebrate paleontology, two on biogeography, and one on wildlife conservation. In all of these essays the disciplines represented are largely, but with some additions, those which have come within the purview of the California Academy of Sciences" (my quotes are from the Foreword).

This unique volume, published under the Academy's imprint but outside our regular series, stands as an important contribution to the literature of science, and may set us a precedent for future publishing ventures.

APPENDIX II

A JOURNAL OF NATURE AND MAN IN THE PACIFIC WORLD

DON GREAME KELLEY

Pacific Discovery was conceived, someone has said, in order to have something to send out to members of the California Academy of Sciences besides the annual bill for dues. This may be partially true; to begin on a negative note, however, the Academy's bi-monthly popular magazine was not designed to fulfill the purposes of a house organ. That function has been well served since January, 1940 by the Academy News Letter, a leaflet containing notices of monthly meetings, lists of new members, news items about the staff, expeditions, distinguished visitors, noteworthy accessions to Library and collections, and all such things supposed to be of particular interest to the society's corporate members.

After six months of preliminary committee and editorial work — choosing a name; determining the 32-page, 8½ by 11-inch format, bi-monthly issue, and other mechanical details; setting editorial policies and appointing an editorial board from the Academy staff plus one representative each from the nearest large universities, California and Stanford; and selecting engraver and printer — *Pacific Discovery* made its bow with the January-February, 1948 issue. It was designed to appeal to a wider public than merely the membership of the Academy; the advance direct-mail campaign, however, brought a 50 per cent increase in Academy membership with a choice of that or subscription only being offered. Not only has this increase held and grown during the past ten years, but the subscription list has virtually doubled. These facts prove that a popular magazine can be a public relations asset to a scientific institution, even while still a financial liability.

Under its subtitle, "A Journal of Nature and Man in the Pacific World," *Pacific Discovery* has ranged widely for its material, not taking its nominal geographic stricture too literally. Its departures from the Pacific area have usually had some justification, however, in Academy activities, such as when it covered serially an Academy collecting expedition to Africa.

The preferred article is one by a scientist, about something he is expert in or has done in connection with his work. We recognize the fact, however, that many of these gentlemen lack the time, the inclination, or — let's admit it — the developed skill to write popular articles. Therefore, a very considerable part of our output has been turned in, mostly unsolicited, by free-lance writers. Besides good writing, we strongly emphasize illustration, preferring top-quality photographs but using good drawings as well as maps and diagrams whenever such things are called for. We have consistently maintained first-class production standards, despite continual cost increases.

Issues are made up from articles on hand with variety of interest in mind. Certain "special issues" are planned well in advance. These have been mostly geographical in their exclusiveness, but having the usual variety of subjects within the regional bounds. Such issues have been: Baja California, Alaska, New Zealand, Australia; many others are projected. A non-geographic special was the extra-page issue for the opening of the Academy's Alexander F. Morrison Planetarium in 1952. Some issues, not called specials, have had regional emphasis — the American Southwest and Northwest, Pacific islands, Mexico.

The magazine has various department headings: Editorial, Conservation, Astronomy, Youth in Science, Roads to Discovery, Science Looks Into It, Reviews, From the Reader, Information Desk — not all appearing in every issue, except Reviews. Book reviews are strongly featured, and related whenever possible to the text, thus serving as guide to selected further reading. In general, if a book is reviewed it is recommended, although we occasionally sound off, in the public interest, against a bad book.

We are much beholden, as I've indicated, to the free-lance fraternity; but it is our strong desire to run more and more first hand material — that is, to encourage more workers in science to tell their own stories, with as much or as little editorial help as may be called for. The public, we think, likes the direct treatment.

METHODS FOR MAKING PLASTIC MUSEUM JARS

S. SANGVICHIEN

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At present it is difficult to procure museum jars of the proper size for the preparation of museum specimens for teaching and exhibition. Glass museum jars are difficult to transport and must be handled carefully. Usually students are not allowed to move the specimens, and therefore only one side can be seen and studied. The present price of jars is much higher than the prewar price. This may be due to the high cost of transportation.

Because of these problems, many museums now embed specimens in plastic. This method has both advantages and disadvantages. The finished preparations are beautiful and of the right size. Specimens can be handled and studied from every angle; they can even be observed under the microscope. But the raw plastic is expensive and cannot be stored for a long time; the colours of the preparation fade easily; plastics are not suitable for preparations fixed in a watery medium — the specimen has to be dehydrated before embedding, and this makes it clearer than natural. Some attempts have been made to remedy this defect (Kerns, 1953), but I have had no experience with them. Besides that, it is doubtful whether a large specimen — such as an entire leg or arm — could be embedded; if it were possible, the cost might be prohibitive.

In order to get museum jars of the right size at a reasonable cost and ones which can be used for preparations preserved in a fluid medium without disturbing the colours of the specimens, we are using plastic sheets to make museum jars. This kind of jar has been in use at Congdon's Anatomical Museum, Department of Anatomy, Faculty of Medicine and Siriraj Hospital for more than five years; and the finished preparations have been sent for exhibition in many places. They are still in good condition.

The plastic sheet is called Plexiglass. In the Bangkok market, 6 feet by 3 feet sheets can be obtained in thicknesses varying from 1/16 to 3/4 inch. They can be sawed into plates of various sizes, and the sawed surfaces can be smoothed down by wood plane and sandpaper. Holes can be bored easily with a drill.

Method of Construction. After measuring the specimen, a plastic sheet is cut into the required size with ordinary ripsaw or electric circular saw. Before assembling, the opposing borders must be smoothed by a plane and sandpapered until they match smoothly throughout their lengths. This is the most important part; one who has no experience in carpentering is not fit for the work. The next step is to cement the plates together. This was a difficult job at first because the jointed surfaces must be perfectly cemented to prevent escape of fluid and to withstand the pressure inside the jar. We tried household cement, plastic bits dissolved in acetone and chloroform, and pure chloroform. All failed. The Rohm & Hass Company, USA, which manufactures this type of plastic, published an instruction booklet on proper methods and chemicals for cementing the plastic but the booklet was not available to us at the time we were experimenting with our design. One of the workmen in our department developed a satisfactory method by making a groove with a sharp point needle along one surface to be cemented (Fig. 1). The groove continues to one margin of the surface (pointer at Fig. 1-A).

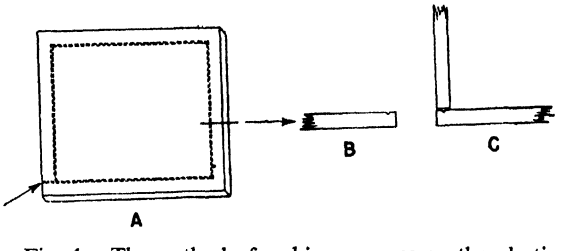

Fig. 1.—The method of making grooves on the plastic plate. A. Groove on the whole plate. B. Cross-section of the plate. C. Groove on the opposing surfaces of the plates.

The plates were then held tightly with wooden clamps to keep the opposing surfaces together (Fig. 2). Chloroform was then injected into the grooved opening with a hypodermic syringe. The chemical dissolves the plastic of the opposing surfaces and cements them together. Usually twenty-four hours are allowed before removing the clamps from the jar. For a large museum jar — as the one shown in Fig. 3 which holds the whole nervous system of an adult human body — double

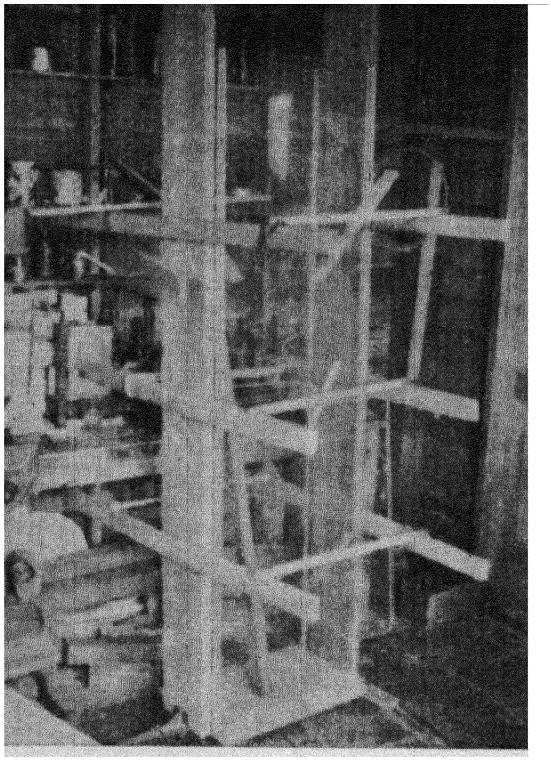

Fig. 2.—Method of binding plates together before the injection of chloroform into the groove.

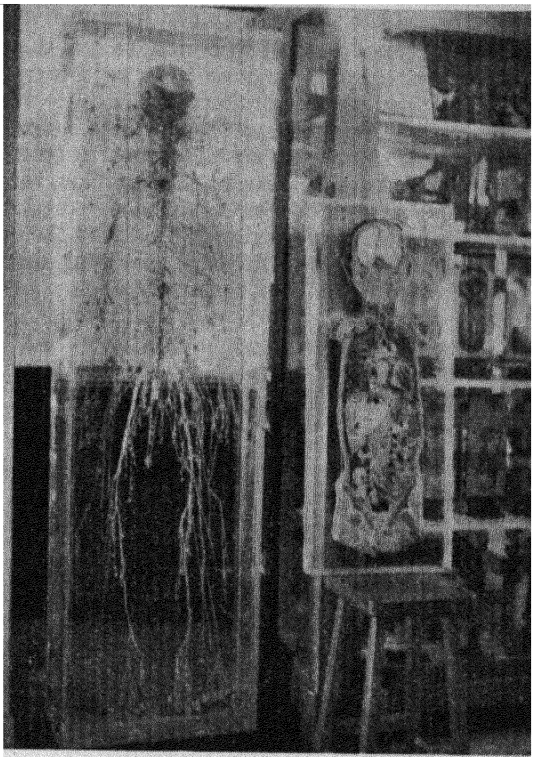

Fig. 3.—Jars made to hold the whole nervous system of the adult human body and frontal section of adult body.

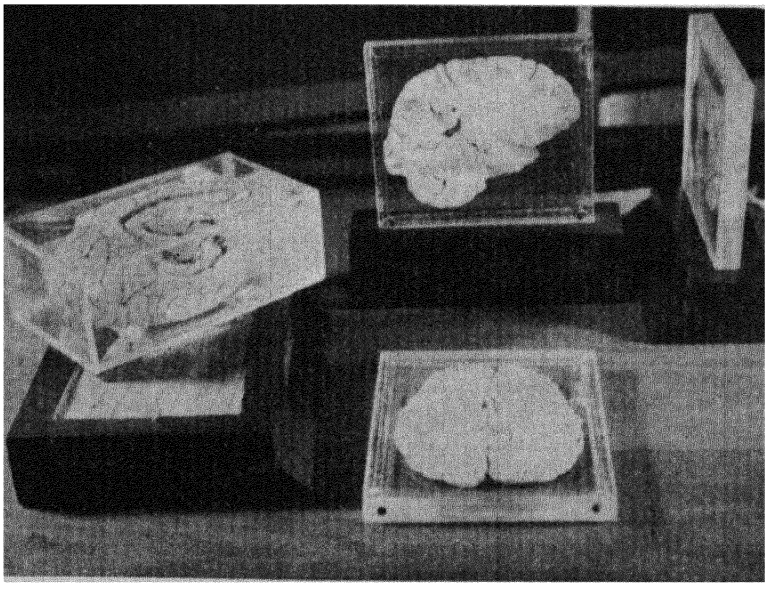

Fig. 4.—Finished neuro-anatomical preparations.

grooves were made. This made the joint stronger to withstand the large amount of fluid in the jar.

In the case of a small specimen, to seal the jar tightly so that it can be handled or used for projection with an opaque projector we first leave one side open. The specimen is then arranged in proper position, sometimes by the use of a straight or curved plastic rod. The remaining plate, with a hole bored at one corner, is then cemented on; the jar is completely filled with fluid, and the hole sealed by inserting a small plastic plug and a drop of chloroform.

The finished preparation of neuro-anatomical specimens is shown in Fig. 4.

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THE USE OF "BRUSHING LACQUER" TO COLOUR ANATOMICAL PREPARATIONS

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Coloured anatomical preparations proved to be of definite value in teaching and for exhibition. The specimens can be seen through the glass and fluid with no more effort than required for viewing an anatomical plate.[1] The invention of coloured photography has further extended its usefulness, the specimens can be made into coloured lantern slides and shown to the class before the study of actual specimens.

Dr. E.D. Congdon, former visiting professor of Anatomy in the Faculty of Medicine and Siriraj Hospital, was the first to introduce the use of albuminous paints in anatomical preparations in this country, after what he had seen at the Institute of Anatomy, University of Munich. The paints were prepared by mixing pigments obtained commercially with the thinner part of the white of an egg or might dilute the commercial albumen paints with thin white of eggs. The commercial albumen paints used by him were "Tempora" colors, manufactured by Reeves & Sons, Ltd., Dalston, London. Before painting, the dissection was allowed to dry slightly and the mixture was applied with a fine camel's hair brush. After the coating had been applied it was sprayed with alcohol and the whole preparation kept in strong alcohol.

The preparations made by this method are beautiful and durable. They have been on display in the museum for more than 25 years and are still in good condition. They have been sent to nearly all parts of the country for medical exhibitions shown to the public and at medical meetings. They were shown also at the Eighth Far-Eastern Association for Tropical Medicine and Hygiene held in Bangkok in 1930. This method has one drawback as the preparation has to be stored in strong alcohol, which evaporates rather quickly even in sealed glass jars, the alcohol turns yellow and has to be changed frequently. The preparations can not be stored in plastic jars, strong alcohol has detrimental effect on jars made with Plexiglass, so large specimens of Dr. Congdon were stored in galvanized tanks in a modified solution. These tank dissections are now almost useless as oxide of iron discoloured the whole specimen.

To remedy this defect we now devised a new method whereby coloured preparations can be stored in formalin. It proves more economical, and the preparation can be kept in museum jars made with plastic sheets. The question of size of specimens can be eliminated. The colours compare favourably with the albuminous paints. It is hoped that the present method may be of some use to those who do colouring of their own preparations for teaching and for exhibitions.

"Brushing lacquer" which contains pigments of various shades and colours, ordinarily used for furniture painting, is used as the colouring substance. It is manufactured by the National Lacquer & Paint Products Co. Ltd., Hongkong. Any lacquer thinner can be used to dilute the pigments. Before applying, the parts to be coloured should be throughly cleaned and connective tissue and adipose tissue completely removed. Allow the part to be partially dried by dabbing with soft cloth or by placing pieces of blotting paper under the part to be painted. Gentle breeze on the specimen or drying the specimen by applying thinner has no deteriorating effect. A rather diluted lacquer should be used for the first coat to allow some pigments to dissipate into the structure. Allow the first coat to dry before applying the next coats which should contain more pigments. Tension must be put on long, thin structures such as nerves and blood vessels to prevent cracks in the colour after drying. Finished specimens can be stored in formalin and in sealed plastic jars which can be handled and studied from all angles. This method has been in used in the Department of Anatomy, Faculty of Medicine and Siriraj Hospital for more than 5 years, some specimens of the first trial showed some fading, but those made after gaining more experience seem to be permanent.

[1] Congdon, E.D., 1933, The use of albuminous paints in anatomical preparations, *Anat. Rec.*, **51**: 327-331.

Symposium: *The Building and Management of a New Museum for Science in the Pacific*

STEPS TOWARD THE DEVELOPMENT OF A SCIENCE MUSEUM IN THAILAND

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At the present time, Thailand has only one archaeological museum, the National Museum, in Bangkok. Twelve small collections along the same lines have been started in upcountry districts to collect antique things, mainly connected with the Buddha and God images which have been found in the provinces.

A private collection of antique and rare things was started by King Rama IV in 1852, and it was opened for the first time to the public at Sahathai Hall in the compound of the Grand Palace by order of King Rama V. After returning from a visit to Europe, King Rama V donated a large amount of money to start a natural history section in the National Museum.

Stuffed animals from many well-known taxidermists in Europe and America were purchased with this money. Among these specimens were the giraffe, hippopotamus, zebra, lion, hyena, moose, reindeer, white-tailed deer, puma, sea lion, black and white swans, birds of paradise, and many others.

At that time the museum also had a few skinners who liked to make stuffings particularly of rare and freak specimens like the albino crow or twin animals. Besides these there were also collections of rocks and minerals and various kinds of wood of Thailand.

These stuffed animals and other objects in natural history, were kept and shown to the public in a big old building called Sivamokphiman in the compound of the present National Museum. In the reign of King Rama VII, the museum committee was interested only in archaeology, and no attention was given to natural history. At a meeting in 1926, the museum committee agreed that they had too much work in archaeology and that they should stop activities in other lines including natural history and distributed all the stuffed animals to the Art School and to some other colleges for the benefit of the students. Within a few months, the stuffed specimens were spoiled and almost all were thrown away. Only a very few specimens were saved and brought to the museum room of Chulalongkorn University. This was the sad ending of the museum of natural history.

At present, we have no museum of natural history, but we have some good collections made up by some of the government departments. There is an entomological collection in the Entomology Section of the Ministry of Agriculture. The object of this collection is to assemble mainly economic insects, but at present they also have a good collection of other insects. All of them have been carefully mounted and labelled, and most of them have been identified.

The herbarium was created by the Botany Section of the Ministry of Agriculture. There is quite a good collection of the flora of our country. All specimens were well preserved, labelled, and identified.

Besides these collections, there are some additional ones in other departments of the government, such as the Geological Department, Fisheries Department, and the Forestry Department.

In 1953, the Science Society tried to start the development of a science museum. It collected some bird skins and tried to make group habitats of some Thai birds and mammals. In addition, some miniature models of machines and other scientific materials were exhibited just to show how interesting it would be if we really had a science museum in the future.

The real purpose of the miniature museum was to appeal for government funds for further development of a real science museum.

On the occasion of the opening of this miniature museum, the premier and all ministers of the government were invited, but only the premier came. There was little enthusiasm in government circles for the museum, so no support for the fund to continue the work was given. Because of the lack of financial support, this miniature museum of the Science Society was later on given

to Chulalongkorn University.

The writer, who is the secretary of the Niyom Phrai Smakom or the Association for the Conservation of Wildlife in Thailand, has made a collection of the country fauna for many years and now has quite a good collection of mammals and birds. Besides these, the author also has some collections of other kinds of fauna such as amphibians, reptiles, and invertebrates. All of these specimens are carefully labelled and identified with full data. Many of them have been sent to museums abroad for identification.

This private collection is very useful to undergraduates, students, and the general public. Students from various schools and people from many societies came to study and attended lectures on zoology and conservation almost every week. This shows clearly that the people in general have a keen desire for nature study. The problem is how to make our government realize the value of the museum and to appropriate funds for the promotion of a museum of sciences in the future.

DISCUSSION

G.P. MURDOCK: Will the proposed museum be in connection with a university, or be a separate institution?

B. LEKAGUL: I suggested to the University some time ago that space be reserved within the University compound for a museum. However, residences have now been built there, and it would be difficult to move the residents.

T. HARRISSON: A museum should not be located in a university, but should be in a place where it can easily be found by the common people and by tourists.

G.C. RUHLE: There should be conservation of effort and expense. I believe that a museum, not necessarily on the campus, but adjacent to it, would result in an economy of funds and effort.

G.P. MURDOCK: A location on or near the campus would draw in the university faculty for scientific and curatorial assistance.

C.A. GIBSON-HILL: The museum should be near but not on the campus. Certain very fine university museums have a very small attendance, because the non-academic public does not frequent university campuses.

R.C. MILLER: The museum should be in a place normally frequented by the public. For example, the museum of the California Academy of Sciences is in Golden Gate Park, San Francisco; the American Museum of Natural History stands at the edge of Central Park in New York City; and the recently built New York Aquarium is located on Coney Island. However, if several alternative sites are available, other things being equal, the one nearest to a university would be preferable.

D. DAVIES: Lumphinee Park is close to the University, people go there, and land is available.

B. LEKAGUL: A museum in Lumphinee Park might take up land that is needed for recreational purposes. The site chosen in the University land would be as readily accessible to the public as any public museum, and yet have the advantage of contiguity to the University.

H.G. DEIGNAN: There is a possible loss of autonomy if a museum is located on the University campus.

R.C. MURPHY: I do not share the fear of closer integration with the University. The trend is more and more toward such association. In the American Museum of Natural History the heads of at least seven departments are also heads of departments in neighborings universities. When I was a student, I was nominally enrolled in Columbia University but took most of my courses at the American Museum of Natural History, under such authorities as Henry Fairfield Osborn, William K. Gregory, and others. I want to emphasize the importance of a natural science museum as a repository of the natural resources of an area, botanical, zoological, and geological. A museum should have a reference collection as complete as possible of the natural resources of the area covered. It is impossible to deal with the problems of agriculture, medicine, etc., without adequate research collections. Much scientific work that would otherwise have great value is lost because of inaccurate identification of the materials worked with. As an example I mention the case of H. De Vries, who made erroneous deductions about the genetics of *Primula* because of the lack of an adequate named collection of wild primroses.

Persons in political life, who have something to say about the financing of museums, should be educated to the fundamental importance of *collections*. Once you have collections, it is easy to pass to a program of exhibits. Simpler and less expensive displays can be more educational than vast halls of dioramas. But again I emphasize that an adequate reference collection—a wealth of identified and labeled material—is indispensable to university research.

Perhaps the museum should be a separate institution, but it should be closely integrated with the educational system, from the elementary grades to the university level. The school program of the American Museum of Natural History reaches two million students a year.

T. HARRISSON: This approach would not appeal to the governments of Southeast Asia. My museum is in a country that has no university—no system of higher education at all. Governments want to spend money for something that can be seen, I suggest that a museum start with displays and then bring research in as opportunity offers. I believe that a museum must not be part of a university, but must have separate funds and separate management.

G.P. MURDOCK: If the museum started by King Rama V had been started in a university, it might still be in existence.

C.A. GIBSON-HILL: Most museums in Southeast Asia were started before the universities. It is easier to get university students to a public museum than to get the public to a university museum.

D. DAVIES: There is a current attitude of interest in science in Thailand. The King is interested. As regards a museum at the University, once you get something in the University it becomes permanent and is carefully guarded and preserved.

C.A. GIBSON-HILL and T. HARRISSON (both inquired as with one voice): Does the National Museum of Archaeology and Art suffer because of a lack of connection with the University?

B. LEKAGUL: I believe that in Thailand it is better for the museum to be associated with the University. If it is a separate institution, the directorship might become a political appointment, and a person be put in charge who has no real interest in museums. I agree with the importance of research collections but feel that public exhibits will be necessary in order to obtain government support.

G.C. RUHLE: The place to start is with a prospectus. Don't start with a building—start with a plan. A prospectus doesn't cost a lot of money.

R.C. MILLER: The purpose of the present panel discussion is to help the local people, at their request, to draw up a plan.

Dr. Miller introduced the subject of museum floor plans. He sketched on the blackboard the floor plans of several museums, including the Peabody Museum at Yale University, the Buffalo Museum of Science, and the Chicago Natural History Museum.

R.C. MILLER: After a museum is planned and the exhibits carefully arranged in a logical sequence, the public shows a marked tendency to go through in the wrong direction. Note the somewhat bizarre plan of Frank Lloyd Wright for the John Simon Guggenheim Museum in New York—a plan which just about compels people to go through all of the exhibits in the right sequence. I do not recommend this plan for science museums. I believe that by careful placing of exhibits and subtle lighting effects, the viewer will instinctively be drawn from one exhibit to the next and thus voluntarily go through the museum in the "right" direction.

After more than a century of experience, involving buildings on three different sites, the California Academy of Sciences has—by trial and error—arrived at a floor plan that seems capable of rather wide applicability. The plan consists of a series of more or less identical units, each consisting of four exhibit halls arranged to form a rectangle, with a court in the center. The court may be merely a pleasant place to step outdoors, or it may be used for the exhibit of objects not affected by weather, such as statuary or ceramics.

The court may be roofed over to serve a variety of purposes—storage of collections, or to house a library stack. At the California Academy of Sciences, one such court contains an auditorium, another a planetarium, each seating over 400 people.

Such units can be added indefinitely, and the museum still retains a logical plan and does not become a labyrinth.

The California Academy of Sciences has adopted a firm plan of building three-story units—a ground floor, an exhibits floor, and a top floor. The exhibits floor has fifteen-foot ceilings, to provide a feeling of spaciousness, and adequate ventilation for considerable numbers of people. The ground floor and the top floor have ceilings of eight to ten feet, and are used for laboratories, shops, offices, and storage of collections.

By following this plan, every time a new exhibit hall is added of, say, 6,000 square feet, twice that amount of space is made available for other museum functions, including research and storage of collections.

Probably in Bangkok, with so much water everywhere, using the ground floor for research would be impracticable. But certainly the prevalence of two-story buildings indicates their wide use, and in a new museum building exhibits could be kept on the main floor, and the second story reserved for offices, laboratories, and research collections.

T. HARRISSON: I agree that a basement for research or storage would be out of the question in this locality, but I highly approve of the idea of reserving the second story for research. I would like to suggest the possibility of adapting temple architecture to museum structures. I have seen a very fine example in Phnom Penh, where a temple structure was integral with a museum. It was a beautiful museum, in keeping with the country, and with effective exhibits. The importance of an inner court, for light and air, and to provide space for certain types of outdoor exhibits should be emphasized.

P. C. Bandyopadhyay, Director of Unesco Science Exhibition on "Energy and Its Transformations," briefly described a museum in a city in Western India where this exhibit had been shown. This museum, designed by the French architect Le Corbusier, was a huge box set up on stilts—a type of structure which might be suitable to a wet country like Thailand. It had excellent wall space and a good overhead lighting system. It had a mezzanine floor for offices, enabling the staff to keep a good eye on what was going on below.

H.G. DEIGNAN: The architects of the U.S. National Museum put windows in the exhibit halls against the wishes of the staff, who wanted solid walls. As a result many exhibits have been ruined by fading through many years' exposure to daylight.

R.C. MILLER: The possibility of using daylight and still getting complete use of wall space by obtaining cross-lighting from windows placed high in the wall, above the level of the cases should be mentioned.

C.A. GIBSON-HILL: What happens when the sun is low—late in the afternoon or in winter?

R.C. MILLER: I think the difference between summer and winter altitude of the sun is unimportant in the tropics, but agree that daylight is unsatisfactory in late afternoon or on cloudy days.

The chairman then brought up the question of the special problems of museums in the tropics, which had been put on the agenda of this session.

C.A. GIBSON-HILL: The termite problem is something which requires careful precautions during building. Two or three courses of slate across the walls at the lower stages of construction will force the termites to go around, and build their tubes where they can be seen and destroyed.

The problem of mold was mentioned, and it was generally agreed that air conditioning — if it be available — should be reserved for the collections and not introduced in the public halls.

P.H. NESBITT: I would like to described a museum in Guatemala with which I was associated for several years, planning the exhibits and designing the dioramas. This museum had all of the problems of a museum in the tropics,

except that it was a museum of archaeology and ethnology and thus escaped some of the problems of natural history museums. It was designed as a large, airy polygon, surrounding an open court. The court was used to display large and heavy objects of Mayan sculpture.

A. SPOEHR: The general conformity to a pseudo-tradition of museum architecture is deplorable. I suggest that the Thai people adapt their museum architecture to local conditions. A single building is not a necessity; several discrete units might be desirable. I refer to the building of the Hawaiian Academy of Arts, which is not completely ideal because it had to be concentrated in a small area because of the very high value of land; but it is an extremely attractive building, with small units to avoid the coldness of the immense museum halls of some American institutions, and with these units surrounding a series of courts. The termite problem was met by erecting the building on a single concrete slab, and by making almost the whole building of concrete. Air conditioning is confined to the collections and the library.

B. LEKAGUL: I would like to conclude the discussion by requesting the assistance of museum experts from abroad, and by emphasizing the importance of a museum that would concentrate on the local flora and fauna. I am afraid that some people would rather see a kangaroo or a zebra than their own native animals. I believe our museum should demonstrate to the people of Thailand the wealth of their own resources in the field of natural science.

Dr. B. Lekagul's final comments were received with acclaim by the Museum Division of the Congress.