(*c*) Three members appointed by the Committee on Oceanography.

(*d*) One member appointed by the Ministry of Agriculture.

(*e*) The director of the station.

This council is to have charge of the financing and the administration of the station.

6. Each regular contributor will be allowed to take part in the administration of the station and, according to the rules of the statute, will be given tables in proportion to the contribution.

7. The director legally represents the station and is responsible to the council of administration.

8. The station is composed of sections of zoology, physiology, and physiological chemistry. The council of administration has the power to organize other sections within certain specifications.

9. The scientific staff is composed of the directors of the various sections of the station, the assistants, and librarian.

10. The directors of the different sections are chosen through competing examinations following the general rules governing the university competing examinations and special regulations to be fixed in the statute. From these the council of administration selects one as director of the station. The director of the station serves for three years and may be reappointed. These will constitute the scientific council. The scientific council provides for the regulation of the station and collaborates in the preparation of the budget pertaining to the financial needs of single sections.

11. The assistants and librarian will be appointed by the council of administration according to the rules to be fixed by the statute. The council of administration also has charge of the appointment of all other of the station personnel.

12. The personnel according to 10 constituting the scientific staff must devote their entire time to the work of the station. The same laws governing civil employees will apply to them.

As the writer understands it, these proposed changes will not prohibit private subscriptions for tables by either Italian or foreign institutions, and such tables may be taken as in prewar times.

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## RESOLUTIONS OF THE PAN-PACIFIC SCIENTIFIC CONFERENCE

### II. ANTHROPOLOGY

#### 1. *Need for Polynesian Research*

RECOGNIZING the necessity for the immediate prosecution of anthropological research in Polynesia, this conference calls the attention of governments, patrons of research and research foundations to this important scientific need. We

*Recommend* that the most prompt and efficient steps be taken to record the data necessary to the understanding of man's development in the Pacific area.

#### 2. *Facilities for Instruction and Research in Anthropology*

Since there is urgent need both for anthropological research and the training of men and women therefore, and since experience has shown the advantage of close association between the graduate departments of universities and persons and institutions carrying on anthropological investigations, this conference

*Recommends* the creation of centers for the study of anthropology and original research therein, such centers to be developed by the expansion of university departments or the alliance of universities with other research institutions with the result that these schools of anthropology shall combine all the essential features of a museum, a research staff and a graduate school. And, further, because of the peculiar conditions under which anthropological data must be gathered necessitating both intensive field work in circumscribed areas extending over several years, and intensive synthetic work by men who are masters in many fields, thus requiring a number of men through a period of years, we therefore recommend the establishment of research fel-

lowships for linguistic research, such endowments being provided that these fellowships will attract the best men available and provide for uninterrupted work during an adequate number of years.

### 3. *The Bayard Dominick Expedition*

It is evident that fuller knowledge of the history and culture of the Polynesian race is essential to the solution of the ethnologic problems of the Pacific; and also that the opportunities for obtaining information are rapidly disappearing. It is therefore gratifying to learn that Mr. Bayard Dominick has conceived a plan for ethnological studies in the Pacific on a scale not hitherto attempted and has provided funds for the initiation of this research under the guidance of Yale University and the Bishop Museum.

*Resolved* that the commendation of the conference be extended to Mr. Dominick for his far-sighted interest and generosity and that assurance of good will and cooperation be given him.

### *Ships for Bayard Dominick Expedition*

The Bayard Dominick expedition of the Bishop Museum is now in the field and the successful continuation of its work depends upon obtaining a ship suitable for the navigation of waters outside of established trade routes.

The conference invites attention of the United States government to the benefits likely to result from providing this expedition with a suitable vessel.

## III. Biological Science

### 1 *Marine Biological Survey*

The necessity for conservation of natural resources has become imperative, since, in the case of the Pacific Ocean, certain economic marine species have been exterminated and others are in peril of extinction or grave depletion. Measures for such conservation must be based on an exact knowledge of the life histories of marine organisms. Knowledge of the biological, physical and chemical phenomena of the Pacific Ocean is meager and wholly inadequate to serve as the basis for rational conservation measures; therefore be it

*Resolved:* (1) That the First Pan-Pacific Scientific Conference recommends that the governments of the several nations bordering on the Pacific Ocean cooperate, through their several agencies concerned in surveying and charting the sea, toward the collection, compilation and publication of data relating to the topography of the bottom, and the temperatures, salinities, acidities, currents and other physical and chemical properties of the waters of this ocean, fundamental to biological research and the improvement and conservation of the fisheries.

(2) That the Conference recommends that a comprehensive systematic biological survey of the Pacific ocean and its contained islands be prepared, with special reference to the economic fisheries problems and that the investigation be carried on in so far as possible through existing agencies, such agencies to be provided with the additional apparatus and facilities necessary, the investigation to be carried on under such cooperation as will prevent duplication of effort.

(3) That the Conference recommends that the several museums biological stations and other institutions engaged in biological investigations relating to the Pacific ocean, associate themselves for the purpose of exchanging information concerning past, current and proposed investigations, the exchange of facilities and personnel, the coordination of work and prevention of duplication in their respective activities. It is further recommended that a survey be made of the facilities afforded by the several institutions, said survey to cover material, equipment, environment and the personal qualifications of the respective staffs for supplying special information and working up material. It is further recommended that the National Research Council of Washington, D. C., be invited to undertake or arrange for such survey and that a committee of this Conference be appointed to represent the interests

of the botanical and zoological sections in this regard, the committee to be appointed by the Chairman of this conference.

(4) That the conference recommends that systematic statistics of the fisheries be collected and published annually and that such statistics be, as far as possible, uniform in character and in such detail as to methods of fishing and geographical distribution as to make them useful in fisheries administration and conservation. It is further recommended that the several governments provide for a joint commission for the arrangement of the details of such statistical compilations.

2. *Recommended Investigations in Marine Biology*

Because of the urgency or importance of certain investigations, this conference

*Recommends:* (1) The collection of *bottom samples from depths under* CJ *fathoms,* since these are not usually obtained by deep sea expeditions and can be readily obtained at anchorage by simple apparatus.

(2) The study of the *Brachiopod Faunas* above the 1,000 fathom line inasmuch as a knowledge of these Brachiopods supplies important evidence on the question of former land connections.

(3) A systematic and thorough study of *Pacific Ocean Algae* and of the conditions under which they occur and of the part they play in their environment; this could be obtained by means already employed for certain parts of the Pacific Ocean and would be of great scientific value.

(4) Because the Hawaiian Islands lie on the margin of the tropical seas, and therefore occupy a critical position for the study of the ecology of marine organisms, among which corals are important; and because data obtained from ecologic investigations in this locality would be of value to geologists in interpreting the conditions under which fossil faunas lived, the conference recommends a careful study of the ecology of the marine organisms of the Hawaiian Islands, and particularly a study of the corals and of the organisms associated with the corals on the reefs.

3. *Land Fauna*

The part played by living animals in the solution of many scientific problems in the Pacific is well recognized. The relationship of their present to their former areas of distribution and to that of extinct allied forms is the key to some of the geological problems; they have direct bearing upon many ethnological problems and they are the chief source of evidence upon which our ideas of evolution must be built. From a knowledge of the land fauna follow great economic advantages, such as the protection of the human race against many diseases and crops against pests.

Although in certain continental Pacific areas and some of the larger islands the land fauna is fairly well known, yet in none is our knowledge complete, and in some, such as Polynesia, it is very incomplete. The urgency for this work is great, as large areas are rapidly being swept of their native land fauna. Therefore this conference

*Recommends:* (1) That surveys, as complete as possible, be made of the land fauna, especially of those smaller islands in which the native fauna is fast becoming extinct, or is likely to be in the near future.

(2). That the attention of zoologists be called to recently made land areas due to volcanic activity and the importance of the study of ecological development with special reference to the appearance of animal life upon such areas.

(3) That, since land mollusks are an important group in zoogeography, recommends that material for a comparative study of the soft anatomy of land snails be obtained from all the high islands of Polynesia, Micronesia and Melanesia, and that faunistic collection be increased as far as practicable by examining islands not now known or only superficially collected over.

4. *Ornithological Survey of the Pacific*

The conference expresses its gratification at the fact that arrangements have been made by the American Museum of Natural History for the purpose of undertaking and carrying on a comprehensive and intensive ornitho-

logical survey of the islands of the Pacific Ocean, particularly those of the South Seas, and extends its thanks to those who have made provision for the expedition.

### 5. *Collecting Polynesian Land Flora*

Since a definite knowledge of the flora of Polynesia is absolutely essential to a proper understanding and correlation of numerous problems bearing on the life and origins of Polynesian peoples, problems of forestry, agriculture, ethnobotany, plant diseases, physiology, and ecology; since the original vegetation of some island groups is rapidly being destroyed, and since botanical exploration of Polynesia has been sporadic and in many regions incomplete, therefore the Pan-Pacific Scientific Conference

*Recommends:* (1) That botanical exploration of Polynesia be extended as rapidly as possible in order to assemble comprehensive collections with as complete notes as possible covering the scientific and economic aspects of Polynesian botany.

(2) That this work of exploration be carried on by existing agencies, by special botanical expeditions and by heads of non-botanical expeditions employing and supervising native collectors whenever feasible for the collection and preservation of botanical material.

(3) That material be collected in bulk—from ten to fifteen specimens of each species—with the object of distributing duplicate material to Pacific institutions and to the larger botanical centers of the world.

### 6. *Plant Ecology on Lava Flows*

Since new lava flows and other volcanic ejecta offer fresh terrane on the abode of life, therefore this conference

*Recommends* that studies be made of the stages of ecological development with special reference to the appearance of forms of plant life on new volcanic deposits following an eruption; and also of plants best suited to the speedy rehabilitation for agricultural uses of regions covered by such volcanic ejecta; and of the resistance of plants to volcanic fumes.

### 6. *Preservation of the Hillebrand Garden (Honolulu)*

Since the botanical garden of the late Dr. William Hillebrand, author of the Flora of the Hawaiian Islands, situated in the city of Honolulu, is one of the most remarkable gardens in the world, possessing as it does many unique and rare plants introduced into the Hawaiian Islands by Dr. Hillebrand, and since the conference believes that the preservation and perpetuation of this garden, which is threatened with destruction, would be a great benefit to botanical science, this conference recommends steps be taken to insure its preservation.

## IV. Geography

### 1. *Topographic Maps*

The exploration of Pacific regions in many branches of science is handicapped by the almost total lack of topographic maps. There is scarcely any human activity which does not depend to a great or less degree upon a knowledge of the configuration of the land. This is especially true in such work as mining, railroad and highway extension, and maintenance, utilization of water resources of the world can not be discovered and utilized efficiently without maps.

Topographic maps of any given area should be adapted in scales, accuracy and details to the scientific and economic needs peculiar to the area.

The benefits derived from adequate topographic maps are far greater than their cost and this conference urges that plans be made for carrying on a topographic survey of the lands of the Pacific regions, and that this plan be designed to give uniformity of results. This conference commends the countries of the Pacific region for the work already done by them.

### 2. *Survey of the Shoreline and Coastal Waters*

A general hydrographic survey of the continental shelves extending off-shore to the one-thousand fathom curve and of the island platforms should be executed, in order to supply basic data essential to all research

work involved in the general scientific exploration of the Pacific ocean.

This survey should establish a system of horizontal and vertical control, determine shore line and adjacent topographic features in true geographic position, develop submarine relief, collect and describe the materials of the bottom, observe temperature and salinity and define vertical and horizontal movements of the water. The hydrographic bureaus of the nations of the Pacific, as now organized and operating, need only expand their equipment and extend their field to meet the requirements of this project. Closer cooperation is desirable in the interest of uniformity and to avoid duplication.

These results, in addition to their bearing upon research work, have such a great economic value to the shipping, fisheries, and other marine interests that the cost of the survey for the collection of the necessary data is relatively insignificant. It is stated in a recent publication of the United States Coast and Geodetic Survey that the vessels wrecked in the coastal waters of California, Oregon and Washington in the year 1917 on account of the incompleteness of the charts involved a loss which amounted to more than double the estimated cost of a complete hydrographic survey of those waters.

This unfinished state of the hydrographic survey along the west coast of the United States is not exceptional; few regions of the Pacific of any considerable extent have been thoroughly developed. This conference makes appreciative acknowledgement of the notable contributions made to the survey of the coastal waters of the Pacific by the several nations bordering thereon; but in view of the magnitude of the work and the length of time involved in its execution it commends this general project and urges its early execution.

### 3. *Use of Wireless Telegraphy in Longitude Determination*

This conference commends the use of wireless telegraphy for the improvement of determinations of the longitude of the islands in the Pacific.

### 4. *Magnetic Survey*

The general survey of the Pacific ocean should be continued to an early conclusion and provision made for such additional work as may be needed to determine annual and secular changes in the magnetic elements. The field of work should be extended to include the coastal waters, where the magnetic phenomena are complex, and their determination essential to many important interests.

Systematic operations under this project are a comparatively recent undertaking; but already excellent results have been obtained in the Pacific from the work of the Carnegie Institution.

The work is of immediate and vital importance to navigation, and surveying, in addition to its bearing upon the general subject of geophysics and this conference hopes that plans may be made for a complete magnetic survey of the Pacific region and that the work may be expedited.

### 5. *Physical Oceanography*

Oceanographic investigations yield results which constitute a basis essential for scientific exploration and research in the Pacific region, notably in meteorology, geology, botany, and biology. Moreover, such investigations are of importance to navigators in disclosing dangers to vessels sailing the ocean, and are of economic value in enabling vessels to save time and fuel in their navigation.

The present knowledge of the oceanography of the Pacific is deficient in every branch, and constitutes but a meager array of data scattered widely.

In the oceanographic investigation of the Pacific waters the configuration of the bottom should be determined, specimens of the bottom deposits collected and their thickness and stratification revealed, the physical and chemical characteristics of the water at different depths and times determined, and the horizontal and vertical circulation of the waters observed.

The field work involved in such investigations must be carried on almost entirely by the governmental hydrographic organizations

of the countries bordering on and contained within the Pacific ocean, owing to the great expense involved in creating new and special agencies, and because the governmental agencies have the personnel trained in this work. Those carrying on oceanographic surveys in the Pacific should avail themselves of the services and advice of individuals and organizations dealing with those branches of science depending upon the results of such surveys.

This conference feels that a systematic oceanographic investigation of the Pacific should be undertaken as soon as possible. The plan adopted should be designed to complete the survey of the most critical areas at an early date, and eventually the whole Pacific region.

### 6. *Meteorology*

Investigations in meteorology, or the physics of the atmosphere designed to lead to an accurate scientific knowledge of atmospheric phenomena are of recognized importance. Very little is known of the behavior of the upper air over the land, and still less over the ocean. The fundamental aspects of these phenomena are exhibited in their simplest manner over the greatest of oceans, the Pacific. Hence it is necessary to make meteorological observation over the Pacific for the use in studying the more complex condition over the land.

Moreover, the collection and prompt dissemination of marine meteorological data are of great benefit to humanity in carrying on its commerce and in weather forecasting which is now limited by a lack of synchronized uniform, meteorological data over great areas not within the customary track of vessels.

Observation at the place of origin of typhoons, hurricanes, larger cyclonic and anticyclonic areas, as well as the development, dissipation, oscillation, and translation of the same, are essential to successful forecasting and the study of ocean meteorology. Moreover the meteorological survey of these ocean areas has practical value; therefore the governments bordering on the Pacific ocean are invited to carefully consider these matters with a view to increasing the number of meteorological vessel and land stations within the confines of this ocean and on its borders, especially the establishment of vessel reporting stations in somewhat fixed positions. In considering these matters, it is believed that special attention should be given to increasing the number of stations in the well known "centers of action."

The Pan-Pacific Scientific Conference commends the ocean navigation companies and their masters of vessels for the valuable assistance they have rendered the meteorological services of the various stations, and urges them to further cooperate especially in the matter of transmitting their weather reports by radiograph as well as by mail.

### 7. *Meteorological Station on Macquarie Islands*

Since the observations made at the meteorological station on Macquarie Island resulting in improvements in the accuracy of weather forecasting, this conference expresses the hope that observations at that station, interrupted by the war, may be resumed at an early date.

### 8. *Meteorological Station on Mauna Loa*

In view of the fact that Mauna Loa, Island of Hawaii, the highest accessible point in the central Pacific, offers exceptional opportunities for the exploration of the upper air, it is recommended that a station of the first order be established on its summit for continuous meteorological observations.

### 9. *Earth Tides*

The successful operation of the Michelson earth-tide apparatus at a station in the United States of America has furnished data from which the knowledge of the physical characteristics of the interior earth has been increased, and it is desirable that earth-tide stations be established in the Pacific region at widely separated points in order to discover whether the physical characteristics vary from place to place.

This conference hopes this work will be extended.

10. *Isostatic Investigations*

Investigations in the theory of isostasy have thrown much light on the subject of deviation from the normal densities in the outer portions of the earth, which is of importance in the study of geology, and in other branches of science.

Much can be added to our knowledge of this subject of isostasy by a mathematical reduction of existing field data, following well-known methods, which would involve only slight expense.

This conference urges, in the interest of geophysical and other sciences, the early reduction of existing geodetic data and the extension of geodetic field work to those regions of the Pacific where such data are now lacking.

This conference commends the Coast and Geodetic Survey of the United States, the Trigonometric Survey of India, and the Geodetic Survey of Canada for work they have done in isostatic investigations.

*(To be continued)*

## BIOPHYSICS

THE need of liaison or coordination between the different but related branches of science is coming to be felt; and indeed may soon prove as great as the need of specialization. The physiologist has long been wont to consult the anatomist about the materials with which he deals, but though his subject consists largely in the physics of living matter, his contact with the physicist has been limited and often unsatisfactory. It is usually hard for the physicist and physiologist to speak the same language. Almost at the outset of the attempt at cooperation the physicist plunges into an entanglement of mathematical formulæ into which the physiologist can not follow him and from which he can not coax him out, and negotiations have to be broken off. The biologist—especially the physiologist—ought to be better grounded in physics, and the physicist would profit much if he knew something of the behavior of living matter and the physical properties in which it so strikingly differs from inanimate matter. Physiologists, even from good laboratories, often reveal ignorance of the physical terms they use by such mistakes as calling a pair of electrodes "an electrode," or transposing the terms abscissa and ordinate. Many use the electric current without sufficient understanding of its behavior to avoid some of the pitfalls into which it may lead them. Physicists on the other hand are usually so drilled in the analysis of the behavior of inanimate matter, which best lends itself to mathematical treatment, that it is hard for their minds to cope with such things as colloids, ameboid motion of protoplasm, action currents in nerve and muscle, reflex inhibition, color sense and many other phenomena which present features peculiar to life. I have seen a physicist, attempting to reduce the nerve impulse to the laws of electrical conduction in insulated cables, greet the suggestion that one must reckon with the electro-chemical condition of the protoplasmic colloid, with the answer that this was merely to relegate the nerve impulse to the realm of things we know nothing about and therefore can not analyze, and that consequently it was better to ignore colloidal chemistry. Thus ignorance of a great field of significant knowledge led to setting aside the kernel of the whole thing. I have heard of physicists being quite incredulous when told of certain well-established facts concerning the behavior of electrical charges in colloidal matter. The physicist who might have his eyes opened and his understanding broadened by a careful examination of vital phenomena, is apt to think these things are too vague and too impossible of quantitative study to merit his notice.

Physiology has sometimes been divided into bio-chemistry and bio-physics. Most research in physiology to-day is concerned rather with the chemical side of the subject than the physical side. Physiologists have effected better coordination with chemists than with physicists. But the branches of physiology abutting on the field of physics are many, and possibly offer as great a wealth of knowl-