

UNIVERSITY OF CALIFORNIA  
BERKELEY

SCRIPPS INSTITUTION FOR BIOLOGICAL  
RESEARCH

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LA JOLLA, July 1, 1920.

*To the President of the University.*

SIR: I present herewith my report for the year July 1, 1919, to June 30, 1920.

OCEANOGRAPHY AND HYDROGRAPHY

Collections of water samples have been made daily throughout the year at the Hopkins Laboratory, Pacific Grove, Point Arguello, Summerland, and Hueneme, as well as at La Jolla, and on boat trips among the Channel Islands, and from Balboa, Panama, to San Diego.

This geographic extension of observations on the conditions of the sea, begun last year, becomes more important with increasing evidence of correlations between summer ocean temperatures and winter rainfall. Such a correlation has now been established for three consecutive seasons. This, taken in connection with other facts pointing in the same direction, goes far enough toward establishing a general rule to make continued and expanded study of the problem very promising. And the vast practical interest involved adds greatly to the reason for the investigation. The prediction, several months in advance, of either deficiency or excess of the ensuing winter's precipitation would be of incalculable value to California.

As a member of the committee of the National Research Council on Exploration of the Pacific, G. F. McEwen, Assistant Professor, Oceanographer and Curator of the Oceanographic Museum, spent December in the East conferring with oceanographers and meteorologists in the government service, with the result that the United States Coast and Geodetic Survey and the Weather Bureau are endeavoring to utilize the opportunities at the institution for the investigation of tides, currents, and weather.

During the year Professor McEwen and his assistant, N. W. Cummings, have entered a field of hydrographic investigation entirely new to the institution, that, namely, of evaporation from fresh water reservoirs in the vicinity of San Diego. Into this they were led, however, by their previous work on the evaporation of the sea at La Jolla.

The object of this extension of their activities is to formulate mathematically certain problems of temperature and evaporation common to

ocean, lakes, and reservoirs, and then to find solutions for these problems. The hope is entertained that these efforts may be preliminary to an extensive series of evaporation investigations on the reservoirs of San Diego County's water systems, and be useful in dealing with the perennial "water question" of California, as well as in interpreting the general results of oceanographic observations.

This department has also collaborated with members of the Citrus Experiment Station at Riverside and with the Farm Bureau Advisor of San Diego in working out certain mathematical formulae involved in the study of plant growth and other problems of the citrus and farming industries of Southern California.

The great amount of work involved in the specific gravity, calorimetric and temperature observations on the sea, and in meteorology, has fallen largely to Mr. Cummings, and strongly emphasizes the importance of clerical assistance in the institution's programme work.

#### PLANKTOLOGY

Investigations in this department have been continued by E. L. Michael, Zoologist and Administration Assistant, W. E. Allen, Biologist, C. O. Esterly, Zoologist, and Mrs. C. Essenberg, Zoologist and Librarian, for whose laboratories quantitative collections have been made at various points along the coast, where the upwelling of water is known to be greatest, as well as at La Jolla. From these investigations it is becoming highly probable that there is a relation between the quantity of plankton and the temperature of the water as dependent upon the phenomenon of upwelling now known to be an important feature in the oceanography of this region.

As indicated particularly by Mr. Michael's statistical studies, the rule is that the plankton (more exactly the phytoplankton) increases geometrically with the arithmetic decrease of the temperature of the water as dependent upon upwelling.

For the fuller elucidation of the extremely complex relations here presented, employment of collecting methods of the greatest possible trustworthiness is indispensable.

To this Mr. Allen has devoted much of his efforts during the first year of his full time connection with the institution. By discarding the drag net method of collecting phytoplankton and substituting therefor the use of a bucket of more than fifty liters capacity, the dipped-up contents of which are filtered, he has succeeded in greatly reducing the error that has heretofore seriously impaired quantitative plankton investigations. He has also subjected the microscopic procedure in estimating the quantity of phytoplankton in the laboratory samples to searching revision. With reference to these methods Mr. Allen writes: "After nine months of daily experience under the new procedure, I feel

confident that our collecting methods are not only statistically reliable but also relatively inexpensive and conducive to great continuity, and that laboratory manipulation has been acceptably stabilized by recent standardization of its details.''

Although, as would be anticipated from the greater complexity of the zoo- than the phytoplankton, the institution's methods of dealing with the latter are more adequate than are those of dealing with the former, progress in the zooplankton part of the programme is also more substantial now than ever before.

Dr. Esterly's entire research time, with an assistant, has been devoted to the quantitative examination of the copepod collections, seventy per week, sent to his laboratory at Occidental College from the institution.

It should also be mentioned that Dr. Ida Hyde as a volunteer investigator has been working most of the year on copepods, her studies being partly experimental and partly statistical. Her results up to date are confirmatory of those reached by Dr. Esterly, in so far as they indicate the impossibility of arriving at trustworthy conclusions about the behavior of the animals in nature from laboratory experiments on the same species. And this is the more significant in that Dr. Hyde's studies have been planned and carried out quite independently of Esterly's.

Dr. Essenberg's work on the Appendicularians has now reached a point where the taxonomy of the group represented in these waters is sufficiently advanced to enable her to begin dealing systematically with the influence of environic condition on the occurrence of the species.

Significant as to the importance of the methods being developed at the institution for handling statistics of the sort involved in the planktonic-environic researches being carried on here are the demands for a paper on the subject published during the year under the joint authorship of Michael and McEwen. This paper, printed in the *Proceedings of the American Academy of Arts and Sciences*, has the title "The functional relation of one variable to each of a number of correlated variables determined by a method of successive approximation to group averages: A contribution to statistical methods.''

The variety of sources from which the many requests for this publication come is particularly noteworthy. They include industrial, medical, social, agricultural, psychological and several other kinds of laboratories.

Through the courtesy of Mr. E. W. Scripps, two members of the institution staff, Messrs. Michael and Crandall, were sent on a collecting trip aboard the yacht "Kemah," the voyage beginning at Jacksonville, Florida, and continuing via the Bahamas, Jamaica, and the Panama Canal to San Diego, California. Quantitative biological phytoplankton hauls were made hourly during the entire period that the boat was under way; and shore collections also were made at various points in the Bahamas and along the western coast of Central America.

## HEREDITY AND ENVIRONMENTAL INFLUENCE

The work of this department has been somewhat curtailed during the last year by the absence of F. B. Sumner, Associate Professor and Biologist, from the institution from August to December inclusive. This period he spent at the University giving courses in the Department of Zoology on Heredity and Evolution and Animal Behavior; and by the resignation of H. H. Collins. Mr. Collins completed his work for the doctor's degree during the summer of 1919, and accepted a position as a teacher of biology.

Breeding experiments, particularly in relation to certain mutant characters in mice, were continued and extensive measurements and statistical studies on race hybrids were made.

A long series of femurs were weighed for testing the possible inheritance of bilateral asymmetry. The results thus far obtained are negative. Slight differences between the right and left sides of the body are not hereditary, according to these results.

Two field trips were made by Dr. Sumner during the spring of 1920 for collecting mice in certain localities offering problems of special biological interest. The expenses of these trips were defrayed from a special fund donated by Mr. E. W. Scripps. The first of these was in company with Professor C. J. Herrick of the University of Chicago to a region in the valley of the Colorado River, about fifteen miles north of Yuma. The second trip was made in company with Professor Joseph Grinnell, Director of the Museum of Vertebrate Zoology, and later with Mr. Richard Hunt, also of the museum staff. This trip comprised visits to a number of desert regions in Southern California. The longest stops were made in Death Valley and in a conspicuous area of black lava, occurring in the Mojave Desert. The latter point was visited in order to test the alleged effects of dark surroundings in increasing the pigmentation of mammals.

Dr. Sumner has been active during the year as a member of the "Committee on the Preservation of Natural Conditions" of the Ecological Society of America.

Mr. R. R. Huestis joined the institution staff on May 1, 1920, as scientific assistant in genetics, his work being with Dr. Sumner.

## EXPLORATION OF THE NORTH PACIFIC

The practical importance of carrying out the Pacific exploration idea, referred to in my last annual report, has been particularly emphasized by two circumstances during the last year: (1) The main fishing industries of the entire Pacific coast (salmon, herring, sardine, tuna, whale) have tended to force attention more than ever to the problems of abundance

and conservation of the ocean's resources in this field. (2) Another winter of deficient precipitation in California, following another summer of excess temperature of the sea, has increased interest in the problem of seasonal weather forecasting on the basis of observations on the conditions of the sea.

Although the merest reference to the general subject of Pacific Exploration can be made here, this must include mention of the magnitude and complexity of the suggested explorations. As insisted in other connections, so extensive are the problems and undertakings involved that it seems hardly possible that any agency less than the national government can be adequate to their prosecution.

The U. S. Navy, the Coast and Geodetic Survey, and the U. S. Weather Bureau seem to be natural government agencies to which to look for portions of the programme which are beyond the ability of local agencies.

But efforts are being made to correlate all projects and agencies, national, state, and private, that are occupied with researches in the Pacific.

With this end in view, a Pacific Exploration Committee of the National Research Council has been formed for the purpose of setting forth the problems now being investigated, formulating others which are in immediate need of investigation, and pointing out what would be necessary to carry through these researches and the possible agencies for doing this.

The present personnel of this committee is: J. C. Merriam, Professor of Palaeontology and Historical Geology, University of California, chairman; William Bowie, U. S. Coast and Geodetic Survey; R. A. Daly, Harvard University; William M. Davis, Harvard University; B. W. Evermann, California Academy of Sciences; H. E. Gregory, Yale University and the Bishop Museum, Honolulu; E. B. Mathews, U. S. Geological Survey; A. G. Mayer, Carnegie Institution, Washington; George F. McEwen, Scripps Institution, University of California; and W. E. Ritter, Professor of Zoology and Scientific Director of the Scripps Institution, University of California.

Messrs. McEwen and Ritter have been active in the work of this committee, both having attended all meetings held, one of these being in New York City on December 7, 1919.

The addresses given at the Symposium on the Exploration of the North Pacific, held at Pasadena on June 19, 1919, in connection with the meeting of the Pacific Division, A. A. A. S., have been published as Bulletin 9 of the Scripps Institution. These addresses were by William E. Ritter, Barton W. Evermann, John N. Cobb, Ellis L. Michael, George F. McEwen, Edward A. Beals, and George D. Louderback.

## LIBRARY AND PUBLICATIONS

Five hundred and eighty-five new books have been added to the library during the year, and the periodical list has been increased to eighty-five. Such a growth would be quite impossible except for the special gifts of money for this purpose made by Mr. E. W. Scripps. And the broadly representative character of this growth is also partly due to the wide range of his interests in science.

Attention should be called to the fact that the tendency of the institution's development appears to make an increasing proportion of its scientific papers unsuitable for the zoology series of the University of California Publications, which series is regarded as the regular medium of publication for the technical writings of the staff. This is particularly true as to the work in oceanography and the more technical application of statistics to various problems. But even in genetics, which subject ought, on its animal side, be regarded as strictly zoological, Dr. Sumner has not felt the University Publications to be suitable for his papers.

## MUSEUM, AQUARIUM, AND SUPPLY DEPARTMENT

The following valuable gifts to the Museum which I wish hereby to acknowledge have been made during the year: A comprehensive collection of local sea weeds by Mrs. M. S. Snyder of La Jolla; a partial collection of water and shore birds of the Southwest by Mr. Frank Stephens of the San Diego Natural History Society; and an important addition of Pacific Coast shells which is yet to be received from Dr. Fred Baker and Mr. F. W. Kelsey of San Diego. All of these will be placed in the new cases that have recently been installed.

What has probably added most to the educational efforts of the institution during the year has been the service of an efficient guide Mr. C. H. Michael, who has explained the various exhibits of the Museum and Aquarium to more than 12,000 visitors.

Although there can be no question about the value of the Aquarium as a means of public education and pleasure, the expense and labor involved in maintaining it at a proper standard are so considerable as to raise a real question about what course to pursue relative to it. Several alternatives are under consideration.

The Supply Department for biological materials, which was more or less inactive during the war, is now reopened and is filling orders from various supply houses, university departments, and individual research workers. It is hoped that this department will soon develop into a self-supporting and, perhaps, fairly remunerative business. Mr. P. S. Barnhart, in charge of this department, is well qualified to make it a success

PROPERTY REPAIRS

Several longitudinal cracks which have appeared in the concrete piling the institution pier are causing some concern. Mr. Ledbetter of Ledbetter & Co., contractors, of Los Angeles, has examined them, and Mr. Crandall has made a careful study of other similar piers in Southern California, but at present no definite solution has been reached for stopping this deterioration. This matter is very important since it concerns the future usefulness of the pier. Steps will be taken to repair the damage as far as possible.

The woodwork of the pier and all of the buildings belonging to the institution have been repainted and, where necessary, refitted, the expense being borne by Miss Ellen B. Scripps.

The roof of the laboratory building is in bad condition and is obviously deteriorating quite rapidly. Past efforts to make it rainproof seem to show that nothing short of a new covering of different type for the entire building will cure the trouble.

Attention is also called to the great need of improvement of the roads, walks, and grounds generally.

A "CHAUTAUQUA IN SCIENCE"

The Scripps Institution in conjunction with the Community Center of the Unitarian Church of San Diego was enabled, by the generosity of Mr. and Mrs. William Templeton Johnson and Mr. E. W. Scripps to present in San Diego and La Jolla last summer the following course of lectures:

"To what extent can Science be applied to Human Relationships," by Dr. William E. Ritter, Scripps Institution for Biological Research.

"The Economist's View of Humanitarianism," by Dr. Jessica B. Peixotto, Department of Economics, University of California.

"The Conflict of Pragmatism and Knowledge," by Dr. Warner Fite, Department of Philosophy, Princeton University.

"The Psychology of Discontent," by Adolph Meyer, Director Henry Phipps Psychiatric Clinic, Johns Hopkins University.

"The Evolution of Types of Civilization," by Dr. Edgar L. Hewitt, Director San Diego Museum and School of American Research.

"Main Characteristics of the Humanitarian Movement During the Past Century," by Dr. Jessica B. Peixotto.

"The Relation of Science to Religion," by Dr. Warner Fite.

"The Present Status of Humanitarianism," by Dr. Jessica Peixotto.

"Freedom and Solidarity," by Dr. Adolph Meyer.

This enterprise had the double purpose of bringing together specialists in different fields of knowledge for a series of more or less technical

discussions at the institution, and giving to popular audiences in San Diego the addresses indicated above.

So satisfactory was the experiment that a similar programme will be carried out during the summer of 1920.

#### VISITING INVESTIGATORS

The following have used the facilities of the institution during the year in prosecution of their special researches: Professor G. H. Parker of Harvard University, working on the reactions of *Renilla*; Dr. Ida Hyde on the influence of magnetism on certain littoral animals and on the activities of two species of copepods in relation to environmental conditions; Dr. Myrtle Johnson and Mr. H. J. Snook in the preparation of a handbook of the marine fauna of the Pacific Coast; Dr. C. Judson Herrick, assisted by Mr. E. R. Gaderer, University of Chicago, on histological studies of the nervous system of invertebrates; Miss Sally Hughes on the cranial nerves of the shark, *Galeus*; and Professor S. S. Maxwell, University of California, on the labyrinth of sharks.

#### SPECIAL GIFTS BY MR. E. W. SCRIPPS

Record should here be made of the special contributions to the work of the institution made during the year by Mr. Scripps. The purposes and amounts of these are as follows:

Stenographic work .....	\$1,500
Assistant in Oceanography (Mr. Cummings) .....	1,200
Library—books .....	1,800
Publication funds .....	2,000
Assistance in Genetics .....	1,500
Field work in Genetics and Ecology .....	1,150
Scientific cruise of the ‘‘Kemah’’ .....	2,500
	\$11,650

#### THE SCIENCE NEWS SERVICE.

During the year this project which, though wholly independent of the institution as to organization, funds and field of work, has been brought into partial existence, and implicates the institution rather closely because of the part being taken in it by the Director, and from the further fact that for the present the headquarters of the service must be at the institution.

For details concerning the nature of this project reference must be made to the records of the organization itself. Only the most essential facts concerning it need be given here.

The purpose of the undertaking as stated by its proposer and financial backer, Mr. E. W. Scripps, in a revised memorandum of March, 1920, is to promote the dissemination of science in the community at large by

any means whatever that in the judgment of the organization may appear wise and practicable. For the present effort will probably be restricted to the newspapers.

At present the organization of the service consists of one representative each of the National Academy of Sciences, the American Association for the Advancement of Science, and the National Research Council, these representatives being, respectively, Director George E. Hale, Mount Wilson Solar Observatory, Pasadena, California; Director D. T. MacDougal, Desert Laboratory, Tucson, Arizona; and Professor A. A. Noyes, California Institute of Technology, Pasadena, California; and also of Mr. E. W. Scripps, Mr. Robert P. Scripps, and Director William E. Ritter, Scripps Institution.

A considerable sum of money has been placed at the disposal of the organization to aid its still farther development and make experiments in getting popularized scientific matter from scientific men and in selling this to the papers. In furtherance of the undertaking conferences among scientific and newspaper men have been held at many of the chief centers of scientific work throughout the United States. In connection with these conferences the Director has made two journeys across the continent since November, 1919.

An enterprise of undoubtedly great potential good is here in process of formation, but the full realization of this will require much effort and many months or even years of time.

It should be pointed out, in concluding this statement about the Science News Service, that although this undertaking is wholly independent, organically, of the institution, its kinship to certain fundamental ideas of the institution is indicated by the fact that a number of more or less definite efforts have been made by the institution itself in past years to disseminate the results of its researches through the public press. The last and most positive effort of this sort has been made during the past year. This has consisted in the appointment of Mr. W. E. Allen to be "publicity secretary," as well as biologist, of the institution, he having had considerable experience before joining the institution staff in writing popular science articles for the newspapers.

The year's efforts by Mr. Allen in this field furnish experience and information that will be distinctly serviceable to the new and larger undertaking. But if the new venture succeeds, the definitive institution experiment will probably be discontinued.

Respectfully submitted,  
WILLIAM E. RITTER,  
Director.