SCRIPPS INSTITUTION FOR BIOLOGICAL RESEARCH

To *the President of the University.* LA JOLLA, July 1, 1925.

SIR: I have the honor to present the following report of the activities of the Scripps Institution for Biological Research for the academic year ending June 30, 1925:

The present policy of the Institution was outlined in the annual report for the year 1923–24 and during the past year there has been no substantial deviation from it. It has been decided, however, that Professor F. B. Sumner should remain a member of the staff of the Institution and not be transferred to Berkeley. He has proposed that he base his future investigations on the study of heredity in geographic races on fishes instead of on mammals of the genus *Peromyscus*. This change is appropriate because he began his investigations with work on fishes and their continuation is thus kept within the logical scope of an oceanographic institution. A summary account of the scientific investigations conducted by members of the staff of the Institution is given later in this report. Certain general statements, however, are appropriate here.

Although no sharp subdivisions can be made between the different kinds of oceanographic work, some kind of subdivision is necessary since no man can be a specialist in all the different fields. The Institution's investigations have therefore been arranged in the convenient divisions of physical, chemical, biological, and geological oceanography. The accounts of the oceanographic work are followed by a summary of the work done by Professor F. B. Sumner on *Peromyscus* during the past year.

Investigations such as those on the ocean are logically divisible into three steps. The first consists in making observations and collecting material for laboratory study; the second, in the laboratory study of the data and collections and preparation of reports for publication; and the third, in publication. At the Scripps Institution provisions have been made for obtaining large quantities of oceanographic data and extensive collections of certain kinds and the Institution has a moderate staff for the laboratory work on both data and collections of materials. The problem of publication is under consideration and it is hoped that a University series entitled Contributions to Oceanography will be established in order to give an appropriate channel for the publications of the reports of the investigations in oceanography prosecuted at the Institution.

Arrangements for obtaining oceanographic data and collections of material.—During a part of each year the Institution has operated along and off the coast of Southern California a small boat either owned or chartered by it. It maintains a number of shore observing stations along the west coast of the United States from the latitude of San Diego to the mouth of the Columbia River. Several of these stations are maintained through coöperation with the United States Bureau of Lighthouses; and one at Pacific Grove, through coöperation with the Hopkins Marine Laboratory.

The vessels of the United States Coast and Geodetic Survey operating off the west coast of the United States, between the United States and Alaska, and in Alaskan waters, obtain for the Institution both hydrographic and meteorologic records and extensive series of water, plankton, and bottom samples. In many places vertical sections of the water from the surface to the bottom have been taken and now sufficient data have been accumulated for preliminary calculations of oceanic circulation off the west coast of the United States according to methods devised by V. Bjerknes.

By an arrangement with the United States Navy, meteorologic and hydrographic records and water and plankton samples have been or are being obtained for the Institution by the destroyer fleet, under the command of Rear Admiral Frank H. Schofield, between San Diego and the Guadalupe Islands; between San Diego and San Francisco; between San Francisco and the Hawaiian Islands, where the destroyer fleet divided; between the Hawaiian Islands and San Diego by that part of the destroyer fleet which returned directly to San Diego; and between the Hawaiian Islands and Australia and return by that part of the fleet which is making that voyage. Before the vessels started on the voyage all of the thermometers used by them were calibrated or provisions were made for subsequent calibration by the Scripps Institution. The arrangement above indicated will give virtually a complete survey of the surface oceanic conditions along all the routes over which the battle fleet will operate during 1925.

The Southern California Edison Company, the Los Angeles Bureau of Light and Power, and the Southern Sierras Power Company have combined to aid the Scripps Institution in its studies of ocean temperatures, and have contributed a fund ($500) for the purchase of two thermographs, one of which will be installed on the pier of the Scripps Institution and the other at Balboa. An arrangement has also been made with the sanitation engineers of Los Angeles for a detailed study of the effect of sewage on sea water in the vicinity of San Pedro, California.

Upon the initiative of the Commandant of the Naval Air Station at San Diego a coöperative study of the fog problem along the coast of Southern California has been undertaken by the officers of the Naval Air Station, the United States Weather Bureau, and the Scripps Institution.

SCIENTIFIC INVESTIGATIONS OF THE INSTITUTION

Physical oceanography.—Associate Professor George F. McEwen continued in charge of the investigations of the problems of the physics of of the sea. He was assisted by Mr. E. Giddings during July; by Professor Hosmer W. Stone during August and a part of September; and beginning on September 22, by Mr. S. W. Chambers who since then has served as assistant in physical oceanography. The following is a summary of the water samples and temperature records received.

From the operation of the boat at stations 5 and 10 miles offshore from the Institution pier, over 1900 water samples and temperature records, about nine-tenths of them being subsurface. Water samples and temperature records from shore stations and lightships are as follows:

Scripps Institution Pier, full year	365
Oceanside, full year	365
Hueneme, full year	365
Pacific Grove, full year	365
Blunts Reef, full year	365
Balboa (Pier), opened Nov. 6, 1924	182
Santa Barbara, opened Jan. 26, 1925	144
Farallon Island, opened May 1, 1925	72
	2,223

Daily temperature records have been received from Columbia River Lightship.

From the U. S. Coast and Geodetic Survey steamers *Guide* and *Pioneer*, 550 water samples and temperature records, about half the number being surface samples and records in the Alaskan region and half largely subsurface samples and records off the coast between Cape Blanco and San Pedro.

The coöperative arrangement with the United States Navy resulted in the collection of water samples, records of temperature and other data by the destroyer fleet of thirty ships while in the Pacific in 1925. About 350 surface samples and 6000 temperature records were taken on the cruise to Guadalupe Island and return during March. About 550 surface samples and 7500 temperature records were taken on the cruise to the Hawaiian Islands during April and May. The temperatures were read from the thermometers already installed in the intake pipes supplying water to the condensers. A programme of hourly observations was arranged, the thermometers were calibrated beforehand, and special care was taken in making the readings. Thus it was possible to obtain very intensive observations over a belt from one-half to one mile in width. Such a series offers a good opportunity for testing the accuracy of such methods of observations through the intercomparison of results.

The results of soundings taken by navy ships from San Francisco to Hawaii during April and communicated to the Institution were as follows:

Somers	72
Mervine	81
Hull	233
Omaha	94
Corry	189
Total	669

The great accumulation of data made it necessary to provide a special filing cabinet. Work has begun on the preparation of a report summarizing the ocean observations made under the direction of the Scripps Institution for the past ten years. The application of the circulation theory of V. Bjerknes to determining ocean currents from differences in density due to temperature and salinity differences has been commenced. Certain data provided by the United States Coast and Geodetic Survey obtained during cruises from the Atlantic to the Pacific Coast and during recent survey work off the Pacific Coast and our data at the 5 and 10-mile stations off La Jolla will be used in the work on this problem.

Professor McEwen has now almost ready for press a paper entitled "A mathematical theory of the temperature distribution in water due to solar radiation, evaporation, and convection."

The theoretical investigations of vertical temperature gradients in lakes and reservoirs and the extension of these results to vertical temperature and salinity gradients in the ocean have been continued intermittently. Weekly observations over one year, which have been taken at the Sweetwater Reservoir, provide data on the seasonal variation in temperature gradients throughout a complete cycle. The engineer's estimate of monthly evaporation is available for use in this investigation.

The studies of seasonal rainfall and ocean temperatures are being continued, and an experimental forecast of seasonal rainfall for Southern California was supplied to a number of interested individuals and companies last October.

Investigation of local tides is being made in coöperation with the United States Coast and Geodetic Survey, which, as stated elsewhere in this report, has established one of its automatic tide-gauges on the Institution's pier and appointed Professor McEwen one of its tide-observers.

Chemical oceanography.—These investigations, in charge of Dr. E. G. Moberg, have largely been a continuation of earlier work. During July and August Dr. H. W. Stone and Miss Maurine Leslie were working in the chemical laboratory, partly on routine work and partly on special investigations. Since December, 1924, until the present time, Miss Isabelle Collins has been engaged in similar work.

Until October, 1924, considerable time was devoted to boat work, two offshore stations being occupied daily for the collection of water and plankton samples. On the water samples were determined the phosphates, hydrogen ion concentration, alkalinity, and (by computing from the alkalinity) free and combined carbon dioxide. Thus was obtained considerable information in regard to the vertical and local distribution of various substances of biological importance. Similar information has been obtained for the water at the pier during the entire year.

The method used for phosphate determination was thoroughly studied and greatly improved by Dr. Stone. He also attempted to determine the carbon dioxide in sea water by means of the Van Slyke blood gas apparatus but no success was attained and the experiments are still being continued at the Southern Branch of the University.

Since no satisfactory method for the determination of nitrates in sea water had previously been found, systematic studies of various methods were undertaken by Miss Leslie, and the results obtained indicate that a suitable procedure was found.

Further analyses of plankton samples, with particular attention to the fat content, have been made.

A paper dealing with the effect of tide upon various properties of the water has been prepared for publication and considerable progress has been made in arranging and analyzing other data. The results of the chemical investigations conducted at the Institution for several years past have been summarized in a manuscript by Dr. Moberg which was presented as his doctor's thesis at the University of California. It is intended to begin the publication of the results of the chemical investigations at an early date. They will have to be given in a series of papers or in a volume divided into several distinct chapters.

Marine biology.—The marine biological investigations were mostly devoted to studies of marine plankton. Assistant Professor Allen has continued his studies of marine diatoms and dinoflagellates according to the plan previously adopted for such investigations. He was assisted by Mr. E. H. Quayle from September 1 until about the first of March and by Mr. Henry P. Dorman from about the middle to the end of June. The routine microscopic examination of the voluminous collections made at the Institution's pier and at the piers at Oceanside, Hueneme, and Santa Barbara, has been brought to near the end of 1922. The report on the collections from the piers in 1921 has been completed and is ready for publication. A report on the large series of collections made by the United States Coast and Geodetic Survey steamer *Pioneer* in Alaska in 1921 can be finished in a very short time. Some work on other series besides those mentioned has also been done.

Because of the lack of storage space the concentration of most of the plankton catches into small vials was undertaken. This concentration has obviated for three or four years the necessity of more space, but it consumed a considerable portion of Professor Allen's time.

Important additions have been made to the collection of microplankton in the calendar year 1925 through the coöperation of the United States Navy, the United States Bureau of Lighthouses, and the United States Coast and Geodetic Survey. The Institution is receiving about 2000 plankton catches per year. At present 3000 unstudied catches are on hand. It is hoped that the addition of an assistant in planktology to the staff of the Institution will render possible overcoming the present arrearage in the study of these collections. Fundamental information on the microplankton of the Pacific is being rapidly accumulated and it now seems possible to make intelligent attacks on a number of special problems.

During the year Professor C. O. Esterly gave his entire attention to the copepods contained in the plankton hauls made at the Institution's pier between August, 1916, and August, 1918, inclusive. There are about 3500 hauls in this series. The numbers of individuals of each of nine species of free-swimming copepods have been estimated for each haul and entered on cards printed for that purpose. The number of individuals of these species in each haul have been tabulated according to the logarithms of the observed numbers, and the logarithms in turn have been arranged according to months, the time of day, and temperature. The summarizing of the data is now in progress, and the final report on the copepods of the "pier series" can be prepared when the summaries have been completed.

Mr. P. S. Barnhart has begun the collection of material for the study of the embryonic and larval stages of a number of fishes which spawn in this vicinity. Attempts to raise the eggs and the larvae in aquaria have not yet been successful but the experiments will be continued.

The paper on statistical methods by Associate Professor G. F. McEwen referred to in the last report is finished. The title is "Methods of Estimating the Significance of Differences and the Probability of Fluctuations Due to Random Sampling: Numerical illustrations, formulae, and tables prepared especially for estimating probabilities when the usual 'method of least squares' or 'normal' law of error may not apply." There are about 450 pages typewritten, of which only 35 pages are text. The principal table contains about 400 pages.

Geological investigations.—The director of the Institution had but little time during the year for scientific research but he has published the third part of his address as retiring president of the Paleontological Society (for 1923), and papers on comparisons between American and European

Tertiary larger foraminifera and American and European Tertiary corals. A paper on some new Miocene corals from the Dominican Republic revised by him and Dr. J. E. Hoffmeister is in press. He also wrote a preliminary report on a collection of larger Tertiary foraminifera from Jamaica for the former Government Geologist of Jamaica, Dr. C. A. Matley, but the paper has not been sent to press. Considerable work was also done on collections of Tertiary foraminifera from Georgia, Florida, Alabama, Mississippi, Mexico, the West Indies, and India.

The building up of a good reference collection of recent smaller foraminifera was begun and the collection is now sufficient for the instruction of beginning students. The foraminifera in waters adjacent to the California coast are receiving particular attention. Dr. Joseph A. Cushman, the leading American authority on this group of organisms, has consented to prepare a report on those found in the California region.

Since April Miss Isabelle D. Collins has devoted a part of her time to work on foraminifera and has rendered valuable assistance.

Large additions were made during the year to the collections of marine bottom deposits at the Institution, and some progress was made in the study of such material. Mechanical analyses of a specially selected set of samples were made at the United States Bureau of Soils and chemical analyses of fractions of the same samples were made at the United States Geological Survey.

As soon as the seismographs to be supplied by the Committee on Seismology of the Carnegie Institution of Washington have been received, seismograph records will be cared for by members of the Institution's staff and turned over to the Committee on Seismology.

Studies of heredity in Peromyscus.—During the past twelve months Associate Professor F. B. Sumner was largely occupied with rearing and studying the three geographic races of *Peromyscus* which were collected in Florida and Alabama during the summer of 1924. One of these races is an extremely pale one, strikingly adapted to a habitat of nearly pure white sand. It is restricted to a single island of geologically recent origin, and its derivation from the quite distinct race found upon the neighboring mainland is practically certain. These races, which breed well in captivity, lend themselves admirably to an experimental study of the amount and kind of genetic change which the island race underwent in becoming differentiated from the mainland type. The genetic relationship of the coast and interior types is also being investigated. Most recent students of heredity and evolution hold rather pronounced views as to the mode of origin of specific characters in nature, but the evidence which is offered in support of these views is based almost wholly upon "mutant" forms which have appeared under laboratory conditions, and not upon the breeding of natural races or species.

Interesting and instructive results have already appeared in the course of breeding this eastern material, and the evidence for a Mendelian interpretation of some of the racial differences seems nearly decisive. This is not in full accord with conclusions previously reached from a study of California material. Further studies of the present stock, if pursued uninterruptedly for another year or more, should make possible a comprehensive interpretation of all the past results, based upon breeding subspecies of *Peromyscus*.

In addition to the study of these recently acquired natural races from Florida and Alabama, Professor Sumner has continued investigations upon certain of the color mutations which have originated in his captive stock. A paper was published upon the curious hairless race, and he is now investigating the hereditary basis of a less simple type of mutation, which he has called "grizzled."

Professor Sumner was assisted during the year by Dr. R. R. Huestis from July 1 until September 20, by Mr. Harold Chambers from October 29 to March 1, and by Mr. Henry Davison from March 1 to June 30.

Inquiry has been started as to the practicability of pursuing genetic and distributional studies on certain species of fishes, and the conclusion has been reached that it would be wise to commence such studies in the rather near future. These would supplement and extend those now being conducted upon *Peromyscus* and would likewise be somewhat more nearly related to the other work of the Scripps Institution. It is not planned, however, to discontinue the studies of *Peromyscus* until they can be abandoned without sacrificing the results of past labor and expense. This may not be possible for another year or two.

Equipment.—During the past year the Institution has obtained the following important additions: Automatic tide gauge which was established on the Institution's pier by the United States Coast and Geodetic Survey and is the property of the United States Coast and Geodetic Survey but is operated by members of the staff of the Institution; piers for the installation of seismographs in the basement of the Museum-Library building of the Institution; a Bausch and Lomb balopticon of the highest grade; a certain amount of equipment for making mechanical analyses of and studying sediments and for work on microörganisms contained in sediments; and two oceanographic thermographs, as mentioned above.

Repairs and improvements.—The special appropriation of $10,000 by the State Legislature for major repairs and improvements of the Institution's property, noted in last year's report as badly needed, makes possible the restoration of the Institution's pier, the erection of a new water tank, and a certain amount of road construction. Plans for this work are now being perfected and as much will be done as the funds

will permit. In the repairs preference will be given to the restoration of the Institution's pier to good condition.

Considerable improvements have also been accomplished by grading in the ravine across the road northwest of the Director's house, and the building of a retaining wall, sidewalk, and gutter; a bridle trail was built in coöperation with the La Jolla Bridle Association from the beach to the road at the east end of the Institution's pier; and the roads of the Institution were put into temporarily good condition by grading and surfacing.

There have been planted on the Institution's grounds 476 young trees and shrubs which were purchased, as well as many other plants donated or raised on the grounds. The total number therefore amounted to a good many hundreds. The Director of the Institution donated all the plants which were put out around the Director's house and he also built a curb and gutter along the front of the grounds immediately adjacent to his house. Numbers of tenants in the cottages donated to the Institution plants which were put out around the houses in which they live and there was in general praiseworthy response among the tenants to an appeal for the improvement of the appearance of the grounds.

The first planting was done under the guidance of Mr. Guy L. Fleming, Custodian of the Torrey Pines Park. Later, through the Dean of the College of Agriculture, the assistance of Professor J. W. Gregg, Professor of Landscape Architecture in the University of California, was procured for the preparation of a plan and programme for the gradual improvement of the Institution's property. Plants have also been donated by Dr. W. T. Swingle, in charge of the Government Date Farm at Indio, California, and the Division of Foreign Seed and Plant Introduction of the United States Department of Agriculture. The Institution also is indebted to Mr. R. H. Cambage of Sydney, Australia, and to the Sydney Botanical Gardens for seeds of trees and shrubs for testing at the Scripps Institution to ascertain whether the different species represented are adapted to this environment. The germination of the seeds from Australia has been undertaken by Dr. R. D. Hooton of the United States Department of Agriculture Experiment Station near Torrey Pines Park.

Incidental activities of the members of the staff.—The Director has given 22 extramural lectures: 3 in La Jolla, 3 in San Diego, 1 at the University of Southern California, 1 at the Synapsis Club at Riverside, 7 in Berkeley, 1 in San Francisco, and 6 at Stanford University. In Washington, on April 30, he gave an account of the oceanographic work of the Scripps Institution at the meeting of the Section on Oceanography of the American Geophysical Union. The Director also attended the annual meeting of the National Academy of Sciences in Washington and those annual meetings of the divisions of the National Research Council

of which he is a member. (The Director is the representative for the United States National Research Council on a committee for the permanent organization of the Pan-Pacific Science Congresses. He is also the chairman of a general committee on the study of temperature, salinity, and other physical and chemical features of the Pacific Ocean, authorized by the Pan-Pacific Science Congress in Australia in September, 1923.)

Professor Sumner attended a meeting of the American Birth Control League in New York City and the annual meeting of the American Society of Mammalogists. During the latter part of October, Professor Sumner and Professor Allen attended the meeting of the San Jacinto Section of the Western Society of Naturalists in Los Angeles.

Professor McEwen attended the meeting of the British Association for the Advancement of Science in Toronto, August 6 to 13, and the International Mathematical Congress, August 11 to 16, and presented three papers before the Mathematical Congress. On February 28, he presented a paper before the Southern California Section of the Mathematical Association of America at Los Angeles, and on May 10 he gave a popular lecture in the lecture room of the California Academy of Sciences at San Francisco.

Professor Allen wrote throughout the year a series of bi-weekly popular science articles in compliance with requests from certain California newspapers.

Visitors.—During the year many scientific investigators visited the Institution. Some of them remained from one to three or four days, inspecting the Institution, familiarizing themselves with its work, and consulting in regard to certain kinds of investigations. There were visitors from India, Australia, Japan, the Hawaiian Islands, Mexico, Scotland, Norway, Germany, and Austria, as well as many scientific men from the United States. Several of the visitors favored the Institution with lectures, a list of which follows:

Date	Name	Title
Sept. 12	C. M. Child, University of Chicago.	Polarity in Organisms.
Sept. 19	V. Bjerknes, Geophysical Institute, Norway.	Practical Work in Meteorology and Hydrography.
Sept. 22	V. Bjerknes	Ocean Dynamics.
Oct. 10	F. Haber, Berlin	Some Chemical Problems of the Sea.
Jan. 2	W. M. Davis, Cambridge, Mass.	Marginal Belts of the Coral Seas.
Jan. 6	W. M. Davis	Illustration of Tides by Waves.
Jan. 9	R. L. Moodie, University of Illinois.	Evidences of Ancient Disease.

Date	Name	Title
Jan. 22	H. C. Richards, University of Queensland, Brisbane.	The Great Barrier Reef of Australia.
Feb. 6	E. D. Merrill, Dean of the College of Agriculture, University of California.	Correlation of Biogeographic Distribution with the Geologic History of Malaysia.
Feb. 7	H. E. Gregory, Director of Bishop Museum, Honolulu.	Investigation of the Native Races of the Pacific.
Feb. 10	W. E. Ritter, Director Emeritus, Scripps Institute.	What is Consciousness.
Mar. 6	V. C. Vaughan, Chairman Division of Medical Sciences, National Research Council.	Growing Bacteria by the Pound.
June 4	B. C. Gruenberg, American Association of Medical Progress, New York.	Work of the American Association of Medical Progress.

The Institution has also been visited by groups of students from the State College at San Diego; the Natural History Society of San Diego; the Junior College at Riverside; the class in agronomy and the class in landscape architecture, both from Berkeley. The total number of these visitors was about three hundred.

Investigators.—Professor N. L. Gardner of the University of California was at the Institution from July 1 to 26, for the purpose of making further collections and study of the marine algae of Southern California and northern Lower California. He was particularly concerned with the flora in the vicinity of San Diego. Professor Gardner says that the facilities of the Station proved very helpful to him and that the time spent, though brief to cover so extensive a field, was amply repaid. Several new species were discovered and much useful material in previously discovered species was found.

Professor C. M. Child of the University of Chicago, was at the Institution from July 1 to September 29. His work consisted in the experimental study of the hydroid, *Corymorpha palma*, carried on by himself and L. H. Hyman at the Scripps Institution in 1922 and by himself in 1924 and was concerned primarily with the problem of the nature of physiological polarity. The investigation included, first, an extensive study of the reconstitution of isolated pieces from different levels of the stem and under different, controlled conditions; second, a study of the physiological gradient as indicated by (*a*) the differential susceptibility of different levels of the stem, (*b*) differences in oxygen consumption and carbon dioxide production at different levels, (*c*) differences in various oxidation-reduction reactions at different levels, (*d*) differences in permeability to certain agents at different levels. In 1924 some study of control and modification of embryonic development was also made.

The experiments on reconstitution showed that polarity could be obliterated from the stem of *Corymorpha* and a new polarity introduced by exposure to a quantitative differential in environmental conditions. The data concerning susceptibility, respiration, oxidation-reduction, and permeability all indicate the existence of a quantitative physiological gradient along the polar axis of *Corymorpha*. It is found further that when polarity is obliterated this gradient disappears and that when a new polarity is established a new gradient appears as a reaction to the environmental differential. All the data obtained constitute definite and positive evidence in support of the conception of physiological polarity as a quantitative gradient in physiological condition, including both chemical and physical factors.

Professor R. L. Moodie, of the University of Chicago, was at the Institution from July 1 to August 25. Professor Moodie was engaged in a continuation of his studies of evidences of ancient disease and utilized the facilities of the Institution largely for library work.

Professor Howard F. McMinn, of Mills College, assisted by Miss Elizabeth McCarroll, utilized the space at the Institution for a study of the relation of certain species of *Artemisia* to hay fever.

Miss Susan B. Nichols, Professor of Botany at Oberlin College, collected filamentous algae from November 6 to 10.

Mrs. H. W. Fitkin of Cleveland, Ohio, spent a week, January 23 to 30, studying and collecting local fauna and flora.

Mr. Guy Fleming, Custodian of the Torrey Pines Park, has continued to use a room in the laboratory building of the Institution for his botanical studies.

It is earnestly desired that the facilities of the Institution shall be utilized to the utmost by investigators who can advantageously pursue here their researches. This invitation is issued to biologists, biochemists, and students of geologic processes operative in the ocean, and to students of terrestrial phenomena as well as to students of phenomena which are confined to the sea.

Students.—Mr. E. G. Moberg was registered as a graduate student throughout the academic year and was in continuous residence except for a short time spent in Berkeley where he passed the final examination for the doctor's degree.

Mr. E. H. Quayle was registered as a student in several lines of oceanographic work for the first semester of the year but because of illness he was obliged to withdraw for the second semester. Mr. Quayle devoted most of his attention to studies of planktology.

Miss Isabelle D. Collins was registered as a graduate student for the second semester of the year and devoted most of her attention to chemical

work but gave considerable time to laboratory work on foraminifera contained in sediments.

Two students not registered as students at the Scripps Institution did some work during the year. One of them, Mr. Arthur S. Campbell, graduate student in the Department of Zoology at Berkeley, from June 1 to 21 collected and studied Tintinnids. The other was Mr. Stephen H. Rook, an upper division undergraduate student at the Southern Branch of the University of California. Mr. Rook did certain preliminary work on foraminifera during a week end in May and the last few days of June and has continued his studies at the Institution after the first of July.

Students other than those regularly registered at the Institution are welcome if they are sufficiently advanced to undertake special work, and all possible assistance is given to them.

Library.—During the past year 220 volumes and 721 separates have been added to the library, bringing the accessioned total to 9686 volumes and 10,815 reprints. About 1700 unbound volumes and pamphlets belonging to series are systematically arranged but are not catalogued.

Museum, Aquaria, and Supply Department.—The biological collections of the Institution are in charge of Mr. P. S. Barnhart. The work in the Museum during the year 1924–25 was largely of a routine nature, such as replacing of specimens, reprinting of labels, and cleaning cases. A few new specimens have been added to the exhibits. A large number of old trawl and dredge collections have been gone over and sorted and much time was spent in the care of the permanent working collections of the Institution. There were 5528 registered visitors to the Institution, but the number was very much larger, as most visitors do not register.

From August, 1924 to May, 1925, the entire work and upkeep of the aquarium was assumed by the curator and this left little time for other duties. Although during this time the aquarium was not kept in first-class condition, about 1150 live specimens, representing 52 species, were exhibited. There has been much difficulty in maintaining the aquarium because of the deterioration of some of the tanks and the cracking of some of the glass fronts. It is intended to undertake considerable repairs at an early date.

The sales of the Supply Department amounted to $801.09. The demand for preserved material was, however, far in excess of the available supply.

Acknowledgments of gifts and other assistance to the Institution.—Miss Ellen Browning Scripps gave during the year $9000 for the salary of the Director and general purposes, and $5000 additional for the support of the work of the Institution.

The United States National Museum has donated valuable specimens of deep-sea deposits and thereby has made the collection of such material belonging to the Scripps Institution representative of very nearly all of the known types of deep-sea sediments.

The United States Geological Survey has had chemical analyses made of a selected set of marine bottom deposits, and the United States Bureau of Soils has made mechanical analyses, including the determintion of the per cent of material in colloidal state, of fractions of the same specimens.

The United States Bureau of Standards undertook to make for the Institution three sets of standard sieves to be used in making the mechanical analyses of sediments. The holders and the wire cloth for the sieves were supplied to the Bureau of Standards but the materials were put together at the Bureau of Standards and the mesh of the sieves certified by it.

The Institution is under deep obligation to a number of other institutions for assistance in the prosecution of its investigations. The more important of these, the United States Navy, the United States Coast and Geodetic Survey, and the United States Bureau of Lighthouses, deserve special mention for the help they have rendered in procuring oceanographic records and collections of materials for laboratory study. Other institutions which have rendered assistance are the Hopkins Marine Laboratory at Pacific Grove and the California Academy of Sciences. Acknowledgments already made for other gifts and assistance need not be repeated here.

Mention should be made of the wholehearted way in which both the scientific and non-scientific members of the staff have coöperated to make the conduct of the Institution's work successful.

Concluding statement.—Comparison of this with last year's report shows that considerable advances have been made during the past year in the development of the Institution. An effort has been made to provide the chief of each branch of research prosecuted at the Institution with adequate assistance. This has been accomplished for every one except the Director, and for the coming year it is possible to get assistance according to the plan outlined in last year's report, and the next expansion will be to start investigations in marine bacteriology and along certain related lines of biochemistry. Such investigations are needed as a basis of understanding numerous marine phenomena of significance to biology and geology. It is also intended to undertake considerable dredging in intermediate depths at the earliest practicable date.

Since difficulty was experienced in chartering a suitable boat during the summer of 1925, the purchase of a boat with a part of the boat fund is under consideration. The Institution would thereby become independent of the vicissitudes of hiring some craft.

The facilities of the Institution for research are utilized to a considerable degree by visiting investigators and advanced students, but a larger number can be accommodated, particularly during the winter months. It is hoped that the number of such visitors will increase and the prospects are good that such an increase will soon be effected.

It is the purpose of the Institution to be as broadly useful as possible through the researches of the regular members of its staff, through its courses of instruction, and the facilities for research offered to visiting scientists, and through coöperating with other institutions whose activities are along related lines.

Respectfully submitted,

T. Wayland Vaughan,
Director.