work. The British Institute of Psychology has been successful in securing the cooperation of the workers and has in some directions increased production by 40 per cent. with decreased fatigue. In every field of activity from the use of pick and shovel, of typewriter and ledger, through the factory and office, to the organization of the work of the executive or the congress of the nation, investigations might be made which if put into effect would add from 10 to 100 per cent. to effective productivity and lessen to an equal extent effort and fatigue.

It is absurd that researches whose economic value can only be told in billions of dollars and whose contribution to human welfare is even more immeasurable should await the pleasure of a few academic psychologists who take them up in the intervals between coaching the members of a junior social and athletic club and helping with the family housework, and then only until they get into difficulties with the president or themselves become presidents. In our competitive and capitalistic system services to an individual or corporation are paid for, often to excess, whereas services to society are paid for only in the fiat currency of reputation, titles, degrees and the like. A surgeon may receive a thousand or ten thousand dollars for saving or killing his patient. If after years of research he should discover a cure or prevention of appendicitis or cancer, he not only would not be paid for his work, but would lose all future fees. The psychologists of the country, as is becoming for those directly engaged in the study of human behavior, have taken the lead in forming a Psychological Corporation whose objects are to conserve for research part of the profits from the applications of our science and to conduct new research on an economic basis. Scientific men should take the place that is theirs as masters of the modern world.

J. MCKEEN CATTELL

(To be concluded)

OCEANOGRAPHIC INVESTIGATIONS OF THE SCRIPPS INSTITUTION FOR BIOLOGICAL RESEARCH OF THE UNIVERSITY OF CALIFORNIA[1]

1. Prior to the retirement of the former director, Dr. Wm. E. Ritter, it was decided to convert the Scripps Institution from one for biological research into an institution of oceanography. With one exception all of the researches at present prosecuted at the institution have to do either directly or indirectly with the ocean.

2. The oceanographic work of the institution is divided into four categories, since some kind of subdivision is necessary. The subdivisions are geological, physical, chemical and biological oceanography. Each of the investigations included under the categories enumerated is in charge of one or more men of recognized research ability.

3. 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 the preparation of reports for publication, and the third, in publication. At the Scripps Institution moderate provisions have been made for the first and second steps and consideration is now being given to the problem of publication.

4. The Scripps Institution has in operation, partly through its own efforts and partly through arrangements for cooperation, an extensive plan for obtaining oceanographic and meteorologic data and plankton, water and bottom samples from the Northeast Pacific.

During a part of each year the institution has operated along and off the coast of southern California a small boat either owned or charted 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 cooperation with the United States Bureau of Lighthouses; and one at Pacific Grove, through cooperation 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 the vessels of the Coast and Geodetic Survey have made vertical sections of the water from the surface to the bottom 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 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 will divide; between the Hawaiian Islands and San Diego by that part of the destroyer fleet which will return directly to San Diego, and between the Hawaiian Islands and Australia and return by that part of the fleet which will

[1] Abstract of a paper presented before the section of oceanography of the American Geophysical Union, Washington, D. C., April, 1925.

make that voyage. Before the vessels started on the voyage all the thermometers used by them were calibrated or provisions were made for subsequent calibration by the Scripps Institution. The arrangements 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 the organizations enumerated have contributed a fund 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 an arrangement has been made for the study of the fog problems along the coast of southern California by the officers of the Naval Air Station, the United States Weather Bureau and the Scripps Institution.

The United States Coast and Geodetic Survey has established on the pier of the institution one of its automatic tide gauges and Dr. G. F. McEwen has been appointed tide observer of that bureau.

An arrangement has been made with the committee on seismology of the Carnegie Institution of Washington for the installation of three seismographs, one for each component, on piers erected in the basement of the Museum-Library building of the Scripps Institution. The seismographs will be contributed by the committee on seismology of the Carnegie Institution of Washington, while the piers have been erected by the Scripps Institution. The instruments will be cared for by members of the staff of the institution but the records will be turned over to the seismologists of the committee on seismology.

The geologic aspect of the work in oceanography comprises cooperation in the study of seismology in southern California and the investigation of marine bottom deposits. During the past year some progress has been made in the study of marine sediments. Large collections of bottom deposits from off the west coast of the United States have been assembled at the institution. It is hoped that these collections will grow and that it will soon be possible to present a new map of the marine bottom deposits of the Northeast Pacific.

The investigations in dynamical oceanography are in charge of Dr. G. F. McEwen. During the past year the salinity has been determined for some thousands of water samples received from a number of different sources. The data on temperature, salinity, and other physical features of sea water are systematically filed. The purpose of acquiring the data of the kind above indicated is to interpret the general physical conditions of the sea and particularly to solve problems of oceanic circulation. Dr. McEwen has now about ready for press a paper entitled "A mathematical theory of the temperature distribution in water due to solar radiation, evaporation and convection." Very shortly it is intended to undertake preliminary computations of the oceanic circulation in the eastern North Pacific; and Dr. McEwen has in preparation a summary of the physical oecanography for the Northeast Pacific from the years 1916 to 1925, inclusive, which should be ready for press during the latter part of 1926. Investigation of the interrelation between oceanic conditions and the rainfall in the Western United States is being continued.

The chemical investigations of the Institution are in charge of Dr. E. G. Moberg. These investigations comprise analysis of plankton per unit volume of water, with particular reference to its relative food value, and the variation in amount and the chemical features of the plankton according to season, depth and a number of other factors; the determination of the hydrogen ion concentration of sea water and the relation between the variation of the hydrogen ion concentration and a number of factors; the determination of nitrogen compounds in sea water; the determination of the amount of phosphate in sea water; and the relation of the run-off from the land to the chemical constituents of sea water. Dr. Moberg has just completed a summary of the chemical work he has done during the past four years and his paper will soon be submitted for publication. It is intended within a short time to undertake detailed chemical analysis of the ash of plankton in order to find out what contribution decaying plankton may make to marine bottom deposits, and to undertake certain work on chemical composition of the organic material associated with bottom deposits.

The biological investigations conducted by the staff of the Institution have been mostly confined to the quantitative study of plankton organisms per unit volume of water and the variation in the composition of the amount of plankton according to a number of factors, such as season, temperature of the water, depth, distance from the shore, hydrogen ion concentration and other factors. Professor W. E. Allen has for a number of years investigated the diatoms and dinoflagellates from the standpoint indicated and has already published many papers, and he has a number of papers either ready or almost ready for press. The number of plankton samples received by the in-

stitution is enormous and one of the most pressing needs of the institution is to obtain additional assistance in the study of the collections already on hand and being received from a number of sources. The results already obtained indicate that light is being thrown on a number of important marine problems by systematic and continued investigations along the lines now being pursued. Professor C. O. Esterly is making investigations of the copepod fauna along and off the coast of southern California in a way similar to the investigations conducted by Professor Allen on the diatoms and dinoflagellates, and has published a number of papers. Recently an arrangement has been made with Dr. J. A. Cushman for a systematic study of the foraminifera along and off the coast of southern California.

The institution helps numbers of marine biologists by offering them facilities for studies at the institution and by supplying material to investigators. In an abstract such as this, it is not practicable to enumerate persons of the two categories indicated who have profited by such facilities as the institution can afford. It is desired that these facilities be utilized up to the institution's capacity.

During the coming summer it is proposed to hold at the Scripps Institution two conferences. The first of these will deal with the physical oceanography and meteorology of the Northeast Pacific and the interrelations of oceanic phenomena with the climate of the western United States. It is hoped to have represented at this conference all those institutions and organizations interested in such matters. It is intended that the second conference shall deal with certain problems of bacteriology, biochemistry and physical chemistry of the sea, and their relation to certain geological processes.

T. WAYLAND VAUGHAN

SCRIPPS INSTITUTION

NATIONAL RESEARCH ENDOWMENT

THERE was noted in SCIENCE last week the plans for a large endowment to establish national research professorships and to promote research in other ways under the auspices of the National Academy of Sciences. The official text of the announcement follows:

The National Academy of Sciences has appealed to a body of prominent public men to join with leading scientists in an endeavor to secure larger resources for research in pure science. It is hoped that an annual income of at least two million dollars can be secured to establish National Research Professorships and in other ways to cooperate with universities and other institutions throughout the country which are prepared to do their full share in the encouragement and support of fundamental research in the mathematical, physical and biological sciences. While the United States is in the forefront of industrial research, it is accomplishing much less in pure science than its population and material resources would lead one to expect.

The academy has created a special board of trustees of the National Research Endowment which includes Dr. Albert A. Michelson, president of the National Academy of Sciences; Gano Dunn, chairman of the National Research Council; Dr. Vernon Kellogg, permanent secretary of the National Research Council; Elihu Root, Herbert Hoover, Andrew W. Mellon, Charles E. Hughes, John W. Davis, Julius Rosenwald, Colonel Edward M. House, Cameron Forbes, Felix Warburg, Henry S. Pritchett; Dr. Robert A. Millikan, foreign secretary of the National Academy of Sciences; Dr. John C. Merriam, president of the Carnegie Institution of Washington; Owen D. Young and Henry M. Robinson; Dr. Simon Flexner, director of the Rockefeller Institute for Medical Research; Dr. John J. Carty, vice-president of the American Telephone and Telegraph Company; Dr. William H. Welch, director of the School of Hygiene and Public Health of Johns Hopkins University; Dr. James H. Breasted, director of the Oriental Institute of the University of Chicago; Professor L. R. Jones, of the University of Wisconsin; Professor A. B. Lamb, director of the chemical laboratory of Harvard University; Professor Oswald Veblen, of Princeton University; Dr. Thomas H. Morgan, of Columbia University, and Dr. George E. Hale, of the Mount Wilson Observatory. Mr. Hoover has been requested to act as chairman of the board and has accepted.

In discussing the vital need for greater financial support of pure science research, Mr. Hoover said in a recent address:

> While we have in recent years developed our industrial research upon a scale hitherto unparalleled in history, we have by no means kept pace in the development of research in pure science. The sudden growth of industrial research laboratories has in itself endangered pure science research by drafting the personnel of pure science into their ranks. Thus applied science itself will dry up unless we maintain the sources of pure science. We must add to knowledge, both for the intellectual and spiritual satisfaction that comes from widening the range of human understanding, and for the direct practical utilization of these fundamental discoveries. A special study in an industrial laboratory, resulting in the improvement of some machine or process, is of great value to the world. But the discovery of a law of nature, applicable in thousands of instances and forming a permanent and ever available addition to knowledge, is a far greater advance.

Elihu Root is no less emphatic than Herbert Hoover in his appreciation of fundamental scientific research. He says: