SCIENCE

A WEEKLY JOURNAL DEVOTED TO THE ADVANCEMENT OF SCIENCE, PUBLISHING THE OFFICIAL NOTICES AND PROCEEDINGS OF THE AMERICAN ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE.

FRIDAY, DECEMBER 25, 1903.

CONTENTS:

MSS. intended for publication and books, etc., intended for review should be sent to the responsible editor, Professor J. McKeen Cattell, Garrison-on-Hudson, N. Y.

GRANTS MADE BY THE CARNEGIE INSTITUTION.

AT the last annual meeting the trustees set apart $200,000 for grants for research during the fiscal year 1902–3. The following is a list of grants made by the executive committee under such authority. Each one is accompanied by a brief statement of the results thus far obtained. When an investigation is completed, a final report will be submitted by the grantee. This may be printed either in abstract or in full in the 'Year Book.'

ANTHROPOLOGY.

G. A. DORSEY, Field Columbian Museum, Chicago, Ill. *For ethnological investigation among the Pawnees.* $2,500.

Abstract of Report.—This scheme of investigation will require four or five years for its completion. It is a study of the religious ceremonies of the Pawnee Indians, with direct reference to the mythological origin of each ceremony, and to obtaining a clear and comprehensive understanding of the religious systems of the Pawnees.

The work of collecting and arranging the details of the region of the religion was begun early in the year, and has been pushed forward as rapidly as possible. The work of the first year was to obtain the mythology of the Skidi on the one hand, and the Chaui, Kitkahahki and Pittahauirata bands of Pawnees on the other, and of the Wichita and Arikara. The second re-

sult sought for was to gain a comprehensive insight into all the ceremonies of the four bands of the Pawnees and of the Arikara. Of these two results as much has been achieved as could be hoped for, inasmuch as the work has progressed for only about nine months.

With the beginning of the first of the Skidi ceremonies early next spring, it will be possible to select certain of the more important ones for more detailed observations. Thereafter each ceremony will be studied independently and in detail, and the observations thus made, together with the ritual as sung, will be prepared for publication.

Wm. H. Holmes, Director Bureau of American Ethnology, Washington, D. C. *For obtaining evidence relative to the early history of man in America.* $2,000.

The phenomena to be considered are scattered and obscure. The geological formations of both continents, ranging from Eocene to Recent, abound in various records, but investigation has been in the main desultory and unscientific, and the isolated observations are to-day without adequate correlation.

Mr. Holmes proposed to begin his work with the compilation of all data respecting previous investigations, and then to begin field work which should extend to deposits in caves and caverns where men have lived, and should also include their ancient sites, such as kitchenmiddens, shell heaps, and earthworks.

Abstract of Report.—The field work in this investigation was done mainly by Mr. Gerard Fowke, archeologist, who began work in Indiana and carried his examinations into Illinois, Kentucky, Tennessee and Alabama, exploiting many caves and making careful investigation of a few. Results were distinctly negative with reference to the principal question at issue, the entire season's work having developed no fact that will tend to establish a theory of the great antiquity of man in America. The season's work, however, was not a failure on this account, since the question is one that must be solved, if not by the discovery of positive evidence, by establishing the universality of negative evidence.

Late in the season explorations were begun on the Atlantic slope by Mr. F. B. McGuire, archeologist, in the caves of the upper Potomac in West Virginia. Mr. Holmes personally made a reconnaissance in Georgia and Alabama for the purpose of collecting definite information regarding the caves of the south.

With the aid of Mr. F. B. McGuire and Dr. J. W. Fewkes, a cave in Porto Rico was explored without expense to the Institution. The present report can be regarded as only one of progress, since Dr. Fewkes and Mr. McGuire are still in the field.

George F. Kunz, New York City. *To investigate the precious stones and minerals used in ancient Babylonia in connection with the investigation of Mr. William Hayes Ward.* $500.

Abstract of Report.—This is an investigation in cooperation with that of Mr. William Hayes Ward. It was deferred until winter in order to secure the cooperation of Mr. Ward after his return from his investigations in Europe.

William Hayes Ward, New York City. *For study of oriental art recorded on seals, etc., from western Asia.* $1,500.

Dr. Ward has been for fifteen years devoting his spare time to oriental archeology, with special reference to the beginnings of art and mythology, as shown in recovered monuments and especially in the seal cylinders, which preserve a large part of the early art. He has handled thousands of seals and has paper impressions of thousands. The investigation covers a period

from about 4000 B. C. to about 400 A. D. and will include a study of the mythological representations and various designs, emblems and inscriptions contained in them.

Abstract of Report.—During last summer Dr. Ward has visited various museums in the United States and in Europe, where he examined the great collections of Paris and Berlin. Every facility was granted by the authorities in charge, and he made notes and obtained casts of such cylinders and seals as were required for his investigations. He is now engaged in the preparation of manuscript and illustrations. It is estimated that it will require about two years to complete the study and prepare the results for publication.

ASTRONOMY.

LEWIS BOSS, Dudley Observatory, Albany, N. Y. *For astronomical observations and computations.* $5,000.

Abstract of Report.—This work has for its ultimate object an investigation upon the motions of the brighter stars (all down to the seventh magnitude), and of all stars, of whatever magnitude, supposed to have motions as great as 10″ per century, and of many other stars which were specially well determined prior to 1850.

During the year Professor Boss's attention was given to—

(*a*) The compilation for each star of all observations for position that have been made upon it during the history of astronomy. Some stars are found in more than sixty catalogues.

(*b*) Investigation of the systematic errors with which each series of meridian observations seems to be affected, in order that the precision of the results may be notably increased. This involves in the first place the establishment of a standard of reference, which must include the positions of all those stars which have been most frequently and accurately observed.

The entire work is proceeding upon a logical plan carefully studied and formulated through the results of experience during past years, with a view to economy in the succession of individual investigations designed to contribute to the final result. In an extensive investigation of this kind there is always an element of danger. If the work is so planned that definite results can not be realized until the completion of the whole work, there is liability to serious loss from the ordinary accidents of life which can not be foreseen. Therefore this work has been so planned that useful results can be secured and promptly published at every successive stage of the work. Each step grows logically out of those which have preceded it. The computations are so planned that successive improvements in the fundamental basis can be introduced with the least possible duplication of work.

It is intended that the catalogue of more than 2,500 standard stars shall be offered for publication to the Carnegie Institution early in 1905, and if no unforeseen accidents occur this program should be entirely feasible.

During the present year the catalogue of 627 standard stars has been passing through the press and is now nearly ready for issue. Subsidiary investigations connected with this catalogue have been carried out under the grant of the institution for this year.

BOSS, HALE AND CAMPBELL. *For investigating proposal for a southern and a solar observatory.* $5,000.

In the Year Book for 1902 a proposition for the establishment of a distinctly solar observatory was presented by Professor S. P. Langley. In the same report (page 89) the astronomical advisers called attention to the lack of observatories in the southern hemisphere, and in an appendix (pages 99

to 104) they treated the subject still more fully.

In order that the board of trustees might be enabled to arrive at appropriate conclusions, Professor Lewis Boss, chairman; Professor George E. Hale and Professor W. W. Campbell were requested to investigate, as a committee, the subject more fully and to consider the question of suitable sites for such observatories.

The result of the work of this committee is submitted in the 'Year Book.'

W. W. Campbell, Lick Observatory, Mt. Hamilton, Cal. *For pay of assistants to take part in researches at the Lick Observatory.* $4,000.

Abstract of Report.—Owing to the difficulty of obtaining satisfactory assistants from the east and providing living quarters for them on the mountain, it was not found possible to provide for an effective use of the grant for the employment of assistants and computers until late in the year. Investigations were begun with the meridian circle work and in spectroscopy. With the construction of additional residence quarters on the mountain, Professor Campbell will soon employ the full number of assistants rendered possible by the grant.

Herman S. Davis, Gaithersburg, Md. *For a new reduction of Piazzi's star observations.* $500.

American and European astronomers have urged that a fresh reduction of these observations by known methods for obviating certain errors should be made. Professor Porro, of Turin, undertook a part of the reductions and Professor Davis the rest. Assistance from private persons and from observatories has contributed to the prosecution of this undertaking. The Carnegie Institution was asked to make a small contribution.

Abstract of Report.—The work accomplished under this grant has been in connection with work that was already begun. This makes it difficult to define specifically the exact amount done under the grant from the Carnegie Institution. The period of nine months, during which the grant has been available, has marked the transition from the routine work of reducing the observed 'apparent' positions of the stars to a common 'mean' epoch to the next large step of deducing therefrom the instrumental errors and compiling the final catalogue. This rendered it necessary to spend this time in rounding out and perfecting all the divers portions of the computations which have been going on uninterruptedly for the past seven years. This has been finished, and also some preliminary work done for the next great and distinct stage of the work: (*a*) To deduce the errors of the telescope for each night of observation; (*b*) to correct all observations for these maladjustments, and (*c*) finally, to combine the definite separate positions into means for each star included in the catalogue, which is the goal of the long labor.

George E. Hale, Yerkes Observatory, Williams Bay, Wis. *For measurements of stellar parallaxes, solar photographs, etc.* $4,000.

Abstract of Report.—Work was begun on the photographic investigation of stellar parallaxes early in May with a forty-inch telescope. Up to October, 114 plates, containing about 350 exposures, had been obtained. These included: (*a*) Twenty experimental plates, (*b*) eighty-eight plates suitable for parallax determinations, and (*c*) six plates of loose star clusters.

Considerable work was also done in the measurement of photographs of star clusters.

Another line of investigation was the photometric determination of stellar magnitudes. Considerable progress was made in this, fields being measured with the six-

inch reflectors and the twelve- and forty-inch refractors. Measures were also made upon the Pleiades group of stars to determine the constant of the equalizing wedge photometer. Measurements were also made of comparison stars for faint variables.

Much progress was also made in the measurement and discussion of photographs of the sun, taken with the spectro-heliograph at the Kenwood Observatory in the years 1892–6, and in other minor investigations connected with the work in hand.

SIMON NEWCOMB, Washington, D. C. *For determining the elements of the moon's motion and testing the law of gravity.* $3,000.

Much of the material for this investigation, consisting of computations of places of the moon from Hansen's tables and their comparison with observations, was preserved in the archives of the Nautical Almanac Office, awaiting an opportunity for their working up. By permission of the Secretary of the Navy, Hon. William H. Moody, these papers were entrusted to the Carnegie Institution and by the Institution to Professor Newcomb.

Abstract of Report.—The importance of this work grows out of the fact that new tables of the moon are urgently required for the purposes of astronomy and of navigation. For a long period the problem of constructing and perfecting such tables has been delayed by an unexplained discordance between the observed motion of the moon and the motion which should result from the action of all known bodies upon it. The exact cause of this discordance can not be recorded, because the observations from 1750 to 1850 have never been worked up and compared with the tables. The problem of determining the exact nature of the deviation of the moon from its predicted place is twofold. The observations since 1750 must be worked up, and in order to compute the comparison the action of the planets on the moon must be recomputed with a view to determining whether any correction to the past computations is necessary.

By aid of a grant from the Carnegie Institution an important term of long period, produced by the action of Venus, has been recomputed.

Professor Newcomb has taken up the work on the adopted plan of the occultations of stars by the moon, a work that he had begun in connection with the Nautical Almanac. This, in connection with the incorporation of other important observations, can probably be completed in two years more.

E. C. PICKERING, Harvard University, Cambridge, Mass. *For study of the astronomical photographs in the collection of Harvard University.* $2,500.

Abstract of Report.—The grant made to Professor Pickering was applied to a great variety of uses. These included sums paid to nineteen different assistants and computers, and for other assistance in connection with the Harvard Observatory.

Each of the numerous investigations is of importance in carrying forward the work going on in the observatory, but they do not appear to be upon sufficiently definite and specific problems, as given in his report, to permit of a distinct statement, in most cases, of the progress of the work under the Carnegie Institution grant.

Professor Pickering reports that in forming a corps of observers to study the photographs, time and money being limited, it was difficult to decide what subjects to select from this vast amount of material. A number of problems have accordingly been studied which serve to illustrate the various investigations which might be undertaken. Abridged results of a portion of these were promptly published in the Harvard Observatory Circulars nos. 69 and

70. The principal researches carried on are as follows: (1) Eclipses of Jupiter's satellites; (2) light curves of Algol variables; (3) position and brightness of stars in clusters; (4) observations have been made of the changes in light of nine variable stars of long period, during several years before they were discovered; (5) early observations of stars of the Algol type and other variables of short period; (6) transit photometer; (7) Nova Geminorum; (8) variations in brightness of Eros; (9) proper motion of stars; (10) missing asteroids, and (11) many images of interesting objects like new stars, variables and asteroids doubtless appear on the photographs. An examination has accordingly been made of several of the plates to determine whether it would be advisable to examine a large number of them systematically for the discovery of such objects.

Wm. M. Reed, Princeton Observatory, Princeton, N. J. *For pay of two assistants to observe variable stars.* $1,000.

Abstract of Report.—Owing to the difficulty of obtaining an observer, work was not begun till March 1. During the seven months from March 1 to October 1, the 23-inch telescope of the Halsted Observatory, exclusively for photometric work, was used on every clear night from early in the evening until daylight. In all 9,015 observations were made on about fifty different stars.

Three classes of stars were observed:

(*a*) Such variable stars as are too faint to be reached by any except the largest telescopes. In particular, selection was made of stars that have become too faint for the Harvard observers and those cooperating with them.

(*b*) Measurement of faint stars that are to be used as standards of magnitude. In this work they are connecting stars of the thirteenth magnitude with those of the fifteenth magnitude. The Lick and Yerkes observatories are connecting the fifteenth magnitude stars with the sixteenth magnitude, and the Harvard Observatory is connecting the eleventh magnitude with the thirteenth magnitude.

(*c*) A special study of the newly discovered Algol variable, 4.1903 *Draconis,* has been made, and a preliminary article giving the results of these observations has been sent to the *Astronomical Journal.*

Mary W. Whitney, Vassar College, Poughkeepsie, N. Y. *For measurement of astronomical photographs, etc.* $1,000.

Abstract of Report.—This work consists in the measurement and reduction of stellar photographs taken at the observatory at Helsingfors, Finland, by Professor Donnor. The measurement of the eight plates is finished and the reduction is well along. A preliminary catalogue of the mean places of 404 stars within two degrees of the pole is nearly completed. The work was pressed during the last quarter, as Professor Whitney then secured the services of an expert computer. The intercomparison of the plates and the determination of proper motion remain to be studied.

BIBLIOGRAPHY.

Robert Fletcher, Army Medical Museum, Washington, D. C. *For preparing and publishing the 'Index Medicus.'* $10,000.

The 'Index Medicus' was established in 1879, under the direction of Dr. John S. Billings and Dr. Robert Fletcher, and discontinued in 1899, after twenty-one volumes had appeared, for the lack of pecuniary support.

Abstract of Report.—The scope of this work is very broad with relation to the medical sciences. It contains, in classified form, month by month, reference to everything published throughout the world which relates to medicine or public hygiene. The latter comprises all that concerns the

public health in its municipal, national and international relations.

Nine numbers of the volume have been issued, and the volume will be complete with the January number, when the 'annual index' will be compiled. The index is a very elaborate piece of work, and will comprise 200 pages in double or triple columns. The work is of great value to all the medical profession, especially to professors in medical schools and colleges, officers of health and workers in scientific laboratories.

The subscribers to the 'Index Medicus' are chiefly residents of the United States, but the list includes subscribers in England, Ireland, Scotland, Canada, Australia, France, Germany, Spain, Portugal, Roumania, Sweden, Switzerland and Manila. There are now 455 subscribers.

HERBERT PUTNAM, Librarian of Congress, Washington, D. C. *For preparing and publishing a 'Handbook of Learned Societies.'* $5,000.

In order that the scientific investigators of this country, and especially those connected with the Carnegie Institution, might have an accurate knowledge of the agencies which now exist for the promotion of scientific inquiry in every part of the world, the advisory committee on bibliography recommended that a descriptive catalogue be prepared of all the learned societies of the world.

At the present time such information, and particularly regarding the publications of learned societies, is incomplete and unorganized, being scattered through a large and miscellaneous collection of volumes, many of which are inaccessible and not well known. A careful and comprehensive list would be of great value to all the librarians of the country who aim at the preservation of the transactions of learned bodies. It would also furnish a basis for exchanges. The funds for research work held by these various institutions have special significance with reference to the activities of the Carnegie Institution. The plan of the handbook included information as to these eleven points: (1) Name or names of the society or institution, indicating any change which may have occurred, with cross references; (2) objects of the society; (3) brief historical note; (4) endowments, research funds, prizes, etc; (5) officers of the society; (6) membership, numbers, conditions and manner of election, dues, etc.; (7) meetings—their character, frequency, time and place; (8) communications—regulations for presentation and publication of papers; (9) list of officers, with address of corresponding secretary; (10) complete and detailed bibliography of all regular or special publications since the foundation of the society, editions (how large?) to satisfy all the above mentioned requirements; (11) publications—conditions and methods of distribution; prices.

According to the plan of work approved, the handbook is to be in volumes; societies to be classified by subjects, with local arrangement, and each class to constitute a separate part. The following order of procedure has been adopted: (*a*) To prepare a list of societies from the exchange lists at the Smithsonian Institution and elsewhere in Washington, and a card catalogue to keep orderly record of communications; (*b*) to issue a suitable circular to these societies, requesting the desired information; (*c*) to prepare for publication the material received, filling out lacunæ by further correspondence and reference to various sources of information; (*d*) in the case of societies not replying to circular or letter, and in regard to which sufficient information can not be obtained from printed sources, to adopt such other methods as the progress of the work may suggest.

The first stage of this work was the preparing of a card catalogue of names of

learned societies and institutions. Every source of information known and available in the Congressional Library was searched to make this as nearly complete as possible, at the same time separating (1) dead societies and (2) societies not publishing any material of importance to investigators.

The second stage of the work was the sending of a circular letter, containing an outline of the information required, to academies and societies dealing with historical and social science in Europe and North America. Russia and other Slavic countries, and also Austria and Hungary, are being treated independently, advantage being taken of a visit to Russia by Mr. A. V. Babine, of the Library of Congress. Mr. Thompson and Mrs. Thompson made personal visits to England, Paris, Belgium, Holland and Berlin for the purpose of supplementing the information obtained by correspondence. It is anticipated that Mr. Thompson will also visit Italy and Switzerland.

The third stage of the work, the reduction of the replies received to standard form, was begun in August, and is now going on in the office at Washington. It is expected that this work will be brought to completion in 1904.

BOTANY.

W. A. Cannon, New York Botanical Garden, N. Y. *For investigation of plant hybrids.* $500.

Abstract of Report.—Under this grant Mr. Cannon worked at the New York Botanical Garden until September 1, 1903. He prepared a paper on the spermatogenesis of the hybrid peas and collected material for the study of the sporogenesis of two fern hybrids.

H. S. Conard, University of Pennsylvania, Philadelphia. *For study of types of water-lilies in European herbaria.* $300.

Abstract of Report.—The grant made to Mr. Conard was to enable him to examine the types of water-lilies in various European herbaria for the purpose of completing a memoir on water-lilies which the Carnegie Institution is about to publish. He was successful in obtaining the requisite data, and the memoir will soon go to press.

Desert Botanical Laboratory (F. V. Coville and D. T. MacDougal, Washington, D. C.). $8,000.

At the meeting of the trustees in November, 1902, a comprehensive plan for the encouragement of botanical researches was submitted by the advisory committee on botany (see 'Year Book,' No. 1, pages 3–12).

In carrying out this plan, Mr. F. V. Coville, botanist of the Department of Agriculture, Washington, and Mr. D. T. MacDougal, director of the laboratories of the New York Botanical Garden, were requested to go to the arid lands of the west and make such further recommendations as might seem to them best. They became persuaded that the best position for the laboratory, considering both natural and artificial advantages, is Tucson, Arizona, and they recommended its establishment there and the engagement of Dr. W. A. Cannon to be resident investigator.

A full report with respect to the organization of this laboratory and of the various circumstances which led up to it will be published in a monograph soon to be printed among the publications of the Carnegie Institution.

Abstract of Report.—Messrs. Coville and MacDougal were appointed a committee on the subject of a desert botanical laboratory.

After their visit to the principal points in the southwestern desert region, a laboratory location was selected near Tucson, Arizona.

The building site, water supply, road and electrical connection were presented by the Chamber of Commerce of Tucson, the cash

value of these concessions amounting to about $1,400, and the discussions that took place initiating what is still more valuable —the hearty interest and cooperation of the citizens in the purposes of the laboratory.

A laboratory building has been planned, contracted for and completed, the contract price being $3,843. The laboratory has been equipped with books, apparatus, furniture and supplies, at a cost of $1,813.50.

Dr. W. A. Cannon, recently connected with the New York Botanical Garden (Bronx Park), New York, was appointed resident investigator, and took charge of the laboratory September 1. He is now engaged in investigating the root systems of desert plants with reference to their special devices for the absorption and storage of water.

The privileges of the laboratory have been granted to Professor Charles B. Davenport, University of Chicago, for an inquiry into the morphological and physiological adjustment of desert animals to their habitat. Other applications are pending.

The committee has presented an illustrated report on the laboratory location, which is now in press as a publication of the institution.

E. W. OLIVE, Crawfordsville, Ind. *Researches on the cytological relations of the Amœbæ, Acrasieæ and Myxomycetes.* $1,000.

Abstract of Report.—Mr. Olive's work has been carried on in Professor Strasburger's laboratory in the Botanical Institute at Bonn, Germany. In order to do this work he resigned his position as instructor at Harvard University. His studies include cultures of the Acrasiæ and of the Labyrinthuleæ, which he had brought from America.

Mr. Olive's report shows definite progress in his research, and the prospect of the completion within two months of two papers incorporating a portion of his results.

JANET PERKINS, working at the Royal Botanical Gardens, Berlin, Germany. *For preliminary studies on the Philippine flora.* $1,900.

Abstract of Report.—Dr. Janet Perkins reports that she was engaged in the proposed investigation from February 20 to October 5, 1903. A catalogue of the Philippine flora was begun, based on various monographs and papers which have appeared in scientific periodicals. This work consumed much time, as literature regarding the Philippines is greatly scattered, and the synonymy needs a thorough clearing up.

Among other matters that were begun were: (*a*) A catalogue of the various native names, (*b*) a list of botanical literature pertaining to the Philippines, (*c*) the attempt to construct a type herbarium of Philippine plants, (*d*) the determination of certain Philippine plants received from the Department of Agriculture, and (*e*) the preparation of a sample copy of the manuscript and illustrations for the position of the family Marantaceæ.

CHEMISTRY.

W. D. BANCROFT, Cornell University, Ithaca, N. Y. *For a systematic chemical study of alloys, beginning with the bronzes and brasses.* $500.

Abstract of Report.—The experimental work under this grant has been done by Mr. E. S. Shepherd, under the direction of Professor Bancroft. They have analyzed the different solid bases and determined the copper-tin-lead diagram except for the alloys containing less than twenty per cent. of copper. They have determined the densities and electromotive forces of the

annealed bronze, and made a careful microscopic study of the same alloys. Work is now under way on the density and determination of bronzes cast in vacuo, the copper-tin-lead diagram, and the making of the necessary analyses. A study of the physical properties of bronzes will be carried on during the winter.

L. M. Dennis, Cornell University, Ithaca, N. Y. *For investigation of the rare earths.* $1,000.

Professor Dennis has been engaged for the past ten years in the study of the rare earths, and has accumulated a large amount of purified material. He proposed to carry on a study with special reference to improvements in the methods for determining the atomic masses of these substances, and for separating the elements of the yttrium group.

Abstract of Report.—The work under this grant was carried on by Dr. Benton Dales in the laboratory of Professor Dennis, of Cornell University. Dr. Dales has submitted a report on the ammonium carbonate and acetic acid method of fractionation. The source of the rare earths used in the work was xenotine, essentially a phosphate of the yttrium group of earths from Brazil. The work is unfinished, owing to Dr. Dales having resigned his position at Cornell University before completing it. Three fourths of the grant was used. A paper containing the results of the investigation, as far as obtained, was transmitted for publication.

H. C. Jones, Johns Hopkins University, Baltimore, Md. *For investigations in physical chemistry.* $1,000.

Abstract of Report.—Under the direction of Professor Jones, Dr. F. H. Gatman began work October 1, 1903, by investigating certain apparently abnormal phenomena manifested by concentrated solutions of electrolytes in water and other solvents. They expect to be able to report considerable progress by the end of the year.

H. N. Morse, Johns Hopkins University, Baltimore, Md. *For researches on osmotic pressure.* $1,500.

Abstract of Report.—Professor Morse reports that the immediate problem to be solved was the development of a practical method for measuring osmotic pressure. Although osmotic pressure has been recognized for twenty-five years as one of the great forces of nature, there have been no direct measurements to furnish an adequate experimental basis for the laws supposed to govern it. Professor Morse has been engaged for several years in attempting to overcome the difficulties which lie in the way of quantitative measurements of osmotic pressure. He states the problem under three heads, as follows: (1) The preparation of a suitable semipermeable membrane, (2) the overcoming of the mechanical difficulties in assembling the different parts essential to the complete osmotic cell, and (3) the production of an efficient porous wall on which to deposit the semipermeable membrane.

Professor Morse has succeeded in solving the problems designated by (1) and (2), and the work since October, 1902, has been prosecuted by him and Mr. J. C. W. Fraser, working in the laboratory of the Johns Hopkins University. They have found it necessary not only to work out theoretically, but also practically, the problem of the production of a suitable porous wall, necessitating the molding of the clay under great pressure in order to give the cell wall a higher and more uniform degree of compactness than is secured by the usual methods of the potter, and to remove thoroughly the air blisters and cavities which render most porous walls unfit for experimental work in osmotic pressure. Their

attention was, therefore, turned, in the second place, to the devising of apparatus for the forming of the clay vessels under pressure, with the result that they now possess two pieces of apparatus which work to entire satisfaction. They next proceeded to take up the problem of baking the clay vessels, and devised an electric kiln which was effective and well adapted to general use in the laboratory. They are now ready to begin the making, baking and burning of porous cells.

A. A. NOYES, Massachusetts Institute of Technology, Boston, Mass. *For certain chemical investigations.* $2,000.

Abstract of Report.—The work under the direction of Professor Noyes, on the electric conductivity of salts and aqueous solutions at high temperatures, has been in progress for several months, with the assistance of Dr. William D. Coolidge. Much of the time has been given to the construction of an effective platinum-lined conductivity cell or bomb, suitable for exact conductivity measurements with aqueous solutions up to 306° or higher, and in other preparatory work.

Now that the serious difficulties in the production of the conductivity apparatus, suitable for measurements at high temperatures and pressures, have been overcome, and the possibility of obtaining accurate results has been demonstrated by a series of determinations extending with a few salts up to 306°, it is highly desirable to extend the measurements to salts of other types and to acids and bases, and to the critical temperature of 360°. This work is very difficult and it will be necessary to continue it for a number of years before it will be completed.

Two other researches for which the aid granted was employed were begun in September, with the assistance of Dr. Herman C. Cooper and Mr. Yogoro Kato.

THEO. W. RICHARDS, Harvard University. *For investigation of values of atomic weights, etc.* $2,500.

Abstract of Report.—Professor Richards has submitted a memoir about to be published by the Carnegie Institution, containing the records of his experiments on a new method of determining compressibility. By means of this method the compressibilities of bromine, iodine, chloroform, bromoform, carbon tetrachloride, phosphorus, water and glass have been determined over a range of 700 atmospheres.

Besides the continuation of the preceding work, several other investigations are in progress, assisted by this grant. One of these concerns the effect of pressure on the electrochemical solution tension of metals; another concerns the heat capacity of solutions, and another concerns the atomic weight of sodium.

J. BISHOP TINGLE, Illinois College, Jacksonville, Ill. *For continuing investigations on the derivatives of camphor and allied bodies.* $500.

Abstract of Report.—The work under this grant was not begun till late in the summer. A number of bases have been tested as to their power to undergo condensation with camphoroxalic acid and its ethylic salt. Experiments have also been made to obtain further information as to the possible presence of hydroxyl groups in camphoroxalic acid, with encouraging results.

ENGINEERING.

W. F. DURAND, Cornell University, Ithaca, N. Y. *For experiments on ship resistance and propulsion.* $4,120.

Abstract of Report.—Professor Durand reports that certain equipment necessary for the conduct of the experiments was completed early in the spring. Experiments in connection with the work on propellers were begun, and all of the work of

observation required for the complete determination of the performance of thirty-five model propellers was finished. To complete the investigation immediately in view, fourteen propellers remain to be experimented with. He feels that the complete experimental determination for thirty-five propellers constitutes a most satisfactory summer's work. This is five sevenths of the entire field to be covered by this particular investigation. The work of making the detailed reductions and analyses of these observations will presumably occupy most of the winter. But very gratifying progress has been made in the preliminary measurements, speed having been determined from distance and time records in 444 cases and thrust-turning momentum determined by integration from autographic records in 655 cases.

Leonard Waldo, New York City. *For study of aluminum bronzes.* $4,500.

Abstract of Report.—Mr. Waldo reports that through the death of his associate, George S. Morison, and the break down in health of his chief assistant progress has been slow; he is unable to do more than report progress. He (*a*) prepared a bibliography on alloys of aluminum and copper and of other aluminum compounds; (*b*) has had in operation six kinds of specially built furnaces, and is building a seventh, to determine the best methods for making large castings and sound wire bars or billets of aluminum bronze; (*c*) his rolling mill experiments for producing tubes, sheet, wire and forged bars, from billets cast during the year, are practically complete and are satisfactory.

Notes taken during the process of rolling and cold drawing, relative to temperature, speeds and cost are awaiting collation and reduction. A complete report will be prepared during the coming year.

EXPLORATION.

Raphael Pumpelly, Newport, R. I. *For preliminary examination of the trans-Caspian region.* $6,500.

Abstract of Report.—The reconnaissance covered a region of 1,750 miles in length, with trips from 10 to 300 miles away from the railroad base. Throughout the great part of this area the remains of ancient occupation abound, in the form of large tumuli, village sites, fortresses and cities.

The structure of the tumuli examined and their contents indicate a very remote beginning and occupation during long periods. The builders had apparently archaic pottery, no metals, slight knowledge of stone implements and probably wooden weapons. The people were settled and had the domestic horse, cow, pig, sheep and goat. Many of these seats of early dwelling seem to have become in time eminences upon which arose fortresses, or to have become the citadels of towns growing up around them. Thus they probably contain the continuous record of the development of the civilizations of the region from a very remote antiquity down to historic times.

The reconnaissance work of Professor Davis, Mr. Huntington and R. W. Pumpelly has shown the former existence of several glacial epochs, and has made much progress in correlating these with the progress of prehistoric physical events in the building of the plains and the expansions of the former Aralo-Caspian seas. Their observations give reason to hope that further study will correlate these physical events with important phases of human development in connection with Asiatic and European history.

GEOPHYSICS.

Frank D. Adams, McGill University, Montreal, Can. *For investigating the flow of rocks.* $2,500.

Professor Adams has been engaged for some years past in an experimental investigation into the nature of the movements set up during the folding and deformation of the rocks of the earth's crust.

Abstract of Report.—Dr. Adams reports that McGill University has provided for his use in carrying on the investigation on the flow of rocks a large room in the basement of the new chemical building of the university. In this room he has installed the apparatus he formerly had and ordered a third and much more powerful hydraulic press, by which pressure up to 120 tons may be secured and maintained, if necessary, for weeks at a time. Ample provision has been made in the installation of the new hydraulic press, looking to the possibility of the extension of the plant in its adaptation to the most varied experimental uses.

On the completion of the installation Dr. Adams commenced the investigation of high differential pressures on dolomites from Maryland, Massachusetts and the province of Quebec. It was found that at ordinary temperatures these dolomites could be made to flow in the same manner as in the case of the pure Carrara marble. He is now carrying on experiments to ascertain the effect of heat upon the flow of dolomite. In order to compare the effects produced at high pressures with those produced by lower pressures, the higher representing the condition at lower depths in the earth's crust, experiments have been begun on the flow of marble with the 120-ton press.

Dr. Adams is also carrying on a series of investigations into the force required to drive water Portland oolite, which is the rock he has selected for further experiments on the deformation of limestones when heated, with water passing through them. He has also assembled material to commence the study of granite essexite and diabase, as typical igneous rocks under very high pressures at ordinary temperatures.

C. R. VAN HISE, University of Wisconsin, Madison, Wis. *For investigating the subject of geophysical research, etc.* $2,500.

In the 'Year Book' for 1902, page 26, an extended report was presented on the subject of geophysics. As the trustees were not prepared to act upon the project, a further study of the problem was made, at the request of the executive committee, by Professor Van Hise, who investigated the subject of geophysical research in European institutions and made a report, which is printed in the 'Year Book.'

GEOLOGY.

T. C. CHAMBERLIN, University of Chicago, Chicago, Ill. *For study of the fundamental principles of geology.* $6,000.

Abstract of Report.—Plans for the consideration of the different phases of the complex subjects of this investigation were arranged with numerous collaborators, and details of this collaboration and the results obtained are given in Professor Chamberlin's report printed in the 'Year Book.'

BAILEY WILLIS, U. S. Geological Survey, Washington, D. C. *For geological exploration in eastern China.* $12,000.

This grant was for the purpose of carrying on a comparative study of the geology of eastern Asia and western North America, by observations in stratigraphy, structure and physiography in eastern China and Siberia, and by the collection of fossils, particularly with reference to the development of the Cambrian faunas.

He proposed to begin his inquiries in the mountain district in Shantung—the Taishan—a geological unit of about 4,000 square miles, where a study could be made of the geology from pre-Cambrian gneisses to the Coal Measures.

Mr. Eliot Blackwelder, an instructor in elementary geology and paleontology in the University of Chicago, accompanied Mr. Willis.

Abstract of Report.—Under date of September 30, 1903, from Tientsin, China, Mr. Willis reports that all preparations are completed, that authority has been received from the Chinese and German governments, and that with his associate, Mr. Blackwelder, he is about to leave for the province of Shantung. From Shantung it is proposed to go to Liautung. Mr. Willis expects to return to Pekin January 1, 1904, and as soon as may be thereafter to enter upon a trip that will probably continue until the end of June, 1904.

HISTORY.

Worthington C. Ford, Library of Congress, Washington, D. C. *For an examination of the historical archives of Washington.* $2,000.

For the purpose of studying the historical archives of Washington and ascertaining their extent and their characteristics, Mr. Ford prepared a scheme of inquiry which was arranged in two divisions. The first division included a general statement of the contents of each repository of archives, a statement of the place in which it is contained, and the history of the collection; also a statement of the funds available for the maintenance of the collection and of the conditions under which documents are accessible. The second division referred to the preservation of the collections and the arrangements for enlarging them.

Abstract of Report.—The purpose of this grant was to defray the expense of making a general survey of the archives of the government and the preparation of a report which would be helpful to historical investigators. Dr. Claude H. Van Tyne and Mr. Waldo G. Leland began the work in January, 1903, following general suggestions offered by Mr. Ford. They have examined the manuscript material in every branch of the government, and have prepared a statement as to the nature and extent of the administration records, as well as of the more important collections of historical material. This description is now nearly ready for printing. It will make a book of 250 or 300 pages of the size of the 'Year Book.' While it does not attempt to describe individual documents, but only classes and collections of documents, it is sure to be helpful to historical scholars seeking material.

PALEONTOLOGY.

E. C. Case, State Normal School, Milwaukee, Wis. *For continuation of work on the morphology of Permian reptiles.* $500.

Abstract of Report.—In connection with the preparation of a monograph on the Pelycosauria of the American Permian deposits, Professor Case spent most of the summer in the British Museum and several weeks in the museums of Paris and Berlin in the study of the reptiles of Permian age contained therein. The main line of work resolved itself into a careful comparison of the faunas of the deposits of America, Russia and South Africa. The most important result was the demonstration that American forms are practically completely different from those of Russia and South Africa, the sole connecting faunas being of the most primitive type, and none, so far as known, being common. This emphasizes the peculiarity of the presence of a typical American Pelycosaurian in the deposits of Bohemia. Professor Case also obtained many isolated facts of morphology that will be of material assistance to him in the study of the fauna.

O. P. HAY, American Museum of Natural History. *For monographing the fossil Chelonia of North America.* $2,200.

Abstract of Report.—Dr. Hay reports that he has prepared 200 pages of typewritten manuscript, and has had made, under his personal supervision, 210 drawings and 80 photographs of fossil turtles. He finds that there are about 180 species, and that there yet remains much to be done before the monograph will be ready for publication. During the summer he spent two months in the Bridger deposits of Wyoming, collecting fossils, and secured 135 specimens of turtles that will add greatly to our knowledge of Eocene forms.

G. R. WIELAND, Yale University, New Haven, Conn. *For continuation of his researches on living and fossil cycads.* $1,500.

Abstract of Report.—Dr. Wieland expects to have a memoir ready by the close of the calendar year, dealing with the fossil cycads from a biological standpoint. He has developed a new method for the study of fossil cycads by perfecting or inventing inverted drills, by means of which he has secured leaves, branches, fruits, flowers and terminal buds in the form of cylindrical cores cut from the cycad trunks. He has also adopted the novel plan of cementing together again, in their original position, the parts of such cores resulting from the cutting of a series of thin sections, and in this way securing a second series, also complete. By these methods he has cut a dozen fruits, in various stages of growth, from a silicified cycad trunk. He has also cut thin longitudinal and transverse sections of flowers surrounded by leaf bases. It is now possible to make, in the case of cycads, intensive studies of single trunks, such as have never before been made in the case of any fossil plants.

S. W. WILLISTON, University of Chicago, Chicago, Ill. *For preparing a monograph on the Plesiosaurian group.* $800.

Abstract of Report.—Professor Williston reports that he investigated the type material of Plesiosaurs at Colorado College, University of Kansas Museum, the American Museum of Natural History in New York, the Museum of the Academy of Natural Sciences, Philadelphia, and the National Museum, Washington. Important material has been sent him from these and other sources, upon which he is at present engaged. He hopes to complete his study during the year 1904.

PHYSICS.

HENRY CREW, Evanston, Ill. *For study of certain arc spectra.* $1,000.

Abstract of Report.—Professor Crew reports that after the building of certain apparatus, which required several months, he began the experimental part of his work. He found unexpected difficulties in working with magnesium and zinc, the two metals in which he hoped to find the order of appearance of the lines of the spark spectra.

His second problem was to complete the maps of the spectra of cadmium and aluminum. The map of the cadmium arc has been completed; that of aluminum nearly so.

The difficulty of obtaining an oscillograph has delayed the beginning of work on the third problem, the determination of the E.M.F. curves with the 'rotating metallic arc.'

A. A. MICHELSON, University of Chicago, Ill. *For aid in ruling diffraction gratings.* $1,500.

Abstract of Report.—Professor Michelson encountered many serious difficulties in the ruling engines for diffraction gratings, most of which he now believes are overcome. The work is now being pushed

vigorously, and he hopes before another year to make a favorable report on the results obtained.

Harold Pender, Johns Hopkins University, Baltimore, Md. *For experiments on the magnetic effect of electrical convection.* $750.

Abstract of Report.—The object of Dr. Pender's grant was to perform in Paris, in conjunction with Mons. B. Cremieu, experiments on the magnetic effect of electrical convection and to confer with M. Poincaré concerning the same. Dr. Pender met with great success in clearing up a controverted question as to the presence of a magnetic field about a bare metallic surface when charged and set in motion, which field is in all probability due to what is usually termed a convection current of electricity.

R. W. Wood, Johns Hopkins University, Baltimore, Md. *For research, chiefly on the theory of light.* $1,000.

Abstract of Report.—Professor Wood reports that one half of the grant has been expended for the salary of an assistant, and that the balance he plans to expend for apparatus. Through the aid given he was able to accomplish much more experimental work than he otherwise could have done. During the year he obtained results which were published in seven papers, all of which pertain to researches connected with the theory of light.

A considerable amount of work was also done on an investigation on the dispersion of sodium vapor; this has not yet been published.

PHYSIOLOGY.

W. O. Atwater, Wesleyan University, Middletown, Conn. *For experiments in nutrition.* $5,000.

Abstract of Report.—The purpose of this grant was to promote researches involving the direct determination of the amount of oxygen consumed by man for sustaining the bodily functions. The grant has been expended chiefly for the services of experts and assistants, for devising and constructing or purchasing apparatus, for developing methods for the determination of oxygen and for efficiency tests and experiments with men in the apparatus.

Several tests of the efficiency of the apparatus and method of manipulation were made. The feasibility of the use of the apparatus for the experiments with men has also been tested by three experiments with different subjects, with satisfactory results. Attention is now being devoted to alterations and improvements in the apparatus and to modifications of methods; efficiency tests and experiments with men are also in progress.

Arthur Gamgee, Montreux, Switzerland. *For preparing report on the physiology of nutrition.* $6,500.

Abstract of Report.—Dr. Gamgee began and has carried on a study of the extensive literature on this subject, which had to be mastered for the purpose of the inquiry on which he was engaged. He began by inspecting European laboratories and by visiting scientific men in Europe. He also visited Professor Atwater, at Middletown, Conn., and acquainted himself with the work now in progress there. He also visited other Americans. It is probable that his complete report will be transmitted in May, 1904.

PSYCHOLOGY.

G. Stanley Hall, Clark University, Worcester, Mass. *For certain investigations on the anthropology of childhood.* $2,000.

Abstract of Report.—The result of Dr. Hall's work in connection with this grant is best indicated by the titles of the papers he has published, giving the results obtained during the year. These are (1) Reaction to light and darkness; (2) children's ideas of fire, heat, frost and cold; (3)

curiosity and interest; (4) showing off and bashfulness as phases of self-consciousness, and (5) marriage and fecundity of college men and women.

E. W. SCRIPTURE, Yale University, New Haven, Conn. *For researches in experimental phonetics.* $1,600.

Report.—Professor Scripture's report is printed in the 'Year Book.'

ZOOLOGY.

H. E. CRAMPTON, Columbia University, New York. *For determining the laws of variation and inheritance of certain lepidoptera.* $250.

Abstract of Report.—In order to obtain data for the problems of variation, their relation to selection and for the study of correlation, Dr. Crampton investigated the following material: (*a*) 848 cocoons of *Philosamia cynthia,* (*b*) 1,410 cocoons of *Samia cecropia,* (*c*) 400 cocoons of *Callosamia angulifera,* etc., (*d*) 75 cocoons (preliminary) of *Attacus orizaba,* and (*e*) one family, *Hypercheiria io.*

The data secured furnished material for examination into variation and selection by comparing: (*a*) Metamorphosing and non-metamorphosing, (*b*) the perfect and imperfect survivors, and (*c*) the mating and non-mating moths.

Dr. Crampton thinks that certain general conclusions are justified from the facts already determined. Surviving individuals are less variable than those which succumb; mating individuals are less variable than those which fail to mate, and the index of correlation of the pupal characters is higher for the selected individuals in both cases. In a word, selection proceeds upon a basis of deviations from type and upon a correlative basis.

J. E. DUERDEN, Chapel Hill, N. C. *For investigation of recent and fossil corals.* $1,000.

Abstract of Report. With a view to obtaining suitable material for continuing his researches on fossil corals, Dr. Duerden has lately visited the principal museums and geological surveys in Great Britain, where Paleozoic corals are most abundant. These museums, and also the Smithsonian Institution, have placed at his disposal numerous specimens. Other material has been purchased. These collections will be studied during the present winter, with the hope of showing the relationship of fossil to recent corals.

Dr. Duerden has deposited with the Carnegie Institution, with a view to its publication, the manuscript and drawings of a memoir entitled 'The coral *Siderastræa radians* and its post-larval development.' This work is illustrated by fifteen plates and numerous text figures and gives an account of the morphology of a coral and its growth for a period of four months. It carries the development of the coral much farther than any previous work and contains many fundamental results in madreporarian morphology.

C. H. EIGENMANN, Indiana University, Bloomington, Ind. *For investigating the blind fishes of Cuba.* $1,000.

Abstract of Report.—Dr. Eigenmann did not begin his work under the Carnegie grant until October. He expects to spend from four to six months in Cuba, during the entire breeding season, and to make general collections in the caves and streams. He will also make an effort to secure the blind fishes from the island of Jamaica. He has made arrangements with the Cuban government to cooperate with him, as far as practicable, in giving him facilities for carrying forward his investigation.

L. O. HOWARD, Department of Agriculture, Washington, D. C. *For preparing manuscript and illustrations for a monograph on American mosquitoes.* $2,000.

Abstract of Report.—Dr. Howard began his work by making arrangements to secure observers at points in the United States, Central America and the West Indies sufficiently different in their faunistic characteristics to promise comparatively little duplication. He also published an announcement of the proposed monograph for the purpose of attracting volunteer observers and contributors; and, through correspondence, a great deal has been done in that direction, both in the West Indies and the United States. He also utilized the services of a number of the members of his force in the Department of Agriculture in making collections and observations.

He reports that the results as a whole have been surprising to him. A number of new species of mosquitoes have been discovered and one new genus, and much important specific information regarding the geographic distribution of the different species has been gained. This information has been of special interest and value regarding the yellow fever mosquito (*Stegomyia fasciata*) and the different species of the malaria-bearing mosquitoes of the genus *Anopheles*. A new species of this genus was found in the immediate vicinity of Washington. Great advance has been made in following out the life histories of the different species and genera; this has been done for nearly one hundred species.

All the collections and specimens have not yet been received by Dr. Howard, but every observer will send a series of specimens of adults, eggs, larvæ and pupæ, together with cast larval skins of all species observed. These have been and will be accompanied by full notes of habits, etc., together with drawings of structural peculiarities.

H. S. Jennings, University of Michigan, Ann Arbor, Mich. *For experiments on the behavior of lower animals.* $250.

Abstract of Report.—Dr. Jennings, who is a research assistant of the Carnegie Institution, is now at the Marine Biological Laboratory at Naples, carrying forward investigations on the reactions and behavior of very low organisms, such as amœba and other rhizopoda. He expects to have a general work in regard to the behavior of the lowest organisms ready for publication during the year. He has submitted to the institution for publication a paper entitled 'Reactions to Heat, Light and other Stimuli in the Ciliate Infusoria and in Rotifera, with Considerations on the Theories of Animal Behavior.'

C. E. McClung, Kansas University, Lawrence, Kans. *To making a comparative study of the spermatogenesis of insects and other classes of arthropods, and if possible to determine the specific functions of the different chromosomes.* $500.

Abstract of Report.—Professor McClung reports that owing to the fact that his own work and that of others show the main features of insect spermatogenesis, he determined to make use of the grant for the prosecution of other more difficult and expensive studies. He commenced by purchasing some literature to which he did not have access, and began the search for an object upon which he might prosecute his investigations. There appeared to be two ways to get at the problem—to study the germ cells of hybrids or to experiment upon fertilized eggs in the early cleavage stages. He decided to adopt the first mentioned plan for the beginning of the work. With this object in view, he spent the summer at the Woods Hole marine biological laboratory, but did not succeed in obtaining satisfactory forms of hybrids. He feels certain, however, that if the proper animals are secured the true function of the chromosomes may be settled as definitely as any other fact relating to cell structure.

E. B. WILSON, Columbia University, New York. *For investigations in experimental embryology, etc., in Naples.* $1,000.

Abstract of Report.—Dr. Wilson utilized this grant to defray the expenses of a visit to the Naples Zoological Station, extending from February to July, during which time he was actively engaged on studies in experimental embryology. His first purpose was to search for available material for the experimental analysis of the early developmental stages in mollusks and annelids, which possess high theoretical interest in their bearings on the general problems of differentiation. He reports a large measure of success in this direction. He found two excellent objects for his research, and made as exhaustive an analysis of them as the time would permit. He demonstrated conclusively the mosaic character of the development in the molluscan egg, and obtained striking evidence of the self differentiation and specification of embryonic cells. This result is interesting from its bearing on the problem of differentiation and also, perhaps, in even a greater degree, through the firm basis which it gives for the general method and point of view in studies of cellular embryology.

A second general division of his work included the experimental study of prelocalization in the unsegmented egg, which yielded results of no less interest than the cleavage stages. Of these the most important relate to the embryonic basis of correlation and to the relation between quantitative and qualitative prelocalization in the germ.

Dr. Wilson adds a general comment on the nature of this work to the effect that its principal significance lies in its connection with recent studies of the cellular basis of inheritance and development, taken in connection with experimental studies of heredity such as those that have grown out of the rediscovery of the Mendelian law. He is fully persuaded that there is now a very good prospect of making an essential advance toward an understanding of the actual mechanism of hereditary transmission, and expresses the hope that the studies in this direction may receive their due share of support.

H. V. WILSON, University of North Carolina, Chapel Hill. *For morphology and classification of deep sea sponges.* $1,000.

Abstract of Report.—In order to complete his investigation of the deep sea sponges of the Pacific Ocean, Professor Wilson visited the museums of London, Paris, Leiden and Berlin to make a direct examination of the types stored therein. He returned to America in August, and is at present engaged upon the text of his report.

MARINE BIOLOGICAL LABORATORY, Woods Hole, Mass.; J. Blakely Hoar, treasurer. *For maintenance of twenty tables.* $10,000.

Abstract of Report.—This appropriation was made for the purpose of aiding the laboratory by paying for the maintenance of twenty research tables. The persons assigned to the tables were selected by the Carnegie Institution.

The following investigators occupied the Carnegie tables during the season of 1903: (1) Professor M. A. Bigelow, Columbia University, N. Y.; (2) Dr. R. M. Strong, University of Chicago, Ill.; (3) Professor C. E. McClung, University of Kansas, Lawrence; (4) Professor George Lefevre, University of Missouri, Columbia; (5) Professor Wm. E. Kellicott, Barnard College, N. Y.; (6) Professor Arthur W. Greeley, Washington University, St. Louis; (7) Mr. C. J. Brues, Columbia University, N. Y.; (8) Mr. Fred. E. Pomeroy, Bates College, Lewiston, Me.; (9) Mr. J. W. Scott, Uni-

versity of Chicago, Ill.; (10) Dr. H. G. Spaulding, College of the City of New York; (11) Dr. Leo Loeb, McGill University, Montreal, Canada; (12) Dr. Henry Kraemer, Philadelphia, Pa.; (13) Mr. Grant Smith, Harvard University, Cambridge, Mass.; (14) Professor Joseph Guthrie, Iowa State College, Ames, Iowa; (15) Miss A. B. Townsend, Cornell University, Ithaca, N. Y.; (16) Mr. M. A. Chrysler, University of Chicago, Ill.; (17) Mr. Gustav Ruediger, Chicago, Ill.; (18) Miss Helen Dean King, Bryn Mawr University, Pa.; (19) Mr. James A. Nelson, University of Pennsylvania; (20) Professor Christian P. Lommen, University of South Dakota.

The director of the laboratory, Dr. C. O. Whitman, reports that the entire number of investigators at the laboratory during the season was 130, of whom 54 were students and 76 original investigators. He further states that every worker at the laboratory shares the general advantage secured by the Carnegie Institution grant; that most of the occupants of the Carnegie tables were investigators of established reputation, a few of them fellows from different universities engaged in their first original work; that it is not expected that the work undertaken will come to publication immediately, as in most cases it will necessarily extend over two or three years; that it is anticipated that the Carnegie support will not encourage hasty and fragmentary production, but will secure thorough work and permanent results.

Marine Biological Station, Naples, Italy.

For maintenance of two tables. $1,000.

Abstract of Report.—One of the tables at this station was occupied for three months during the spring by Dr. E. B. Wilson, of Columbia University, and the other by Professor H. S. Jennnings, of the University of Michigan. The remainder of the year the tables were open to whomever the director of the laboratory might wish to assign to them. The arrangement with the laboratory was that the tables were intended for the use of persons engaged in original biological researches, and carried with them the right to be furnished with the ordinary material and supplies of the laboratory.

STUDENT RESEARCH WORK IN WASHINGTON, $10,000.

A special committee was appointed to consider the question of making provision for training in Washington students who desire to avail themselves of the various openings that may be offered to them. The executive committee, after full discussion, decided to place the report of the special committee on file, without action.

RESEARCH ASSISTANTS.

In pursuance of the policy approved by the trustees at their meeting in November, 1902, the sum of $25,000 was set aside by the executive committee for the purpose of assisting a certain number of young investigators who have shown exceptional ability and desire to pursue special lines of inquiry, under the oversight of qualified guides, more or less authoritative, according to the circumstances of each case.

Announcement of this plan was made by a printed circular, which was published in the winter of 1902–1903, and addressed to the heads of universities, colleges, laboratories, and other scientific institutions.

In response to this announcement 127 applications were received. These were distributed according to the subjects of investigation and referred to the confidential advisers, whose written opinions were laid before the executive committee with accompanying papers. The persons below named were then selected: J. H. Bair, Columbia University, New York, N. Y.; J. W. Baird, Cornell University, Ithaca, N. Y.; A. J.

Carlson, Stanford University, California; C. D. Child, Colgate University, Hamilton, N. Y.; Arthur B. Coble, Lykens, Pa.; W. W. Coblentz, Cornell University, Ithaca, N. Y.; Lee H. Cone, University of Michigan, Ann Arbor, Mich.; Elias Elvove, Lexington, Ky.; Shepherd I. Franz, Hanover, N. H.; L. E. Griffin, Missouri Valley College, Marshall, Mo.; Ellsworth Huntington, Milton, Mass.; Herbert S. Jennings, Ann Arbor, Mich.; George D. Louderback, Reno, Nev.; Albert P. Morse, Wellesley, Mass.; C. P. Neill, Catholic University, Washington, D. C.; Hideyo Noguchi, University of Pennsylvania, Philadelphia; James B. Overton, Jacksonville, Ill.; H. F. Perkins, University of Vermont, Burlington, Vt.; H. N. Russell, Kings College, Cambridge, England; George W. Scott, University of Pennsylvania, Philadelphia; R. M. Strong, Haverford, Pa.; H. G. Timberlake, University of Wisconsin, Madison; J. B. Whitehead, Jr., Johns Hopkins University, Baltimore; E. J. Wilczynski, Berkeley, Cal.; F. S. Wrinch, Princeton, N. J.

One of the persons thus selected, Mr. H. G. Timberlake, died in July, 1903, and one of them, Mr. C. D. Child, did not accept the appointment on account of a change in his plans. From all the others satisfactory reports of progress have been received, which again have been referred to specialists for their scrutiny and comment.

PUBLICATIONS AUTHORIZED.

The publication of eleven scientific papers has been authorized.

1. 'The Collected Mathematical Works of the Astronomer,' George William Hill.

2. 'Desert Botanical Laboratory of the Carnegie Institution,' by F. V. Coville and D. T. MacDougal.

3. 'New Method for Determining Compressibility,' by T. W. Richards and W. N. Stull.

4. 'Waterlilies—a Monograph of the Genus *Nymphæa*,' by H. S. Conard.

5. 'Fecundation in Plants,' by D. M. Mottier.

6. 'On the Behavior of Lower Organisms,' by H. S. Jennings.

7. 'The Coral *Siderastrea*,' by J. E. Duerden.

8. 'Catalogue of Double Stars,' by S. W. Burnham.

9. '*Chimera*—a Memoir on the Embryology of Primitive Fishes,' by Bashford Dean.

10. 'Host Index of Fungi,' by W. G. Farlow.

11. 'Results of Investigations of Poison of Serpents,' by Drs. Simon Flexner and Hideyo Noguchi.

APPLICATIONS RECEIVED.

All applications, from the beginning to October 31, 1903, are summarized in the following table:

LIST OF APPLICATIONS RECEIVED FROM BEGINNING TO NOVEMBER, 1903.

Subject.	Applications.			Amount Asked For.
	Not Stating Amount Desired.	Stating Amount Desired.	Total.	
Agriculture ...	3	1	4	$5,000
Anthropology ..	26	18	44	90,083
Archeology	11	5	16	17,700
Art	10	.....	10	.....
Astronomy	21	37	58	567,750
Bibliography ..	15	12	27	82,250
Biology	14	1	15	100,000
Botany	28	32	60	138,300
Chemistry	37	52	89	90,500
Economics	38	8	46	72,500
Education	20	1	21	500
Engineering ...	20	5	25	24,040
Exploration ...	2	3	5	110,000
Fellowship	39	2	41	1,700
Foreign	7	8	15	17,000
Geography	1	2	3	1,500
Geophysics	3	9	12	33,250
Geology	21	16	37	145,800
History	30	9	39	101,400
Inventions	21	2	23	2,100
Literature	10	.....	10	.....
Mathematics ..	11	9	20	13,525
Medicine	35	11	46	16,325
Meteorology ...	2	6	8	32,750
Miscellaneous .	25	7	32	68,200
Paleontology ..	5	5	10	11,900
Philology	12	1	13	750
Psychology	22	15	37	77,600
Physics	32	26	58	37,350
Physiology	23	20	43	30,975
Publication ...	37	18	55	90,250
Religion	9	2	11	37,000
Zoology	46	63	109	182,400
Total	636	406	1,042	$2,200,398

GRANTS RECOMMENDED BY ADVISORY COMMITTEES.

In addition, the advisory committees have submitted a number of recommendations not included in the foregoing table. These are printed on pages xxxiv–xxxv of the confidential report to the trustees, issued November 11, 1902, and that for the southern and solar observatories in the present report:

Physics, per annum	$ 250,000
Geophysics, per annum	150,000
Psychology, per annum	45,000
Physiology, per annum	50,000
Southern Observatory, twelve years ($820,000), first year	80,000
Solar Observatory, twelve to fourteen years ($1,280,000), first year	150,000
History, per annum	17,500
Botany, per annum	24,000
Exploration, per annum	120,000
Geology, three years, per annum	25,000
Total	$ 911,500
Adding this to the total amount in above summary	2,200,398
Gives a total of	$3,111,898

The above total would have been still larger if all the grants had been made as requested. Frequently grants are requested for one year which, if made, would involve a number of subsequent grants before the completion of the work.

This is not intended as a close analysis of the amount of money desired. It merely shows the impossibility of making the present income of the Carnegie Institution provide for more than a small part of the grants requested.

Substantially all these applications have been carefully examined and considered. Many of the more important are explained in the first 'Year Book.'

Most of these applications have been considered unfavorably by the committee because they are not regarded as proper or useful purposes for expenditure from the income of the trust.

Some, however, have seemed to the committee only less important than the matters favorably reported upon, and these should, the committee thinks, be regarded as subjects of future consideration whenever available funds shall permit.

MEMBERSHIP IN THE AMERICAN ASSOCIATION.

THE following persons have completed membership in the association since the publication of the last list of members, contained in Volume LII., Washington Proceedings, and corrected to June 15, 1903:

Albert, Harry Lee, professor of biology, State Normal School, Cape Girardeau, Missouri.

Allis, Edward Phelps, Jr., Palais Carnoles, Menton, France.

Anderson, William G., M.D., associate director, Yale Gymnasium, New Haven, Conn.

Ashton, Charles Hamilton, assistant in mathematics, University of Kansas, Lawrence, Kansas.

Avis, Edward S., Ph.D., president of the North Georgia Agricultural College, Dahlonega, Ga.

Bair, Joseph Hershey, Ph.D., Columbia University, New York, N. Y.

Baird, Robert Logan, Oberlin College, Oberlin, Ohio.

Balch, Alfred William, assistant surgeon, U.S.N., Navy Department, Washington, D. C.

Barck, Dr. Carl, 2715 Locust St., St. Louis, Mo.

Birge, Edward A., dean of the College of Letters and Science, University of Wisconsin, Madison, Wis.

Brown, George P., president of the Public School Publishing Co., Bloomington, Ill.

Blum, Sanford, M.D., 1243 Franklin St., San Francisco, Cal.

Cady, Hamilton Perkins, assistant professor of chemistry, University of Kansas, Lawrence, Kansas.

Cannon, W. A., Ph.D., Tucson, Arizona.

Clements, George E., M.D., 522 Capitol Ave., Springfield, Ill.

Comstock, Daniel F., 102 Huntington Ave., Boston, Mass.

Coombs, Zelotes Wood, professor of modern languages, Worcester Polytechnic Institute, Worcester, Mass.