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FRIDAY, JANUARY 26, 1906.

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REPORT OF THE PRESIDENT OF THE CARNEGIE INSTITUTION.[1]

IN compliance with the provisions of article IV. of the by-laws of the Carnegie Institution of Washington, I have the honor to submit the following report on the work of the institution during the fiscal year ending October 31, 1905, along with recommendations of appropriations for work during the succeeding year, and with some suggestions concerning the future course and progress of the institution.

Coming as the writer has to the presidency of an institution already well organized, but still in the earlier stages of its development, it is essential for the purposes of a report to assume as a point of departure the plan and scope of operations found well under way. Accordingly, the résumé of the work of the year given below is an account of work planned substantially by the executive committee of the preceding year. Similarly, the recommendations made with respect to the ensuing year are mainly in accord with the lines of policy hitherto followed by the executive committee. The additional experience of this year seems to confirm, especially, the wisdom of concentrating the resources of the institution on a small number of large projects rather than on a large number of small projects. Concerning this

[1] From the 'Year Book' for 1905.

mooted question, however, some observations will be found in a later section of this report. As regards the larger aspects of the work of the institution, this report aims to give only a few suggestions derived from a preliminary reconnaissance of the fields of activity already entered. A survey of these fields, not to mention other promising fields of activity, will obviously require more than the available time of one year.

Existing Plan, Scope and Mode of Administration of the Institution.

As a matter of record, and as a matter of information to the general public, which takes an enlightened interest in the affairs of the institution, it seems desirable to explain briefly, in this connection and at this epoch, the plan, scope and mode of administration of those affairs. Referring to the articles of incorporation and by-laws, published on pages 1–8 of the 'Year Book,' for a full statement of the objects of the institution and the rules adopted for its administration, the fields in which its activities are now concentrated may be summarized under four principal heads, namely:

1. Large projects, whose execution requires continuous research, usually by a corps of investigators, during a series of years. Ten such projects are already under way.

2. Small projects, which are usually carried on by individual experts during a limited period of time. About three hundred grants in aid of such projects have thus far been made.

3. Tentative investigations, carried on by young men and women who have shown aptitude for research and have desired to pursue specific problems for one or two years. A limited number of persons have been aided by the institution in this line of work in the hope that some of them might develop exceptional abilities.

4. Considerable sums of money have been allotted annually for the publication of meritorious works which would not otherwise be readily printed, and for the publication of the reports and results of the investigations carried on under the auspices of the institution. This promises to be a fruitful field of activity. About forty volumes of works in diverse fields have already been issued.

Briefly described, the administration of the institution is vested in a board of trustees, which meets annually. During the intervals between the meetings of the board of trustees, the affairs of the institution are conducted by an executive committee, chosen by and from the trustees, acting through the president of the institution as chief executive officer.

Financial Statement for the Year 1904–5.

The following table shows the balances brought forward from previous appropriations; the amounts appropriated for the year 1904–5 by the board of trustees at their meeting of December 13, 1904; the revertments during the year; the totals available for expenditure during the year; the allotments for the year, and the unallotted balances for large grants, minor grants, research assistants, publication and administration, respectively:

	Unallotted Oct. 31, 1904.	Appropriation, Dec. 31, 1904.	Revertments, Oct. 31, 1904, to Oct. 31, 1905.	Total.	Allotments.	Balance Unallotted Oct. 31, 1905.
Large grants	$4,250.00	$310,000	—	$314,250.00	$304,500.00	$9,750.00
Minor grants	230.68	148,000	$6,692.33	154,923.01	130,625.00	24,298.01
Research assistants	—	20,000	—	20,000.00	10,400.00	9,600.00
Publication	24,683.49	40,000	4,474.73	69,158.22	29,388.15	39,770.07
Administration	18,195.59	50,000	150.00	68,345.59	36,868.92	31,476.67
Totals	$47,359.76	$568,000	$11,317.06	$626,676.82	$511,782.07	$114,894.75

The following list shows the departments of investigations to which the larger grants were assigned and the amounts of those grants:

Station for Experimental Evolution	$ 12,000
Tortugas Marine Biological Laboratory	15,700
Desert Botanical Laboratory	6,000
Horticulture	10,000
Economics and sociology	30,000
Terrestrial magnetism	25,000
Historical research	14,000
Solar observatory	150,000
Geophysical research:	
A. L. Day	15,000
G. F. Becker	7,500
F. D. Adams	1,500
Nutrition:	
F. G. Benedict	7,500
T. B. Osborne	4,000
R. H. Chittenden	2,500
L. B. Mendel	2,000
Paleontology (transferred to minor grants)	1,800
Total	$304,500

The fields of investigation to which the minor grants were assigned, the names of the grantees, and the amounts of the grants are shown in the following list:

Anthropology:	
Dorsey, G. A.	$ 3,000
Archeology:	
Pumpelly, R.	26,000
American School of Classical Studies:	
Athens	2,500
Rome	2,600
Astronomy:	
Boss, L.	6,000
Campbell, W. W.	3,000
Davis, H. S.	1,500
Newcomb, S.	2,500
"	5,000
Bibliography:	
Index Medicus	10,000
Botany:	
Cook, O. F.	2,000
Spalding, V. M.	600
Swingle, W. F.	1,500
Lloyd, F. E.	500
Chemistry:	
Bancroft, W. D.	1,000
Baskerville, C.	2,000
Baxter, G. P.	1,000
Jones, H. C.	1,000
Morse, H. N.	1,500
Noyes, A. A.	2,000
Richards, T. W.	2,500
Geology:	
Chamberlin, T. C.	6,000
Willis, Bailey	2,475
History:	
Wright, J. M.	250
Phillips, U. B.	300
Haskins, C. H.	1,000
Paleontology:	
Case, E. C.	800
Hay, O. P.	1,800
Wieland, G. R.	1,500
Philology and linguistics:	
Flügel, E.	7,500
Hempl, G.	1,000
Scripture, E. W.	2,700
Physics:	
Barus, C.	1,000
Burgess, C. F.	2,500
Wood, R. W.	1,000
Woodward, R. S.	3,000
Nichols, E. L.	1,000
Zoology:	
Castle and Mark	600
Howard, L. O.	3,000
Marine biological laboratory	10,000
Naples zoological station	1,000
Tower, W. L.	1,500
Pearl, R.	1,250
Duerden, J. E.	750
	$130,625

The following table shows the fields of investigation, the names of research assistants, and the amounts of their grants:

Field of Investigation.	Names of Research Assistants.	Amount of Grants.
Anthropology	Jones, W.	$1,000
Botany	Olive, E. W.	1,000
Chemistry	Sill, H. F., and Zerban, Fritz	1,000
History	Scott, G. W.	1,200
Physics	Whitehead, J. B.	1,200
Zoology	Lutz, F. E.	1,000
	Shull, G. H.	1,000
	Johnson, R. H.	1,000
	Morse, A. P	1,000
Total		$10,400

The sources and the amounts of the revertments during the year are as follows:

REVERTMENTS FROM NOVEMBER 1, 1904, TO OCTOBER 31, 1905.

Minor grants:		
O. P. Hay, from large grants	$1,800.00	
Southern and Solar Observatory, grant No. 70	657.38	
Archives United States Government in Washington, grant No. 28-B	984.12	
E. S. Shepherd, grant No. 176.	250.00	
R. S. Woodward, grant No. 282	3,000.00	
G. Stanley Hall, grant No. 61.	.83	
		$6,692.33
Publication:		
W. O. Atwater	$1,900.00	
J. W. Baird	8.25	
W. W. Coblentz	474.91	
H. S. Conard	679.22	
J. E. Duerden	251.40	
H. S. Jennings	10.85	
A. P. Morse	27.85	
George H. Shull	51.89	
N. M. Stevens	64.60	
A. C. McLaughlin	1,005.76	
		4,474.73
Administration:		
300 copies publication No. 16 University of Pennsylvania		150.00
		$11,317.06

RÉSUMÉ OF WORK OF THE YEAR.

The Larger Projects.

One of the tasks the president has undertaken is that of conferring personally with all investigators at work under the auspices of the institution and inspecting all laboratories, observatories or other establishments where projects of the larger type are under way. Since there have been about three hundred and sixty men and women at work under grants during the past year, and since they reside in widely separated localities, it has been impossible to complete this task in the three hundred days thus far available for the work. Nearly all of the more important establishments have been visited, however, and conferences have been held with nearly all of the investigators.

Considering the wide range and the technical character of the researches of these investigators, it would be presumptuous to attempt in a general report anything more than a summary of their work, and this summary may be brief, since the reports of individual investigators, which will be found on pages 51–52 of the 'Year Book,' are designed to give all needed details.

Specially worthy of mention in this connection are the ten larger projects now under way. Without seeking to designate them by inelastic terminology, for they are in a process of development, they may be classified departmentally as shown in the following list, which gives also the names of the principal investigators conducting these works of research:

Experimental evolution in biology: Charles B. Davenport.

Marine biology: Alfred G. Mayer.

Desert plant biology: D. T. MacDougal and F. V. Coville.

Horticulture: Luther Burbank.

Economics and sociology: Carroll D. Wright.

History: Andrew C. McLaughlin and J. F. Jameson.

Geophysics: F. D. Adams, George F. Becker and Arthur L. Day.

Nutrition: F. G. Benedict, R. H. Chittenden, L. B. Mendel and T. B. Osborne.

Solar physics: George E. Hale.

Terrestrial magnetism: L. A. Bauer.

Of these departments of research, four have semi-permanent quarters constructed or under construction by the institution. These are the Station for Experimental Evolution in Biology at Cold Spring Harbor, Long Island, N. Y., in charge of Professor Charles B. Davenport; the Marine Biological Laboratory at Dry Tortugas, Fla., in charge of Dr. Alfred G. Mayer; the Desert Botanical Laboratory at Tucson, Ariz., at present in charge of a non-resident committee of advisers, Dr. D. T. MacDougal and Mr. Frederick V. Coville, and the Solar Observatory now under construction on Mount Wilson, near Pasadena, Cal., and in charge of Professor George E. Hale. Although these departments are barely started, and necessarily require additional time for the formative stages, they are

already producing noteworthy results and need only the energetic application of patience and persistence to insure contributions to knowledge of prime importance.

Biological Investigations.

The observational and experimental work undertaken in animal and plant biology is of a fundamental character, and is contemplated, it is thought, according to a scale adequate for the solution of the very difficult problems presented. The systematic study of these for a series of years can hardly fail to yield results of signal practical and theoretical value. Several publications with reference to these investigations have already been issued and others will soon be ready for publication. The advantages for research in botany and zoology afforded by our biological stations are attracting the attention and stimulating the activity of eminent investigators. Several of the leading zoologists of America availed themselves during the past summer of the facilities for the study of marine fauna afforded by the laboratory at Tortugas, Fla. Similar use has been made of the opportunities presented by the station at Cold Spring Harbor, N. Y.; while the Desert Botanical Laboratory, by reason of the novelty and the probable economic importance of its work, is an establishment of profound interest alike to the scientific and to the general public.

Horticultural Experiments.

The horticultural experiments and the remarkable achievements of Mr. Luther Burbank are well known in a popular way, though it must be said that the more important aspects of his work remain yet to be interpreted to men of science as well as to the interested public. Owing to the impracticability, during the past year, of securing the services of a trained biologist, the preparation of a scientific account of the ways, means, methods and results of Mr. Burbank's work has been delayed. He has continued his experiments, however, as related in his report, and it is hoped that the necessary arrangements for securing the scientific account of his work contemplated by the board of trustees will not be long deferred. Little short of five years will be required for this work if it is done thoroughly well.

Department of Economics and Sociology.

As will be seen from the report of Dr. Wright, the department of economics and sociology has undertaken a comprehensive project which should bring, in a few years, extensive contributions to the social and economic history of the United States, and probably also equally important data for a forecast of American social and economic development. The goal of science is capacity for prediction, and although economic and social science are still sometimes regarded as somewhat 'dismal' in comparison with the older science of astronomy, for example, they are plainly destined to play an increasingly important rôle in the progress of mankind.

Department of Historical Research.

The department of historical research, which was one of the first to be organized under the auspices of the institution, has attained an assured position of prominence and approval in the historical world. Under the energetic direction of Professor Andrew C. McLaughlin, this department has stimulated historical research to a noteworthy degree. The publications issued under his editorship have been widely read by students and by investigators, and the demand for historical papers and documents issued and discovered by the department is constantly increasing. It is with regret that the executive committee has been called upon to accept the resignation of Professor McLaughlin, to take effect at the end of the current fiscal year. His re-

port for this year will be found in the 'Year Book,' and attention is invited to the summary he gives of the work of the department up to date. Professor McLaughlin has been succeeded by Professor J. Franklin Jameson, formerly professor of history in the University of Chicago.

Geophysical Research.

Work in geophysics has been carried on independently by three investigators, namely, by Professor Frank D. Adams, at McGill University, Montreal, and by Dr. George F. Becker and Dr. Arthur L. Day, of the U. S. Geological Survey. Briefly characterized, their researches aim to determine the modes of formation and the physical properties of the rocks of the earth's crust. We may confidently expect that the results of these researches will be of great economic as well as of great theoretic importance. The conditions of occurrence of rock constituents and materials, including the precious metals, appear now essentially discoverable by means attainable in the laboratory.

Certain kinds of rocks have already been made artificially, and the making of others is only a question of time and the application of available resources. Publications already issued and in press from this department of work are furnishing remarkable contributions to our knowledge of the properties of matter, alike of interest and value to the theoretical physicist and to the practical engineer.

Investigations on Nutrition.

Some degree of novelty, it may be said, attaches to the investigations into the physics and chemistry of human nutrition carried on by Professor F. G. Benedict at Wesleyan University, Middletown, Conn.; by Professors R. M. Chittenden and L. B. Mendel, at Yale University, New Haven, Conn., and by Dr. T. B. Osborne, of the Connecticut Agricultural Experiment Station, at New Haven, Conn. The details of these investigations are far too numerous and technical to permit adequate description here. Summarily, however, it may suffice to state that Professor Benedict is making experiments on men similar to the experiments made by mechanical engineers on steam-engines and power plants to determine their physical properties and efficiencies. An apparatus has been devised whereby man as an engine, or power plant, may be studied as carefully and as conclusively as any other mechanical plant. An account of this apparatus and of the results to be expected from its use will soon appear as No. 42 of the publications of the institution. Professors Chittenden and Mendel, on the other hand, are studying the chemical and physiological processes and effects in man arising from the qualities and quantities of foods he consumes; while Dr. Osborne is engaged in an exhaustive determination of the chemical properties of that large group of foodstuffs known as proteids. The prospective value of these researches admits of no doubt; and in addition to their direct bearing on the human economy, in health and disease, they possess a peculiar interest arising from the fact that the instruments of investigation are also the objects of research.

The Solar Observatory.

Of the larger projects undertaken by the institution the solar observatory ranks first in order of cost for initial construction and equipment. This cost, however, is no more than commensurate with the magnitude of the problem attacked, namely, that of the physical constitution of the sun and his rôle in the solar and stellar systems of the visible universe. The work of construction and equipment of the observatory has been pushed forward with great energy and efficiency during the year, so that the establishment may be expected to be nearly if

not quite complete by the end of another year. Through the courtesy of the University of Chicago, the Snow telescope of the Yerkes Observatory has been mounted and been in constant use at the solar observatory during the past summer. This three-foot reflecting telescope has already furnished excellent results and justifies the sanguine expectations entertained with regard to the five-foot reflector now nearing completion. The unusually favorable atmospheric conditions which prevail day and night at the site of the observatory have attracted the attention of astronomers and astrophysicists generally. During the past summer a party under the direction of Professor S. P. Langley, secretary of the Smithsonian Institution, has been there observing data for the solar constant; while Professor E. E. Barnard of the University of Chicago, has utilized the peculiar facilities of the site by installing the Bruce telescope of the Yerkes Observatory and extending his remarkable photographic charts of the Milky Way.

Department of Terrestrial Magnetism.

Not very remotely allied to the work of the solar observatory is the work of the department of terrestrial magnetism, though the utility of the latter is perhaps more apparent than the utility of the former. All of the sciences, however, like the phenomena of nature, are more or less interrelated, and this is especially the case with solar and terrestrial physics. There is no doubt, at any rate, that solar activity and terrestrial magnetism are in some degree related. Since the publication of the investigations on terrestrial magnetism by the illustrious Gauss, during the first half of the nineteenth century, comparatively little progress has been made in either theory or practise until within the past decade. It is but just to remark that the recent fruitful renewal of activity in this line of work is due chiefly to the enterprise and energy of Dr. L. A. Bauer, in charge of the department of terrestrial magnetism. The execution of the plan he has outlined for a magnetic survey of the oceanic areas, as well as of the land areas, can not fail to secure data of signal value alike to marine transportation and to magnetic theory. By means of specially devised instruments and apparatus, as explained in Dr. Bauer's report, the department has demonstrated the practicability of making magnetic measurements on a moving ship, and the brig *Galilee,* chartered at San Francisco and refitted for this special purpose, is now engaged on such a survey in the North Pacific Ocean. Considering that the oceanic areas are in the aggregate about three times the aggregate of the continental areas, it is seen that the fulfillment of the plan contemplated will add greatly to our knowledge of the actual distribution of terrestrial magnetism, even if it should not immediately elucidate this obscure phenomenon.

Minor Projects.

Separate mention of the large number of investigations carried on by the aid of small grants would require undue space here. It will be seen from the list given above that there were sixty-four such grants subject to payment during the year. Many more than this number of investigations, however, were under way, while a few grantees of the year have been unable to begin their projects. A number of researches undertaken by aid of grants made in previous years have been completed and offered for publication. Some of these have been issued during the year and several of them are now in press. It should be stated also that numerous preliminary papers resulting from researches under way have appeared in the current journals. A list of these, obtained by aid of the authors themselves, will be found on pages 43–50 of the 'Year Book.'

Specially worthy of mention among the minor projects are the following, by reason of contributions already published or soon to be ready for publication, namely:

1. The archeological and geological researches of Professor Raphael Pumpelly in Turkestan. The first volume of a report on these researches has been issued during the year and a second is in preparation. Professor Pumpelly had planned to resume field work in Turkestan during the past summer, but the Russian government declined to permit him to return there at this time.

2. The preparation by Professor Lewis Boss of a fundamental catalogue giving the precise positions of about six thousand stars, embracing all stars from the brightest down to the sixth magnitude. This will make a solid contribution to stellar astronomy.

3. The researches on the moon by Professor Simon Newcomb.

4. The precise quantitative investigations of Professor A. A. Noyes and T. W. Richards in chemistry.

5. The comprehensive researches in geology and cosmology by Professor T. C. Chamberlin, whose preliminary papers have already proved full of interest and suggestion to a wide circle of readers.

6. The work of Professor Carl Barus on the nucleation of dust-free atmosphere; of Professor E. W. Scripture on researches in phonetics; of Professor G. R. Wieland on American cycads, and the work of Mr. W. L. Tower on the evolution of beetles, all of which are now in press.

Publications and Their Distribution.

One of the most pressing demands that fell to the president immediately after assuming the duties of his office was that of devising a mode of distribution of the publications of the institution. Accordingly, at the meeting of the executive committee held January 9, 1905, the following tentative rules were submitted and adopted:

1. That, unless otherwise ordered by the executive committee, the edition of the publications of the Carnegie Institution of Washington be 1,000.

2. That, unless otherwise ordered by the executive committee, the publications be distributed as follows: (*a*) to the founder and trustees of the institution; (*b*) to the leading public libraries of the world; (*c*) to a few of the principal journals which give space to critical reviews of current scientific progress.

3. That, subject to approval by the president, authors of publications of the institution be permitted to designate a list of 100 persons to whom copies of said publications may be sent free of charge.

4. That authors be furnished free of charge with 25 copies of their contributions published by the institution.

5. That the president have authority to distribute not to exceed 100 copies of each publication of the institution, if in his discretion it may seem advantageous to do so.

6. That copies of publications not otherwise provided for be offered for sale at a price sufficient to cover the cost of presswork, paper and binding, plus an addition of 10 per cent.

Soon after the adoption of this basis for action, a list of the principal libraries and institutions of the world contemplated under rule 2 was compiled, and having been approved by the executive committee the work of distribution rapidly followed.

The plan thus adopted has worked without serious embarrassment up to date, but it promises to become inadequate to meet the demands for gratuitous distribution to the less important libraries and to the great number of individuals who may be designated as bibliophiles rather than as users of books. Concerning this matter, some suggestions will be found in a later section of this report.

Great pains have been taken to secure a high quality of paper and first-class presswork for the publications of the institution. This has proved no easy task, since it has been essential to deal with many authors and firms whose desires, standards and

judgments are often found in conflict with what appears to be for the best interest of the work from the institution's point of view. Thus some lack of obviously desirable uniformity in paper, presswork and binding has resulted. Certain of these defects have been unavoidable, owing to the fact that some publications had been intrusted wholly to grantees or authors. It is hoped, however, that arrangements will soon be perfected whereby the desired uniformity and excellence in paper and presswork of the publications of the institution may be secured.

A list of the twenty volumes published by the institution during the year will be found on page 42 of the 'Year Book.' They aggregate 2,339 octavo pages and 1,450 quarto pages, making a total of 3,789 pages.

SUGGESTIONS CONCERNING PENDING PROBLEMS OF THE INSTITUTION.

Large Versus Small Projects.

Rationally considered, the development of a novel institution, like the Carnegie Institution of Washington, can not be expected to proceed without encountering difficulties and dangers. That the mere establishment of such an institution is no easy matter is witnessed by the fact that the Congress of the United States debated the question of founding the Smithsonian Institution for a decade before attaining a definite plan of procedure. Although the Carnegie Institution of Washington has been free in large measure from difficulties in the way of initial organization, it has nevertheless met with other difficulties of a somewhat ominous character. Among these is that of the relative merits of large and small projects and hence large and small grants.

In the absence of experience it might well appear doubtful whether the income of the institution may be best used in promoting a small number of large projects not likely to be undertaken by other agencies, or whether the income may be best used in promoting a large number of small projects for which the ways and means are already in part available. Strong *a priori* arguments may be adduced in support of each of these extreme methods of administration of the income, and the executive committee has no doubt acted wisely in taking a mean course, testing thus simultaneously, by actual experience, the merits of both methods.

While careful observation and study of these methods during one year only may not justify the recommendation of any radical departure from the course hitherto followed, it seems essential to indicate certain grave objections to the policy of awarding numerous small grants. These objections are:

1. The excessive amount of time and energy required in the consideration of applications for and in the administration of small grants. Thus far the institution has formally considered about 1,200 applications for such grants and has made awards to about 300 applicants; but the amount of attention given to the consideration of formal applications represents only a part of the time and labor consumed by the importunities incident to, if not inherent in the policy in question. Many of the evils of the 'spoils system' already confront us. Some applicants file claims; many are impatient for speedy action; and may, as in the case of academic degrees, speak in the possessive case with respect to grants long before they are awarded.

2. The returns from small grants do not seem to justify the outlay, especially since it is applied in many cases to work which would go on as well without aid from the institution. Probably a more deliberate and searching investigation of the applicant than has hitherto been practicable would insure better results. It is certain, at any

rate, that the possession of a laboratory and enthusiasm, along with a bundle of recommendations, should not suffice to qualify an applicant for the arduous work of research.

3. A graver objection to this system of small grants lies in its tendency to supplant other sources of support for scientific investigation in allied institutions, and especially in colleges and universities. The facts should be known that thus far the institution has carried on work through aid given to about 270 individuals connected with 89 different institutions. Of these latter, nearly three fourths are schools, colleges and universities. Since the normal condition of an educational institution too often borders on poverty, it is only natural that investigators connected with such organizations should look to the Carnegie Institution of Washington for relief. An easy calculation, however, shows that the possible relief from this source in inadequate. Thus, a conservative estimate of the men and women connected with American institutions of learning alone, and capable of making fruitful researches, would include not less than one thousond. The smallest average annual grant that would be effective in such work is $1,000. Hence it is seen that twice the income of the institution would not begin to meet the demands on it coming from educational institutions alone. Depending unduly on another institution for support tends also, it would appear, not only to dry up the local springs of support, but to sap the independence of educational institutions. That any of them should desire to know how much aid may be expected from the institution before making up their budgets for an academic year is a matter of serious import. Obviously it is the duty of the Carnegie Institution of Washington to avoid the danger of supplanting, while seeking in part to supplement, the functions of educational institutions.

No similar difficulties or objections have arisen in the administration of the larger projects of the institution. In the case of these projects, however, the ways and means are provided by rather than for, and the investigators are chosen by rather than for, the institution. In short, the institution is, in this case, enabled to assume and fix responsibility in the conduct of its affairs and to push them energetically; whereas, in the other case, responsibility is divided, energy is generally lacking, and time and money are in constant danger of being frittered away amongst a multitude of minor interests.

Summarily stated, therefore, the indications are that the policy of awarding numerous small grants to self-suggested investigators is destined to break down under the sheer weight of the importunities it entails; that the results to be expected from such grants are meager; and that the award of them, unless narrowly limited and carefully guarded, may work grave injury to educational institutions.

New Projects.

The demands for attention from applicants for small grants have left scant time during the year for the consideration of more important prospective work falling within the scope of the institution. It has been deemed essential, also, to devote most of this time to the larger projects already under way, with a view to increasing their facilities and insuring their success. Nevertheless, many new projects have been contemplated, and several of these may be formulated for action without undue delay whenever the institution is ready to consider them.

Two of these projects which merit special attention, by reason of the fact that they have been considered at much length by advisory committees and by the executive committee during the past three years, are: (1)

an astronomical observatory in the southern hemisphere and (2) a laboratory for geophysical research. Referring to 'Year Books' 1 and 2, therefore, for voluminous details with reference to the history of these projects, it is desired here to commend them as worthy of favorable action by the board of trustees as soon as the essential funds are available.

With regard to new projects in general it appears fitting here to call attention to the desirability of allotting ample time for the preparation of plans and specifications and to the necessity of allotting ample time for their execution. The inevitable dangers that confront a research institution are dilettanteism and haste for results. Thorough deliberation in preparation and energetic patience in execution are indispensable to the highest success of such projects.

Since the query whether different departments of research are likely to be equally promoted by the institution is often raised, it seems worth while to remark that it is an obvious duty of the executive committee to select those projects which give highest expectations of adequate returns. Projects of this kind are generally susceptible of denite specifications as to ways, means and objects. At present, however, judging from the great inequalities in definiteness of the projects submitted to the institution, it must be much easier to formulate plans for good work in some sciences than in others. Hence, quite irrespective of personal prepossessions, it seems best, in this case, to follow lines of least resistance, promoting chiefly those departments of research which promise sure returns, while seeking at all times to raise the less highly developed to the level of the more highly developed sciences.

Suggestions on Distribution of Publications.

A difficulty which is likely to beset the institution in the near future is that of a just and equitable distribution of its publications. Society has only lately emerged from a period when libraries were maintained chiefly for librarians and bookbinders and when every scholar was either his own librarian or a bibliophile. Along with this *laissez faire* system there grew up also a system of exchanges, especially between learned academies and men of learning; but the number of such academies and individuals was until lately quite small and well within the limits of a possible free distribution or exchange of publications. In recent decades, however, the number of institutions maintaining libraries and the number of individuals desiring access to publications have greatly increased. The needs of individuals, it must be said, have been admirably met in a general way by the facilities afforded in all of the great libraries of the world, so that the worker with books can no longer afford to be his own librarian any more than he can afford to be his own banker. Nevertheless, the demand for a free distribution of books has increased to an extent far surpassing the increase in effective libraries and effective workers with books. This demand has grown to large proportions in the United States especially, partly by reason of the broadcast distribution of public documents.

Questioning the wisdom of an indiscriminate distribution of the publications of the institution, the provisional rules given on page 128 above were drawn along conservative lines. The experience of the year, however, shows that great pressure will soon be brought to bear on the institution by individuals and by smaller libraries desiring to be placed on the free omnia list. Since drawing up such a list, which embraces about three hundred of the leading libraries of the world, an attempt has been made to prepare various special lists of institutions and individuals to

which, respectively, publications in the varied departments concerned might be sent. This attempt has developed certain baffling obstacles. Chief among these is the awkward duty of discriminating between the persons and the institutions which should and those which should not receive books gratis. The officer called upon to decide must necessarily play the rôle frequently of a dispenser of favors, and be thus subject to the charge of favoritism.

The practical questions raised by this matter are, first, Is the work entailed worth what it costs? And, secondly, Does such work advance science? My opinion is that both questions should be answered in the negative; and my suggestion is that a distribution of publications at once practicable, equitable and effective may be attained by offering all of them for sale except those reserved for free assignment to authors and to the leading libraries of the world. Publications thus distributed would be pretty certain to go where they are needed, and they would thus also stand or fall by reason of their merits or demerits, as the case may be.

Relations of Institution to the Public.

Precisely what relations the Carnegie Institution of Washington should sustain to the public is a question which does not admit a ready answer. Experience alone can disclose a complete reply, since it must evolve with the development of the institution itself. Clearly, however, it must be regarded as a semi-public organization, somewhat similar to a university. More exactly, it may be likened to a university in which there are no students.

Obviously the institution ought to sustain close relations with universities, since they are now the chief centers of research; and, within the limits permitted by mutual independence, those relations should be cooperative, to the end that time and effort may be conserved. Similar relations should obtain, likewise, between the institution and learned societies. But the possible methods of effective cooperation remain, essentially, to be discovered.

Much less obvious, though hardly less essential of provisional definition, are the relations which the institution should sustain to the larger, non-academic world. One of the favorable signs of the times is seen in the intelligent interest taken in the affairs of the institution by this larger world. In spite of a widely prevalent tendency to anticipate the marvelous and the spectacular from scientific investigations, and thus to expect too much, if not the impossible, there is manifest a very generally just appreciation of such work. Hence the commendable eagerness of the modern public to learn the results of recondite researches calls for some sort of cooperation between the institution and existing media for the dissemination of information, with a view to furnishing such information in a form at once intelligible and trustworthy. This, among many other questions concerning the relations of the institution to the general public, seems to merit special consideration in the near future.

Attention may be not inappropriately called here to the fact that while the institution deeply appreciates the interest in its affairs shown by the public, there is no possibility of following more than a small fraction of the suggestion and the advice welcomed from that source, for their abundance is overwhelming and a choice must be made. Out of the chaos of such suggestion and advice and out of the deliberations within the institution itself, ways and means for growth and achievement will be found. In the meantime there will be a common need for application of the forbearance and the patience so indispensable

to the higher forms of research which it is the object of the institution to promote.

R. S. WOODWARD.

November 11, 1905.

ANNUAL MEETING OF THE CENTRAL BOTANISTS HELD AT ANN ARBOR, DECEMBER 28 AND 29, 1905.

THE annual meeting of the Central Botanists was held on the afternoons of December 28 and 29 at Ann Arbor, conjointly with morning sessions of the Society for Plant Morphology and Physiology on the same days. The meeting was opened by past-president Professor Stanley Coulter, and Professor F. C. Newcombe was elected president for the ensuing year and presiding officer for this session. He with the past-president, Professor William Trelease, and Secretary-treasurer Dr. H. C. Cowles will constitute the executive committee for next year.

The following papers were read:

The Structure and Division of the Oospore in Coleochaete: CHARLES E. ALLEN.

Three species were studied—*C. scutata*, *C. soluta* and *C. pulvinata*. The oospore contains a large nucleus and eight parietal chromatophores, each of the latter containing, usually, one pyrenoid and many starch grains. In the cytoplasm are many large rounded vacuoles, which are not fat drops, but which contain varying amounts of a substance which stains blue in the triple stain. The time of germination in the spring depends upon the season, the prophases of the first division appearing (in *C. scutata*) about three weeks after the disappearance of the ice. Divisions were induced in the oospore of *C. soluta* by bringing the plants indoors in the fall and keeping them in changing water at a temperature of about 12°–13° C. The first and second nuclear divisions in the germination of the oospore display the characteristics respectively of the heterotypic and homeotypic mitoses in the higher plants. From these facts it is concluded that chromosome reduction occurs immediately upon the germination of the oospore; there is, therefore, no cell generation, except the oospore itself, which contains the double number of chromosomes, and hence no sporophyte generation.

Spore Formation in Derbesia: BRADLEY M. DAVIS.

The Life History of Polysiphonia: SHIGEO YAMANOUCHI. (Presented by Dr. Davis.)

Variation of Habitat of some Bog Plants in Michigan: CHARLES A. DAVIS.

Spore Formation in the Many-spored Asci in Streptotheca and Rhyparobius: J. B. OVERTON. (Presented by Dr. Allen.)

The Division of the Nuclei in Living Filaments of Oscillatoria: EDGAR W. OLIVE. (Presented by Dr. Allen.)

Living filaments of *Oscillatoria* show, under dim illumination, two sharply differentiated regions—lens-shaped, refractive, granular bodies, alternating with clear, vacuole-like spaces. The latter are the so-called 'central bodies.' These on examination are seen to be in a state of division, and their constriction is accomplished by the growth inward from the periphery of a ring-formed partition. Every few cells apart in a filament will be seen regions of maximum division, where constriction has progressed farthest, and regions of minimum division. Thus maxima and minima alternate rhythmically with one another. The 'central bodies' prove to be nuclei, on sectioning and properly staining, which are constantly in a state of division, since they never appear to enter on a state of rest.

Cortinarius as a Mycorhiza-producing Fungus: CALVIN H. KAUFFMAN.

It was shown that the red-colored mycelium of an undescribed species of *Cor-*