sand. With its history of honorable achievement and its present success this association may confidently look forward to a future of greatly increased power and usefulness for the advancement of science.

I now declare open this fifty-seventh meeting of the American Association for the Advancement of Science, and in so doing I express the hope, which our program indicates to be indeed an assurance, that the sessions and social functions of the association, of the various sections and of the affiliated societies may be full of interest, pleasure and profit to those in attendance.

Our program now calls for announcements by the general and local secretaries. Has the local secretary any announcement to make?

Doctor Cattell: The local arrangements are announced in the general program, which may be obtained in the entrance hall. Notices in regard to excursions and receptions which concern only sections or affiliated societies will be made in those societies' meetings. Perhaps the only thing that needs to be said is that ladies accompanying members are very cordially invited to the receptions that have been arranged. These include the reception by President Butler, of Columbia University, in Earl Hall, at 9 o'clock this evening, a luncheon and general meeting on Saturday at the College of the City of New York, the unveiling of ten busts of pioneers of American Science at the American Museum of Natural History, on Saturday afternoon, and in the evening a reception given by the trustees of the museum and the New York Academy of Sciences, with an exhibition of scientific progress by the academy.

Doctor Welch: We will now hear from the general secretary, Mr. Hayford.

Mr. Hayford: A letter which has just been received from the secretary of the building committee of the United Engineering Societies, which is the holding corporation for the Engineering Society's building. (Reading) "It gives me pleasure as secretary of the United Engineering Society, which is the holding corporation for the Engineering Societies' building at No. 29 West 39th Street, to extend an informal invitation to the members of the American Association for the Advancement of Science to visit our building during the week of the meeting." Signed by F. R. Hutton, secretary.

Doctor Welch: Our printed program contains the detailed announcements. It is in order to move an agreement on the hours of the meeting.

Doctor Smith: I move that the hours of the meeting of the various sections be as specified in the printed program. (The motion being seconded, the president put it to a vote, which being unanimously in the affirmative, the motion was declared carried.)

Doctor Welch: The session is now adjourned. The association will meet again on Tuesday morning at ten o'clock in this hall.

THE POLICY OF THE CARNEGIE INSTITUTION[1]

Since the trend of development of the institution still hinges to some extent on the relative merits of large projects carried on under the direct supervision of the institution itself and of small projects committed to individuals whose affiliation with the institution may be only temporary, a large amount of attention has been given to this question during the year; much more in fact than to any other. It is a matter of daily correspondence, of daily interviews and of daily importunities. With a desire to see all sides of this question and to hear

[1] Concluding part of the report of the president, 1906.

all arguments thereon, the president has solicited much of this correspondence and many of these interviews. He has received a wealth of highly esteemed advice and suggestion along with much more that must be characterized either as impracticable of application or as fraught with grave danger if applied.

A considerable portion of this advice and suggestion would make instructive reading if printed, although they are in large degree conflicting and need, obviously enough, here and there, correction for personal equation; but, aside from greater concentration on matters of detail, they do not differ essentially in the aggregate from the advice and suggestion given by members of the advisory committees whose reports are printed in the earlier year books of the institution. Hence it does not seem worth while to add to the bulk of printed discussion along this line, even in the cases of correspondence whose authors would doubtless approve publication of their views. The president desires here, however, to express his warm appreciation of the counsel on this question given him confidentially by many colleagues in the academic and scientific world. Whether this counsel has been pro or con as regards his own views an effort has been made to weigh it fairly.

In the meantime there have been some opportunities for reflection on the various aspects of the question, while the institution is accumulating experience which, though not as yet conclusive in its bearings, furnishes important indications of the lines along which development may be expected to be effective or ineffective. It seems desirable, therefore, to state here some of the provisional conclusions to which observation, experience and reflection have forced me, not without opposition, in some cases, to preconceived notions.

Categorically these conclusions are the following:

First, that the institution may not advantageously enter the fields now occupied by colleges and universities. It should be no part of the function of the institution to endow scholarships and fellowships for indigent students, nor to supply helpers, assistants, apparatus, libraries, museum collections, etc., for purely educational work, nor to supplement meager salaries of college and university professors whose work is primarily educational. This conclusion and the specifications enumerated seem so axiomatic that their statement would be quite superfluous here if the institution were not daily importuned for aid in one or more of these and many similar ways. Some eminent minds maintain, indeed, that since the object of the institution is, in the last analysis at any rate, educational, these numerous ways of promoting education should not be overlooked, for the sphere of effective influence of the institution, it is argued, may be thus widely extended. The experience of the institution thus far, however, appears to be in direct opposition to this view. We are learning how the giving of aid by one institution to another, even indirectly, tends to sap the independence and to diminish the available income of both. Moreover, we encounter by this method the endless difficulties arising from diverse interests and divided responsibilities, along with the inevitable bitterness of disappointment from those who feel that the distribution of funds has not been equitable amongst the fields of research or amongst the institutions supplying the investigators.

Secondly, that the institution may not advantageously seek to scatter its resources simultaneously over all available fields of research. It should rather choose a limited number of fields of activity at any epoch and concentrate its energies on these until

they are brought to a satisfactory degree of completion. This conclusion seems likewise almost axiomatic, since it is determined essentially by a limited income. Many, if not a majority, however, of highly esteemed colleagues oppose this conclusion, and argue that a distribution of income in small grants to widely scattered investigators will be more productive in immediate results and of more ultimate benefit to society. But this argument does not appear to be supported by the experience of the institution. It is impossible, of course, to draw precise inferences from this limited experience; but after a careful examination of the facts at hand I think it safe to state that no direct return may be anticipated from more than half of the small grants made up to the present time for minor researches and for research assistantships. Moreover, it appears to me that this is as high a percentage of efficiency as may be reasonably expected from miscellaneous applicants for aid, since a majority of them will be men and women of enthusiasm and promise merely rather than of demonstrated ability to carry researches to successful conclusions.

In weighing this matter the educational value of such widely scattered aid should not be overlooked. Many a meagerly equipped laboratory or library may be thus strengthened and many young men and women may be thus trained for work of research. The possession of a piece of apparatus, or a rare volume, or the opportunity to pursue early in life a year or two of uninterrupted scientific investigation, is, doubtless, of inestimable value to a few individuals. But the obvious objection to such a disposition of resources is that it serves only to supplement the educational work of colleges and universities. They already occupy this field, and it appears unwise as well as unfair to encroach on their domain even in a supplementary way. A less obvious objection is that arising from the diverse interests and the divided responsibilities which such a course entails. It may be observed also that as regards themselves the experience of colleges and universities appears to be inimical to such a course, for we have not heard of any of them proposing to use its income, or any considerable share thereof, in building up departments of educational work in other institutions. But the fundamental objection to such a disposition of funds is that it promotes research only indirectly, whereas the primary object of a research institution should be to promote research directly. A research institution should aim to take up investigations which, by reason of their expense or magnitude, are not likely to be carried to completion in other ways. And in the pursuit of this work it should be free to choose the best ways and means; it should not be hampered by a host of applicants backed by endless recommendations of doubtful validity.

Thirdly, that the institution may advantageously limit much more narrowly than hitherto the award of minor grants. It should seek to eliminate the amateur, the dilettante and the tyro as far as possible from the list of eligible applicants, and concentrate attention chiefly on those who have already demonstrated ability to produce results. This policy will restrict the range of operations of the institution to some extent, but it will diminish the hazard to a greater extent, and will permit a degree of thoroughness of work not otherwise attainable.

One of the most serious objections to giving aid to numerous small projects lies in the fact, amply shown by experience, that the estimates of the cost thereof are generally vague and almost always too small for the accomplishment of good work. Many, if not most, authors of such projects proceed without plans and specifications,

often ignoring somewhat contemptuously such estimates of cost and probable outcome as may be supplied in most cases by judicious forethought. The projects are so small that it does not appear essential to individual investigators to consider carefully their cost and bearing. Indeed, only investigators of considerable experience are able to use adequate forethought in this respect. But when one contemplates not a single small project, but the aggregate of a large number of them, the need for carefully drawn plans, specifications and estimates is seen to be as important as in the case of any large project.

By limiting the fields of activity in this direction it will be possible for the institution not only to make a choice amongst promising investigations, but likewise to make a choice amongst tried investigators. This appears to me to afford a workable compromise also between the extremes of a limited number of large projects and an unlimited number of small projects—a compromise whereby the essential advantages of both extremes may be secured and their inherent disadvantages avoided.

But while it appears desirable to limit the range of activity of the institution at any epoch, it appears still more desirable to insist on a high standard of efficiency determined by the quality and the quantity jointly of results attained. To secure this end the institution must not only seek to aid mainly eminent investigators, but it must seek to aid them for such periods and to such an extent that their best efforts may be enlisted. The grantee should be able to feel that his connection, though temporary, with the institution is creditable, and, reciprocally, that the aid he accepts implies higher obligations than those attaching to an educational scholarship or fellowship. In many cases within the experience of the institution grantees appear to have regarded the system of small grants as a sort of lottery, involving neither credit to nor responsibility from either party to an award. Experience of this and similar kinds is inevitable, however, in the formative stages of the institution; for the distinction between a research institution and an educational institution is not yet so clearly defined that contemporary society can avoid attributing to the former the eleemosynary function which is being slowly eliminated from the latter.

In conformity with the views here set forth the president is disposed to recommend that in general minor projects be aided only when they can be carried on by investigators of known competence; that such investigators become for the time being affiliated to and advisers of the institution, and that they be designated as research associates of the institution. The periods of affiliation of such associates must be determined, of course, by the circumstances of individual cases. But it may be observed that as a rule these periods will be from two to five years, or more, since few investigations well worth undertaking by the institution can be brought to satisfactory conclusions in shorter intervals of time.

It appears worthy of note, from the point of view of evolution, that the institution finds itself occupied with two principal divisions of activities, namely, those arising from its internal affairs and those arising from its external affairs. On the one hand, we are busily engaged with many investigations, in many diverse fields, carried on under widely varying conditions. On the other hand, we are equally busily engaged with a multitude of external relations which are usually more or less conflicting and often incompatible. Thus the development of the institution may be likened to the struggle of an organism which is trying at once to discover its

proper functions and to adjust itself to the conditions of its environment.

It is worthy of note, also, from the same point of view, that this struggle is inevitable to a great degree, and that it is only out of the resulting chaos of opinions as to ways, means and methods, and out of the experience of the institution itself, that definite and approved lines of action and policy may be attained.

In view of these circumstances, it seems essential to warn our allies of the academic world and the public at large against the danger of expecting more from the institution than is possible of accomplishment in a limited time and with a limited income. Although the work of the institution is in a peculiar degree novel and untrammeled, it is yet subject, properly enough, to the restrictions set by human experience and by contemporary society. Hence, if the reviewer of the year books finds reason to complain of a bewildering array of technical details, he should reflect that this array is far less than a host of investigators would like to have it. If the humanist or the scientist finds reason to complain that little or no aid has been given to him or to his special field of research by the institution, he may derive comfort from the fact that he is one of an overwhelming majority necessitated by the limitations of available resources. And if the bibliophile has found reason for dissatisfaction in the distribution of the publications of the institution, he may be disposed to be lenient with the latter on learning that he is one of many thousands soliciting favors.

Out of this plexus of internal and external relations and interrelations it is the duty of the administrative branch of the institution to evolve, so far as practicable, such a degree of order and system as will best promote productive and thorough work of research, and at the same time to restrict, so far as practicable, an unproductive or wasteful expenditure of energy and resources. Although progress towards an adequate fulfilment of this duty must be of necessity slow in order to be sure, it is believed that distinct advances are accumulating, and that the obvious difficulties and dangers which beset the development of so novel an institution are only such as may be overcome by a reasonable application of time and patience.

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Scientific Books

The Principles of Heredity. By G. Archdall Reid. London: Chapman and Hall.

The problems presented in the study of heredity are so diverse and so intricate that they should be illuminated by data drawn from all fields of biological science. Possibly, the phase of the subject which has been the least systematically studied is that of the evidence bearing on heredity afforded by disease, and the publication of a volume by a medical man of high scientific attainments, which embraces this neglected data is to be welcomed. The existence of statistical records makes it possible to utilize the observations made on the inheritance of diseases, and, in this particular field, 'The Principles of Heredity' is a contribution deserving of much consideration. Dr. Reid, the author, has made notable contributions to the study of evolution and heredity in earlier works, as 'The Present Evolution of Man' and 'Alcoholism. A Study of Heredity.'

The analysis of the subject of heredity is now changing from the stage of general treatment to a very critical one, based on measurements and experiments, as well as on the closest microscopic examination of the hereditary substance and its behavior during initial stages of development. This makes it difficult for any writer to satisfy present standards. It will be appropriate to examine Dr. Reid's work with this situation in mind.

The title of the book, 'The Principles of Heredity,' leads the reader to expect something