NATURAL SCIENCES - PROGRAM AND POLICY

Extract from Report of
Committee of Appraisal
Presented Trustees Meeting
December 11, 1934 DR486

Complete Report including
all Divisions is filed : 900
Pro -27

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III. The Natural Sciences

At the meeting of the Trustees of the Foundation in April, 1933, a program was adopted in the natural sciences involving two fields of concentration:

1. Vital processes

2. Earth sciences

Our discussion follows this classification.

The Vital process program

By this title is meant, in briefest form, the bringing to bear of the quantitative techniques of mathematics, physics and chemistry onto the basic problems of biology. The sub-fields in biology indicated in the program are:

(1) Internal secretions
Hormones, enzymes, etc.

(2) Nutrition
Vitamins, etc.

(3) Radiation effects
Ultra violet, X-rays, cosmic rays, mitogenetic rays, etc.

(4) Biology of Sex
Physiology of sex, fertility, etc.

(5) Experimental and chemical embryology
Fertilization and sex determination, transplantation, regeneration, organizers, etc.

(6) Genetics
Chromosomes, genes, cytology, etc.

(7) General physiology
Cell physiology, nerve conduction, electrical effects, osmosis, permeability, etc.

(8) Biophysics and biochemistry
Spectroscopy, microchemistry, basic studies.

As the officers have conceived this program it is linked with the program of psychiatry in the Medical Sciences Division and with the work of the Social Science Division. To use their words, it represents the support and

stimulation of research in the sciences underlying the behavior of man. They report that "certain researches have already progressed to the point where they may at once be applied to relieve physical and mental distress"; while "a vast array of problems and methods are emerging, but have by no means reached application and are not likely soon to do so except under the stimulation of large and continued support."

Illustrative examples of what this program has involved since April, 1933, follow:

University of Chicago
Grant for research in biology during 1934-35 ..... $ 50,000

California Institute of Technology
For research work in biology under the direction of Professor T. H. Morgan 50,000

Roscoe B. Jackson Memorial Laboratory
Emergency assistance to safeguard, for one year, the research group in mammalian genetics under the leadership of Dr. C. C. Little 11,000

California Institute of Technology
In support of research in electron diffraction methods 10,000

University of Chicago 11,750

University of Michigan 8,800

McGill University 10,000

Harvard University - Massachusetts Institute Technology . 4,000

These four grants represent support, each over a 1-year period, for cooperative researches on the application of spectroscopic methods to biological or medical problems.

American Society of Naturalists
Toward the support, over a 5-year period, of a Drosophila Stock Center at Cold Spring Harbor 9,000

Columbia University
A grant to purchase upwards of a gallon of so-called "heavy water" and to provide for full-time research assistants in a program of investigating the biological and physiological effects of the heavy isotope of hydrogen 22,500

In addition, the program has been supplemented by fellowships and grants-in-aid.

Your committee did not feel itself competent or qualified to pass judgment on a program in this highly technical field. We therefore sought the aid of an expert group to advise us in the matter. The group was made up as follows:

Dr. Simon Flexner, Chairman
Director, Rockefeller Institute for Medical Research,
New York City

Professor Walter B. Cannon
Professor of physiology, Harvard Medical School,
Boston, Massachusetts

Dr. Henry D. Dakin
Director, Institute of Pathology, Russell Sage Foundation,
New York City

Dr. William H. Howell
Physiology, Johns Hopkins University,
Baltimore, Maryland

Professor Frank R. Lillie
Dean of Division of Biological Sciences, University of Chicago,
Chicago, Illinois

Your committee met with this advisory group, and the vital process program was presented by Dr. Mason and Dr. Weaver. Thereafter, after consultation, each member of the advisory group filed a report. In addition to these reports, your committee has sought counsel in other quarters, and as a result of the information and advice which we have received, we are presenting the following conclusions:

(1) The term "vital processes" appears to be unhappily chosen. The impression which it conveys is vague and its implications are troublesome. Professor Lillie suggested as a substitute "Experimental Biology" - a designation which seemed to meet with the general concurrence of the other experts

whose advice we sought. By this term would be meant the application of experimental procedures to the study of the organization and reactions of living matter.

(2) In general, this field, thus defined represents a promising area for exploration and development. It is not a new field nor is it based on a new idea. In the Foundation, biology is an interest running back nearly fifteen years. The subjects proposed for study are of world-wide interest, and, with exceptions, are engaging the close attention of laboratories, both academic and industrial. Thus, there is a large commercial side to investigations of vitamins and hormones.

(3) We believe that development in this field of experimental biology will follow the course of comparable undertakings: namely, that there will be a slow, painstaking accumulation of knowledge which in a decade or in a few decades will prove perhaps of profound importance. We do not believe that quick or startling results are to be anticipated, and we would deprecate any idea that the Foundation was building its hopes on such expectations. The prompt solution of important biological problems cannot be prophesied, nor can it necessarily be hastened by large expenditures. In other words, we have no confidence that large efforts would be so rapidly productive as to justify a program conceived in ambitious terms.

(4) Our recommendation would be that this program in experimental biology be conducted on a modest, tentative, and opportunistic basis. This would involve appropriations in moderate amounts similar to those already made in the development of the program. It would particularly involve the use of fellowships and grants-in-aid for purposes of exploration. The

strategy would be to feel out the area, to proceed cautiously, to be misled by no preconceived hopes, and to maintain a detached and healthy kind of skepticism in relation both to the program as a whole and to its constituent parts. Specifically, your committee would expect that expenditures made on this basis might in the aggregate over a period of years reach a reasonably large amount; but we wish to make it clear that we would not expect an elaborate program to be launched which would involve large individual items; nor would we recommend, for the time being at least, annual totals measurably above the present level.

(5) The nature of the program, i.e., the application of experimental procedures to biological problems, involves the necessity of wide knowledge and acquaintance in the fields of both the physical and biological sciences. While the Foundation's program is headed up in the Division of Natural Sciences, the broad scope of the projects demands not only cooperation between that Division and the Division of Medical Sciences, but collaboration and participation as well. Otherwise we might be placed in the position of asking experts in the physical sciences to assume responsibility for technical competence in biology and medicine. The officers are fully conscious of this difficulty, and your committee understands that collaboration between the two divisions in question is being developed.

(6) Two or three of our advisory group questioned whether the Foundation was not assuming an unwise responsibility in indicating, even to the limited extent found in our annual reports, what type of work it viewed with favorable consideration. It was suggested that the subtle influence arising from such a statement of preference might have undesirable consequences. Dr. Howell expressed the matter as follows:

> "It seems to me highly desirable that the Division, or the Foundation in general, should avoid as far as possible the appearance of controlling the direction of biologic investigations, or of taking any steps that

would seem to threaten the freedom of research. The course of events in recent years has seemed to me to have a trend of this character. In many of our institutions biologic research is subsidized by industrial organizations along specified lines, and the appropriations from foundations have had somewhat the same general effect, in the sense that the problems worked upon are set from the outside, so to speak, instead of arising out of the interests of the workers themselves. One outcome has been the development of a sort of competitive struggle for tangible results which gives to scientific research something of the character of a business proposition. I realize that competition of this nature is very stimulating to activity and probably accelerates the acquisition of useful results. Moreover it is probable that many investigators of the technician type do better work when their problems are set for them than when left to their own devices. But the system tends to lower the idealism and independence of scientific research, and in the long run may prove to be a misfortune."

Dr. Cannon, on the other hand, was equally outspoken on the other side:

"I do not share the fear expressed that a great foundation may seriously skew scientific progress by expressing and supporting an interest in some and not in other research projects. The generous contributions of the Rockefeller Foundation to public health, for example, have had, I believe, no demonstrably retarding effect on activities which were not favored - the positive influence was not the occasion for a negative influence elsewhere. In science the genuine investigator is so deeply interested in his own ideas and plans that he is not readily diverted by possible financial support in strange directions; and this would be more and more true as his labors lie distant from the favored fields."

Your committee raises this point because we referred to it in a previous section in our discussion of research. That there is at least an element of danger in the situation, no one who is acquainted with the influence of foundations can easily deny. It seems to us that this is a point which the officers in their relations with the fields should constantly keep in mind. Dr. Howell's apprehensions would perhaps be realized by too ardent a championship of a particular line of research. With a modest approach, with no attempt to "sell" an idea to scientific groups or institutions, or push the development of any particular program, the danger, it seems to us, can certainly be minimized and perhaps avoided altogether.

The Earth Sciences

At the meeting of the Foundation in April, 1933, the officers presented a program in the Earth Sciences which was accepted by the Trustees. Since that time, pending the report of your committee, it has been held largely in abeyance. By earth sciences were meant projects in geo-physics, including meteorology, seismology, earth currents and magnetism, and atmospheric electricity. This was by no means a new interest for the Foundation; in previous years oceanography and geo-physics had received grants totaling about $2,750,000.

Your committee is not inclined to believe that this program should continue to represent one of the interests of the Foundation. There are several reasons for this belief. In the first place, our income is now far below its former figure and the Foundation is forced to exercise a severe kind of choice between desirable programs and opportunities. In our opinion the field of the earth sciences is interesting but not vital. In the second place, the range of subjects included under this head are already obtaining support from other sources. The support is not as large as it could be, but it cannot be claimed that these are starved and neglected fields. Our additional support would doubtless hasten the development of the earth sciences, but with time and with the impetus they now have they will catch up anyway. In the third place, the Foundation should not attempt to cover too many fields. A few programs, sharpened and well-directed, are better than many programs which because of sheer pressure on the officers cannot receive adequate administrative attention.

We therefore recommend that the program in earth sciences be definitely discontinued.

Recommendations:

3. Natural Sciences:

(a) The term vital processes is vague and we suggest that experimental biology be used instead.

(b) In general this field represents a promising area for exploration and development.

(c) We would expect that expenditures in this field might in the aggregate over a period of years reach a reasonably large amount; but we would not expect that an elaborate program would be launched involving large individual items; nor would we recommend, for the time being at least, annual totals measurably above the present level.

(d) We urge the closest collaboration in this field between the Division of Natural Sciences and the Division of Medical Sciences.

(e) It is recommended that the program in earth sciences be discontinued. (See pages 55-61).