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THE NATURAL AND MEDICAL SCIENCES COOPERATIVE PROGRAM

Extract from Interim Report  
Presented Trustees Meeting  
December 13, 1933 DR475

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# THE MEDICAL AND THE NATURAL SCIENCES

In the sciences, both medical and natural, the new program involves a concentration of interest in psychiatry and in vital processes. Stated otherwise, the new program centers upon the modern science of man, with special emphasis on the medical, biochemical, biophysical, and psychological analysis of his behavior. The interests of the Medical Sciences and of the Natural Sciences in the program are closely interlocked, and it is proposed to give here a joint statement of initial developments.

Continued study by the officers has deepened their conviction of the possibility of fundamental progress from the support and stimulation of research in the sciences underlying the behavior of man. Men of ability are available. Problems of potential and of actually great significance await solution. Support, direction, correlated stimulation are requisite in so important a situation. It is now possible to restate, in somewhat more definite form, the general scheme for development of the program. In briefest form, the sub-fields of interest are:

- (1) Psychobiology  
Psychiatry, psychology, neurophysiology, etc.
- (2) Internal secretions  
Hormones, enzymes, etc.
- (3) Nutrition  
Vitamins, etc.
- (4) Radiation effects  
Ultra violet, X-rays, cosmic rays, mitogenetic rays,  
etc.
- (5) Biology of Sex  
Physiology of sex, fertility, etc.

- ✓ (6) Experimental and chemical embryology.  
Fertilization and sex determination, transplantation,  
regeneration, organizers, etc.
- (7) Genetics  
Chromosomes, genes, cytology, etc.
- (8) General physiology  
Cell physiology, nerve conduction, electrical  
effects, osmosis, permeability, etc.
- (9) Biophysics and biochemistry  
Spectroscopy, microchemistry, basic studies.

So brief a table is likely to be misleading without some explanation, especially since the listing gives no indication of emphasis. The ultimate aim and the central problem of the program is the analysis and rationalization of human behavior. With a sufficiently broad interpretation, therefore, "psychobiology" is the single principal topic, all the other subjects being viewed as contributory. A large percentage of the activity in the Medical Sciences will, from the outset, fall in this first category; while the Natural Sciences will be more concerned with the immediately contributory studies. A further word of explanation is in order. One justification for this program is the fact that certain researches have already progressed to the point where they may at once be applied to relieve physical and mental distress. A second and contrasting justification is the fact that 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. Within rough limits the above table indicates the probable immediacy of application. The first four topics, for example, cover many studies which are in present "practical" use. The fifth topic is rapidly passing from the laboratory to the hospital and the home. The remaining topics are, as yet, not often found on the actual firing line, but are even now furnishing communication and



supply service without which the front lines could not continue safely to advance.

The field that lies before the medical and natural sciences under the title of psychobiology offers to consistent and well-planned research, results of the highest importance for the welfare of man. To understand, for example, anxiety or despondency in terms of natural laws is to rob such states of most of their intangible power and terrifying irrationality.

At no time in the past has the likelihood of progress been so great or the need of psychobiological knowledge more urgent. In research upon the anatomy and physiology of the nervous system lies the promise of understanding not only the control of movement and sensation but also essential factors in the emotions of an individual. Areas of the brain are being found that affect internal secretions, growth, sexual activity, milk secretion, and even the symptoms of bodily disease.

In some ten places in the body, chiefly in ductless glands, are secreted chemical substances, called hormones, which, although present in fantastically small amounts, affect a wide variety of physiological and psychological processes. "Their influence is pervasive in all that we do and are. In the present they co-operate in determining the forms of our bodies and the working of our minds. In the past they may have set the pattern for our advancement through the ages." No less than five sex hormones are known. Theelin, one of the best known, has been obtained in pure form, as have several other hormones. The normal sex activity of an unsexed white rat is restored for three days by  $1/8000$  of a milligram of theelin, while an artificial derivative is similarly effective for from eleven to eighteen days. Metabolic disturbances, chronic nervous exhaustion, Addison's disease, exophthalmic goiter, abnormal sex

characteristics, gigantism and dwarfism, cretinism, diabetes, normal growth and development, the psychic and physical disturbances of menstruation and menopause, - all these and many other bodily and mental harmonies and inharmonies are due to or under the control of hormones.

The support of the Foundation has played an important rôle in the development of sex endocrinology, and great opportunities exist in this and in the more general field. In purifying the internal secretions biochemistry has offered the refinement of procedure essential to clear understanding. Immediate advance has followed the discovery of quantitative measurements, as in the work still in progress upon the internal secretions of male and female reproductive organs.

Another approach to the mastery of defect and disability is the field of nutrition. Scurvy, rickets, and beri beri are among the conquests of the past; awaiting further study are forms of sterility, certain defects of growth and susceptibilities to infection which now appear to depend upon food elements, negligible in quantity but considerable in importance. Again the suggestiveness and resourcefulness as well as the precision and certainty of chemistry and physics are ready to advance our knowledge of the requisites of sane and healthy living.

Still another form of biological research in the dawn of development is the science of genetics. It is being proved that cases of resistance to disease, nervous and physical constitution, mental defects and emotional types of behavior are heritable, i.e., that in the germ plasm of an organism lie factors predisposing to results hitherto ascribed to the environment. An immense vista is opened by the recent studies in genetics, as for example the new varieties of plants and animals produced by irradiation of the germ plasm.

The rôle of heredity in determining disposition and personal traits, defects or tendency to disease, though a difficult subject, invites a degree of study it would almost certainly reward.

The remaining topics, as well as the ones just discussed, are essentially those which have already been presented at the previous meeting; and it is perhaps unnecessary to document with further details. Since, however, emphasis has been given above to practicability as measured crudely in terms of applicability, it is well to point out the obvious fact that one cannot afford to concentrate so much interest on harvesting that he neglects plowing and seeding. The basic studies must be continued, both because they furnish essential support to present applied developments, and because basic studies continuously and in unpredictable ways lead to new fields of application.

To stimulate and support progress, the officers have proposed four principal mechanisms:

- (1) Recruitment and training of personnel
- (2) Grants in aid of research
- (3) Project support
- (4) Development of major and minor centers

Since last April the opportunities have been under steady examination and the divisions are moving promptly into the new field. In the Natural Sciences an appropriation for special fellowships has been set up, and candidates are now under consideration. In the Medical Sciences eleven special fellowships have already been granted, and nine are now under consideration. General sums for grants-in-aid have been set up by both divisions, and allocations have been made. In support of larger research projects, the Medical Sciences has made three grants totaling \$154,900 in psychiatry and neurophysiology; while the Natural

Sciences has made (or is recommending at this meeting) five grants totaling \$185,000. One of these grants is in mammalian genetics, one in radiation effects, one continues the previous work of the National Research Council Committee for Research in Problems of Sex and permits them to expand into the field of the physiological and behavioristic aspects of sex in man, while two grants are distributed over all the topics listed above. The project support in the Medical and Natural Sciences would be greater by \$300,000 and \$500,000 respectively if five-year grants instead of one-year grants were being proposed at the December meeting. The development of centers is naturally a slower procedure, to be entered into only after most careful and wide study. Important opportunities of this sort are, however, under present consideration, and will probably appear as recommendations at the April meeting.

As the other interest of the Medical Sciences is the field of teaching in public health, a review of the opportunities for preparing qualified teachers in this field has been made and a system of training devised which will begin at least the improvement of the teaching in this subject. With approximately 20,000 physicians on salary out of a total of 140,000 in the United States and with a far larger proportion so remunerated in some of the European countries the practice of medicine is changing and the teaching of medicine must be adjusted to this change which emphasizes so sharply the social and public importance of the doctor.



Appropriations in the Medical Sciences - 1933

Emergency:

Special Research Aid for Deposed Germans (allocated to MS)	\$60,000	\$ 60,000
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Obligations of Old Program:

Columbia University - Studies in common cold - additional appropriation .....	\$ 6,000	
Cheeloo University - Final (\$17,000 1933-34 and \$9,000)	26,000	
Chinese Medical Association .....	9,750	
Nursing Fellowships - final appropriation to I.H.D. ....	50,000	
Fellowships - Peiping Union Medical College .....	<u>29,000</u>	120,750

General Support:

Fellowships - Medical Research Council of Gt. Britain ...	\$15,000	
Medical Literature - Russia .....	15,000	
National Research Council - MS fellowships .....	30,000	
National Research Council - R. Aid - MS .....	15,000	
Research Aid - European Office .....	85,000	
Research Aid and Developmental Aid - China - MS and NS ..	<u>15,000</u>	175,000

New Program:

General

Harvard Infantile Paralysis Commission .....	\$ 5,000	
Grants-in-Aid for psychiatry and public health .....	<u>30,000</u>	35,000

\*Psychiatry

Central Institute for the Deaf - Neurology - Dr. de No .....	\$ 2,600	
Johns Hopkins Department of Psychiatry .....	80,000	
Harvard University - development of psychiatry unit ...	80,000	
University of London - A.V. Hill - biophysics .....	16,400	
Washington University - neurophysiology .....	<u>58,500</u>	237,500

Public Health Teaching

Dalhousie University	\$44,000	<u>44,000</u>
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Total .....		\$672,250
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\*The restriction to single-year grants for proposal at the December meeting reduces this item by about \$300,000.



The Natural Sciences - Summary for 1933

Emergency:

*Apia Observatory, Samoa, New Zealand .....	\$ 2,500	
American Mathematical Society .....	9,000	
Special Research Aid Fund (Deposed Scholars) .....	<u>100,000</u>	\$111,500

Obligations of Old Program:

Aid to Chinese Institutions .....	\$ 35,000	
Resident Fellowships - China .....	5,000	
*University of Utrecht (Institute of Comparative Physiology) .....	101,000	
Marine Biological Association - China .....	2,250	
Jungfrauoch High Altitude Station .....	<u>35,700</u>	178,950

General Support:

National Research Council - Fellowships .....		\$150,000	
*Fellowships - Europe and China Foreign .....		100,000	
*Research Aid Fund - Europe .....		50,000	
Research Aid Fund - National Research Council .....		<u>35,000</u>	335,000

## New Program

General:

Grants-in-Aid .....	\$ 30,000	30,000
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Vital Processes:

NRC Committee on Research in Problems of Sex .....	\$ 65,000
NRC Committee on Radiation - Mitogenetic Rad. ....	10,000
California Institute Technology - Biology, Morgan	50,000
- Theor. Org.	
Chem. Pauling	10,000
Jackson Memorial Lab. - Genetics, Little	11,000
University of Chicago - Biology .....	<u>50,000</u>
	196,000

Earth Science:

Mass. Inst. Tech. - Aerological Research .....	\$ 8,300	
Univ. of Leipzig - Geophysical Institute .....	<u>17,500</u>	<u>25,800</u>
Total .....		\$877,250

This classification does not too accurately indicate the extent of the shift in emphasis to the new program, also, the starred items are either related, more or less closely, to new program, or represent mechanisms which are in process of being redirected to serve new program.

Were it not for the recent decision to avoid term grants at the present, the total of items under Vital Processes would be \$720,000 in place of \$196,000.