

NATURAL SCIENCES - PROGRAM AND POLICY

The Program in Vital Processes  
Report by Warren Weaver  
October 24, 1934

Used in connection with  
preparation of material  
for Committee on Appraisal

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THE PROGRAM IN VITAL PROCESSES

The Natural Sciences  
The Rockefeller Foundation

Warren Weaver, Director  
October 24, 1934

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## THE PROGRAM IN VITAL PROCESSES

### A. General considerations

Each division of The Rockefeller Foundation extends, under present program, a certain amount of broad support over the whole field in question (for example social sciences, humanities, natural sciences, etc.) but concentrates a considerable amount of support within certain areas of special interest. The division of The Natural Sciences has chosen for its major field of special interest a program in what it has, for want of a better term, called "vital processes". This program recognizes the following tentative schedule of sub-fields:

- 1) Internal secretions  
Hormones, enzymes, etc.
- 2) Nutrition  
Vitamins, etc.
- 3) Radiation effects  
Ultra-violet, x-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
- 7) General physiology  
Cell physiology, nerve conduction, electrical effects, osmosis, permeability, etc.
- 8) Biochemistry and biophysics  
Spectroscopy and other electro-optical effects, micro-chemistry, basic studies.

It will be seen at once that these sub-fields include major interests of modern experimental biology, and place special emphasis upon developments which are making use of the delicate and powerful experimental techniques of chemistry, physics and mathematics.

In addition to these numbered sub-fields, which admittedly do not form entirely distinct compartments, the program recognizes a major interest in those studies, chiefly in experimental psychology, psychobiology or neurophysiology, which bear directly upon the general behavior problem and which correlate with the Medical Science division's program in psychiatry.

This program has been chosen on account of the conviction that sound and careful researches in these fields are creating a body of knowledge which is basic for the improvement of the physical, mental and emotional status of man. The great potential importance but, on the other hand, the danger of hasty applications in certain of these fields (particularly in hormone and vitamin research) both indicate the high desirability of furnishing adequate support for able and conservative workers. The type of project, in the various sub-fields, which would receive support will be made more clear by the remarks of the next section (B) of this memorandum and by the illustrative projects listed in section C.

#### B. Mechanisms of support

This program is now being served by four principal modes of support:

- 1) Fellowships
- 2) Grants-in-aid
- 3) Support to national committees
- 4) Project

1) There are two usual types of fellowships. Post-doctoral training fellowships, usually of two or more years' duration, enable a few very carefully chosen men to acquire broad training for effective attack on problems in the above fields. This fellowship experience often involves emphasis upon chemistry or physics for men whose work has been largely in biology, or vice-versa. Experience fellowships, of one year's duration, are granted to more mature workers of established creative productivity, who lack broad contacts with other laboratories. Lists of appointments will be found below.

2) The grants in aid of research are similar in general character to those made by the National Research Council, but are definitely restricted to the above fields, and have a considerably higher possible upper limit. This procedure is used largely as an exploratory mechanism.

3) For some years past, support has been given to two committees of the National Research Council. These committees are the Committee for Research on Problems of Sex and the Committee on the Effects of Radiation on Living Organisms. The grants will be found in Section C, List 3.

4) The program in vital processes received tentative approval of the Trustees of The Rockefeller Foundation in April, 1933. During the interval since that time it has not seemed wise, for a variety

of reasons, to undertake large commitments. A considerable number of projects in the field have, however, received support. These are, in most instances, research projects each of which centers about the work of one man. The grants typically provide for research assistance, and in many instances for apparatus and consumable supplies. Specific illustrations will be found in Section C, List 4.

As this program develops, projects of larger financial magnitude and broader scientific significance will naturally arise. Such projects may involve assistance in the rounding out of an already strong situation through additions to staff and long-term or permanent provision for support.

#### C. Illustrations of support

While this program represents a considerable shift of emphasis, the Foundation has, for many years, made both large and small grants in the field. The following list shows pertinent examples of larger appropriations made prior to the adoption of the special program.

##### 1) Internal secretions

University of California (1929) ..... \$ 50,000  
 For researches under the direction of  
 Dr. H.M. Evans on chemical aspects of  
 vitamins and hormones

National Research Council (1931,1932) ..... \$225,000

A grant administered by the Committee for Research in Problems of Sex, Approximately one-half of the funds of this Committee has been used to institute and carry on studies of the importance of internal secretions in their relation to sex phenomena. The membership of the present Committee is: R.M. Yerkes (Chairman), Francis G. Blake, Walter B. Cannon, Frank R. Lillie, Adolf Meyer and Clark Wissler.

## 2) Nutrition

Univ. of Szeged (1931) ..... ~~\$165,000~~ <sup>\$155,000</sup>

For equipment and maintenance of research in physiology and biochemistry. This grant has included the work of Szent-Gyorgyi and his associates.

## 3) Radiation effects

Univ. of Paris (1932) ..... 120,000

To provide the salaries over a 10-year period of four full-time scientists under the direction of Prof. Regaud, in the Div. of Biophysics of the Radium Inst. of the Univ. of Paris. A special object of study has been the response of living tissue to radium emanations, x-rays, and light of various types.

National Research Council (1928) ..... 62,500

(By the General Education Board) A grant administered by the Committee on the Effects of Radiation on Living Organisms. The present membership of the main Committee is: W.C. Curtis (Chairman), C.E. Allen, D.H. Tennent, Lorende L. Woodruff; while Kenneth S. Cole, William Crocker, Leslie C. Dunn, B.M. Duggar, Janet H. Clark, Farrington Daniels, G. Failla, Charles Packard and Henry W. Popp serve on sub-committees.

✓ 4) Biology of sex

National Research Council (1931,1932) ..... \$225,000

A grant administered by the Committee for Research in Problems of Sex. Approximately half of the amount here listed (see second item of group 1) was used to support investigations on the physiology of sex, sex determination, fertility and sterility, and similar topics. Previous appropriations totalling \$507,000, made by the Bureau of Social Hygiene, included similar studies.

5) Experimental and chemical embryology

Univ. of Stockholm (1931) ..... 12,200

A grant to support experimental chemical studies on the development of eggs of lower organisms. This research is under the general direction of Prof. John Runnstrom.

Research aid grants have also been made to Spemann and to Mangold.

6) Genetics

Cornell Univ. (1930) ..... 250,000

In support of the researches of Dr. C.R. Stockard, and his associates. The general problem is an analysis of the role of heredity, on the one hand, and developmental influences, on the other, in determining fixed abnormal type and constitution.

K.W.G. Institute for Anthropology  
Berlin-Dahlem (1932) ..... 9,000

To support researches, under Prof. Eugen Fischer, on twins, and on the effects of poisons on the germ plasma.

7) General physiology

K.W.G. Inst. of Cell Physiology  
Berlin-Dahlem (1930) ..... 220,000

The work at this Institute centers around the research of Otto Warburg.

Research Inst. of Experimental Biology,  
Copenhagen (1932) ..... \$250,000  
Towards the endowment of the institute  
for the study of cellular physiology  
of the Carlsberg Foundation. Dr.  
Albert Fischer is the director.

Univ. of Pennsylvania (1929) ..... 75,000  
In support, over a 5-year period, of re-  
searches under the direction of Dr. Eliot  
R. Clark on the destruction, repair and  
growth of tissue under both normal and  
abnormal circumstances. This work makes  
use of ordinary tissue culture and  
microdissection methods, and also of the  
Sandison oar arrangement devised by one  
of Dr. Clark's former assistants.

University College, London (1927) ..... 575,000  
For the endowment of Depts. of Anatomy,  
Pharmacology and Physiology. This has  
placed upon a permanent and satisfactory  
basis departments whose special interests  
have related to the brain, the special  
senses and the physiology of nerve action.

#### 8) Biochemistry and Biophysics

Univ. of Leipzig (1931) ..... 67,000  
A grant to provide, over a period of 7  
years, resident research fellowships to  
work under Prof. Karl Thomas of the Inst.  
of Physiological Chemistry.

Harvard Univ. (1930) ..... 175,000  
For researches under Dr. Cannon and Dr.  
Cohn in physiology and physical chemistry.

University of Upsala (1931) ..... \$12,000  
To the Institute of Physical Chemistry,  
(Prof. The Svedberg) for research by  
physical techniques on complicated protein  
substances.

Technische Hochschule, Munich (1931,32) ..... 5,600  
For research in blood chemistry under  
Prof. Hans Fischer.

since April, 1933, under the four mechanisms of support already  
described.

Research Inst. of Experimental Biology,  
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As has been pointed out earlier, the program in vital  
processes has been under way since April, 1933, although circumstances  
have precluded rapid development or large projects. There will be  
found, immediately following, four lists which report grants made,  
since April, 1933, under the four mechanisms of support already  
described.

## LIST 1

FELLOWSHIP APPOINTMENTS MADE SINCE APRIL 1933

## TRAINING FELLOWSHIPS

Richard Hugh McCoy. Dr. McCoy has received thorough training in biochemistry, with minors in organic chemistry and bacteriology, at the University of Illinois under Professor Wm. C. Rose. The fellowship provides two years' additional training in physiology. This fellowship has been sponsored by Professor Rose and by Professor Roger Adams.

Mark A. Foster. Dr. Foster has taken his degree in zoology at the Univ. of Wisconsin, his special field being endocrinology. The fellowship will provide two years' additional training in advanced medical histology, clinical pathology, pharmacology and clinical diagnosis. The first year will be spent at the University of Wisconsin and the second year either at Harvard or Johns Hopkins. The fellowship is sponsored by Professor Frederick L. Hisaw and Professor Michael F. Guyer.

Adrian Buyse. Dr. Buyse has had all of his training and experience, both undergraduate and graduate, at the University of Rochester. The fellowship will provide one year's additional training at Yale University under Professor R. G. Harrison and J. S. Nicholas in experimental embryology and with Dr. Edgar Allen in endocrine research. This fellowship is sponsored by Professor Geo. W. Corner, Professor B. H. Wallier, and Professor R. K. Burns, Jr.

Melvin Henry Knisely. Dr. Knisely's interests were originally in physics. He has completed the pre-clinical medical course at the University of Chicago and has subsequently been engaged, in the Anatomy Department, upon a direct study, by physical techniques, of the circulation in the spleen. This fellowship will provide two years' additional training at the Univ. of Chicago under Professor Bensley and at the Univ. of Pennsylvania under Professor Richards. This appointment has been formally sponsored by the entire membership of the Department of Anatomy of the University of Chicago.

Ladley Husted. Dr. Husted has been trained in biology at the University of Virginia, the major emphasis being upon cyto-genetics. The fellowship will provide two years' additional training at the Univ. of Missouri under Dr. Stadler and at the Univ. of Chicago under Dr. Sewall Wright. Dr. Husted wishes to devote himself, in the future, to irradiation methods and the artificial production of mutations. The fellowship is sponsored by Professor Ivey F. Lewis of the Univ. of Virginia and Professor Orland E. White, Professor of Agricultural Biology and Director of the Blandy Experimental Farm.

Carl August Baumann. Dr. Baumann has been trained along biological-physical lines at the Univ. of Wisconsin, where he has recently been an assistant in biochemistry associated with Prof. Harry Steenbock. The fellowship will provide two years' additional training under Prof. Mansfield Clark at Johns Hopkins and with Prof. J. Barcroft at Cambridge. This fellowship has been sponsored by Professor Harry Steenbock and by Professor Edwin B. Fred.

Alan C. Burton. Dr. Burton was originally trained in physics at the Univ. of London and at the Univ. of Toronto. For the past two years he has been associated, as research assistant, with Professor John R. Murlin at the University of Rochester on diathermy problems and on the theoretical aspects of heat diffusion in the human body. The fellowship will provide two years of additional training at the Univ. of Pennsylvania and at Harvard, to fill in a necessary background of biological and physiological knowledge. This fellowship has been sponsored by Professor W. O. Fenn and by Professor John R. Murlin.

#### EXPERIENCE FELLOWSHIPS

John Warren Williams. Dr. Williams is Associate Professor of Physical Chemistry at the Univ. of Wisconsin. This fellowship will permit Mr. Williams to spend 11 months in the laboratory of The Svedberg at Upsala, applying dielectric methods to the measurement of the molecular weights of proteins and other large molecules. This fellowship has been sponsored by Professor J. H. Mathews and by Professor Farrington Daniels.

Philip Brownell Armstrong. Dr. Armstrong is Assistant Professor of Anatomy at the Cornell Univ. Medical College. The fellowship will permit Dr. Armstrong to spend a year with Prof. Joseph Needham at the Univ. of Cambridge. Dr. Armstrong's interests are in chemical embryology, and particularly in (1) arrested and abnormal development and its metabolic factors and (2) neurohumoralism in the embryonic heart. This application has been sponsored by Prof. C. R. Stockard and by Prof. Herbert S. Gasser.

Harold William Beams. Dr. Beams is Assistant Professor of Zoology at the State University of Iowa. This appointment will permit him to spend 10 months with Professor Gatenby at Dublin University, Ireland. Dr. Beams appears to be one of the most able young cytologists in this country. The application has been sponsored by Prof. J. H. Bodine of the Univ. of Iowa and by Prof. M. F. Guyer of the Univ. of Wisconsin.

John Mann Beal. Dr. Beal is Professor of Botany at the University of Chicago. This appointment will permit six months' experience in cytological investigations with Dr. C. D. Darlington of the John Innes Horticultural Institution and with Prof. Victor Gregoire of the Univ. of Louvain. The application has been sponsored by Prof. E. J. Kraus and Dean F. R. Lillie.

Alva E. Brandt. Dr. Brandt is Research Assistant Professor of Statistics at the Iowa State College. The appointment will permit 10 months spent in biomathematical research at the Galton Laboratory under Professor R. A. Fisher. This application has been sponsored by Prof. E. W. Lindstrom of the Department of Genetics and by Prof. E. R. Smith, Chairman of the Department of Mathematics at Iowa State College.

#### SPECIAL FELLOWSHIPS

Nicolas Rashevsky. Dr. Rashevsky has been thoroughly trained in mathematics, mathematical physics and physics. Of recent years he has been interested in the physico-mathematical aspects of cellular growth and development and of nervous activity. This Special Fellowship permits Dr. Rashevsky to spend 15 months at the Univ. of Chicago. The appointment has been sponsored by Prof. Ralph S. Lillie, Dean Frank R. Lillie and Professor Arthur H. Compton.

Willard M. Allen. Dr. Allen holds an MD degree from the University of Rochester. He has had unusually wide training in chemistry. He is now gaining his full time training in obstetrics and gynecology. This Special Fellowship, which provides partial support over a two-year period, assures the continuance of Dr. Allen's researches on the chemistry of "progestin". This application has been sponsored by Dean Geo. H. Whipple, Dr. Karl M. Wilson, and Dr. Geo. W. Corner of the Univ. of Rochester Medical School.

#### PARIS APPOINTMENTS

The fellowship appointments made from the Paris Office of the Foundation are not restricted to special program interests, although the proportion of appointments which fall within the special program is being increased. The following appointments made by the Paris Office since April 1933 are related to the program here under discussion:

Jean Dufrenoy. Dr. Dufrenoy has been, since 1930, the Director of the Station de Pathol. Vegetale, Pont-de-la-Maye, Gironde. This appointment extends his studies at the Univ. of Calif. at Riverside, Calif., under Professors H. S. Reed, Batchelor and Fawcett, on the response of cytological structure to environmental and internal changes. This application was proposed by Prof. L. Mangin of the Museum of Natural History, Paris, and seconded by Prof. L. Blaringhem of Ecole Normale, Paris.

William Lancelot Francis. Dr. Francis is a demonstrator in the Department of Experimental Zoology at Cambridge University. The appointment enables him to pursue studies of the permeability and bioelectrical properties of animal and vegetable membranes with Dr. W. Osterhout of The Rockefeller Institute for Medical Research. This application was proposed by Prof. J. Stanley Gardiner and seconded by Prof. J. Gray, both of Cambridge University.

Boris Ephrussi. Dr. Ephrussi has been in charge, since 1928, of the tissue culture laboratory of the Institut de Biologie physico-chimique, Paris. The appointment makes possible studies with Professor T. H. Morgan and Dr. M. T. Burrows at the California Institute of Technology and at Woods Hole, Mass. The application was proposed by Prof. E. Faure-Fremiet, Lab. d'Embryologie comparée, Paris, and seconded by Prof. A. Mayer, Collège de France, Paris.

John Axel Mauritz Rannström. Dr. Rannström is one of the leading zoologists of the Scandinavian countries. This Special Fellowship enabled him to carry out researches in cellular metabolism in animal cells and tissues, with special relation to the coupling between oxidations and synthesis in the cells, at The Rockefeller Institute for Medical Research with Prof. L. Michaelis, and also at Woods Hole.

F. Baltzer. Dr. Baltzer has been, since 1921, the Director of the Zoology Institute at the University of Berne, his special field of interest being problems of sex determination. This Special Fellowship makes possible an 8 months' visit, most of which will be spent at the Univ. of Chicago and at Woods Hole.

Richard J. Pumphrey. Dr. Pumphrey is a University Demonstrator in Zoology at Cambridge. This appointment will make possible 12 months' research at Woods Hole and at the Univ. of Pennsylvania under Prof. Detlev Bronk.

Rudolf Brdicka. Dr. Brdicka is an assistant in the Physico-Chemical Institute, Charles University, Prague. The appointment will make possible a year's researches with Prof. Carl L. A. Schmidt, Prof. of Biochemistry at the Univ. of California, on the electro-chemical properties of proteins, making use of the polarographic method devised by Dr. Brdicka's chief, Professor T. Heyrovsky.

Henry Albers. Dr. Albers is an assistant at the State Institute of Chemistry, University of Hamburg. The appointment will make possible 10 months' researches with Prof. H. von Euler at the Univ. of Stockholm on enzyme chemistry.

Jannik Bjerrum. Dr. Bjerrum is an assistant at the Medico-Physiological Institute of the Univ. of Copenhagen. Dr. Bjerrum will carry on, for 12 months, researches in biological chemistry under Prof. Michaelis at The Rockefeller Institute for Medical Research.

Ludwik Monné. Dr. Monné is Docent in Zoology and Comparative Anatomy at the University of Lwow. He will carry on researches for one year under Prof. R. Chambers of New York University on the embryology of invertebrates, and more particularly on an experimental analysis of histogenetic processes by tissue culture and micro-manipulation.

## LIST 2

GRANTS IN AID OF RESEARCHBy the New York officer

University of California .....	\$ 4,425
To finance an investigation of the disposition of fixed minerals in the living cell as shown by the micro-incineration method, under the direction of Dr. T.H.Goodspeed.	
University of Wisconsin .....	1,200
To assist in financing investigations on hormones, particularly the investigation of pituitary and ovarian activity in women, under the direction of Dr. Elmer L. Sevringhaus.	
University of Rochester .....	500
To provide technical assistance for the investigations of genetic problems in drosophila under Dr. Curt Stern.	
California Institute of Technology .....	450
To finance the investigation of the genetics of hybrid sterility in the numerous races of drosophila pseudo-obscura, under Dr. T.H.Dobzhansky.	
Washington University .....	4,800
To finance investigations of the nature of the nerve impulse and related problems in nerve physiology, under Prof. F.O.Schmitt.	
Columbia University .....	450
For the purchase of scientific apparatus in connection with research by Prof. P.E.Smith in endocrinology.	
University of Virginia .....	2,500
To complete an investigation, begun under the financing of the National Research Council, on the magneto-optic method of Allison. This work was supported on account of the great importance, if the method be found sound, of application to biological analysis.	
McGill University .....	5,936
To provide research assistants and to purchase materials and equipment in connection with researches by Prof. R.L.Stehle on the posterior lobe of the pituitary gland.	

Stanford University .....	\$ 2,400
To provide a research assistant and to contribute toward the purchase of a Hilger interferometer in connection with research on colloids and their relation to other forms of matter, and investigation of the structure of surfaces by Prof. J.W. McBain.	
George Washington University .....	2,198
To provide a research assistant and purchase experimental animals and chemicals in connection with researches on the higher homologues of cystine and methionine by Prof. V. duVigneaud.	
Johns Hopkins University .....	1,750
To provide a research assistant in connection with investigations of the hydrogen molecule and its heavy isotopes by Prof. G.H.Dieke. A limited support to researches on heavy hydrogen has been deemed advisable since hydrogen plays so important a role in all biologically important compounds and since the viological environment is formed to so great an extent by water.	
University of Missouri .....	2,000
To employ research assistants in connection with research on organs related to reproduction in the bat, under Dr. M.J.Guthrie.	
University of Rochester .....	1,000
To assist in developing a new type of calorimeter for studying the continuous heat production of warm-blooded animals under the direction of Dr. J.R. Murlin.	
Cornell University .....	1,800
To provide a research assistant (Dr. Barbara McClintock) for Prof. R.A.Emerson in his studies on the cytogenetics of maize.	
University of Illinois .....	675
To assist in the purchase of an amplifying system and a cathode ray tube for investigations in animal hearing under the direction of Prof. E.A.Culler.	
Princeton University .....	2,000
Toward the salary of research assistants and for the purchase of animals, chemicals and gland materials in connection with the researches of Prof. W.W. Swingle on the hormone of the adrenal cortex.	

Stanford University .....	1,500
To assist in the purchase of a monochrometer, filters, galvanometer, and other special equipment for investigations of biological oxidations under the direction of Prof. J. Percy Baumberger.	
Clark University .....	1,850
To provide a research assistant and equipment for researches in nerve physiology under the direction of Prof. Hudson Hoagland.	
Emma Pendleton Bradley Home .....	1,500
For the purchase of scientific apparatus required in connection with the researches in nerve physiology of Dr. Herbert H. Jasper of the Dept. of Psychology of Brown Hospital.	
Thorndike Memorial Laboratory .....	1,000
For the purchase and care of experimental animals and the salary of a technician involved in connection with the research work, under the direction of Dr. G.R. Minot on the vitamin B excretion of rats on a controlled diet.	
Cornell University Medical School .....	5,000
To provide scientific apparatus and technical assistants in connection with researches in neurophysiology under the direction of Prof. H.S. Gasser.	
Emma Pendleton Bradley Home .....	3,000
For the salary of a technical assistant (a physicist) and the purchase of apparatus and supplies in connection with researches on nerve physiology under the direction of Dr. Herbert H. Jasper	

By the Paris office:

University of Frankfurt, Germany .....	1,000
In support of researches, under the direction of Prof. G. Embden at the Institute of Vegetative Physiology, on intermediate processes in glycolytic formation of lactic acid and carbohydrate metabolism.	
University of Oxford .....	1,700
For scientific apparatus and consumable research supplies, including animals, in connection with the investigative work of Sir Charles Sherrington, Dir. of the Institute of Physiology.	

University of Helsingfors .....	\$ 1,100
To purchase scientific apparatus (chiefly an oscillograph and a camera) for research on the physiology of vision under Dr. Ragnar Granit.	
University of Copenhagen .....	250
To purchase scientific apparatus required in connection with research on carbon dioxide metabolism under Dr. Soren L. Orskov.	
Hospice de la Salpetriere .....	1,200
To promote physical research on the nervous system through assistance to the Department of Electrophysiology under the direction of Prof. G. Bourguignon.	
University College London .....	1,500
To enable the Institute of Pharmacology to secure for one year the services of Prof. Otto Kraye in connection with research on anti-diuretic function of the pituitary body.	
University of Cambridge .....	1,750
For technical assistance and research material required for research on pigments of cellular origin and particularly of haemoglobin derivatives, carried out by Dr. David Keilin at the Moltene Institute of Cambridge.	
Karolinska Institutet, Stockholm .....	3,000 <del>300</del>
For apparatus required in connection with the investigative work of Prof. Einar Hammarsten. A program of research on secretin is being carried out in collaboration with Prof. The Svedberg of Upsala. A quartz microscope was required for investigation on the chemical structure of chromosomes.	
University of Munich .....	3,278 <del>2,300</del>
To provide Prof. R. Wilstaetter with funds for the continuation of his investigations in the study of enzymes.	
Technical Highschool, Munich .....	2,800
To provide Prof. Hans Fischer with funds for the continuation of his investigations on blood pigments and bile pigments.	
University of Leipzig .....	3,780
To provide assistants and for the purchase of reagents and rare sugars required in the researches of Prof. B. Helferich on glucosides, both natural and synthetic, and the splitting effects produced in these compounds by enzymes.	

Oxford University, England .....	\$ 1,500
To provide equipment and special supplies for the Dyson Perrins Laboratory at Oxford, under the direction of Prof. R. Robinson, in connection with the investigations in the chemistry of organic coloring substances of plants and related vitamins.	
University of Upsala .....	1,000
In continued support of the researches under the direction of Prof. The Svedberg.	
Physiological Institute of Basel .....	1,000
For technical assistance and research materials required for investigations on problems of the physiology of absorption and on the relationship of vitamins to internal secretions.	
Institute of Histology and Embryology, Lisbon .....	1,000
To foster research on endocrine glands and their relation to the central nervous system carried out by Prof. A.P. Celestino da Costa.	
University of Copenhagen .....	350
To purchase scientific apparatus for the investigative work of Dr. H. Dam, assistant at the Biochemical Institute, on cholesterol metabolism.	
University of Basel .....	1,500
To foster research on the enzymes present in nerve and brain substance, under the direction of Prof. Siegfried Edlbacher	
University of Basel .....	1,800
To promote the application of physical methods to the elucidation of pathological problems, with particular reference to mineral content of tissues, under the direction of Prof. Werner Gerlach, Dir. of the Inst. of Pathological Anatomy.	
University of Freiburg .....	6,000
For apparatus, supplies and technical assistance for researches, under the direction of Prof. S. Thannhauser, on the formation of biliary pigments and lipoids.	
University of Leiden .....	2,000
To foster physico-chemical research on monomolecular films and on the absorption spectra of certain blood protein derivatives carried out by a group of young investigators under the direction of Prof. E. Gorter, Dir. of the Clinic of Pediatrics.	

Strangeways Research Laboratory .....	\$ 1,500
To promote research on growth and differentiation of tissues.	
American University of Beirut .....	1,500
To promote research, directed by Prof. Stanley E. Kerr, on brain metabolism in the Dept. of Biological Chemistry.	
University of Florence .....	2,160
To promote research on viruses by spectrographic methods at the Institute of General Pathology, under the direction of Prof. Francesco Pentimalli.	
University of Amsterdam .....	2,370
To promote spectro-photographic research in the field of endocrinology under the direction of Prof. I. Snapper.	
University of Copenhagen .....	880
To provide scientific apparatus for research on endocrines and their relation to metabolism and to the central nervous system, under Dr. Harald Okkels and his collaborators at the Institute of Pathological Anatomy.	
University of Stockholm .....	1,270
To further, by physical means, newer lines of investigation on hormones carried out by Dr. Caspersen and others at the Institute of Chemistry.	
University of Paris .....	3,000
In promotion of studies on secondary sexual characteristics and on vitamin C in endocrine organs, conducted at the Histological Laboratory of the Faculty of Medicine by Prof. C. Champy and his associates.	
Biochemical Institute, Copenhagen .....	1,370
To foster investigations on hormones, enzymes and vitamins under the direction of Prof. Ege.	
Cambridge University .....	1,040
To promote studies in oxygen metabolism and cell respiration carried on by Prof. David Keilin at the Moltene Institute for Research in Parasitology.	
University of Turin .....	2,500
To secure scientific apparatus for research on nerve muscle metabolism carried on by Dr. Rodolfo Margaria at the Physiological Institute.	

University of Copenhagen .....	\$ 2,200
To promote research on hereditary anterior pituitary abnormalities, cytological studies on human chromosomes, and genetic studies on psychopathic cases carried on by Dr. Tage Kemp at the Institute of General Pathology.	
University of Leiden .....	2,800
To further research on the central nervous system and on the endocrines, carried on at the Institute of Physiology under the direction of Prof. C.G.J. Rademaker.	
Medical Research Council of Great Britain .....	1,560
To support chemical research on the conduction currents in nerves carried on by Sir Henry Dale and Dr. Werner Feldberg at the National Institute for Medical Research at Hampstead.	
K.W.Institute of Biochemistry, Berlin-Dahlem .....	2,920
To enable Prof. C. Neuberg to continue his investigations in the field of enzyme action and fermentation.	
University of Rome .....	890
To provide necessary items of equipment to enable past fellow G. Montalenti, First Assistant at the Zoological Institute, to carry out his researches in physiological genetics and avian endocrinology.	
University of Lyons .....	990
To provide necessary items of equipment to permit past fellow Prof. Claude Fromageot to carry on his researches on the biochemistry of micro-organisms.	
University of Oslo .....	1,320
To provide assistance, animals and materials to Prof. Christine Bonnevie for her researches in human genetics.	
Technical Highschool, Danzig .....	5,000
To provide apparatus and animals required in the researches of Dir. Prof. A. Butenandt in the field of the chemistry of hormones.	
University of Leeds .....	4,800
To provide necessary equipment and a biologically trained assistant for the researches of Dir. W.T. Astbury on the x-ray analysis of the structure of tissues.	

Pasteur Institute .....	\$	450
To provide a microscope and accessories to permit Dr. Marc Simonet to carry on his researches in genetic cytology of plants.		
University of Vienna .....		400
In support of research on comparative enzyme metabolism of invertebrates.		

## LIST 3

SUPPORT TO NATIONAL COMMITTEES

National Research Council Committee on the Effects of  
Radiation on Living Organisms ..... \$ 10,000

A grant made at the request of this Committee to  
finance a survey of the field of mitogenetic ra-  
diation.

National Research Council Committee for Research in  
Problems of Sex ..... 65,000

An extension, for one year, of support for the  
activities of the Committee. By arrangement with  
this group, the Foundation has assumed direct re-  
sponsibility for certain of the larger and thorough-  
ly stabilized projects previously supported by the  
Committee. This grant, therefore, actually repre-  
sents an increase in the level of previous support,  
and permits an exploratory program in certain be-  
havioristic aspects of sex phenomena.

## LIST 4

PROJECT SUPPORT SUBSEQUENT TO APRIL, 1933

University of Chicago .....	\$ 50,000
Grant for research in biology during 1934-35. This includes support which previously came from the National Research Council Committee for Research in Problems of Sex. The larger projects have been under the direction of Dr. Frank R. Lillie, Dr. F.C.Koch, Dr. B.H. Willier, Dr. W.H.Taliaferro, Dr. W.C.Allee, Dr. G.K.K.Link, Dr. William Bloom, Dr. G.W. Bartelmez, Dr. C.M.Child, Dr. C.A.Shull, Dr. E.O.Jordan, Dr. A.J.Carlson, Dr. C.J.Herrick, Dr. A.B.Luckhardt, Dr. R.S.Lillie, Dr.E.J. Kraus, Dr. R.W.Gerrard, Dr. H.H.Newman.	
California Institute of Technology .....	50,000
For research work in biology under the direction of Prof. T.H.Morgan. This grant makes possible the addition to the staff of a physiologist (Dr. C.A.G.Wiersma) and also provides research aid in biophysics and biochemistry over a 3-year period. The work supported by this grant will be particularly concerned with the relationship between the genes and the fertilized egg, and the finished characteristics of the organism.	
Roscoe B. Jackson Memorial Laboratory .....	11,000
Emergency assistance to safeguard, for one year, the research group in mammalian genetics under the leadership of Dr. C.C.Little.	
California Institute of Technology .....	10,000
In support of the researches of Prof. Linus Pauling. Dr. Pauling is developing electron diffraction methods of analysis which are sufficiently powerful to permit study of the detailed structure of chlorophyll, haemoglobin and other substances of basic biological importance.	
Long Island Biological Association .....	20,000
Approximately half of this grant is emergency assistance, and has only general relation to the special program. The remainder of the grant made possible the summer colloquium in quantitative biology. This particular summer's colloquium was directed towards the problem of growth and development.	

University of Chicago .....	\$ 11,750
University of Michigan .....	8,800
McGill University .....	10,000
Harvard University - Massachusetts Inst. 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. At Chicago, under the direction of Drs. Hogness and Koch, such methods are being applied to hormone and other studies. At Michigan, under Prof. O.S. Duffendack of the Dept. of Physics, Dr. L.H. Newburgh (Prof. of Int. Med.), and Dr. F.H. Wiley (Research Chemist of the Medical School) such methods are being applied to the rapid and accurate determination of magnesium, sodium, potassium and calcium in urine. At McGill under the direction of Prof. J.S. Foster (Dept. of Physics) and Drs. W.V. Cone and C.K. Russell (Dept. of Neurology) such methods are being applied to the determination of lead in spinal fluid. At Harvard and Massachusetts Institute of Technology, under the direction of Prof. G.R. Harrison (Director for experimental physics at MIT) and Dr. Kenneth D. Blackfan (of the Medical School at Harvard) such methods are being applied to the study of the blood of anemic children.

New York State College of Agriculture at Cornell Univ.	5,000
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Toward the support, over a 5-year period, of the "maize genetics clearing house" located at Cornell and directed by Prof. R.A. Emerson. This organization acts as a clearing house for names and symbols of maize genes, collects and distributes summaries of linkage data and other important information, serves as a repository for collecting, storing and disseminating seed stocks, and raises all such stocks at Cornell to insure against loss of valuable new races.

American Society of Naturalists .....	9,000
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Toward the support, over a 5-year period, of a Drosophila Stock Center at Cold Spring Harbor under the direction of Dr. H. Demerec. The service rendered by this center is closely comparable to that, described just above, which Dr. Emerson's group furnished for maize geneticists.

University of Michigan .....\$ 5,000

The Department of Physiology of the Medical School of the University of Michigan, under the leadership of Prof. R. Gesell, has concentrated its research largely upon the fundamental factors involved in the control of respiration. This department has excellent physical facilities, but cuts in the budget and the resultant dropping of research assistants has seriously crippled their research activity. This grant provides, for a period of one year, full-time research assistants.

Stanford University ..... 10,000

For the support, over one year, of investigations on the effects of irradiation and other chemophysical agents on unicellular organisms under the direction of Prof. C.V. Taylor.

Washington University ..... 58,500

For investigative work in nerve physiology over a 5-year period. This program is under the primary direction of Dr. G.H. Bishop with the close collaboration of Erlanger and others in physiology, Ranzoni in biochemistry, Bartley in psychology, Hembesker in neurosurgery, O'Leary in neuro-anatomy.

University of Iowa ..... 10,000

For the support, over a 1-year period, of investigations on the physiology of the normal cell under the direction of Prof. J.H. Bodine. This grant provides for necessary apparatus and supplies, as well as for the salaries of assistants. A renewal of this grant is indicated at a considerably lower level.

Columbia University ..... 5,000

University of Rochester ..... 3,300

University of Wisconsin ..... 4,000

These three grants are strictly within the program of the National Research Council Committee for Research in Problems of Sex, but the grants have been made directly from the Foundation largely for administrative reasons. The Columbia grant is in support of the researches of Drs. P.<sup>B</sup>. Smith and E.T. Engle, the Rochester grant for the researches of Dr. G.W. Corner, and the Wisconsin grant for researches carried on under the direction of L.J. Cole and F.L. Hisaw.

Columbia University ..... \$ 22,500

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 isotopes of hydrogen. This program is under the direction of Prof. H.C.Urey, the experimental discoverer of heavy hydrogen. The various biological projects are under the direction of H.D. Sherman (Prof. of Chemistry), Gary N. Calkins (Prof. of Protozoology), Sam F. Trelease (Prof. of Botany) and Hans T. Clarke (Prof. of Biochemistry).

University of Upsala ..... 11,000

Toward the support for one year of the researches of Prof. The Svedberg and his associates. Prof. Svedberg is applying ultra-centrifuge methods to the study of the physico-chemical properties of proteins, enzymes, etc. This grant will make possible an extension of his program to the study of double refraction under enormously great magnetic fields and to the study of dielectric properties of the heavy molecules in question.