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SUMMARY STATEMENT OF THE ACTIVITIES OF THE NATIONAL RESEARCH COUNCIL, 1938–39

By Dr. ROSS G. HARRISON
CHAIRMAN

and

Dr. ALBERT L. BARROWS
EXECUTIVE SECRETARY

INDUSTRIAL RESEARCH

MUCH of the attention of the National Research Council has been directed during the past year, based upon the culmination of previous interests, to various aspects of the function of research in industry. Large as are the expenditures for research in scientific institutions and in universities, the traditional seat of the quest of knowledge, and for research by the agencies of government, necessary in connection with their administrative and regulatory functions and service to the public, probably both of these together are now nearly equaled by the expenditures for research by industry. Moreover, if the amounts appropriated by the government for research in agricultural and engineering fields were added to the amounts directed to research in private industry, by far the greater amount of money expended at present for scientific work in this country would be found to be devoted to the applied sciences. Although mere expenditures of money are an imperfect criterion for real values, they are nevertheless indicative in these cases of the avidity with which knowledge is being sought after and increased for man's direct profit and advantage.

These trends are reflected in some of the activities of the Council. During the past year the Division of Engineering and Industrial Research of the Council

has been reorganized with particular view to bringing the resources of industrial research into more effective touch with emergency needs of the Government. An Industrial Research Institute has also been organized under auspices of this division of the Council to study problems relating to the organization of research for industrial uses, mainly in manufacturing. The Council published last winter the sixth edition of a directory of industrial research laboratories of the United States, listing some 1,769 such laboratories. A study of the physiological, psychological and social effects of working conditions upon employees in industry has also been carried on for the past two years.

Last spring the National Resources Committee requested the National Research Council to undertake a study of research in industry in the nature of an appraisal of the scientific resources and interests represented. This is for the purpose of knowing more clearly than we do now how extensively industry has come to depend on the rational application and development of scientific knowledge, the trends of progress of the scientific industries, the range and capacity of industrial laboratories for scientific work and the ways in which science and technology are influencing or affecting human welfare through the utilization of human labor in industry and through the manufacture of useful products and the rendering of convenient services.

FELLOWSHIPS

The post-doctorate fellowships of the Council, supported by funds provided by the Rockefeller Foundation, are now administered by two boards, one for the medical sciences and one for the natural sciences. The Medical Board at its meeting early last spring made nine new appointments and three reappointments out of a total of 77 applications considered. These appointments are for twelve months at stipends ranging from $1,600 to $2,300 for the year. In the natural sciences 155 applications were considered by the Board and 24 appointments were made, including one reappointment. These are at annual stipends ranging from $1,600 to $2,000.

In reviewing recently the course of the administration of these fellowships during the past twenty years, the National Research Fellowships Board in the Natural Sciences has felt that distinct changes have occurred in the educational situation, in conditions of professional employment and in the progress of research during this period, and that changes should accordingly be made in the administration of these fellowships as a stimulus and aid to the advancement of science. Among changes adopted in its policies, the most significant perhaps are the intention of the board to make its future appointments, as a rule, from applicants who have taken the doctor's degree a year or more before applying for a fellowship and to reappoint fellows for a second year less frequently than heretofore. The basic annual stipend for fellowships in the natural sciences will be increased from $1,600 to $2,000 (effective for 1940–41). The Board has also advanced the date of announcement of fellowship appointments to about March 15 instead of May 1, beginning with 1940, and correspondingly the closing date for the receipt of applications has been changed from February 1 to December 15.

During the past year the Board offered a plan for participating fellowships in cooperation with universities. This plan received some expressions of interest, but in the particular cases considered it was not possible to put the plan into operation. Under this plan the Board will contribute one half of an annual compensation of $2,000, to be matched by a similar contribution from the university. The fellow, jointly appointed, will have approximately one half of his time free for research, but will be expected to devote the other half of his time to university duties. For the coming year the Board intends to repeat its offer of cooperation with universities in this way.

SCIENTIFIC AIDS TO LEARNING

For the past two years a committee of the Council on scientific aids to learning has been engaged in directing studies upon the utilization of recent technological achievements in motion pictures, radio, photography, sound recording and reproduction, and other devices for aid in the process of learning in the schools. These studies have been supported generously by the Carnegie Corporation of New York. The program of the committee includes over forty projects of investigation which have been undertaken with the assistance of specially engaged investigators in some cases or with the cooperation of institutions and individuals interested in the matter. Several of these projects are concerned with the utilization of sound recording in public school teaching, as, for instance, in courses in speech, in English drama and in general science; with the possible classroom usefulness of sound slide films; and with the selection and improvement of instruments for the reproduction of visual and auditory material. The committee has been instrumental in arranging assistance to scholars requiring the development of instruments for the handling of large masses of data. Its interest in promoting the scholarly uses of microfilm has led to the setting up of a study of the whole problem of visual fatigue.

Results of the visual fatigue study should have an important bearing upon the use of the eyes in many occupations and skills and in general reading as well as in the narrower field of microfilm. For its orientation in the matter of visual fatigue, the Council ar-

ranged for a conference (on May 20 and 21, 1939) to consider the several aspects of the problem and to develop information essential to a program of investigations leading to a clearer recognition of the conditions which bring on excessive fatigue of the eyes. An advisory committee, the personnel of which includes physicists, psychologists, ophthalmologists and physiologists, is setting up a program of study for this purpose.

Several reports have been published for the Committee, which maintains offices in its own name (Committee on Scientific Aids to Learning) at 41 East 42d Street, New York City. These include:

Reports on the Reading of Microfilm.

The Present Status of Equipment and Supplies for Microphotography.

Auditory Aids in the Classroom.

The Possibility of Improving Documentation in Research Centers by Microfilming.

Eye Fatigue in the Reading of Microfilm.

Local Broadcasts to Schools.

Broadcast Receivers and Phonographs for Classroom Use.

AMERICAN GEOPHYSICAL UNION

The twentieth annual meeting of the American Geophysical Union was held in Washington, D. C., from April 26 to 29, 1939. Regional meetings of the Section of Hydrology were held in Los Angeles on December 16 and 17, 1938, and in Spokane on December 28, 1938. The *Transactions* of these meetings have recently been published in four parts, totalling 740 pages.

The American Geophysical Union was also engaged during the past year in preparations for the seventh triennial general assembly of the International Union of Geodesy and Geophysics, which was held in Washington, D. C., during the period from September 4 to 15, 1939. The invitations for this assembly had been extended through the National Research Council to the Union at its meeting in Edinburgh in 1936. The funds to cover necessary expenses were contributed in approximately equal shares by (1) the Federal Government, (2) the Carnegie Corporation of New York, (3) the Geological Society of America, (4) the National Research Council and (5) the members and friends of the American Geophysical Union.

The registered attendance at this general assembly of the International Union was 546, including delegates and guests from 23 of the 34 countries adhering to and from three countries not adhering to the Union. Over 300 papers were presented and discussed at this meeting, and a large number of national reports on earth physics and of additional papers were recorded in the program, to be published later in the *Transactions* of the assembly and of the seven individual associations of the Union. Although the increasing tenseness of the international situation in Europe during the weeks just before the meeting and the eventual outbreak of war prevented many delegates from attending from abroad or from remaining for the assembly after reaching the United States, the program was carried through in its entirety.

SIXTH PACIFIC SCIENCE CONGRESS

Much of the attention of the Council during the past year has been devoted to the preparations for the sixth Pacific Science Congress, with assistance from a Pacific Coast committee on arrangements. The congress was held between the dates July 24 and August 12, 1939, with sessions on the campus of the University of California and of Stanford University, and at Pacific House on the grounds of the Golden Gate International Exposition. The registered attendance was about five hundred, and over 700 papers were included in the program. These papers will be published during the coming year in the *Proceedings* of the congress. While most of the attendants at the congress were from the United States, representatives were included from some thirty countries of the Pacific region and of European countries having colonies in the Pacific.

In the absence in the Orient of international congresses in special fields which occur so frequently in Europe, this series of Pacific Science Congresses, of which the first was held in Honolulu in 1920, represents the coordinated interests of scientific men in all parts of the Pacific area in problems of that region in a number of the major fields of science. These include, for example, the relationships of land masses, the lines of volcanic and seismic activity, the courses of the ocean currents, the meteorology of the region as a whole, its plant and animal migrations, the movements of its peoples, its biological and mineral resources and the distribution of disease. Vast as the region is, the scientific problems of its various parts can be seen as closely related, and those of one field of science as bearing significantly upon those of another. For these reasons this series of congresses with their wide range of discussion has been found to be of great value. The seventh congress of this series has been announced to be held in Manila in 1943.

WASHINGTON BIOPHYSICAL INSTITUTE

For the purpose of stimulating the adaptation of the methods of physics to biological research, and also for the encouragement of quantitative studies of the physical aspects of the functioning of the plant and animal organisms, the Rockefeller Foundation has given to the Council a generous appropriation to be available over the five-year period ending June 30, 1942. The use of this fund is in charge of an agency organized in 1934

and termed the Washington Biophysical Institute, which operates as a committee of the Council.

The value of this institute lies in the fact that it provides a means through which the interests of university physicists and biologists implemented by the appropriation of special funds can be coordinated with the interests and facilities of governmental agencies in this field. The work is conducted in the laboratories of the National Institute of Health in Bethesda, Maryland. The facilities of the National Bureau of Standards are available for the construction and testing of apparatus. A staff of several investigators and instrument makers is maintained responsible directly to the Biophysical Institute, but having access to the large facilities of these two government laboratories.

The main program of the institute is the investigation of biological substances by photochemical methods. Sterol and bile acid derivatives have been selected for these studies because they afford a rich source through body processes for derivative substances of great biological importance. The work, it is hoped, will throw light upon the origin in the animal body of such substances as antirachitic vitamins, hormones and muscle stimulants as well as the possible formation of carcinogenic substances.

In connection with this research a large number of pieces of special apparatus have been designed and constructed by the staff of the institute in collaboration with the associated government bureaus, including monochromators to produce light of known and controllable quality, self-recording spectrographs in visible, infra-red and ultra-violet light, as well as photocell detectors and integrators for specific regions of the spectrum.

The Washington Biophysical Institute has initiated a number of lines of work which have already found a continuing place in government research, including studies of genetic and lethal action of ultra-violet, photosensitized action of visible radiation, isotopic tracing and the development of spectrocytology by means of the ultra-violet microscope. The institute looks forward to the development of services which it is hoped will be of general value in biophysical research.

Narcotics Research

The program of research on the chemistry and pharmacology of narcotic drugs which the Council undertook in 1929, through its Committee on Drug Addiction, has undergone a transition during the past year. The chemical and pharmacological studies, which have been pursued at the University of Virginia and at the University of Michigan since the beginning of the committee's work, are now being carried on as a major part of the program of chemotherapy investigations of the United States Public Health Service at the National Institute of Health. The Committee on Drug Addiction is acting as an advisory committee to the Public Health Service in the continuation of this work. It is also pushing ahead the clinical program which was undertaken as the necessary corollary to the chemical and pharmacological studies. A publication of the Public Health Service issued last fall[1] summarizes the results obtained during the course of the committee's work, "with special reference to the chemical structure of opium derivatives and allied synthetic substances and their physiologic action."

The problem of the committee has been to produce a substance of high analgesic properties with a minimum of euphoric characteristics, which on this account would be a more nearly ideal drug than the present derivatives of opium. Although the ideal drug has not been found, nor as yet a substance which can be unqualifiedly recommended as a substitute for morphine, much has been learned fundamentally concerning the chemistry of alkaloids and methods for testing their physiologic effects. Through the cooperation of hospitals not only for the treatment of drug addiction itself but also for the treatment of tuberculosis and cancer as well, certain of the substances, numbering over 400, which have been produced by the chemists have been or are being tested therapeutically, and there is some indication that a better drug than morphine may result from this work.

Whereas, when this work was initiated, only one or two American chemists were interested in alkaloid chemistry, now a corps of highly competent investigators has been developed in this field. Also, a procedure for patenting new narcotic substances and for providing the necessary control over them has been devised for the benefit of the public, and a pattern for successful cooperation among university groups, industrial laboratories and governmental scientific and control agencies.

Research in Problems of Sex

For the current academic year the Committee for Research in Problems of Sex has made eighteen research grants, totalling $57,080, to collaborators located at fifteen institutions, continuing in the main investigations which it has been supporting for some years with funds furnished by the Rockefeller Foundation for the purpose. The Committee "was appointed eighteen years ago because of our ignorance concerning phenomena of sex and reproduction and the prevalence of prejudice against inquiry into sexual phenomena. The primary purpose, as originally conceived and recognized in policy, was the furtherance of the study of fundamental phenomena of sex. In the last two decades progress in the field of interest of the committee has been rapid, and the current

[1] Supplement No. 138 to the Public Health Reports.

research situation is radically different from that which it originally faced. Inquiry has become much more varied; endocrinology has developed remarkably; psychobiology has discovered new ways of investigating, and of using investigatively, aspects of sexual behavior." The committee has, accordingly, changed the direction of the support which it has been giving, and five years ago decided that the fields of endocrinology and of hormonal reactions needed but little further assistance on its part. In the less well-developed fields of research relating to sexual phenomena to which the committee has since turned its principal attention are the neurological and psychobiological problems of sex, and among the grants made by the committee for the current year about as many grants have been made in these fields as for general physiological problems. A second edition of the volume "Sex and Internal Secretions," edited by Dr. Edgar Allen, of Yale University, was published last spring.

ENDOCRINOLOGY

The Committee on Research in Endocrinology has continued the program of coordinated research in this field which it inaugurated in 1937. Its program is adjusted with that of the Committee for Research in Problems of Sex by including the operation of gonadal factors on bodily processes in the general range of endocrinology, but omitting problems dealing directly with sex and reproduction, and the procedure followed by this committee is similar to that of the Committee for Research in Problems of Sex. For the current year (1939–40) twenty-nine grants have been made, totalling $54,300, from funds provided by the John and Mary R. Markle Foundation, carrying forward most of the investigations which were supported last year. These covered problems concerning neoplasia and internal secretions, the relation of endocrines to old age, carbohydrate metabolism and diabetes, the pituitary or "master-gland" of the body, endocrine control of gastro-intestinal functions, lactation, water and salt metabolism, changes in organs with diet and growth and methods of testing for endocrine secretions.

RADIATION

With the termination of funds this summer the program of investigations which the Committee on Radiation has been conducting for the past eleven years upon the biological effects of various forms of physical emanations has been brought to a close. The resources of the committee, generously furnished in funds by the General Education Board, the Commonwealth Fund, the Rockefeller Foundation and through the contribution or loan of apparatus and supplies by a considerable number of manufacturers, have been devoted during this period to the application of new techniques to the old biological problems of modifiability and inheritance. These new methods have opened up large new fields of experimentation in genetics and its relation to evolution, and there are now many agencies and many investigators engaged upon these problems.

The trend of present work in this field includes the mechanism by which radiations influence the development, the morphology, the cytology and the genetics of organisms, and especially the effects of different wavelengths of emanation, the photosynthesis of hormone reactions in plants, radiosensitivity of tissues, photodynamic reactions and more recently the action of neutrons on living cells, the use of artificially radioactive substances in tracing the metabolism of minerals in the animal body and the mechanism of the process of the recovery of cells after injury by various forms of radiation. This committee has thus been supporting by means of grants and the loan of apparatus to collaborators in a large number of institutions work which is similar to that which the Washington Biophysical Institute is conducting directly in a portion of this field in cooperation with government laboratories.

OTHER ACTIVITIES OF THE COUNCIL

It is not possible to refer in this brief report to all the current activities of the Council. These will be covered in the regular annual report to be published later. A word, however, may be said here about some of these developments, as follows:

Two monographs have recently been issued (through a commercial publisher), VII. "Internal Constitution of the Earth" and VIII. "Terrestrial Magnetism and Electricity," in the series of monographs on "The Physics of the Earth," which have been published by the Council since 1931.

In addition to the *Proceedings* of the eighteenth annual meeting of the Highway Research Board last fall, the Board has issued this year: (1) A discussion of rural traffic problems (mimeographed); (2) a résumé of contributions at the annual meeting concerning roadside improvement; (3) a census of highway research in progress (mimeographed); (4) a volume on "Soil Mechanics and Soil Stabilization."

Annual meetings of a committee on electrical insulation held some years ago have expanded to the proportions of two-day conferences for the presentation and discussion of technical papers, the eleventh having been held in Pittsburgh last November with an attendance of over one hundred electrical engineers and university physicists.

The Third Report of the Council's Committee on Catalysis, reviewing advances in this field since 1930, was issued last summer. Arrangements have also been made for the publication (commercially) of a catalogue of ring systems used in organic chemistry, which has been under compilation for a number of years and

now presents diagrams and formulae for some four thousand organic substances.

A symposium of contributions on processes of geologic sedimentation prepared under auspices of a committee of the Council has been published by the American Association of Petroleum Geologists. Arrangements are also being made for the commercial publication of a "Symposium on Some Relations of Structural Features to Ore Deposition."

The Council has subscribed for a table at the Naples Zoological Station, which is at the disposal of American zoologists on request. Committees of the Council have prepared programs of investigation on the biological processes of aging and for studies of inheritance in man.

A committee of the Council's Division of Anthropology and Psychology has advised in recent years in the conduct of archeological excavations made in the Tennessee Valley in areas to be inundated by the building of power dams, and the division has also been requested to advise the Work Projects Administration in regard to basic problems of American archeology. A second edition of an international directory of anthropologists is now in preparation.

Among other new undertakings of the Council, as represented by the appointment of committees during the year, are the following:

The application of x-rays to physics and chemistry, and the use of spectroscopy in analytical chemistry.

The compilation of thermochemical data for the chemical industries.

The technology of organic plastics.

The organization of basic geographic data and the development of new techniques for geographical research.

The construction of a Pleistocene glacial map for North America.

The importance of breeding pure-line strains of animals for scientific purposes.

International Scientific Meetings

The Council has been represented at international scientific congresses abroad as follows:

15th International Geographical Congress and General Assembly of the International Geographical Union, Amsterdam, July 18–28, 1938 (at which cartography in the United States was represented by an extensive exhibit); 4 representatives.

6th General Assembly of the International Astronomical Union, Stockholm, August 3–10, 1938; 6 representatives.

6th General Assembly of the International Scientific Radio Union, Venice, September 5–15, 1938; 5 representatives.

7th International Congress of Genetics, Edinburgh, August 23–30, 1939; 5 representatives.

AWARD OF THE MEDALS OF THE ROYAL SOCIETY[1]

By Sir WILLIAM BRAGG

THE Copley Medal has been awarded to Professor Thomas Hunt Morgan.

In those branches of biology which are called botany and zoology the most important advance during the present century has been the development of genetics. The establishment of definite laws of heredity, and the discovery of the mechanism, the gene, by which hereditary qualities are carried on from generation to generation, has revolutionized our outlook on the function of the nucleus of the cell and of the chromosomes it contains; it has enabled us to understand the significance of the maturation of the germ cells and of fertilization as they occur in higher animals and plants, and thus led to a very rapid development of nuclear cytology. The theory of the gene has given us a new outlook on the determination of the development of an animal or plant. But nowhere has genetics produced greater changes than in our attitude to evolution. The observation that mutations arise *de novo* at a definite rate, that the number of different mutations occurring in a single species may be very large and that the mutations in allied species are essentially identical, have shown us for the first time the materials which are available as a basis for evolutionary change. The quantitative nature of genetics has made it possible to examine the effects which result after many generations from the establishment of a community by a few individuals of different hereditary composition, and to estimate the effect of a definite advantage attaching to one particular quality on the ultimate composition of a population. It has thus put the theory of natural selection on a sound theoretical basis. Furthermore, it has enabled us to observe indirectly the effects of natural selection in wild populations, and to plan experiments to determine its effects.

The practical applications of genetics are as important as its influence on theory. The whole of the breeding of many cultivated plants, including maize, is now firmly based, and the process of improvement immensely hastened by cytological examination. Genetics is already influencing animal breeding, and in its modern developments is throwing much light on the possi-

[1] From the address of the president at the anniversary meeting, November 30, 1939.