I. GENERAL ORGANIZATION AND ACTIVITIES

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THE origin of the National Research Council lies in an offer which the National Academy of Sciences made of its services to President Wilson following the spring meeting of the Academy in 1916, when it was seen that the United States would probably become involved in the world war. The services offered by the Academy were for the coordination of the non-governmental scientific and technical resources of the country with the military and naval agencies of the Government, in the interests of national security and preparedness for the emergency which this country was then facing. A similar crisis had, in fact, brought about the organization of the National Academy for the assistance of the Government in 1863.

President Wilson at once accepted this offer, and at his request the Academy organized a central committee which it called the "National Research Council." This committee set up a number of special technical committees on various problems involved in the mobilization of the scientific and technical resources of the country. During the ensuing two years the National Research Council was engaged largely in the service of the Federal Government, acting as the Department of Science and Research of the Council of National Defense, and also as the Science and Research Division of the Signal Corps of the Army, and in cooperative relationship with other branches of the Government to meet its military and naval needs.

By the close of the war the recognition of the valuable services which such an organization might continuously render to the country under peace conditions had become apparent. This was particularly appreciated in view of the "new and important possibilities . . . opened through the heavy demands upon science and research which had arisen through the exceptional necessities brought about by the war." Accordingly, President Wilson issued an executive order on May 18, 1918, requesting the National Academy to perpetuate the National Research Council. The purpose of the Council is expressed in its Articles of Organization as follows:

> It shall be the purpose of the National Research Council to promote research in the mathematical, physical, and biological sciences, and in the application of these sciences to engineering, agriculture, medicine, and other useful arts, with the object of increasing knowledge, of strengthening the national defense, and of contributing in other ways to the public welfare, as expressed in the Executive Order of May 11, 1918.

During the early part of 1919 the Research Council was reorganized by the Academy on a permanent basis centering around an executive board of some 44 members as a central governing body, with certain additional general committees called divisions, representing the major fields of interest of the Council. The number of these divisions is now eleven, four of them representing general relationships of the Council with the Federal Government, with international scientific organizations, with educational institutions and with scientific agencies of the state governments. The divisions of science and technology number seven, including the physical sciences, engineering and industrial research, chemistry and chemical technology, geology and geography, the medical sciences, biology and agriculture, and anthropology and psychology. The membership of these several divisions ranges in number from 18 to 44. The Council also maintains a research information service for the organization of general data and for assistance in locating sources of information.

The reorganization of the National Research Council in 1919 further provided for the enlistment of the cooperation of research men throughout the country, by inviting the national technical and scientific societies of the United States to designate representatives in the membership of the Council. In the seven divisions of science and technology these society representatives constitute the majority of the divisional membership. Each division also contains in addition a limited number of members-at-large, selected by the division. At present 79 societies are affiliated with the National Research Council in this way. The total number of members of the Council in its executive board and in its divisions is this year 285. The administrative and technical committees through which the Council conducts most of its operations number 135, and include 888 members in addition to the officers and members of the Council, making a body of 1,173 scientific men directly related to the Council, besides a large number of other collaborators in its various undertakings.

The chairmen of the Council and the chairmen of its executive board, since the inception of the Council, have been:

George E. Hale,	1916–1919
John J. Carty,	1916–1918
James R. Angell,	1919–1920
H. A. Bumstead,	1920
John C. Merriam,	1921–1923
Gano Dunn,	1923–1928
George K. Burgess,	1928–1932
William H. Howell,	1932–1933

The office of secretary, executive secretary or permanent secretary of the Council during this period has been filled by:

Cary D. Hutchinson,	1916–1918
John Johnston,	1918–1919
A. O. Leuschner,	1919
Vernon Kellogg,	1919–1931

In addition to relating the National Research Council to the national research societies of the country, the reorganization of the Council in 1919 provided in each of its divisions of science and technology for an active leader as the chairman of the division. Each division chairman during his term of office has given his major attention to the promotion of the projects sponsored by his division, with the constant assistance of an executive committee which has met with him at stated intervals. This leadership, supported by the extensive relationships afforded through the membership of the divisions and by other facilities offered by the Council, has been the unique feature in its organization.

During the past year the Research Council has been giving particular study to the problem of its organization and relationships in the light of its experience in the past thirteen years. Certain changes, principally in the direction of economy of organization, which are to be put into effect next year, will, it is hoped, result in a simplification of its administration and in an increased effectiveness.

The financial resources of the Council came from various sources during the war years, but largely from the Engineering Foundation and from the Federal Government. Subsequently, the Council has been supported in its general administration wholly from private sources and mainly on the income from an endowment provided by the Carnegie Corporation of New York. Of the original gift of $5,000,000 from the Carnegie Corporation, about one third was taken for the erection of a building in Washington, D. C., to service as headquarters for the National Academy of Sciences and for the National Research Council.

In addition to its income from endowment, which is used mainly for administrative expenses, the Council among its other activities administers funds placed in its hands for special research purposes. These funds in recent years have totalled about $800,000 annually. The purposes for which they have been used include (1) the maintenance of research fellowships, (2) the support of coordinated programs of cooperative research through the allotment of grants to collaborators in these projects, (3) the awarding of individual grants in support of research, and (4) the administration of the funds of independent scientific bodies without the assumption, however, of responsibility for their work.

One of the most important of the undertakings of the Council has been the administration of three series of post-doctorate fellowships in physics, chemistry and mathematics, in the medical sciences and in the biological sciences, including anthropology and psychology and the fundamental aspects of forestry and agriculture. These fellowships are supported on funds furnished by the Rockefeller Foundation, and, in the earlier years of the series of medical fellowships, by the General Education Board also. The purpose of these fellowships is to give promising investigators at the beginning of their careers additional years of training and experience in research. At present about 140 appointments are made annually at basic stipends of from $1,600 to $1,800 per year, with additional allowances for dependents. Some of these fellows are appointed to study abroad. Altogether about 850 fellows have been appointed, about one third of the total number of applications. Of the 700 or more past fellows approximately four fifths now hold positions in educational institutions.

For the past three years the Council has also had the administration of a research aid fund for the assistance mainly of individual research. During this time 375 grants have been made to individuals and 19 grants for conferences and other general research purposes. The total amounts thus granted is $250,-775.01.

Among other general undertakings the Council has sponsored the publication of the "International Critical Tables of Numerical Data of Physics, Chemistry and Technology," in seven volumes, with a comprehensive index now in the course of preparation. The Council has also given its assistance to the collection of funds in this country for the publication in Paris of the "Annual Tables of Numerical Data of Chemistry, Physics, Biology and Technology." At the request of the trustees of the Chicago "Century of Progress" Exposition, the Council organized a group of committees in 1929 and 1930 to advise the trustees in regard to certain aspects of the plans for the scientific exhibits at this exposition. The Council has acted as the fiscal agent for the Tropical Plant Research Foundation, for the Crop Protection Institute and for the Commission on Standardization of Biological Stains in the early years of these organizations, and still administers the editorial funds for the "Biological Abstracts." The Council has also supported the work of the American Geophysical Union, which is the principal coordinating agency in the United States for research in geodesy, oceanography and related subjects.

In addition to the material support of research, represented by the research funds administered by the Council, largely through committees of the divisions

of the Council, other special committees of the divisions have sponsored a wide variety of enterprises which require not so much funds as other forms of assistance. These enterprises have included the encouragement of research through the coordination of investigations in certain fields, the preparation of surveys of the conditions of research in special subjects, and the holding of conferences for the discussion of the current status of research in problems of large scope. The chairmen of divisions have themselves undertaken special studies of conditions affecting the course of research in their respective fields. A long series of publications has been issued in a *Bulletin* and a *Reprint and Circular Series*, consisting of reports of committees of the Council and the reissue of timely articles in various fields of scientific research. Several books have been prepared under auspices of committees of the Council and have been issued through commercial publishers.

"The primary function of the Council is the promotion of research in the United States; . . . it justifies its existence not through the maintenance of an organization but solely through the definite projects which that organization is maintaining and promoting." With this object in view the Council has functioned as an agency through which many cooperative undertakings have been initiated. It has furnished auspices under which scientific men have acted by a wide variety of means for the encouragement of research. By virtue of its organization and its affiliations it has been in position, also, in many cases, to bring together the workers and the benefactors of science in a common endeavor to promote the advancement of knowledge. Whatever has been accomplished, however, in the support of research has been possible mainly because of the personal contributions of the large body of American scientific men associated with the Council, who have collaborated in these enterprises and have given generously to them of their time and effort. The Council relies upon this cooperation from the scientific men of the country for the successful operation of the mechanism which has been set up.

II. DIVISION OF PHYSICAL SCIENCES[1]

By Professor F. K. RICHTMYER
CHAIRMAN

THE Division of Physical Sciences of the National Research Council, formally organized May 1, 1919, was the natural outgrowth of the activities of the Physics Committee and later the Division of Physics, Mathematics, Astronomy and Geophysics of the Council, and also of the Science and Research Division of the Signal Corps, which rendered important research services during the war. For perhaps the first time, it was realized that, in addition to direct results, the indirect benefits of directed cooperative effort among scientists was very great. The men who sponsored the Division of Physical Sciences had all seen war service in one way or another, but the organization of the division which they set up and the program of activities which they initiated were directed toward the peace-time development of the sciences of physics, mathematics and astronomy. Accordingly, "the primary object of the Division is to stimulate and to facilitate research in the various related sciences grouped in the Division."

Two methods were adopted to accomplish this purpose. First, the Division was so organized as to bring together in its organization men in the different sciences and geographically separated—it being believed that such association would promote better acquaintance and would pave the way for spontaneous cooperation. Second, the policy was adopted of setting up research committees to survey and summarize research in various fields and to prepare short monographs which should be "distributed to all scientists in the group . . . to put the readers *au courant* with the present state of the science as regards the subject of the monograph." A third method was soon added. The Rockefeller Foundation generously provided support for the now well-known National Research Fellowships in physics (including astronomy), chemistry and mathematics. And the Division of Physical Sciences was asked to organize and to sponsor a fellowship board to administer these fellowships.

The organization of the division provided for a chairman, vice-chairman, members-at-large and representatives from each of the several national societies in the fields of science included within the division. During the past several years the division has contained twenty-one members, of which three are members-at-large and seventeen represent the following societies: American Astronomical Society, Acoustical Society of America, American Mathematical Society, American Physical Society, Mathematical Association of America and the Optical Society of America. Meetings of the division are held annually to discuss matters of general policy, work of the preceding year and plans for future activities.

It will be not without interest to record the names

[1] This is the second of a series of ten articles prepared to describe briefly the nature of the activities with which the National Research Council has been engaged during the past fourteen years.