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.

of those who have served as chairmen of the division since its organization:

1918–1919—R. A. Millikan
1919–1920—C. E. Mendenhall
1920–1921—Augustus Trowbridge
1921–1922—Henry G. Gale
1922–1923—William Duane
1923–1924—Oswald Veblen
1924–1927—Joseph S. Ames
1927–1930—Dayton C. Miller
1930–1933—F. K. Richtmyer

Since 1919, there have been associated with the division as officers, or members, or as members of research committees, altogether some 355 *different* persons. Many of these persons, through their connection with the division in one way or another, have become mindful of the value of cooperative support of research, as well as of the latent possibilities of the service which such an organization as the National Research Council can render. These contacts have tended to emphasize the community of interest which scientists have in the promotion and general well-being of science as a whole.

Recognizing the importance of these indirect influences, the division has not thought it wise to undertake a great variety of activities in the promotion of research in physics, mathematics and astronomy. Rather, the efforts of the division have been concentrated on the formation of various research committees to survey and to report upon timely research topics, whenever such a survey would seem to serve a useful purpose.

Since the organization of the division in 1919 there have been appointed a total of thirty-eight research committees in such subjects as: Acoustics, Algebraic Numbers, Analysis Situs, Atomic Structure, Celestial Mechanics, Electrodynamics of Moving Media, Hydrodynamics, Line Spectra of the Elements, Luminescence, Numerical Integration, Photo-Electricity, Physics of the Earth with various subsidiary committees, Quantum Theory, Radiation in Gases, Theories of Magnetism, X-rays and Radioactivity, X-ray Spectra and many others. Of these committees, seven are still active. A large proportion of the remainder, having completed the reports for the preparation of which they were appointed, has been discontinued.

In addition to numerous articles in current scientific periodicals, reports to the number of thirty-three prepared by these committees have been published or are in press as bulletins of the National Research Council. These bulletins have ranged from pamphlets of forty or fifty pages up to large volumes of several hundred pages. They are sold at cost of manufacture. The subjects covered are varied; to mention only a few: The Quantum Theory (1920); Problems of X-ray Emission (1920); The Present Status of the Atomic Problem (1921); Certain Problems of Acoustics (1922); The Present Status of Visual Science (1922); Algebraic Numbers (1923); Critical Potentials (1924); Radioactivity (1925), reprinted (1929); Quantum Principles of Line Spectra (1926), reprinted (1928); Molecular Spectra in Gases (1926), reprinted (1930); Hydrodynamics (1932).

As illustrative of the service which the division is rendering in the preparation of these monographs, special mention should be made of the Committee on the Physics of the Earth, organized by Dr. Joseph S. Ames during his term as chairman. This committee, with a total membership of approximately 100 physicists, chemists, geologists, geophysicists and others, is divided into nine subcommittees as follows: The Figure of the Earth; Age of the Earth; Meteorology; Oceanography, Volcanology; Seismology; Internal Constitution of the Earth; Terrestrial Magnetism and Electricity; and Field Methods for Detecting Unhomogeneities in the Earth's Crust. The first six of these subcommittees have completed their reports, and they have been published in the Bulletin Series of the National Research Council. Reports from the remainder are nearing completion. This group of bulletins is a noteworthy contribution to the literature of this important subject. Although intended to stimulate research in the general field of earth physics, the bulletins are nevertheless of particular interest to the general scientific reader, since for the most part they are written in non-technical language.

It is the purpose of the division to form new committees whenever work in any field of research would be furthered thereby. It has been felt that the research bulletins have been of special service to investigators in providing up-to-date surveys not otherwise available; and in suggesting new problems and lines of attack. Research, particularly in pure science, is most effectively carried on as a result of individual initiative, rather than by the organized parcelling out of problems. The division has never attempted to "organize" research.

In 1920 and 1922, the division received from the National Research Council a sum of $1,500 to initiate a revolving fund for the publication of mathematical books. It was the purpose of this fund to underwrite the publication of important mathematical books which could not find publication through commercial channels. To date three such books have been published by and from this fund. Royalties received have slightly exceeded expenditures.

In 1926 and 1928, the division received from the International Education Board a total sum of $20,000 in support of astronomical research surveys under the direction of Professor A. O. Leuschner.

As was mentioned above, the Fellowship Board in

Physics, Chemistry and Mathematics—the first of the three National Research Council Fellowship Boards now operative—was organized under the auspices of the division in 1919. The administration of these fellowships has been one of the chief activities, as well as one of the major accomplishments, of the division. The chairman of the division serves, *ex officio,* as the secretary of the board, which in addition to its chairman and secretary consists of ten members—three in physics, three in mathematics and four in chemistry, the last named including, *ex officio,* the chairman of the Division of Chemistry and Chemical Technology. The board meets once each year, in April, for the appointment of fellows for the ensuing year.

Appointments are for one year, and are offered only to those who have the Ph.D. or who have had equivalent training. A limited number of appointments are made for work abroad, but for the most part fellows work at the various universities and other research institutions in the United States and Canada. Appointments are frequently renewed for one year.

Since 1919 the Fellowship Board in Physics, Chemistry and Mathematics has considered upwards of 1,000 applications. In that period nearly 400 appointments have been made, over fifty of which have been for work abroad. At present there are sixty fellows active, of whom six are working abroad. In this period nearly $1,300,000 has been paid to fellows in stipends.

About 39 per cent. of appointments have been in chemistry, 39 per cent. in physics, and the remainder in mathematics.

Fellows have been appointed from (that is, have taken their respective Ph.D's in) some thirty-five different universities in America. While the larger proportion of fellows have come from the larger universities, a study of the distribution shows that the relative number of appointees from the several universities is roughly proportional to the number of Ph.D's conferred by each.

There is an equally wide distribution of institutions in which fellows have worked. Some thirty-two American and twenty-five foreign universities and research institutions have cooperated with the National Research Council in offering facilities to fellows to carry on research. In the aggregate this service which the various institutions have thereby rendered is very great indeed.

It was the original purpose of those who sponsored the fellowship program to provide the more able young scientists with opportunities to acquire "momentum" in research, before settling down to permanent positions. That this objective is being realized is at once evident from a consideration of the present location and activities of past fellows. Nearly 80 per cent. of past fellows hold positions in educational and similar research institutions, where not only are they continuing their researches, but they are in many cases leaders in promoting the research program of the institution. The remainder are connected with industrial or governmental institutions. *With very few exceptions, all past fellows are entering upon active research careers.* There are many who would heartily endorse the statement that had the National Research Council engaged in no activity other than the promotion and administration of the National Research Fellowships, its existence would have been justified.

The services of the Division of Physical Sciences have been utilized in providing a sponsorship for the American sections of several international unions. At present there are organized under the auspices of the division the American sections of, respectively, The International Astronomical Union, The International Scientific Radio Union and the International Union of Pure and Applied Physics.

Each of the several divisions of the National Research Council can be of most effective service by organizing and by engaging in activities so as most adequately to meet the needs of the particular group of sciences concerned, due regard being had for other agencies in the field, such as societies, research institutes, academies and the like. In common with other divisions, it is the policy of the Division of Physical Sciences to stand ready to be of service wherever and whenever such service can be best rendered, and to cooperate to the fullest extent with other agencies so as to avoid needless duplication of effort.

OBITUARY

MEMORIALS

A BRONZE tablet in memory of Josiah Royce was placed on April 9 by the Harvard Club of San Francisco in the library of his native city, Grass Valley. At the ceremony Rudolph Altrocchi, professor of Italian and chairman of the department of Italian, and now president of the Harvard Club of San Francisco, presided. A paper on Josiah Royce was read by Jacob Loewenberg, vice-president of the club and professor of philosophy in the University of California. Dr. Royce was professor of philosophy at Harvard University from 1882 until his death in 1916.

A BRONZE bust of Ernest Haeckel, the German nat-