The National Academy of Sciences and the National Research Council

Raymund L. Zwemer, *Executive Secretary*

THE NATIONAL ACADEMY OF SCIENCES has been from its origin closely associated with the American Association for the Advancement of Science, and both of them with the Smithsonian Institution, which was founded somewhat earlier "for the increase and diffusion of knowledge among men."

Just a hundred years ago the American Society of Geologists and Naturalists broadened its scope to become the American Association for the Advancement of Science, several members of which in turn were instrumental in helping to establish the National Academy of Sciences.

In connection with the Centennial Celebration of the AAAS it is interesting to note that 11 of the 15 presidents of the National Academy were also presidents of the AAAS, and, of the 97 presidents of the AAAS, 84 are on the rolls of the Academy.

It was at a meeting of the AAAS in 1851 that Alexander Dallas Bache, grandson of Benjamin Franklin, pointed out in his retiring presidential address that "an institution of science supplementary to existing ones is much needed in our country to guide public action in reference to scientific matters." A further quotation from this address is as pertinent today as it was then:

> Our country is making such rapid progress in material improvements that it is impossible for either the legislative or executive departments of our Government to avoid incidentally, if not directly, being involved in the decision of such questions. Without specification, it is easy to see that there are few applications of science which do not bear on the interests of commerce and navigation, naval or military concerns, the customs, the light-houses, the public lands, post-offices and post-roads, either directly or remotely. If all examination is refused, the good is confounded with the bad, and the Government may lose a most important advantage. If a decision is left to influence, or to imperfect knowledge, the worst consequences follow.
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> Such a body would supply a place not occupied by existing institutions, and which our own is, from its temporary and voluntary character, not able to supply.

Twelve years later, in February 1863, Joseph Henry, secretary of the Smithsonian Institution, Alexander Dallas Bache, superintendent of the Coast Survey, and Charles H. Davis, chief of the Bureau of Navigation, Navy Department, were named as a commission to report on various matters of science and art, but chiefly of a practical import and relating to the physical sciences. Davis' letter of appointment is preserved in the archives of the Navy Department. The members of this commission were active, in consultation with others, in forming a plan for a National Academy of Sciences which would have the dual nature of honoring members elected to the group and of serving as adviser to the Government. The plan culminated in an Act of Congress which was passed by the Senate and by the House of Representatives and signed by President Abraham Lincoln—all on Tuesday, March 3, 1863.

In carrying out subsequent requests of Federal government agencies for advice from the Academy, it was found that many problems required the combined action and thoughts of a specific group of people. Committees were therefore named, and a brief mention of some of these may be interesting as illustrations of the questions presented.

Advice was requested on weights, measures, and coinage. A committee on this subject is still in existence and has been called on from time to time. Other committees dealt with metric standards for the states; with philosophical and scientific apparatus; with protection of the bottoms of iron vessels; with magnetic deviation in iron ships; with the astronomical day, the solar eclipse of 1886, and the erection of a new naval observatory; and with questions on meteorological science and its application. The Department of State requested an Academy committee to look into the matter of restoration of the faded writing of the original manuscript of the Declaration of Independence. As a result of the report of this committee the manuscript was removed from exhibition in 1893, sealed between glass plates, and placed in a steel safe, where it was no longer exposed to light and was secure from careless handling.

The Department of Agriculture requested committees on silk culture and on sorghum sugar, which was suggested as a substitute for the then-scarce cane sugar.

The Department of the Interior in 1896 requested information on a rational forest policy for the forested lands of the United States. An official expression from the National Academy was requested upon the following points:

(1) Is it desirable and practicable to preserve from

fire and to maintain permanently as forested lands those portions of the public domain now bearing wood growth for the supply of timber?

(2) How far does the influence of forest upon climate, soil, and water conditions make desirable a policy of forest conservation in regions where the public domain is principally situated?

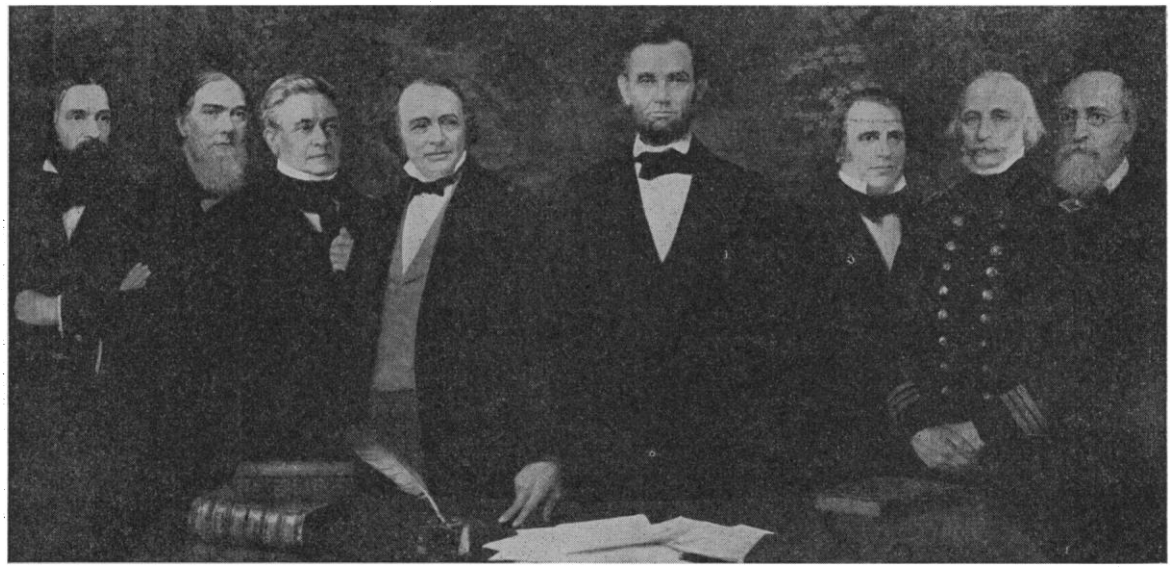
(3) What specific legislation should be enacted to remedy the evils now confessedly existing?

The members of the committee appointed spent three months in laborious study and inspection of forests and found widespread devastation caused by fires started by careless or ignorant campers or hunters, devastation by herds of animals, and theft of timber. The preliminary report to the Secretary of the Interior recommended the establishment of 13 new forest reservations covering more than 21,000,000 acres. The report was forwarded to President Cleveland on February 6, 1897, and on February 22 the President proclaimed the establishment of these reservations. The full committee report on the inauguration of the forest policy was comprehensive in scope and contained definite recommendations for the establishment of a National Forestry Service.

Soon after the organization of the National Academy of Sciences, Alexander Dallas Bache added a codicil to his will leaving a trust fund, the income of which should be for the "prosecution of researches in physical and natural science by assisting experimentalists and observers in such manner and in such sums as shall be agreed upon by the board of direction in the said clause named." The first grant for scientific research was made in 1871 to Prof. J. E. Hilgard in connection with the magnetic survey of the United States. The chairman of the trust fund committee was Joseph Henry. Through this fund and subsequent bequests, the Academy has been given an important instrumentality for the promotion of scientific research. There are now 8 Trust Funds of the Academy which give grants; additional ones have been established for the awarding of medals and honoraria for distinguished research.

Notable contributors to the advancement of science in this and other countries are honored by the awarding of medals and prizes.

Stress of war brings problems soluble only by scientific research, and successful research requires trained investigators. In April 1916, when the entry of the United States into World War I was being foreseen, the National Academy of Sciences offered its services to the President of the United States. The result of this offer is appropriately given in the words of George Ellery Hale, who did so much in the establishment of the National Research Council:



The founders of the National Academy of Sciences as painted by Albert Herter. Left to right: W. B. Patterson, A. D. Bache, Joseph Henry, Louis Agassiz, Abraham Lincoln, Senator Henry Wilson, Admiral Charles H. Davis, and B. A. Gould.

> President Wilson at once requested that steps be taken to organize the research agencies of the country, not solely with respect to the necessities of possible war, but also because of the importance of developing and utilizing them more effectively under peace conditions. This led to the establishment in September 1916 of the National Research Council, a federation of governmental, educational, privately endowed, and industrial research agencies, resting upon the charter of the National Academy, and extending the scope of its activities into every branch of the mathematical, physical, and biological sciences, and their applications to engineering, medicine, agriculture, and other useful arts.

Thus our National Research Council differs fundamentally in several respects from the Advisory Councils for Scientific and Industrial Research recently established by the British, Australian, and Canadian Governments, though its general objects are similar to theirs. Those Councils are branches of the Government, with officers appointed by the party in power and thus subject to political influences and exigencies. The National Research Council is closely connected with the Government, through the charter of the Academy and the Executive Order issued by President Wilson on May 11, 1918, which provides for the cooperation of Government Departments, and for the appointment by the President of representatives of their scientific and technical bureaus to membership in the Research Council on the nomination of the National Academy of Sciences. The constitution of the Research Council is determined, however, by the National Academy, and this assures its scientific soundness. Moreover, the scheme of organization adopted by the Academy provides that the several divisions of the Research Council shall be made up of nominees of leading national scientific and technical societies interested in research. This gives the Council a thoroughly representative character, and makes it an actual federation of research agencies. Thus it is peculiarly well fitted to secure the cordial cooperation of the numerous elements that must work in harmony, if extensive plans for cooperation in research are to be carried into effect.[1]

For two years the Research Council acted as an emergency or a temporary organization to assist the Government in coordinating the scientific resources of the country. On May 11, 1918, by Executive Order, the President requested the Academy, in view of the new and important possibilities of science and research in time of peace as well as war, to establish the Council on a permanent basis. The purposes of the Council can best be expressed by the Executive Order itself.

Meeting of the National Academy of Sciences in Mineral Hall, Smithsonian Institution, about 1871: 1, Joseph Henry; 2, Mary Henry; 3, W. J. Rhees; 4, F. W. Clarke; 5, J. S. Newberry; 6, J. C. Dalton; 7, J. E. Hilgard; 8, J. J. Woodward; 9, Peter Parker; 10, Alfred M. Mayer; 11, William Ferrel; 12, Benjamin Silliman; 13, C. E. Dutton; 14, Emil Bessels; 15, Arnold Guyot; 16, J. H. C. Coffin; 17, B. A. Gould; 18, Elias Loomis; 19, C. A. Schott; 20, George Eugelmann; 21, Benjamin Peirce; 22, Simon Newcomb; 23, Lewis H. Morgan; 24, A. A. Michelson; 25, John S. Billings; 26, Weir Mitchell; 27, Frederic M. Endlich.

Executive Order

The National Research Council was organized in 1916 at the request of the President by the National Academy of Sciences, under its congressional charter, as a measure of national preparedness. The work accomplished by the Council in organizing research and in securing cooperation of military and civilian agencies in the solution of military problems demonstrates its capacity for larger service. The National Academy of Sciences is therefore

[1] From *The national importance of scientific and industrial research*, by George Ellery Hale and others.

requested to perpetuate the National Research Council, the duties of which shall be as follows:

1. In general, to stimulate 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.

2. To survey the larger possibilities of science, to formulate comprehensive projects of research, and to develop effective means of utilizing the scientific and technical resources of the country for dealing with these projects.

3. To promote cooperation in research, at home and abroad, in order to secure concentration of effort, minimize duplication, and stimulate progress; but in all cooperative undertakings to give encouragement to individual initiative, as fundamentally important to the advancement of science.

4. To serve as a means of bringing American and foreign investigators into active cooperation with the scientific and technical services of the War and Navy Departments and with those of the civil branches of the Government.

5. To direct the attention of scientific and technical investigators to the present importance of military and industrial problems in connection with the war, and to aid in the solution of these problems by organizing specific researches.

6. To gather and collate scientific and technical information, at home and abroad, in cooperation with governmental and other agencies, and to render such information available to duly accredited persons.

Effective prosecution of the Council's work requires the cordial collaboration of the scientific and technical branches of the Government, both military and civil. To this end representatives of the Government, upon the nomination of the National Academy of Sciences, will be designated by the President as members of the Council, as heretofore, and the heads of the departments immediately concerned will continue to cooperate in every way that may be required.

(Signed) WOODROW WILSON

The White House
11 May, 1918

An appreciable part of the war work conducted by the Council or under its auspices did not terminate in 1918 but was continued for longer or shorter intervals, and some of the committees are still operative, having been assimilated into the peacetime organization. This was peculiarly true of those whose work was most closely related to industrial problems, many of which are quite as significant for times of peace as for war. Certain metallurgical researches which were continued under the Division of Engineering are cases in point.

The membership of the Research Council, numbering about 220, is now composed largely of appointed representatives of more than 90 of the major scientific and technical societies of the country, together with representatives of certain other research organizations, representatives of government scientific bureaus, and a limited number of members-at-large. These members receive their appointments from the President of the National Academy of Sciences. Representatives of the government executive agencies are appointed with the approval of the President of the United States.

Many projects which contributed directly to the successful conclusion of World War II were financed through contracts made with the Office of Scientific Research and Development, the War Production Board and other government departments and agencies. Important projects undertaken included military medicine involving extensive cooperation with the Committee on Medical Research, food and nutrition, research on critical metals and other materials, and certain problems of actual warfare, many of them highly confidential.

The National Research Council administers a large number of fellowships generously supported by organizations such as the Rockefeller Foundation, the American Cancer Society, Merck & Company, Inc., the Radio Corporation of America, the National Foundation for Infantile Paralysis, and, most recently, by a large grant from the Atomic Energy Commission.

Neither the Academy nor the Research Council receives appropriations directly from the Government. Support for the central organization and maintenance of the building and grounds is derived from an endowment which was a gift of the Carnegie Corporation. Special projects are financed by contracts with government agencies, nonprofit philanthropic organizations, and foundations. Grants-in-aid of research are available from a number of Trust Funds and from some of the resources enumerated above.

The National Science Fund was established by the National Academy of Sciences in April 1941. The Academy receives, and the National Science Fund applies, large or small gifts for all physical and biological sciences. The Fund also offers its services as adviser to any prospective donor to science.

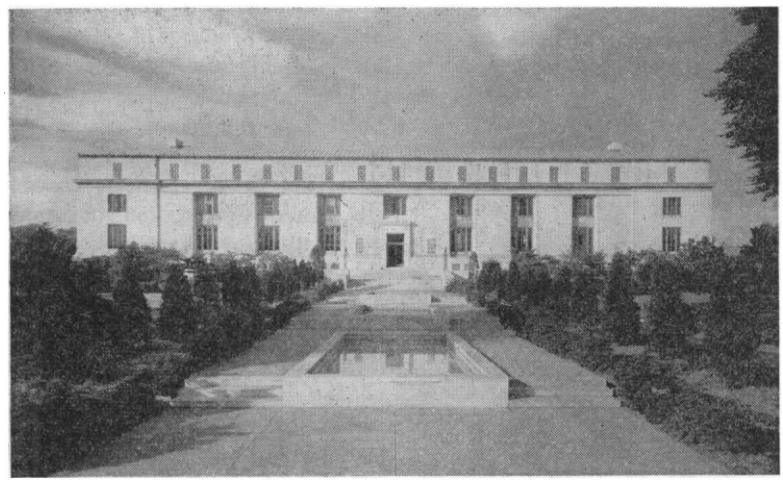
Giving money wisely is not a simple task. This is particularly true of support for fundamental scientific research. Recognition of this fact led to the establishment of the National Science Fund, which offers an organization controlled by a Board of Directors composed of distinguished scientists and qualified laymen to help donors to give wisely and usefully for the advancement of science.

The *Proceedings* is the official organ of the National Academy of Sciences and of the National Research Council for the publication of brief accounts of im-

portant current research of members of the Academy and of the Council, and of other American investigators. Larger contributions to knowledge have been issued as *Scientific Memoirs,* among which might be mentioned "Report of the Eclipse Expedition to Caroline Island," "On the Temperature of the Surface of the Moon," "The Cave Fauna of North America," "The Solar and Lunar Spectrum," "Contributions to Meteorology," "Catalogue of the Meteorites of North America to January 1, 1909," "Studies Upon the Life Cycles of the Bacteria," "Panama Canal Slides," and many others.

The Academy has also sponsored, together with the Research Council, publication of a number of books, some of which have attained the rank of best sellers.

The *Biographical Memoirs* furnish much of human interest to the historical records of the Academy.



The Academy Building

The National Research Council issues a series of Bulletins giving general sources of scientific knowledge; directories of research laboratories and personnel and of scientific societies and their officers; reports upon the status of various fields of research; and special contributions of an original character. Its Reprint and Circular Series is for less extensive papers and for reprints of timely articles, some of which have had initial circulation elsewhere.

The activities of each year, reported by the president of the Academy, the chairman of the Research Council, and the chairmen of Divisions of the Research Council, are contained in an Annual Report submitted to Congress through the president of the Senate.

The building of the National Academy of Sciences and National Research Council, which was designed by the late Bertram Grosvenor Goodhue, was completed in 1924. The land on which it stands was purchased with funds subscribed by about 20 friends of science, and funds for its erection were provided by the Carnegie Corporation.

The building is of white Dover marble, trimmed in bronze. Over the doorway is a representation of the elements with which science deals—earth and cloud, and the various forms of vegetable and animal life to man; at the apex is the sun, source of warmth and light. Bronze panels on either side of the doorway and pierced stone window grills have woven into the scroll pattern the initials NAS and NRC, indicating the joint occupancy. The cornice of the building is composed of alternating figures of the owl and the lynx, typifying wisdom and alert observation, with a coiled serpent at each corner. The bronze window panels depict the progress of science from Greek to modern times by means of a succession of the great founders. The bronze doors portray 8 episodes in the history of science from Aristotle to Pasteur.

No scientific laboratories are maintained by the Academy or Research Council. Instead, they seek to coordinate the work of individual scientists and laboratories dealing with large problems in the fields of science. Among the means of carrying out these aims are conferences, technical committees, surveys, sponsorship of new organizations for research and of scientific publications, and the administration of funds for research projects.

This brief description of the very complex structure and function of the National Academy of Sciences and the National Research Council will, it is hoped, serve to remind the reader of the part these organizations have played in the development of science in this country during much of the past 100 years.