

FOREWORD

The report of the activities of the National Science Foundation for the year ended June 30, 1953, is comprehensive and reflects in considerable detail the substantial progress made by the Director and the staff toward the accomplishment of the Foundation's mission as set forth in section 3 of the National Science Foundation Act of 1950. The National Science Board wishes to express appreciation of the efforts of the Director and staff and of the scientists and others who have served on Divisional Committees and Advisory Panels. The services of consultants play an important part in the Foundation's activities. It is with satisfaction that we record, as last year, the continued cooperation they have given the Foundation.

It is unnecessary in this Foreword to comment on details of the report. It is desirable, however, to present the point of view of the Board on certain broad problems of the Foundation. Such a statement of principles may be of general interest and it should be generally available for critical review and comment.

The Board learned with satisfaction that the Congress had amended the Act of 1950 removing the \$15,000,000 ceiling upon annual appropriations to the Foundation. This action cleared the way for the Foundation to assume greater responsibility for the support of basic research—a course clearly thought to be desirable by the Administration and the Congress. More important, however, in the view of the Board, under the previous ceiling the Foundation could not have fulfilled the functions with which it is charged by the Act. The existence of a ceiling made a contradiction in the Act that appeared likely to interfere with the maintenance of competent staff and the continued cooperation and support of individuals and public and private academic institutions.

The sympathetic response to this problem by many members of the Congress was encouraging. Nevertheless, it seems clear that misunderstanding or lack of understanding of science and its methods is widespread. This is probably due, at least in part, to the great speed of

scientific development in the past 50 years. In 1900 X-rays and radioactive elements had just been discovered, nuclear physics hardly begun, the nature and carriers of yellow fever and malaria only recently learned, modern genetics barely started, antibiotics unknown—the list could be expanded for pages. Progress in science almost stuns us, yet it is easy to take for granted. We fail to realize that it comes from deep devotion, hard work, sacrifices, and the popular support of our academic institutions. Wider public understanding of science, scientists, and the implications of scientific development is of vital concern not only to the National Science Foundation, but to the Federal and state governments, academic institutions, and industrial concerns.

The very rapid progress outlined above has wrought radical changes in, what I shall call, the economics of basic scientific research. Perhaps 50, certainly one hundred years ago, it was uneconomic to give general support to basic scientific research. The lag between a scientific discovery and its practical application was so great that even a large ultimate value had little present worth. The isolation of scientific discovery caused the lag. Scientific knowledge was not dense. A glance at present-day textbooks, encyclopedias, libraries, and the voluminous digests convinces one of how this has changed. There are and probably will continue to be new isolated discoveries, but for the most part new knowledge is quickly tied to old knowledge, and the inferences from the combination rapidly lead to further expansion of knowledge or new practical applications.

We ask today: How much can we afford to spend for basic research? The answer is: We cannot spend as much as would be economically advantageous. The bottleneck, I believe, will be lack of men and women who have the capacity, the interest and the willingness to pursue science. In numbers they constitute a restricted part of the population; and science is not the only profession calling for high intelligence and disciplined capabilities.

The upshot is that an economic test of basic research is now irrelevant. This does not mean that we should disregard budgetary, fiscal, and short-term administrative problems. It does mean that solutions to many current problems reside in the long-term functions of the National Science Foundation. It is the duty of the National Science Board to make this clear.

What are the relatively immediate consequences of basic research? First, the development of scientists. These are the people who by training and experience know how to use scientific knowledge, scientific

techniques, and scientific instruments. Second, the production of new scientific knowledge, a high proportion of which may prove useful in ways unforeseeable today. Third, the application of the results of research to the solution of practical problems by a body of men who know how to apply scientific methods. An example is what has been called "Operations Analysis," which has for its objective not knowledge, but the best practical decisions. More and more we shall depend upon such talent for both military and industrial operations.

The National Science Foundation Act of 1950 authorizes and directs the Foundation "to develop and encourage the pursuit of a national policy for the promotion of basic research and education in the sciences." Except for certain specified operating functions, the Foundation is essentially an authoritative advisory body, potentially capable of securing factual knowledge and advisory opinion, that makes its advice authentic but not determinative. Whom does it advise? Obviously, the President and the Congress; but also, through publication and consultation, other agencies and institutions, public and private, and individuals. The point to these observations is that the Foundation can neither police nor direct activities of other agencies, of academic institutions, of industrial research, or of individual scientists.

The Board believes it important to emphasize this view, because there is, on one hand, a natural tendency to utilize the Foundation for secondary purposes and immediate administrative convenience and, on the other, a fear that the interposition of government in science will lead to attempts to dominate science and thus to destroy it. The Board is aware of these dangers. It believes that its major function is to operate so as to minimize both dangers. But we realize that a new era has come when the interest of governments and of societies in the development of science is great and the need exists for large financial support to scientific research and for the development of adequate numbers of scientists.

CHESTER I. BARNARD,
Chairman, National Science Board.