

estimated, would be \$29,000,000 after the fourth year of operation. Although I do not think this amount of money too large in view of the paramount importance of the Federal scholarship plan for scientists in terms of the national welfare, I do recognize the need this year of keeping Federal expenses down. I therefore suggest that the number of scholarships and fellowships might well be set at half the figure I have just given. I should not advocate writing this or any figure into the bill. I assume the matter would be handled in connection with the appropriation which must be made if the bill becomes law. A total expenditure of somewhere around \$14,000,000 for the plan when it is in operation seems to me reasonable, particularly when one remembers that this will provide for fewer scholarships (12,000) than the number authorized under the Navy plan, which calls for a maximum of 14,000. There is no doubt in my mind that a program of the dimension I have just mentioned would

be very worth while indeed. If such a scheme could be operated for five or six years, ample evidence would be accumulated to enable Congress and the American people to assess the value of the plan.

Now, in conclusion, may I once again endorse the whole proposition—the establishment of a National Science Foundation as specified in the legislation I am supporting. I have confined my remarks to the scholarship program because I believe it is of the first importance. But the other features of the bill—the graduate fellowships and the support of research—are likewise of great significance for the future welfare of the Nation. I venture to hope that your Committee will report favorably on this matter and that the Senate will in due course take similar action. We need a Science Foundation both to forward our domestic economy and to strengthen our military establishment.

A National Science Foundation

*Statement by Vannevar Bush, Chairman, Joint Research and Development Board,
before the Committee on Interstate and Foreign Commerce,
House of Representatives, March 7, 1947*

THIS STATEMENT HAS BEEN SUBMITTED to the Bureau of the Budget, although time has not been sufficient to permit a reply. I want to make it clear, therefore, that I do not purport to represent the opinion of the President.

It is quite unnecessary for me to take up your time with an argument tending to prove that our economic and industrial progress, our national security, and our national health and welfare are dependent on continually extending that knowledge of our environment which comes only from basic scientific research.

It is equally unnecessary to make a lengthy argument that the time has come for the Government to intervene in support of basic research. The devastation of a large part of Europe has effectively eliminated many of our principal sources of fundamental scientific knowledge. Within the United States, our principal sources have always been the nonprofit educational institutions and endowed foundations. These institutions now are faced with increasing costs and decreasing income. We must, therefore, replace the lost sources of new scientific knowledge and strengthen those which we still have.

I believe that these statements reflect the views of most of the scientists, educators, and industrialists in the United States. In the last session your Committee heard a number of leaders in these fields testify to that effect. Committees of the Senate heard the testimony of well over a hundred such leaders. With one exception, all of those who testified before committees of Congress on

science legislation supported the proposition that the Government must undertake the support of basic scientific research.¹

Now, the witnesses at those hearings differed rather widely in their views as to precisely what action the Government should take, how far it should go, and what kind of instrumentality should be established to take such action. Several bills were introduced in the 79th Congress, and there were many drafts and redrafts of some of them. In addition, there were many discussions and conferences between interested scientists and educators, and members of Congress. In the course of these discussions the various divergent views were analyzed, and many of the differences were reconciled. The issues were thus narrowed so that you now have before you only two different bills, H.R. 942 and H.R. 1830. Since H.R. 1815, H.R. 1834, and H.R. 2027 are identical, I shall refer to them collectively as H.R. 1830.

Now, both bills have many desirable objectives in common. They both establish a National Science Foundation as an independent agency. They both provide that the Foundation should support basic research. They both provide that, with respect to matters affecting the

¹ See the record of the Hearing before a subcommittee of the Committee on Interstate and Foreign Commerce, House of Representatives, 79th Congress, 2nd Session, on H.R. 6448 and of the Hearings on Science Legislation before a subcommittee of the Committee on Military Affairs, United States Senate, 79th Congress, 1st Session, pursuant to Senate Resolution 107 (78th Congress), and Senate Resolution 149 (79th Congress).

national defense, the Foundation may not only support basic research but also perform applied research and development. They both provide for the award of scholarships and fellowships in science, to young men and women of outstanding ability, and neither bill attempts to limit the recipients to any particular field of scientific study or to retain any control over them after completion of their studies. Both bills contemplate an internal structure for the Foundation composed of divisions, each of which is to be concerned with a major field of science, and in addition, a division of scientific personnel and education. Moreover, they both permit additional divisions to be established when necessary or desirable. Both bills provide for an advisory committee of specialists to be attached to each division. Both bills provide for correlation of existing government research activities. Both bills provide for international cooperation in research and for fostering the interchange of scientific information, both domestically and internationally. Several other provisions which these bills have in common give to the Foundation special authority and certain exemptions from existing provisions of law. These provisions recognize the unique nature of the Foundation and will greatly facilitate its operations. I need not go into detail as to why all of these objectives are desirable and necessary, but I would like to point out and analyze the principal differences between the two bills.

The most important of these differences is the locus of ultimate authority and responsibility within the Foundation. H.R. 942 vests this authority and responsibility in a single administrator who would act with the advice of a part-time board. On the other hand, under H.R. 1830 the Foundation would be headed by a board of outstanding men, which in turn would appoint an administrator to carry out its policies and to handle the administrative affairs of the agency.

Now, it has been the experience of the Government that when commissions or boards attempt to handle operational details, they are very apt to run into difficulty. Disagreements among the members can cause lengthy delays. Conflicting orders may be given by the several members, and disputes and hard feelings can arise over matters of administrative detail. I do not feel, therefore, that a commission or board, as a group, should be directly active in the actual operations of an agency. But there is no reason whatever why this should occur. Several government agencies which carry on extensive operations, as opposed to performing quasi-judicial functions, are organized on the basis of reposing the ultimate control in a group of men. As a matter of fact, I have had a good deal of experience with one such agency, the National Advisory Committee for Aeronautics. This agency consists of a Committee appointed by the President, with a full-time paid administrator to carry out policies established by the Committee and to handle all the administrative affairs of the agency.

The organization contemplated by H.R. 1830 would be very similar to that of the NACA, and there is every reason to anticipate that it would function as effectively. If you fear that under H.R. 1830 the executive committee of the Foundation might attempt to concern itself with operational matters, a provision could be inserted in the bill, expressly prohibiting such activities. I do not think, however, that such a provision would be necessary. The full membership of the Foundation is required to meet only once a year, and the executive committee is required to meet only six times per year. Although either could meet more often, it seems to me that the intent of these provisions is clear, that neither body should be in continuous session. Moreover, the salary provided for the director in H.R. 1830 is adequate to secure an excellent administrator for this position. He would be expected to be in charge of all the administrative affairs of the Foundation.

There was considerable argument at the last session of Congress, to the effect that the Foundation should, at all costs, be free from political controls. These arguments are valid only in the sense that the operations of the Foundation should be free from the pressures of any special interests whatever. The Foundation is to be a government agency, and the Government is designed and established to be of the people and for the people. The Foundation should, therefore, be fully responsible to the people, and this means to the Congress of the United States. Moreover, the Foundation should not be insulated from the Executive Branch of the Government. I believe that it should be subject to the operating procedures, policies, and controls to which other agencies are subject, and which are necessary for an efficient and effective Executive Branch. It should, therefore, be subject to the controls of the Bureau of the Budget with respect to appropriations, transfers of funds, and other matters. It should also be subject to the Civil Service laws and regulations, except with respect to scientists in a very limited number of special cases.

Certain other exemptions from existing provisions of law and certain special authorizations are necessary to enable the Foundation effectively and economically to carry out its unusual functions. I have in mind such provisions as that permitting the Foundation to enter contracts without requiring performance bonds and without advertising for bids, and the provision that part-time specialists, by reason of their service with the Foundation, would not be subject to the provisions of certain criminal statutes, except with respect to matters affecting the Foundation. But these special authorities and exemptions, as they now appear, contain within themselves their own limitations, and they would not and should not place the Foundation outside any other of the usual procedures applicable to all executive agencies.

In addition to these government-wide administrative

controls and procedures, I feel that the administrative head of the Foundation should also be subject to the general control of a board of outstanding men and women with widely diversified training and experience. The Foundation will be faced with many different but exceedingly complex and highly technical questions. For example, it must annually evaluate the relative importance of scholarships, basic research, international undertakings, and publications in terms of the over-all national welfare. Within its allocation for research, the Foundation must determine the relative importance of the different fields of science. Finally, it must be able to evaluate, on the basis of their scientific merits, not only the relative importance of the various specific projects but also their potential effectiveness. Decision of these questions will require not only extensive and varied scientific knowledge but also broad and sound concepts of the Nation's best interests. In other words, the decisions must be wisely made from the standpoint of many considerations.

In the long run and in general, the Congress should, as representative of all the citizens, make decisions of policy. It is obvious, however, that the Congress lacks sufficient time to inform itself as to the various considerations involved in making these particular decisions. It must therefore delegate to others the power to make them, retaining its ultimate control through annual reports and appropriations. In my opinion, this delegation should not be to one man but should be to a group of the ablest men and women in the United States, drawn from all parts of the country, who would represent the different fields of science, education, and public affairs.

I cannot overemphasize the importance of securing the services of the ablest possible individuals to guide the Foundation. A board which is only advisory would bear responsibility for the decisions of the administrator, but would not have any real authority to control those decisions. I believe that in order to be sure to secure members of the requisite caliber, it is essential to give them authority commensurate with their responsibility.

Now, the two bills are very different in their treatment of inventions made in the course of research supported by the Foundation. H.R. 1830 directs the Foundation, in making contracts and other arrangements for research, to consider the public interest and the equities of the research organizations and individuals with which it deals. It further provides, however, that no officer or employee of the Foundation shall derive any personal benefit from inventions which may be made by him in the course of performing his assigned activities for the Foundation. This, I believe, is as far as this legislation should go in controlling the policies of the Foundation. I believe that an able director, guided by this directive and by more detailed policies which

would be established by the Foundation, would protect the public interest and, at the same time, be fair to the individuals and organizations which will be performing research for the Foundation.

Now, there are three provisions in H.R. 942, the necessity of which is open to some question. I refer to Section 5, which provides for the apportionment of certain percentages of the Foundation's funds among the several states, among different types of institutions, and for different fields of research. The provisions for allocating fixed percentages of funds to nonprofit institutions and for certain named fields of research are questionable only on the grounds that they are unnecessary. I am sure that both quotas would be exceeded in practice.

The principle of wide distribution of research appropriations throughout the country seems to me basically sound. It is necessary, if our basic scientific research is to remain energetic and fruitful, that we maintain and strengthen many different research organizations throughout the country. It seems to me, however, that such wide distribution could be effectively accomplished by the Foundation under the terms of H.R. 1830. The large membership of that board, together with the stipulation that its members shall be selected so as to represent scientific opinion in all parts of the country, constitute an effective guarantee that the Foundation's funds will not be concentrated in a few large institutions or in any one section of the country. In my opinion, therefore, the policy expressed in Section 15 (h) of H.R. 1830 is quite adequate to assure that the desirable purpose of strengthening our smaller research organizations will be accomplished without imposing upon the Foundation the technical difficulties and the burden of detailed accounting which would be required by the terms of H.R. 942.

Similar considerations apply to the provisions in both bills for geographical distribution of scholarships and fellowships. I feel that scholarships and fellowships should be distributed as widely as possible, but with due regard for the ability of each applicant. Consequently, I prefer Section 9 (a) of H.R. 1830 to the corresponding provisions of H.R. 942 in that it subordinates the factor of residence to that of ability.

One or two further points of difference between the bills seem to deserve brief comment. One is the provision in each bill concerning the divisional structure of the Foundation. H.R. 942 establishes eight divisions and authorizes the administrator, with the advice of the board, to establish up to three additional divisions. H.R. 1830 establishes five divisions, but it authorizes the Foundation to abolish any of them, except for the Division of National Defense, as well as to establish new divisions. This allows greater flexibility than the arrangement of H.R. 942. Although the divisions provided in each bill cover most of the basic fields of research in

which the Foundation, as presently contemplated, is likely to engage, it is quite possible that, from time to time, it will be expedient to rearrange these divisions.

In the last session of Congress there was considerable controversy over a provision in the Kilgore-Magnuson Bill which would establish, within the Foundation, a division of social sciences. This provision was eliminated on the floor of the Senate, and I believe that was a wise move. But I do think that the controversy was unfortunate. If we, as a democratic nation of free individuals are to survive, we must seek to understand the forces which affect our social organizations in order that they may be anticipated and guided in safe directions. A large amount of research is already being devoted to various aspects of the social sciences, both by the Government and by private individuals and organizations. Much more could be done to advantage. In view of the magnitude and complexity of this field, however, it seems to me that the Foundation should carefully survey it with a view toward determining those areas which could be made the subject of fruitful research under its auspices. Under H.R. 1830 this could be done, and I hope it will be done. But it is well to make research in the social sciences permissive rather than mandatory.

Finally, I should like to say a few words about the size of the undertaking which you are considering. The Foundation, particularly at the outset, need not be a grandiose venture. In my report to the President, *Science: the endless frontier*, I suggested a budget, for the first year, of \$33,500,000, including \$7,000,000 for scholarships and fellowships. That budget was carefully prepared on the basis of replies to questionnaires sent to

more than 300 educational and other institutions. I still think the estimate is reasonable, but two factors have intervened to make an initial appropriation of this size unnecessary. The Servicemen's Readjustment Act of 1944 will materially help to reduce the accumulated deficit of trained scientists and technicians. That does not mean that the Foundation need not commence its scholarship program immediately. It takes from four to seven years to train a scientist, as you know. However, it will lessen the urgency of the demand and permit the Foundation to plan its program carefully and begin it gradually. The Foundation will then be in a position to assume the full burden when the benefits of that act cease to be available.

The second, and greater factor, is the immediate availability of certain funds which can be transferred from the Services. The Army and Navy have shown great vision in undertaking basic research as an interim measure. Many of their research projects can, and, I am informed, will be transferred to the Foundation, supported by funds already appropriated by the Congress. These funds will materially decrease the initial appropriation necessary for the operations of the Foundation.

Of course, neither of the two bills before you is perfect, but H.R. 1830 is the best bill I have seen on the subject of science legislation. I have written to your Committee making several suggestions for changes. You will wish to make others. But those suggestions are primarily on details. What is of vital importance is that a National Science Foundation be established, and that it be established as promptly as is consistent with full examination of the matter by the Congress.

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