Other Provisions of the Bills

I believe that the four points just discussed cover the most important variations in the bills which you are considering. In most other major respects the bills are substantially the same. I am glad to note, for example, that all the bills provide for the coordination of the scientific activities of the Federal Government through a standing Interdepartmental Committee on Science, and that the existing scientific agencies of the Government may receive research contracts from the Foundation as a supplement to their regular activities and appropriations, and not in substitution therefor. These two provisions are of great interest to the Department of Commerce, which includes several of the important scientific agencies in the Government, such as the National Bureau of Standards, Weather Bureau, and Coast and Geodetic Survey in the natural sciences, and the Census Bureau and Bureau of Foreign and Domestic Commerce in the social sciences.

In conclusion, let me say that the general objectives of this legislation have the fullest support and endorsement of the Secretary of Commerce, for whom I am speaking, and of the President. (I am, of course, in no sense committing the President on all the specific points I am raising.) On the other hand, there is serious question as to whether the Foundation could operate properly and in the public interest under some of the forms of administrative organization which have been proposed. The combination of the best features of the single administrator and an advisory board which were worked out last year, and which are incorporated in H.R. 942, seem to be the desirable solution of this problem. With respect to the social sciences and the allocation of research funds, the provisions of H.R. 942 also appear to be preferred to those of the other bills. Finally, it is my judgment that the patent problem is a separable issue and that government-wide patent policy should be considered independently of the Science Foundation Bill.

It has become increasingly recognized that widespread support of science is essential to technological advance, economic progress, and higher standards of living and to our national security. There is no question but that the public financial support of science which you are considering will in the long run represent a small expenditure compared with the great gains which experience has shown we may confidently expect.

A National Science Foundation

Statement by James B. Conant, president of Harvard University, before the Committee on Interstate and Foreign Commerce, House of Representatives, March 7, 1947

I APPEAR BEFORE YOU TO URGE FAVORABLE action on identical bills H.R. 1815, 1830, 1834, and 2027, which are concerned with a National Science Foundation. I wish to address myself at the outset to those sections which empower the Foundation to grant scholarships and fellowships. For to me these are by far the most important parts of the bills. I make this statement advisedly, for there is no use considering ways and means of spending money on research unless first-rate men are available to do the work.

In all the discussion about research that goes on in these days, an obvious fact is sometimes overlooked, namely, that it is men that count. And today we do not have the scientific man power requisite for the job that lies ahead. The bottleneck of our scientific advance is essentially a man power shortage, and unless something is done about it, the bottleneck will be more constricted a decade hence. Now let no one imagine that, like some of the man power shortages in the war, this can be cured by mobilizing and training for a short time the first people who come to hand. Scientific and technical advances depend on quality as well as on quantity or, to put it another way, on the quantity of exceptional men. These men have to be located when they are young and then given a long and expensive scientific education. If the proposals before you become law and Congress appropriates the money, we will see a flowering of scientific work in this country the like of which the world has never seen before. For only in this Nation, where universal education reaches to the high school level, is it possible to locate the hidden reservoir of talent which, if tapped, can enrich our life and that of all mankind.

The bill before you provides for a long-term plan. The measures proposed would have been desirable even if there had been no war and no consequent deficit in our scientific and technical man power. To the extent that we fail to cure this deficit in the next few years by proper governmental action, to that extent a Federally-supported scholarship and fellowship program is even more essential.

The arguments in favor of Congress providing for such a program and making adequate annual appropriations can be summarized as follows:

(1) The welfare of a free society in an industrial age depends on a continuous advance of science and the application of the new knowledge to useful ends.

(2) Both the advance of science and the application of science to industry, to medicine, and to agriculture depend on the quality and quantity of scientists and engineers available in a nation.

(3) The supply of men depends on the number trained and the innate ability of those who undertake the special training.

(4) The scientific professions in question require a long and expensive education beyond high school.

(5) This education is of such a nature that it can be given at only a relatively few centers in every state.

(6) Therefore, unless a student lives in one of these centers, his professional training must be costly for he must pay for room and board away from home as well as other expenses.

(7) The consequent financial barrier now prevents many boys and girls of high ability from going on with an advanced education. Much talent is lost to the Nation by this educational waste.

(8) To right the balance, a Federally-supported scholarship and fellowship program is required.

Such is the argument in a few words in terms of the peaceful development of the country. When we turn to consider the possible contingency of war and measures for national defense, the argument for finding and developing scientific talent is even stronger. There is no longer any argument about the role of science in a defense program. If we are to remain strong from a military standpoint, as I believe we must until international agreement provides a reasonable plan of disarmament, our need for scientists is as great as our need for Army and Navy officers. A relatively few men of great ability, imagination, daring, and with the proper training as officers of the armed forces have more than once in history determined the fate of nations. A relatively few men of great scientific ability and imagination, and thoroughly trained, can play a part in building the military strength of this Nation in the next decade to a degree that can hardly be imagined by those who are not close to the research and development program of the Army and the Navy.

Granted that in terms of the industrial development of the Nation, in terms of public health, and above all in terms of military strength, we must find and train our scientific talent, you may ask why a Federally-supported program of scholarships is required. I wish that all who raise this question could take the time to read the last section of the document entitled, *Science: the endless frontier*. The answer to the doubting Thomases is there set forth in detail. I shall endeavor in this statement to give only a brief summary of the important points.

The facts presented in that report and in other documents prove convincingly that we have been to a large degree wasting our most valuable national asset—the innate ability of each new generation. Table III on page 165 of *Science: the endless frontier*, for example, illustrates what every educator who probes deeply into this matter knows, namely, that *outside of the university towns and cities*, whether a student attends college or not is very largely a matter of family income. The figures quoted in this table refer to the college attendance just before the war of *superior* Milwaukee High School graduates (note the adjective, please). Here it is shown that while 100 per cent of those whose families had an income of $8,000 or higher attended college, the figure dropped to 44 per cent for the income range, $3,000–$2,000, and to 20 per cent for those under $500. These percentages are not for the entire class—far from it. These are the *superior* graduates of the high school—all college material. Similar evidence has been obtained by many other studies. I believe it is a conservative estimate to say that before the war there were as many boys and girls of real ability who graduated from high school but who did not attend a college as there were students of the same ability going on for further education. Once the veterans' educational benefits are over, the same situation will reoccur in this country unless steps are taken.

Let me remind you of what the report calls "The Educational Pyramid." This is an attempt to give an over-all statistical picture of the present educational selection in the United States; it represents the average for the whole country.

Starting with 1,000 pupils enrolled in the fifth grade (figures for earlier grades are confusing because of pupil retardations), the following figures show the extent to which they are reduced in each successive year:

Elementary school:	
Fifth grade, 1930–31	1,000
Sixth grade	943
Seventh grade	872
Eighth grade	824
High school:	
First year	770
Second year	652
Third year	529
Fourth year	463
Graduates, 1938	417
College:	
First year	146
Graduates, 1942	72

Now there are many reasons why boys and girls drop out of school, but there can be no question that to a large extent financial considerations play a part. This is particularly true in regard to the drop from 417 graduates of high school (per 1,000 of fifth graders) to 72 graduates of college. To the extent that family finances are the determining factor, potential professional talent is lost for the service of the Nation.

There is one very important point which I should like to emphasize in connection with the proposals I am urging today. We are concerned here only with the advanced education beyond high school of certain types of professional men and women; we are not concerned with

the problem of education beyond the high school in general. I am not advocating a Federal subsidy so that everyone can go to college—not even everyone who under our present standards can get by the entrance examination boards. The question of expanding public education beyond the high school for vast numbers is an entirely different story. As I see it, the pattern for public education in the future will be that of expanding the opportunities for education beyond high school as far as possible locally; that is, through institutions somewhat similar to those we now call junior colleges, two-year terminal institutions. This is the economical way to provide so-called higher education at public expense, for the student lives at home.

But there are certain types of education which cannot be given in every small city or town. They require very specialized staffs, expensive laboratories, large libraries. Training for these professions is the work of the universities or, in the case of engineering, the universities and engineering schools. To attend these institutions the poor boy needs support. It is in the interests of the Nation to give him this support. For the reasons I gave at the beginning of these remarks, it is imperative that this be done in the case of the future research worker in physics, chemistry, and biology, and the future engineer.

I hardly need remind this Committee that Congress, in considering the recruitment and training of naval officers, recently recognized the educational situation which I have just explained. By the adoption of the Holloway Plan the Federal Government has equalized the opportunity for college education for a limited number of talented youth from low-income families if they are enrolled in the NROTC units. Authorization was given, I believe, for 14,000 regular students in NROTC units in 52 colleges and universities. The cost of tuition, fees, and textbooks will be paid by Federal funds. Uniforms will be provided, and students will receive retainer pay for other expenses during college at the rate of $600 a year. Undoubtedly, a great many very promising young men will obtain a college education in this manner who might otherwise have received little or no training beyond high school. The recruiting and education of the regular Navy and Reserve Officers will be facilitated. On both counts the welfare of the Nation is promoted. I congratulate Congress and the Navy on the adoption of this plan. But measured solely in terms of our military strength, can the Nation afford not to adopt a somewhat similar scholarship program for the scientists? If you envisage the nature of our present and future armaments as I do, you will agree that the need for outstanding scientists is comparable to the need for naval officers.

The type of young man who should and will apply for the Navy program, by and large, will not be the type who would benefit from the Federal scholarship program I am advocating. The Navy needs, for the most part, future operators, men of action and decision. But the mechanisms they operate must be designed by research and development men, and the work of those applied scientists in turn rests on the discoveries of the pure scientists. The bill I am supporting, of course, provides for no counterpart of the NROTC. And none is needed. The recipients of the scholarship would be free to choose their own college or university. Fortunately, it is no longer necessary to argue that a good selection can be made from among the high school graduates of the country. This has now been demonstrated by our war experience and is a premise of the Holloway Plan. The same type of nation-wide aptitude test now used by the Navy would be used with perhaps a somewhat different slant. Final selection, as in the Holloway Plan, might well be in the hands of State Selection Committees.

All the details of administration should be left to the Foundation and its officers, as the bill quite properly does. However, I think that provision of Section 9 (a) is wise. It provides "that the Foundation shall award the available scholarship or scholarships or fellowship or fellowships to the applicants in such manner as will result in a wide distribution of scholarships and fellowships among the States, Territories, possessions and the District of Columbia." I am inclined to think that the administration of the scholarships might, if the Act permits, be along the lines indicated in the document to which I earlier referred. For example, on page 146 of *Science: the endless frontier* is given an allocation of the proposed 6,000 scholarships a year on a state basis. I believe this recommendation or an approximation to it would be sound national policy for two reasons:

(1) It emphasizes local administration, which I think highly important in all educational matters.

(2) It will stimulate the educational development of many states which do not at present contribute their share of talent. We should recruit our professions more uniformly from the country and by so doing stimulate talented young people in more sections of the country to take the necessary advanced education which is required. At present our research scientists are drawn in large measure from a relatively few states. That is not a healthy situation. I believe a Federal program of scholarships for certain professions administered on a state quota basis would in a generation change this picture. It should be understood, of course, that the recipient of the scholarship could enter any institution he chose. The universities within each state would then have to compete for the Federal scholars both within and without their region by giving as good scientific and professional training as could be obtained anywhere in the country.

The scholarship and fellowship program set forth in *Science: the endless frontier* called for 6,000 scholarships annually awarded for four years to high school graduates —a total of 24,000—and a total of 900 graduate fellowships. The maximum annual total cost of the plan, it was

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).