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COMMITTEE ON
MILITARY AFFAIRS

NATIONAL SCIENCE
FOUNDATION
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Calendar No. 1153

79TH CONGRESS, 2d Session | SENATE | REPORT No. 1136

NATIONAL SCIENCE FOUNDATION

REPORT

FROM THE

COMMITTEE ON MILITARY AFFAIRS

UNITED STATES SENATE

PURSUANT TO

S. 1850

A BILL TO PROMOTE THE PROGRESS OF SCIENCE AND THE USEFUL ARTS, TO SECURE THE NATIONAL DEFENSE, TO ADVANCE THE NATIONAL HEALTH AND WELFARE, AND FOR OTHER PURPOSES

APRIL 9 (legislative day, MARCH 5), 1946.—Ordered to be printed

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APRIL 9 (legislative day, MARCH 5), 1946.—Ordered to be printed

Mr. THOMAS of Utah, from the Committee on Military Affairs, submitted the following

REPORT

[To accompany S. 1850]

The Committee on Military Affairs, to whom have been referred several bills for the support and promotion of science, H. R. 3440, S. 1297, S. 1720, and S. 1850, having considered the same, report favorably upon S. 1850, (a bill to create a National Science Foundation), bearing the title "A bill to promote the progress of science and the useful arts, to secure the national defense, to advance the national health and welfare, and for other purposes", and recommend that it do pass.

STATEMENT

The Committee find that Federal support is indispensable to the full development and application of the Nation's scientific and technical resources in an age when scientific achievement is basic to the national defense and the national health and welfare.

The recommendations of this Committee for the establishment of a National Science Foundation are based upon comprehensive studies conducted by the Subcommittee on Science Legislation of the Military Affairs Committee and the Subcommittee on Science Legislation of the Commerce Committee, as well as studies made under tne direction of Dr. Vannevar Bush for the executive branch of the Government. The Committee have had the benefit also of studies of the problem of Federal support for science made by the Senate Committee on Naval Affairs and the House Committee on Military Affairs.

The science subcommittee of the Senate Military Affairs Committee has been concerned with the problem of the Federal support of science

since the fall of 1944. All aspects of the problem have been thoroughly examined, and extensive hearings, investigations, and conferences have provided a basis for intelligent legislative action. The need for such action is now urgent.

The bill recommended by your Committee reconciles in the most constructive manner a number of alternative proposals which have been put forth on the subject of Federal support for science. In particular, it reconciles the viewpoints of experts on public administration and scientists.

Under S. 1850 the National Science Foundation is headed by an Administrator, appointed by the President, by and with the advice and consent of the Senate. The Administrator has the benefit of an advisory board, also appointed by the President, consisting of experts serving on a part-time basis.

S. 1850 provides for allocation of funds to the several States, on a basis which assures that at least 25 percent of all funds administered by the agency shall be distributed among the several States on an equitable geographic basis.

The Committee have rejected the proposal that the social sciences be specifically excluded from support by the new agency, because of the demonstrated interdependence of the physical and social sciences. S. 1850, however, makes special provision to assure that all social studies supported by the Foundation are in fact scientific in character.

S. 1850 provides that the results of federally financed research be made freely available to the public. The bill provides protection for the commercial rights of private organizations or individuals who have contributed substantially to a particular development partially financed by Federal funds. The proposed legislation makes no revision of existing patent laws.

The report from the subcommittee on science legislation has been adopted in full by the Committee on Military Affairs and is herewith embodied. It is followed by the report of the subcommittee of the Committee on Commerce and by reports from the War, Navy, and Interior Departments.

SUBCOMMITTEE REPORT, COMMITTEE ON MILITARY AFFAIRS, FEBRUARY 27, 1946

NATIONAL SCIENCE FOUNDATION

Mr. KILGORE, from the subcommittee considering science legislation, submitted the following

REPORT

Mr. Chairman, your subcommittee has the honor to submit herewith a bill providing for the creation of a National Science Foundation, which it recommends for early legislative action. In October 1945 you requested your subcommittee to study and report on S. 1297, a bill to promote the progress of the useful arts, to secure the national defense, and to advance the national health and welfare. At the same time Mr. Bailey, chairman of the Senate Committee on Commerce, appointed Mr. Magnuson chairman of a subcommittee which was requested to study S. 1285, a bill parallel and closely related to S. 1297. Your subcommittee held joint hearings with this Commerce Subcommittee at which 100 witnesses testified and more than 1,000 pages of testimony were taken. On December 21, 1945 your subcommittee submitted the draft of an improved bill (S. 1720). Since that time, jointly with the Commerce Subcommittee, we have continued our studies and have perfected a new bill (S. 1850) which we now recommend with the concurrence of our colleagues on the Commerce Subcommittee. The report of the Commerce Subcommittee is attached hereto.

The bill now being recommended by your subcommittee meets the objectives for science legislation set forth by President Truman in his message to Congress on September 6, 1945.

THE NEED FOR LEGISLATION

I

Today no nation is stronger than its scientific resources. It is the considered opinion of your subcommittee that the full and balanced development of science in America cannot take place without broad national support contemplated in this legislation.

The evidence is clear that America's industrial preeminence in the modern world will be transitory unless it is strengthened by a firm foundation of basic scientific research, which can be supplied only by a general Federal program of supplementary support of the excellent scientific activity now being conducted in the diverse private and public scientific facilities of the Nation.

The evidence is equally clear that we stand at the threshhold of an era of great opportunities for the improvement of the health and general welfare of the people of this Nation through scientific advancement. With an annual expenditure of an infinitesimal portion of our total national income we can take giant strides toward the conquest of diseases which are the scourge of mankind. We have emerged from a war which has demonstrated that mechanical skills and vast production facilities must be augmented by the deeper understanding of the forces of nature yielded through science. Not only will this deeper understanding provide us with increased material benefits, but it will provide the greater enlightenment which since the days of Franklin and Jefferson has been the aspiration of this Nation.

In these unshakable conclusions we are joined by our colleagues of the Senate Committee on Commerce, who have worked closely with your subcommittee in perfecting the legislation which we now recommend, and who concur with us that it is precisely at the moment when the future security and welfare of the Nation are so dependent on scientific progress that the existing support of such activity in the United States is inadequate.

This conclusion has been forced upon us by the men who work in and manage the existing scientific institutions of this country; their testimony was virtually unanimous that the scientific needs of the Nation could not be met without Federal support. The conclusion has been strengthened by the testimony of leaders from all sections of our national life: Education, labor, industry, government, agriculture, science, medicine, clergy, and others, who urged congressional action.

II

The introduction in July 1945 of S. 1285 and S. 1297, the principal bills which your subcommittee has been studying jointly with the Commerce subcommittee, was preceded by exhaustive studies of the Government's scientific activities in relation to the Nation's requirements.

The problem of Federal support for science was emphasized by the important report, entitled "Science: The Endless Frontier," submitted by Dr. Vannevar Bush to President Truman in July 1945. This report was in response to a request made by President Roosevelt in November 1944, and was based on individual studies of the relation of science to the public welfare, the problems of medical research, the development of scientific talent, and the publication of scientific information. These studies were prepared by more than 50 prominent scientists, educators, and businessmen. On the basis of these studies Dr. Bush concluded that—

> Legislation is necessary. It should be drafted with great care. Early action is imperative, however, if this Nation is to meet the challenge of science, and fully utilize the potentialities of science. On the wisdom with which we bring science to bear against the problems of the coming years depends in large measure our future as a nation.

In January 1945 your subcommittee submitted to you a 326-page survey of the scientific activity of the Government agencies. In its report in July 1945 your subcommittee recommended the creation of a central scientific agency to assure a balanced scientific research program for the Nation and submitted a draft of a bill as the basis for further legislative study.

The recommendations of the Bush report were incorporated in the bill S. 1285 and the recommendations of your subcommittee were incorporated in S. 1297.

On September 6, in his message to Congress, President Truman emphasized the importance of early legislative action to provide Federal support of science.

Beginning on October 8 and ending on November 2, joint hearings were held which were followed by further study designed to determine the precise form of such legislation as would meet the needs which had been demonstrated. A considerably improved bill was contained in a preliminary report submitted to you on December 21. In the preparation of the perfected bill now being recommended, your subcommittee has had the benefit not only of these studies and the extensive body of testimony taken in the joint hearings, but also the cooperation of many of the Nation's leading scientists.

The principal documents in the legislative history of the bill now being recommended by your subcommittee include:

President Truman. Message to Congress, September 6, 1945. Excerpt relating to science legislation, appended herewith as appendix 1.

Vannevar Bush. Science: The Endless Frontier. A report to the President by the Director of the Office of Scientific Research and Development, July 1945.

Documents of the Subcommittee on War Mobilization of the Committee on Military Affairs, United States Senate:

Fifth interim report: The Government's Wartime Research and Development, 1940–44:
Part I. January 23, 1945. Survey of Government Agencies (326 pp.).
Part II. July 1945. Findings and Recommendations (74 pp.).

Senate Document No. 92: Legislative Proposals for the Promotion of Science: The Texts of Five Bills and Excerpts from Reports. August 1945 (89 pp.).

Monograph No. 4: Industry Opinion on Proposed Science Legislation. October 18, 1945 (30 pp.).

Hearings on Science Legislation (S. 1297 and related bills). 1945:
Part 1. October 8–12 (pp. 1–198).
Part 2. October 15–19 (pp. 199–456).
Part 3. October 22–26 (pp. 457–736).
Part 4. October 29–31 and November 1 (pp. 737–923).
Part 5. November 1–2 (pp. 924——).

Monograph No. 5: Science Legislation: Analytical Summary of Testimony. December 1945 (138 pp.).

Seventh interim report: Preliminary Report on Science Legislation: The National Science Foundation. December 21, 1945 (29 pp.).

The State of American Science and the Scope of a National Science Program

BASIC SCIENCES

The contributions of science to our victory in World War II and the justifiable publicity given to such developments as the atomic bomb, radar, proximity fuse, and penicillin lead the average citizen to conclude that American science is in a healthy condition. And now with our return to peace, he confidently expects to begin enjoying the peacetime applications of these and other scientific discoveries.

After careful study of the status of American science, your subcommittee cannot share this optimistic opinion concerning either the condition or the future of American science. A sober analysis of our wartime science yields several disturbing conclusions.

First is the fact that practically no basic scientific research was carried on during the war years; scientists were too busy developing practical applications of previously discovered scientific principles to continue their basic research. In the words of one of the witnesses appearing before your subcommittee:

For the most part, what happened during the war was not in any proper sense scientific work; it was the exploitation of skills, techniques, fundamental knowledge, all of which had been cultivated in the days of peace; an exploitation which has tended to impoverish our stocks rather than to increase them.

Even more disturbing to your subcommittee was its finding that the basic scientific discoveries on which most of the wartime scientific developments were based were made not by American but by European scientists. Again to quote from a distinguished scientist:

It should be somewhat humiliating to us to realize that the revolutionary sulfa drugs had their beginning in German research laboratories; that atom splitting was discovered in Berlin; that the basic pioneer work that has led to radio and radar and the enormous American electronic industries was that of a German professor. Penicillin came from England; DDT from Germany and Switzerland.

Witness after witness emphasized the relative weakness of American science in fundamental studies, but perhaps none so effectively as one great chemist, a Nobel laureate:

This contrast between the relative strength of pure science and its industrial applications in Europe and the United States can be illustrated in other ways. We are strong on applications and weak in fundamental science.

The point I wish to make is illustrated by the statistics on the number of men who have received Nobel prizes in chemistry, physics, and medicine. These prizes are not the only measure of scientific excellence, as all scientists are aware, but they are a significant index, since they are awarded without regard to nationality.

Here are the statistics showing the number of Nobel prize winners in the United States and Europe:

	United States	Europe
Chemistry	4	37
Physics	8	39
Medicine and physiology	6	37

And to quote the conclusion from the Bush report:

Our national preeminence in the fields of applied research should not blind us to the truth that with respect to pure research—the discovery of fundamental new knowledge and basic scientific principles—America has accepted a secondary place.

In view of the destruction wrought in Europe during the past few years, it seems hardly likely that we dare depend on European scientists and laboratories to offset our weakness in basic science.

SHORTAGE OF SCIENTIFIC PERSONNEL

The above facts are in themselves disturbing, but they become even more so when we realize that there is a real and serious deficit of trained American scientists. A study made by the American Institute of Physics estimates that the war resulted in a deficit of at least 17,000 doctoral degrees in the natural sciences and engineering. Although America because of its educational system had previously enjoyed a relative superiority with respect to availability of scientific personnel, it does not appear that we shall continue to do so unless definite program is undertaken to maintain this superiority. While

we were drafting potential scientists into military services both Soviet Russia and Great Britain were developing their resources of scientific personnel to an extent greater than ever before and this expansion appears to be continuing.

FINANCIAL SUPPORT OF AMERICAN SCIENCE

Finally your subcommittee was disturbed by the conclusion forced on it by an analysis of the financial support of American science. In 1938 we spent a total of approximately $270,000,000 on research of all types. Of this sum, only one-seventh was spent for basic research. For comparison it should be noted that in England expenditures for basic and applied research are approximately equal. This inbalance in our research budget became accentuated during the decade preceding the war. Between 1930 and 1940 the research expenditures by American industry (of which it is estimated only 5 percent was used for basic research) increased 100 percent. During the same decade, the Government's research budget, 15 percent of which supports basic research, increased 200 percent. On the other hand during the same period funds for research in our universities, of which 70 percent go to basic work, increased only 50 percent.

During the war our total national research budget increased from a prewar level of 300 to 400 million dollars to more than 800 million dollars in 1944; of these amounts, Federal research expenditures were approximately 70 million in 1940 and 700 million in 1944. With this ample support, and for the purposes of war, we were able for the first time to realize the full potential of our scientific resources.

But what of the future? The full peacetime utilization of our scientific resources will require funds of a similar magnitude.

Support for science has in the past come from three sources: private philanthropy, city, State, or Federal taxes, and from industry. In general, private philanthropic funds have been expended in universities, tax funds in universities and Government laboratories, and industrial expenditures used chiefly to support applied research in commercial laboratories. Available evidence indicates that industrial research budgets will soon exceed their prewar level of $300,000,000, but only 5 percent of these expenditures are devoted to basic research, on which all industrial as well as other applied research depends for its future development.

At the same time, we find that private contributions to university research are on the decline, just at the time when we are most in need of a greatly expanded program of fundamental scientific research.

Research in the natural sciences is becoming increasingly costly, and traditional support from private gifts, from endowment income, from grants by the large foundations, and from State appropriations are not and cannot be expected to meet the need. The search for other sources of income for basic research shows that no additional private resources are available.

Certain of the wartime scientific developments have opened the way for scientific progress of incalculable benefit to human welfare. For example, our increased knowledge of atomic energy and the development of radioactive isotopes of the common elements should permit chemists and physiologists to make rapid strides in their studies of living tissues and disease. Many devices developed for wartime uses

promise to become laboratory instruments as important as the microscope or the vacuum tube in the conduct of research.

These inescapable facts, Mr. Chairman, force your subcommittee to the conclusion that the future of American science on which depends the future of our security, our industrial progress, our health, and our general welfare requires that Congress provide immediate support for its continued development.

The primary need is support for all basic sciences. It is this which provides the source material for all advances in industrial techniques, in agriculture, in medicine, in weapons and other fields of application.

SCOPE OF BASIC SCIENCE TO BE SUPPORTED

In recommending the Federal support of basic science in America, your subcommittee emphasizes its conviction that such support must be provided to all work which will further the basic objectives of the legislation without excluding any field of science. Victory in World War II depended on contributions from every scientific discipline. The progress of modern science has been characterized by a tendency to break down earlier distinctions between various fields; new borderline sciences, such as physical chemistry, biochemistry, physiological psychology, are continually developing and we feel it would be unwise if this legislation were to place any arbitrary obstacles in this natural evolutionary process.

With a substantial majority of the witnesses heard, we are firmly convinced that the program of support of the basic sciences should include those fields of inquiry known as the social sciences. While it is true that these younger disciplines have not had time to perfect their specialized techniques, they have already developed to a degree which enables them to make significant contributions to almost every department of government. With a carefully planned and administered program of support, the social sciences promise to make even more important contributions to the solution of the problems of the future. Because the specific research needs of the social sciences have not been subjected to such careful study as those of the physical and biological sciences, your subcommittee has recommended that initial support of research in these fields be limited until adequate planning studies have been completed.

SCHOLARSHIPS AND FELLOWSHIPS

Our scientific strength is at all times limited by the availability of talented and trained scientific personnel. Money spent on laboratories and equipment will yield but small return unless we take positive steps to develop our human resources.

As has been pointed out above, America is faced with a serious deficit of scientists, a deficit which will constitute a serious limitation to the full development of a sound program in the basic sciences. Since studies have shown that many excellent students have, in the past, been unable to continue their scientific training because of an inability to pay for this training, your subcommittee believes that the national science program must include support for worthy students in the form of a program of scholarships and fellowships. Practically all witnesses appearing at the hearings spoke strongly in favor of

such a program. The scholarship program would be dictated by the needs of the Nation, with the requirement that individuals be selected solely on the basis of aptitude.

NATIONAL DEFENSE

There are two fields of applied research which should be supported in conjunction with the recommended program for basic research and scholarships. These are (1) health and medical sciences, and (2) national defense research.

Our armed forces have become almost completely dependent on the development of new weapons and defenses based on scientific discoveries. Recognition of this by the armed forces is indicated by the marked strengthening of the research organizations within the Army and Navy. It has become quite clear, however, that these research organizations within the services, excellent as they are, are not adequate to meet all scientific needs of national defense. The primary mission of military research organizations is that of developing and perfecting new weapons whereas wartime experience has repeatedly shown the necessity for integrating that type of work with the progress being made in the basic sciences. It is for this reason that the Wilson Board as well as the Bush report recommended the establishment of a part-civilian, part-military research group. Making this group an integral part of the proposed agency would bring it into close relationship with the broad programs of basic research and thus enable the military research organizations to maintain a close working relationship with civilian scientists engaged in research with possible military applications.

It should be made clear that your subcommittee does not regard the national defense program to be conducted under the proposed agency as in any sense competing with those being carried out in the military services. The actual development of new weapons would properly remain the business of the services but the highly technical and oftentimes extensive work involved in translating a new scientific discovery into a practical military application, would be an appropriate function for the national defense division of the agency.

The only reason which your subcommittee has found for not integrating the civilian military scientific group in the proposed agency grows out of the concern for maintaining secrecy regarding developments essential to national security. It is believed, however, that the bill proposed herein includes adequate safeguards in this respect.

MEDICAL SCIENCE

Research in the causes of disease, disability, and death has never received the financial support or the scientific encouragement which its significance to the health, security, and welfare of this Nation clearly demands. Furthermore, short-term grants for limited projects necessitating evidence of positive results have been the rule and not the exception under private foundation support. Comprehensive, well-planned, thorough research projects have been generally discouraged because of lack of long-term funds. Research fellowships, distressingly small in amount, have also been short-term awards and the turn-over of research personnel in medical research has been excessively great.

The brillant accomplishments in medical research in the fields of epidemiology, preventive medicine, chemotherapy, and traumatic surgery during the war were the result of coordinated efforts of many scientists on large-scale plans supported by Government funds. Moreover, this war experience has destroyed the bugaboo of Government intrusion into the medical research laboratory.

Now we are faced with the opportunities of peacetime solution of other great problems. Few families in the United States have escaped affliction from one or more of those diseases now considered chronic, incurable, or generally resistant to treatment.

Heart disease, diseases of the blood vessels, tuberculosis, arthritis, and nervous and mental diseases together account for well over half the annual deaths in the country and over half of all the cases of chronic disability.

The common cold is the most costly of all ailments in terms of worktime lost, yet its prevention and rational treatment is unknown. Little is understood about the aging process in man, and of the factors which result in a steady loss of physical and mental abilities with advancing age.

These great disease groups and problems, and many, many more have never been subjected to a comprehensive program of coordinated research. Scientists working in the fundamental fields which will contribute to the solution of these problems must be given the type of support which was afforded in the programs which produced the great achievements of the war period.

Such research will be expensive and will require resources not now available except from Federal funds—in the words of the Bush report:

> University funds that can be used for medical research are decreasing as research costs rise. Income from endowment is steadily shrinking, while endowment itself is no longer being increased by large new gifts. Medical schools must continue to meet relatively fixed expenses of teaching and overhead from smaller budgets, with the result that less money is left for research.

In the opinion of your subcommittee, medical research is on the threshold of an era of great discoveries. Even the byproducts of other scientific developments made during the war promise to accelerate medical research, thus, for example: Biophysiological studies carried out as part of the Manhattan project may have an important bearing on cancer research. Wartime studies on the physiology of high-altitude flying may be brought to bear on the problems of asthma and other respiratory diseases. Military research in bacteriological warfare should contribute much to the treatment and prevention of bacterial diseases. Thus, medical science is in a position to reap a valuable harvest from our military programs but it must be provided with adequate support.

ESTIMATED COST OF AN ADEQUATE NATIONAL SCIENCE PROGRAM

Your subcommittee believes that the several programs should be started on a modest scale to meet the most widely recognized needs after which the annual budget should be adjusted from year to year to the actual needs of each activity as may be necessary to maintain a healthy, balanced, and integrated over-all national science program.

It is the opinion of your subcommittee that the Bureau of the Budget and congressional Committees on Appropriations should in recommending annual appropriations, approve separate budgets for each of the major divisions of the Foundation. However, except under unusual circumstances, it is believed the details of the divisional programs and the allocation of funds to specific projects within the divisions should be left to the discretion of the scientific personnel charged with the administration of the Foundation's activities.

Estimates of the probable cost of a national science program appear in Dr. Bush's report, Science, the Endless Frontier. These admittedly rough estimates are 33.5 million dollars for the first year of operation and 122.5 millions for the fifth year, by which time it is expected that operations would have reached a fairly stable level. These figures did not include any estimate of the needs for either research or scholarships and fellowships in the social sciences.

President Truman has recommended in his 1946 Budget message $40,000,000 for the first fiscal year of the Foundation's operation.

In recommending a national science program involving the expenditure of this very small fraction of the national budget, your subcommittee is convinced it is recommending an investment which will pay handsome long-term dividends in the improvement of the health, security, and general welfare of our people.

How Should the Needed Federal Support Be Administered?

The need for Federal support of American science is urgent and immediate. Your subcommittee has given considerable study to the problem of determining the manner in which such support would most likely accomplish the desired ends. We have concluded that the greatest gains both to science and the Nation would result from strengthening the scientific program in existent organizations, especially in institutions of higher learning which have traditionally been the chief sources of our basic scientific development. We became equally convinced that the development of a balanced, coordinated, and effective program demanded the establishment of a new coordinating science agency.

Before arriving at this decision, your subcommittee considered several alternative ways by which Federal funds could be used to support American science. In each case, the possible alternatives were rejected in favor of a National Science Foundation. For instance, Federal funds could be appropriated to each of the States with the general provision that they should be used to support science. This, in effect, would result in the necessity of establishing 48 State science foundations with no provision for coordination of their separate programs. Alternatively, the Congress could make appropriations direct to each of the colleges and universities of the country in proportion to their enrollments. This in effect would mean the creation of several hundred local research foundations with even less likelihood of balanced programs. Or we could go to the other extreme and establish a number of new and elaborate Government laboratories and research centers. Although this alternative plan would probably work, it could be carried out only by weakening the Nation's universities and colleges, depriving them of scientific personnel and removing potential sources

of financial support. Such unnecessary centralization was rejected. Your subcommittee, therefore, recommends that the Federal support of American science be provided by the creation of a new Federal agency and that this agency should not operate facilities of its own, but should support science through existing facilities, primarily those of universities, Government laboratories, and other nonprofit institutions which are recognized to be public centers of scientific research and training. It further recommends that the program of the agency be carried out in conformity with the following basic principles:

(1) The maintenance and promotion of scientific freedom for the individual scientist, combined with the encouragement of local initiative by educational and research organizations.

(2) The minimum central control to maintain a balanced and coordinated program of scientific training and research in all fields of science.

(3) Full publication of findings and free availability to the public of all scientific discoveries growing out of federally financed research.

(4) An equitable geographic distribution of funds throughout the Nation.

(5) The maximum possible participation of all scientists in the over-all program of the agency.

The proposed Federal agency is unique in that it is to be not an operating organization but an instrument for expending public funds primarily in non-Government agencies.

After much deliberation your subcommittee has arrived at that form of administration which will not only be efficient but will simultaneously safeguard the interests of the general public supporting research through their Government and the interests of the non-governmental facilities which will perform the needed research.

The new administrative organization is believed to be distinctly superior to that proposed in either of the original bills. It is discussed in detail in the section-by-section analysis of the bill contained in this report. In brief, the proposal is to use parallel staffs of full-time and part-time scientific personnel. The full-time staff is charged with the actual administrative responsibility for the activities of the Foundation but part-time non-Government scientists will participate actively in planning and evaluating all programs of the Foundation. While it is believed that these two groups will normally work together harmoniously, provision is made whereby each serves as a continual check on the other, thus increasing the probability that the Foundation will at all times remain equally responsible to the needs of both scientists and the general public.

Availability of Federally Financed Discoveries and Inventions

Free communication of information is the very lifeblood of science. Unless the scientist has free access to all information related to his own studies his work will soon become isolated from the main stream of science and thereby lose much of its value. It has long been a tradition in science that the fullest possible dissemination of knowledge be provided.

In the fields of basic research this is normally accomplished by the publication of results in scientific journals. This information is then

freely available to scientists throughout the world and becomes rapidly integrated in the programs of all related research. Your subcommittee is convinced that results in basic science which come from Government-supported research should be treated in this traditional fashion. Consequently the Foundation provides for the free publication of such data in the standard scientific journals.

Scientists have testified that present publication facilities in some fields of science need strengthening. The proposed bill accordingly gives the Foundation full and flexible authority to provide support for the publication and dissemination of scientific information resulting from its own activities, as well as from other sources. For these purposes the facilities of existing scientific journals should be fully utilized.

Although much of the Foundation's research activities will be carried out in supporting basic studies which are undertaken with no immediate practical applications in view, part of its program involves fields of applied science. This is especially true of the work which will be carried out by the Divisions of National Defense and Health and Medical Science.

In applied science as well as in basic science progress may depend on the freedom with which scientific information is made available. If data applicable to industrial processes arising from federally financed research are not freely available industry will lose much of the benefit which can be derived from the research work of all Federal agencies. If the Congress is to appropriate public funds for the support of scientific research it is also obliged to take steps which will assure that the results of this work are available to all who would use them.

It is widely recognized that even in basic research projects, discoveries may be forthcoming which are patentable, and certainly it must be expected that patentable discoveries will arise in all fields of applied science supported by the Federal Government. In making available the results of federally financed research, provision must be included not only for publication of scientific data but also for the availability of patentable discoveries. It seems axiomatic that when the research is fully financed by Federal funds, the results of this research should be made available on a nondiscriminatory basis to all possible users. There was no disagreement with this fundamental principle on the part of any witness who appeared before the subcommittee or on the part of the thousands of individuals who have expressed interest in the legislation under consideration. The section of the bill dealing with the subject of making available the results of federally financed research has been, however, from time to time misconstrued because the mention of patents suggested to some persons that the legislation considered was an effort to reform the present patent system. The bill now being recommended contains no provision for the modification of existing patent laws or the right of any individual or corporation to patent, hold, transfer, or exploit privately developed inventions.

The new bill's provisions, first of all, set forth the basic principles—to which you subcommittee has found no disagreement to date: (1) That the results of research fully financed by the Federal Government, whether patentable or nonpatentable, should ordinarily be made freely available to the American public; (2) that where a private organization undertaking by contract a research project for Federal

agencies, has contributed substantially to a particular invention or discovery through earlier or current research activity financed by that organization, the private organization may retain such portion of commercial rights as will be agreed upon as being equitable. In the application of the second principle, commercial rights may be retained by nonprofit institutions as well as commercial organizations. However, since the whole philosophy of the present legislation is to view nonprofit laboratories as public centers of research suited for Federal support, additional safeguards have been introduced to insure that where commercial rights are retained by nonprofit institutions, no private organization is a special beneficiary, but that commercial rights are reserved primarily to reimburse the nonprofit institution for expenditures from its own funds.

The evidence presented to the subcommittee shows that it is inconceivable that a large-scale program for scientific research should be initiated at this time without certain minimum safeguards which assure that the result from scientific discoveries financed by the Federal Government be made fully and freely available to the public. The establishment of a clear-cut congressional policy on this point is made all the more urgent by the differences existing with respect to the policies established by individual Federal agencies. In the absence of congressional policy, many of the Government agencies have been operating under conflicting and variable policies.

Another important matter covered is the establishment of a procedure for handling inventions now owned by the Federal Government. Because the Government agencies have to date had no well defined policy in this field, many questions have been raised concerning the proper use of Government-owned patents. The bill provides that all inventions now owned by the Government shall be made freely available to the public, with the exception of those which the President or his designee decide should not be made public for national security reasons. The result of the passage of this legislation will be to make available to the public for immediate use many inventions now without security classification that came out of the war research work of the Office of Scientific Research and Development and other Government agencies.

The security aspects of future federally financed research and development in the field of national defense are recognized by a general provision exempting from all the requirements relating to public dedicating and similar requirements for the necessary period of time any scientific or technical information and inventions determined by the President or his designee to be essential in the interest of national security.

The principal concern of the subcommittee with respect to this availability feature of the legislation has been the drafting of adequate legislative formulas which on the one hand provides the necessary safeguards to the Federal purse and to the public supporting research through the Government, and, on the other hand, provides that private commercial organizations who have contributed to inventions and discoveries which they ultimately complete under a Federal research contract retain such commerical rights as they are entitled to. After extensive testimony, as well as consultation with many experts including, particularly, the Patent Commissioner, Casper W. Ooms, and the chairman of the Commerce Committee studying the

patent system, William H. Davis, the subcommittee has developed what it believes to be a completely adequate formula.

International Cooperation

Science knows no international boundaries, and no nation can long hope to attain a high level of scientific advancement without interchange of information with other nations. This has been the tradition of science—a tradition which has inspired confidence and harmony among the scientists of many nations—a tradition which has only been interrupted by the war. It is a tradition which is essential not only for the flourishing of science itself but one of the essentials for creating world peace.

In preparing the present bill your subcommittee endeavored to take into account the new problems that would be created by the extensive Federal support of basic science. We believe that this new legislation should be an opportunity to strengthen rather than weaken the machinery for international cooperation. In the course of its extensive hearings it found widespread support for making specific provision for strengthening the machinery for international cooperation of science.

The recommended legislation therefore provides for the strengthening of international cooperation with respect to American scientific activity in a number of ways, including (1) assistance to American scientists participating in international scientific congresses, (2) the strengthening of channels of exchange of basic scientific information among nations, and finally (3) international cooperation in specific science projects. The advantages of this third type of cooperation has been abundantly demonstrated during the war, particularly in the fields of medicine and weapons of war.

Relation of National Science Foundation to Other Federal Scientific Activities

Long before this war, and even before World War I, the need for better coordination of the Government's manifold scientific activities was recognized. As long ago as 1884 a committee of the National Academy of Sciences recommended the consolidation of four agencies into a department of science or, at least, the appointment of a committee to coordinate the Government's scientific work. Neither was done. In 1903, Congress, in establishing the Department of Commerce and Labor, provided that the President by Executive order might make certain transfers of scientific work to the new department. Shortly thereafter, President Theodore Roosevelt appointed a special committee to study the better coordination of the Government's scientific work. Mr. Pinchot wrote the chairman of this subcommittee on January 12, 1945, that his committee's report was never submitted because it was "obviously impossible to get legislative approval at that time." Again in 1908 and 1933, studies were made which recommended better coordination of the Federal Government's scientific activity. As the Federal agency structure mushroomed into an ever-growing organization to meet various recognized public needs, over twoscore of scientific agencies of the Federal Government came into existence by 1940.

During the war, coordination of their work was achieved by an elaborate system of formal committees and informal arrangements, but such coordination was of a temporary character and is already disintegrating. An intelligent use of the Federal expenditures for research can only be accomplished by bringing into being some definite mechanism which hitherto has not existed. At the outset, it must be recognized that coordination of science cannot be accomplished by a decree or fiat, but by a mutual understanding and exchange of problems, men, facilities, and findings. The scope of such coordination must be the whole range of scientific activity in the Federal Government. This is provided for in the bill recommended by your subcommittee. The new bill provides for the needed mechanism under the aegis of the Foundation without disturbing the administrative autonomy or budgetary arrangements of existing agencies. It creates a central switchboard by which the scientific agencies of the Government can coordinate their efforts with one another into an intelligent, over-all scientific program. Where exchange of information and a mutual discussion does reveal the need for modifications in administrative action, these can be achieved on the part of the agencies involved or through use of mechanisms for such purpose, namely, the Office of the President, and; particularly, the Bureau of the Budget.

Relation of Recommended Bill to Other Pending Scientific Legislation

The bill recommended by your subcommittee embodies the objectives and machinery proposed in S. 825 and H. R. 3440, and is intended to obviate the necessity for passing these bills which provide for the creation of new and separate civilian-military research agencies. The representatives of the War and Navy Departments have testified in hearings that the creation of a National Science Foundation, with a special division for national defense research, will meet their civilian research needs.

The National Science Foundation legislation in no way prejudges any of the pending measures relating to the control of atomic energy. It is true that to the extent that any atomic energy commission would engage in scientific research, its work, like that of other scientific agencies, would be coordinated on a voluntary basis with that of the National Science Foundation.

While the legislation now being recommended sets forth a general policy on the availability of federally financed scientific discoveries your subcommittee recognizes that certain special provisions will be made in the case of atomic energy discoveries. It is also expected that if national science legislation is enacted prior to atomic energy legislation that the atomic energy discoveries will be exempted for the interim period from these provisions of the national science bill under the discretion given to the President.

The Foundation is not given any authority or responsibility with respect to the control and utilization of atomic energy. Research in nuclear physics supported by the Foundation would be subject to whatever controls are established by atomic-energy legislation.

TEXT OF BILL

79TH CONGRESS
2D SESSION

S. 1850

IN THE SENATE OF THE UNITED STATES

FEBRUARY 21, 1946

Mr. KILGORE (for himself, Mr. MAGNUSON, Mr. JOHNSON, Mr. PEPPER, Mr. FULBRIGHT, Mr. SALTONSTALL, Mr. THOMAS of Utah, and Mr. FERGUSON) introduced the following bill; which was read twice and referred to the Committee on Military Affairs

A BILL

To promote the progress of science and the useful arts, to secure the national defense, to advance the national health and welfare, and for other purposes.

Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled, That this Act may be cited as the "National Science Foundation Act of 1946".

DECLARATION OF POLICY

SEC. 2. The Congress hereby finds that a full development and application of the Nation's scientific and technical resources is essential for the national defense, national prosperity, and the national health and welfare. The Congress declares it to be the purpose of this Act among other things to provide support for scientific research and development, to enable young men and women of ability to receive scientific training, to promote the conservation and use of the natural resources of the Nation, to correlate the scientific research and development programs of the several Government agencies, to achieve a full dissemination of scientific and technical information to the public, and to foster the interchange of scientific and technical information in this country and abroad. The Congress further finds it essential for these purposes to create a central scientific agency within the Federal Government.

NATIONAL SCIENCE FOUNDATION

SEC. 3. (a) There is hereby established an independent agency of the Federal Government to be known as the National Science Foundation (hereinafter referred to as the "Foundation"), and administered by an Administrator (hereinafter referred to as the "Administrator") who shall be appointed by the President, by and with the advice and consent of the Senate, and shall receive compensation at the rate of $15,000 per annum. The President, before appointing an Administrator, shall consult with and receive the recommendations of the National Science Board created in section 4 (and hereinafter referred to as the "Board"). The Administrator shall appoint a Deputy Administrator, who shall perform the functions of the Administrator during his absence or when there is a vacancy in the office of the Administrator, and shall perform such other duties as may be delegated to him by the Administrator. The Deputy Administrator shall receive compensation at the rate of $12,000 per annum.

(b) There shall be within the Foundation a Division of Mathematical and Physical Sciences, a Division of Biological Sciences, a Division of Social Sciences, a Division of Health and Medical Sciences, a Division of National Defense, a Division of Engineering and Technology, a Division of Scientific Personnel and Education, a Division of Publications and Information, and such additional divisions, not to exceed three in number, as the Administrator may from time to time establish after receiving the advice of the Board. The functions of each division shall be prescribed by the Administrator after receiving the advice of the Board, except that until the Administrator and the Board have received general recommendations from the Division of Social Sciences regarding the support of research through that Division, support of social science research shall be limited to studies of the impact of scientific discovery on the general welfare and studies required in connection with other projects supported by the foundation. Each division shall be headed by a Director, who shall be appointed by the Administrator and shall receive compensation at the rate of $12,000 per annum.

(c) Except as provided in section 4, the Administrator shall appoint and fix the compensation of such personnel as he may deem necessary to carry out the provisions of this Act. Such appointments shall be made and such compensation shall be fixed in accordance with the provisions of the civil-service laws and regulations and the Classification Act of 1923, as amended, except that, when deemed necessary by the Administrator for the effective administration of this Act, expert scientific, technical, and professional personnel, including part-time personnel, may be employed without regard to the civil-service laws, and their compensation fixed without regard to the Classification Act of 1923, as amended.

NATIONAL SCIENCE BOARD AND DIVISIONAL SCIENTIFIC COMMITTEES

SEC. 4. (a) The Administrator, in exercising his authority under this Act, shall consult and advise with a National Science Board and, through the Directors of the several divisions, with divisional scientific committees, on all matters of major policy, program, or budget. The Board shall consist of nine members appointed by the President,

by and with the advice and consent of the Senate, from among persons who are especially qualified to promote the broad objectives of this Act, plus the chairmen of the several divisional scientific committees. The scientific committee for each division, except the Division of National Defense, shall consist of not less than five and not more than fifteen members appointed by the Administrator, with the advice and approval of the Board, except that the initial members of each such divisional scientific committee shall be appointed by the Administrator with the advice and approval of the Board members appointed by the President.

The scientific committee for the Division of National Defense shall consist of not more than forty persons, of whom at least half shall be civilians appointed by the Administrator, with the advice and approval of the Board, and the remaining members shall be divided equally between such chiefs of such services and divisions of the War Department and such chiefs of such bureaus and offices of the Navy Department as the Secretary of War and the Secretary of the Navy, respectively, may from time to time designate. There shall be within the divisional scientific committee for the Division of National Defense a five-man executive committee consisting of the chairman of the divisional scientific committee, as chairman; two civilian members elected annually by the civilian members of the divisional scientific committee; together with one Army officer, and one naval officer, each of whom should be charged in their respective Departments with the coordination of research, designated by the Secretary of War and the Secretary of the Navy, respectively.

Each divisional scientific committee shall be reasonably representative of the major scientific interests and functions of its division. Members of the Board appointed by the President and members of the divisional scientific committees appointed by the Administrator shall serve for three-year terms, except that (1) at least one-third of such members originally appointed shall be appointed for one-year terms, and at least another third for two-year terms, and (2) any member appointed to fill a vacancy occurring prior to the expiration of the term of his predecessor shall be appointed for the remainder of such term. No person thus appointed to serve as a member of the Board or any divisional scientific committee shall be eligible again to serve as a member of the same group until the expiration of one year after his term has expired, except that a member appointed for a term of less than three years may be appointed for a succeeding three-year term.

(b) The Board and each divisional scientific committee shall annually elect its own chairman from among its own members, and shall devise its own rules of procedure. The Board and each such committee shall meet at the call of its own chairman or at such times as may be fixed by itself, but not less than six times each year, including at least once each calendar quarter. Vacancies in the membership of the Board or of any divisional scientific committee shall not impair the authority of the remaining members to execute its functions, and a majority of the members of the Board or any divisional scientific committee as constituted at any given time shall constitute a quorum.

The Board shall appoint and prescribe the duties of an executive secretary of its own selection who shall receive compensation at a rate, not exceeding $12,000 per annum, to be fixed by the Board.

The Administrator shall pay the compensation of such executive secretary and may furnish the Board and the divisional scientific committees such additional personnel, and such facilities, services, and supplies as may be necessary for the proper performance of the functions of the Board and the divisional scientific committees.

(c) The Board shall continuously survey the activities and management of the Foundation, and shall periodically evaluate the achievements of the Foundation in accomplishing the objectives of this Act. Each divisional scientific committee shall survey continuously the scientific field which it encompasses, shall undertake to determine the specific scientific needs of such field, and shall evaluate proposed programs and projects. The Board and each divisional scientific committee shall, upon its own initiative or upon request by the Administrator, make appropriate recommendations and reports relating to its duties and findings. The Board and each such committee shall have full access to all information in the possession of the Foundation.

(d) The Administrator shall render an annual report to the President and the Congress, summarizing the activities of the foundation, together with such recommendations as he may deem appropriate. The Board shall annually and at such other times as it deems necessary make such recommendations to the President and the Congress as in its opinion will further the objectives of this Act. The annual report shall include such independent recommendations concerning the budget, organization, and management of the Foundation, and such other recommendations as the Board and the divisional scientific committees may deem necessary to better effectuate the purposes of this Act. The annual report shall include whatever dissenting opinions may be submitted for that purpose by individual members of the Board or of the divisional scientific committees. The Administrator shall, whenever requested by the Board or any divisional scientific committee, publish and disseminate widely any recommendations or reports prepared by the Board or such committee.

(e) Members of the Board and of the divisional scientific committees shall receive compensation at the rate of $50 for each day engaged in the business of the Foundation, and shall be reimbursed for their necessary travel and other expenses incurred in the work of the Board or of any such committee. Persons holding other offices in the executive branch of the Federal Government may serve as members of the Board or any divisional scientific committee, but they shall not receive remuneration for their services as such members during any period for which they receive compensation for their services in such other offices, nor, except for representatives of the War and Navy Departments on the scientific committee for the Division of National Defense, shall they in their services as such members serve as representatives of the Government agency by which they are employed.

(f) Members of the Board and of any divisional scientific committee established under the provisions of this Act, and any other officers or employees of the Foundation, shall be chosen without regard to their political affiliations and solely on the basis of their demonstrated capacity to carry out the purposes of the Foundation and their fitness to perform the duties of their office.

(g) The Administrator may create such specialized additional advisory committees or employ the services of such advisory personnel

as he may deem necessary to better effectuate the objectives of this Act. Persons so employed shall be reimbursed for their necessary travel and other expenses incurred in the work of the Foundation. Such persons may be noncompensated or may receive compensation at a rate not to exceed $50 for each day of service. Members of the Board and of the divisional scientific committees, and any other person serving in an advisory capacity pursuant to this section, may serve as such without regard to the provisions of sections 109 and 113 of the Criminal Code (18 U. S. C., secs. 198 and 203) or section 19 (e) of the Contract Settlement Act of 1944, except insofar as such sections may prohibit any such person from receiving compensation in respect of any particular matter which directly involves the Foundation or in which the Foundation is directly interested.

SUPPORT OF RESEARCH AND DEVELOPMENT

SEC. 5. (a) The Administrator is authorized to enter into contracts or other arrangements pursuant to which he will finance, in whole or in part, or otherwise support, research and development activities to be carried on by other Government agencies or by other organizations.

(b) Of the funds appropriated to the Foundation for research and development activities, not less than 15 per centum shall be available only for expenditure for research and development, pursuant to contracts or other financial arrangements made by the Administrator under this section, including contracts or arrangements to which subsection (c) is applicable, in each of the following fields: (1) National defense and (2) health and the medical sciences.

(c) Of the funds appropriated to the Foundation for research and development activities (excluding funds expressly appropriated for national defense), not less than 25 per centum shall be apportioned among the States as follows: Two-fifths shall be apportioned among the States in equal shares, and the remainder shall be apportioned among the States in the proportion that their respective populations bear to the population of all the States, determined according to the last preceding decennial census; and the amounts so apportioned to each State shall be expended only for carrying on research and development activities in the facilities of tax-supported colleges and universities, including the land-grant colleges, within such State pursuant to contracts or other financial arrangements made by the Administrator under this section. In making such contracts or other financial arrangements, the Administrator shall give each individual institution the widest latitude in its selection of individual research and development projects but the Administrator shall not be required to expend funds in any institution unless it submits proposals for the expenditure of such funds which the Administrator finds to be consistent with such general program and standards as he may, after receiving the advice of the Board, establish in order to carry out the objectives and provisions of this Act. For purposes of this section the term "State" includes Alaska, Hawaii, and Puerto Rico. Of the funds appropriated to the Foundation for research and development activities (excluding funds expressly appropriated for national defense), an additional amount of not less than 25 per centum shall be expended in the facilities of nonprofit organizations without regard to the above limitations

relating to State quotas or the tax-supported character of the organization. In meeting the requirements of this subsection, the Administrator may take into account whatever funds may be expended by the Foundation for facilities to be operated by the land-grant, tax-supported, or other nonprofit organizations, even though the title or ownership rights of such facilities remain with the United States.

(d) The activities of the Foundation shall be construed as supplementing and not superseding, curtailing, or limiting any of the functions or activities of other Government agencies authorized to engage in scientific research and development. Funds allocated by the Administrator to other Government agencies shall be utilized for projects approved by the Administrator and undertaken on behalf of the Foundation, and shall be in addition to, and not in lieu of, funds regularly appropriated to such other Government agencies.

(e) In all research and development activities financed or otherwise supported by the Foundation, the Administrator shall make every effort to eliminate restraints upon the free expression of scientific views and to insure full freedom in the exercise of creative talents, in the development of new ideas, and in the methods of research. Any person engaged in such research and development activities shall not be precluded from independently discussing, writing, or publishing his own views and conclusions relating to such research and development.

SCHOLARSHIPS AND FELLOWSHIPS

SEC. 6. The Administrator is authorized to award scholarships and fellowships to persons for scientific study or scientific work in any field of science, including but not limited to the mathematical, physical, biological, medical, and social sciences at nonprofit institutions of higher education, or other institutions, selected by the recipient of such aid, for such periods as the Administrator may determine, in the United States or in foreign countries. Persons shall be selected for such scholarships and fellowships solely on the basis of aptitude, within the limits of such quotas as may be established to insure an equitable selection of such persons from among the States and territories. Persons selected for such scholarships and fellowships may include employees of the Federal Government and such employees selected and detailed for scientific study or training shall not lose their status or seniority ratings for reason of absence from regularly assigned duties during the course of such study or training.

REGISTER OF SCIENTIFIC PERSONNEL

SEC. 7. The Administrator shall maintain a register of scientific and technical personnel and in other ways provide a central clearinghouse for information concerning all scientific and technical personnel in the United States and its possessions. No individual shall be listed in such register without his consent.

USE AND DISSEMINATION OF RESEARCH FINDINGS

SEC. 8. (a) The Administrator shall make and maintain an inventory of all current federally financed research and development projects. In cooperation with the Commissioner of Patents, the

Administrator shall establish a central register of all inventions, discoveries, patents, patent rights, and findings, including references to related data in which the United States or any agency thereof has any right, title, or interest, or which pursuant to this section have been freely dedicated to the public. The Administrator shall record, collect, index, and promptly publish or cause to be published significant data on all inventions and discoveries and other findings produced in the course of federally financed research and development activities, or arrange with other Government agencies for such publishing, recording, collecting, and indexing. In consultation and collaboration with the Library of Congress and other Government agencies, the Administrator shall take such steps as he may deem necessary to make such information and other available significant scientific and technical information accessible to the public, including the preparation and distribution of reports, periodic catalogs, inventories, abstracts, translations, bibliographies, and microfilm and other reproductions thereof; and for such purposes the Administrator may utilize the facilities of Government agencies and other organizations to the extent that he deems necessary or desirable, and may contract for the expenditure of funds for such purposes without regard to the provisions of section 87 of the Act of January 12, 1895 (28 Stat. 622), and section 11 of the Act of March 1, 1919 (40 Stat. 1270) (U. S. C., title 44, sec. 111).

(b) Each contract or other arrangement for federally financed research or development entered into between any Government agency and any organization shall provide that such organization will make available to such agency full data on all inventions, discoveries, patents, patent rights, and findings produced in the course of such research or development, including such reports with respect thereto as may be required by such agency. Each Government agency, upon the request of the Administrator, shall make available to him such data and such reports with respect to research and development activities financed by such agency, as may be necessary for the purposes of this section.

(c) All inventions, discoveries, or findings in which the United States (or any Government agency), now or hereafter, hold any rights, including patent rights, shall be made available to the public on a nonexclusive and on a royalty-free basis to the extent the United States or such agency is entitled to do so under the rights held by it. Except as provided hereafter in this subsection and in subsection (d), any invention, discovery, or finding hereafter produced in the course of federally financed research and development shall, whether or not patented, be made freely available to the public and shall, if patented, be freely dedicted to the public. The requirements of this subsection, to the extent that they require modification of contracts or other financial arrangements already entered into by the United States (or any Government agency) shall not go into effect until one hundred and twenty days after the date of enactment of this Act.

(d) The head of any Government agency financing by contract, or otherwise administering, federally financed research and development activities, may, by stipulation in the contract or by other advance agreements with any organization, provide for the retention by the organization, or by the inventor, or by their assignees of such patent rights based on discoveries, inventions, or findings produced

in the course of such research and development as the head of such Government agency deems fair and equitable, and consistent with the national interest: *Provided*, That (1) the head of such Government agency shall, before entering into any such contract or agreement, make a finding that the agency has made every reasonable effort to arrange for the conduct of the necessary research and development without entering into a contract containing such provision; (2) the organization shall contribute or shall have contributed substantially to the development of the particular inventions, discoveries, or findings for which patent rights are retained through earlier or current research and development activities financed by the organization; (3) in every case, the contract or agreement shall provide for at least an irrevocable, nonexclusive, royalty-free license for governmental purposes to the United States; and (4), in the case of any nonprofit organization, the head of such Government agency further determines (A) that the research and development is essential in the field of national defense or in such other fields as the President may specify for such purpose and, (B) that the patent rights retained will not be used to serve the special benefit of any organization conducted for profit or of any individual, and will be made available or licensed to applicants on a nonexclusive, uniform, and reasonable royalty basis.

In the administration of the provisions of this subsection, the head of any Government agency shall be guided by such rules and regulations as the President may deem necessary and prescribe by Executive order.

(e) The Administrator shall make a quarterly report to the President and to the Congress concerning contracts and agreements containing the provisions authorized by subsection (d). This report shall include a list of all contracts and agreements containing such a provision entered into by any Government agency during the preceding quarter, the reasons supporting the approval of such provision in each case, the amount of Federal funds expended or to be expended under each contract or agreement containing such a provision, the name of the organization with which the contract or agreement was made, and the general nature of the patent rights reserved for private use in each case. The report shall also include a list of all inventions, discoveries, or findings in which patent rights were permitted to be retained pursuant to the provisions of subsection (d) and which were first recorded or finally authorized during the preceding quarter, identification of the contract or agreement under which such inventions, discoveries, or findings were produced, and the nature of the rights retained. The report shall also include the Administrator's recommendations, if any, for such further Executive or legislative action as he may deem necessary.

(f) Notwithstanding any other provision of this Act, the President, or any person designated for that purpose by him, may exempt from the provisions of this Act relating to dedication to the public, publication, dissemination, or making available, any scientific or technical information, data, patents, inventions, or discoveries produced in the course of federally financed research or development or in which the United States holds any rights, if and so long as the President or such designated person determines that such exemption is essential in the interest of national security.

INTERNATIONAL COOPERATION

SEC. 9. (a) The head of any Government agency is hereby authorized, with the approval of the President and through the Department of State, to conclude reciprocal agreements with foreign governments or agencies thereof, relating to the interchange of scientific and technological information (including models and samples for information purposes), and the use and availability of patents and patent rights owned or controlled by the respective governments.

(b) The Administrator is hereby authorized, with the approval of the President and through the Department of State, to cooperate in any international research or development activities consistent with the purposes or provisions of this Act and to expend for such international research activities such sums within the limit of appropriated funds as the Administrator may deem desirable.

(c) The Administrator may defray the expenses of representatives of Government agencies and other organizations and of individual scientists to accredited international scientific congresses and meetings whenever he deems it necessary in the promotion of the objectives of this Act.

INTERDEPARTMENTAL COORDINATION

SEC. 10. (a) There is hereby established an Interdepartmental Committee on Science, to consist of the Administrator, as Chairman, and the heads (or their designees) of such Government agencies engaged in or concerned with the support of scientific activity to a substantial degree as the President may from time to time determine. The Interdepartmental Committee shall meet whenever the Chairman so determines, but not less than once a month.

(b) The Interdepartmental Committee shall advise and assist the Administrator in gathering and correlating data relating to the scientific research and development activities of the Federal Government; shall study and evaluate such data in relation to the program of the Foundation and the scientific research and development programs of the other Government agencies; and shall make such recommendations to the Foundation and other Government agencies as in the opinion of the Committee will serve to aid in effectuating the objectives of this Act and other legislation providing for Federal support of scientific research and development. The Administrator, in consultation with the Interdepartmental Committee, shall, from time to time, make recommendations to the President for the achievement of maximum effectiveness in the conduct of all federally financed research and development.

MISCELLANEOUS

SEC. 11. (a) To enable the Administrator to carry out his powers and duties, there is hereby authorized to be appropriated annually to the Foundation, out of any money in the Treasury not otherwise appropriated, such sums as may be necessary to carry out the provisions of this Act. The funds appropriated to the Foundation, as herein authorized, and funds hereafter appropriated to any Government agency for scientific research or development, as herein defined, shall, if obligated during the fiscal year for which appropriated, remain available for expediture for four years following the expiration of the

fiscal year for which appropriated. After such a four-year period, the unexpended balances of appropriations shall be carried to the surplus fund and covered into the Treasury.

(b) The materials or equipment purchased by Federal funds or furnished by the Federal Government in connection with research and development activities shall be the property of the United States. The Administrator shall not, however, through the Foundation or its own employees, operate any laboratories, pilot plants, or other such scientific or technical facilities which he may acquire.

(c) In carrying out his functions under this Act, the Administrator is authorized—

(1) to prescribe such rules and regulations as he may deem necessary to govern the manner of the operations of the Foundation and its organization and personnel;

(2) to make such expenditures as may be necessary for carrying out the provisions of the Act;

(3) to enter into contracts, or amendments or modifications of contracts, without performance or other bonds, and without regard to section 3709 of the Revised Statutes (U. S. C., title 41, sec. 5) in the case of all contracts which relate to scientific research or development;

(4) to make advance, progress, and other payments which relate to scientific research or development without regard to the provisions of section 3648 of the Revised Statutes (U. S. C., title 31, sec. 529);

(5) to acquire by purchase, or otherwise, hold and dispose of by sale, lease, loan, or otherwise, real and personal property of all kinds necessary for, or resulting from, scientific research or development; and

(6) to prescribe, with the approval of the Comptroller General of the United States, the extent to which vouchers for funds expended under contracts for scientific research and development shall be subject to itemization or substantiation prior to payment, without regard to the limitations of other laws relating to the expenditure of public funds and accounting therefor.

(d) The provisions of the Reorganization Act of 1945 shall be applicable with respect to the Foundation, and with respect to the transfer of agencies and functions to and from the Foundation, without regard to the provisions of section 5 (e) of such Act.

(e) The Office of Scientific Research and Development, and its constituent committees shall be transferred to the Foundation; together with such of the powers, functions, duties, personnel, property, records, funds (including all unexpended balances of appropriations, allocations, or other funds now available), contracts, assets, and liabilities as may be determined by the President. The National Roster of Scientific and Specialized Personnel shall be transferred from the Department of Labor to the Foundation, together with such of the personnel, records, property, and balances of appropriations as have been utilized or are available for use in the administration of such roster as may be determined by the President. The transfers provided for in this subsection shall take effect at such time or times as the President shall direct.

(f) If any provision of this Act, or the application of such provision to any person or circumstance, is held invalid, the remainder of this

Act, or the application of such provision to persons or circumstances other than those as to which it is held invalid, shall not be affected thereby.

DEFINITIONS

SEC. 12. As used in this Act—

(a) "Research and development" means theoretical analysis, exploration, and experimentation in any field of science (including but not limited to the mathematical, physical, biological, medical, engineering, and social sciences), and the extension of investigative findings and theories of a scientific or technical nature into practical application, including the experimental production and testing of models and processes.

(b) "Federally financed research and development" means research and development conducted directly by the Federal Government and all other research and development financed in whole or in part directly by the Federal Government from funds designated for research and development, under a contract, grant, or other direct form of financial assistance for research and development.

(c) "Government agency" includes departments, independent agencies and commissions, corporations, and other instrumentalities of the Federal Government.

(d) "Organizations" includes State and local government agencies, corporations, partnerships, nonprofit institutions, and individuals.

(e) "Scholarships and fellowships" means stipends covering tuition and other fees, and such living, travel, and other expenses as the Administrator may determine.

SECTION-BY-SECTION ANALYSIS OF S. 1850

SECTION 1. NAME

"National Science Foundation" was selected as the name of the proposed new agency after careful consideration. Although not strictly comparable to private research foundations, the proposed Federal agency is designed to serve very similar functions; it is not to be an operating agency but rather serve to support scientific work in already existing organizations. Consideration was given to the name "National Research Foundation" but since the agency is to support not only scientific research, but also programs of scientific training and publication, the broader term "National Science Foundation" seems more appropriate.

SECTION 2. DECLARATION OF POLICY

The hearings emphasized clearly the need for Federal support of basic scientific research, as well as for the application of science to practical problems of health, national defense, agriculture, and industry. Progress in applied technology depends on maintaining and continually adding to our reservoir of fundamental scientific knowledge. Witnesses pointed out, for example, how wartime advances in armaments and medical care were possible only because of the existence of a vast fund of basic scientific knowledge upon which scientists and technologists could draw. This knowledge was, in many cases, far removed from practical applications hence it must be emphasized that no national science program can operate in terms of practical results only, but must assure continuance of fundamental work and exploration.

This declaration of policy is intentionally broad as befits the comprehensive and integral role which science plays in modern civilization and national welfare. In creating a central scientific agency within the Federal Government, there is no intent to limit or control the appropriate scientific work now being well carried on by many Federal agencies; rather the intent is that of providing a central switchboard for coordinating what, at present, are many independent scientific programs, while also providing, for the first time in history, for the financial support of fundamental scientific research on a Nation-wide basis. Such a national program in support of fundamental research, combined with the programs of applied research in Government departments and commercial laboratories will go far toward assuring both the welfare and the future security of our Nation.

SECTION 3. NATIONAL SCIENCE FOUNDATION

Subsection 3 (a) establishes the National Science Foundation as an independent agency of the Federal Government. It provides that the Foundation be administered by full-time Government officials,

the Administrator to be appointed by the President, by and with the advice and consent of the Senate.

Attention is called to the provision requiring that, before appointing an Administrator, the President shall consult with and receive the recommendations of the National Science Board. While not necessarily binding on the President, who must accept final responsibility for his appointees, this provision is included as a means of assuring harmony between the Administrator and the Board and to emphasize the necessarily high qualifications essential in the Administrator. Although a review of the history of appointments to scientific posts in the Government gives no basis for believing that a President is likely to use this appointment as a political reward, your subcommittee regards the Administrator of the Foundation to be so important as to merit this provision of the bill.

Your subcommittee also considered the alternative proposal of vesting the powers of the Foundation in a board or commission of full-time Government employees, but it believes that the organization recommended in this bill represents a more efficient form of administration and which by utilizing the part-time services of larger numbers of scientists on the National Science Board and on the Divisional Scientific Committees, and on other advisory bodies (see sec. 4), makes for an even fuller participation of the Nation's scientists in the program of the Foundation.

In recommending a single full-time Administrator, your subcommittee follows the established principle of executive responsibility which it believes necessary to an agency of the scope of the Foundation. This principle is followed in the administration of executive departments, which are headed by Cabinet officers, and in most Government agencies other than those with semijudicial functions.

The Administrator will not personally carry on the detailed activities of the Foundation any more than the Secretary of War or the Secretary of Agriculture conduct the many diverse activities of their departments. However, there will be one person whom the President, the Congress, and the public may hold responsible for the Foundation's activities. It will be noted that the salary proposed for the Administrator, while admittedly inadequate in relation to his responsibilities, is the same as that of a Cabinet officer with similar responsibilities.

Your subcommittee considered but rejected the alternative proposal of vesting the powers of the Foundation in a board of noncompensated members. This would be a delegation of congressional power to persons who would of necessity be devoting the major part of their time and energies to other work. The policy has been established, and we believe wisely, in sections 109 and 113 of the Criminal Code, that persons employed by private organizations cannot hold positions of administrative responsibility in the Federal Government which might be affected by the outside employment. The purpose of this law is to avoid situations where personal loyalties might conflict with the public interest; in the case of the Maritime Commission, persons are required to have severed all financial connections with shipping companies at least 3 years before being eligible for appointment as members of the Commission.

From its studies your subcommittee is convinced that the program of the Foundation can be best carried out by the creation of a number

of divisions within the Foundation, each charged with the administration of a generally defined area of activity. Section 3 (b) provides for the creation of eight divisions, each headed by a full-time director.

Three of these divisions would be responsible for all matters pertaining to fundamental or basic research in the several sciences. These are a Division of Mathematical and Physical Sciences, a Division of Biological Sciences, and a Division of Social Sciences. Although recognizing the inherent unity of all science, testimony presented at the hearings leads to the recommendation of these three separate divisions, each devoted to a relatively natural grouping of subject matter. The initial limitation with respect to the support of research in the social sciences has been included in the bill because none of the studies which served as a background for this legislation had considered the research needs of these fields.

The bill provides for the establishment of two research divisions whose functions are primarily related to the solution of problems in applied science. These are a Division of Health and Medical Science and a Division of National Defense. The subcommittee conceives the function of the Division of Engineering and Technology to be the support of research in the fundamental engineering sciences and other studies basic to the broad development of technology, not the engineering development of machines or processes. It is thus clear that the functions of this division do not conflict with those of the Office of Technical Services which S. 1248 would establish in the Department of Commerce to aid private inventors and industries with the engineering development of new ideas.

The Division of Scientific Personnel and Education has been provided to administer the scholarship and fellowship program, to maintain a national roster of scientific personnel, and to carry out related functions associated with the training and effective employment of the Nation's scientists.

Finally, there is provided a Division of Publication and Information to promote the widespread dissemination and utilization of scientific findings. In section 8 the Foundation is authorized to provide for direct publication, financial and other assistance to nongovernmental scientific journals, aid to the work of translating and abstracting scientific publications, and other activities which will make scientific literature more readily accessible to working scientists and other users of scientific information.

Your subcommittee has received many suggestions for additional divisions of the Foundation, as, for example, a Division of Natural Resources and a Division of Foreign and Cultural Studies; it believes however, that any additional divisions should be established by the Foundation only after integrating its several programs with those of other agencies and after careful study of the needs for other possible divisions. In order to provide for future developments in science or for necessary and appropriate expansion of the Foundation's program, up to three additional divisions may be created under this bill.

Subsection 3 (c) makes provision for employment of a full-time staff as may be required for the efficient operation of the Foundation. With the exception of the Administrator, the Deputy Administrator, the directors of the several divisions, and certain expert scientific consultants and part-time employees, members of the staff are to be appointed and paid in accordance with the provisions of the existing

civil-service laws and regulations. This section also provides for employment of part- or full-time personnel without regard to the civil-service laws when the Administrator believes that their employment will be necessary to accomplish the purposes of this act. Thus the Foundation will be able to take advantage of civil-service personnel as long-term career scientists and still obtain the expert services of other scientists on a short-term basis.

As will be noted, subsection 4 (f) specifies that all officers and full- or part-time employees of the Foundation shall be chosen solely on the basis of their capacity and fitness without regard to political affiliation. Although this provision is not necessary with respect to the civil-service employees, your subcommittee would eliminate the possibility that at any future time the positions to be filled by appointment might be regarded as political rewards.

SECTION 4. NATIONAL SCIENCE BOARD AND DIVISIONAL SCIENTIFIC COMMITTEES

Most essential to a National Science Foundation program is the active participation in its direction by as many of our scientists as possible. The preceding section provides for a full-time operating staff which will necessarily consist chiefly of scientists working as full-time Government employees. This section provides for a parallel structure of advisory boards which will make possible participation in the work of the Foundation by large numbers of scientists who cannot give full time.

In this manner, the regular staff of the Foundation will be continuously stimulated by contact with working scientists who would be regularly consulted. To prevent these advisory groups from becoming perfunctory bodies, regular and frequent meetings are required and their recommendations will be made public as they desire.

The National Science Board will advise the Administrator in regard to over-all policies and programs. The Board is composed of nine persons appointed by the President, with the advice of the Senate, from among persons who are especially qualified to promote the broad objectives of the Foundation. In addition, the Board will include the chairmen of the eight divisional scientific committees, who will be particularly familiar by virtue of their position with the specialized scientific problems of the Foundation.

At the divisional level, the divisional scientific committees serve a function comparable to that of the Board for the Foundation as a whole. Members of these committees are to be appointed by the Administrator with the advice and approval of the Board. Their relatively short term assures a continuous flow of new men and new ideas into these groups, and thus into the National Science Board. Your subcommittee is convinced that the scientific activities of the Foundation must take place primarily at the divisional level and it has, therefore, provided that the functions of these divisional scientific committees shall include a continuing survey of the scientific fields covered by the Division. These committees will also offer recommendations concerning the over-all divisional program and the specific proposals and projects submitted to the Division.

Your subcommittee calls special attention the divisional scientific committee recommended for the Division of National Defense. It

would create within the Foundation the Research Board for National Security originally recommended to the Secretaries of War and the Navy by the Wilson committee and proposed for legislative action in the May bill (H. R. 3440) and the Byrd bill (S. 825).

The bill also permits appointment of such additional standing or temporary committees which may be needed for fuller participation of outside experts in scientific fields.

In addition to the National Science Board and the divisional scientific committees, your subcommittee anticipates that the Foundation will seek the advice and services of other recognized scientific organizations, especially that of the National Academy of Sciences, which by act of Congress is an official governmental advisory body for scientific matters. Since the authority granted the Foundation is sufficiently broad to defray expenses incurred, it is contemplated that the Foundation will avail itself of the many specialized services of the Academy and its operating agency, the National Research Council.

The importance which your subcommittee regards the National Science Board and its functions is indicated by the provisions that the Board shall report directly to the President and the Congress and that it shall select and employ its own full-time executive secretary.

In describing the responsibilities and duties of the Board and divisional scientific committees, the subcommittee has attempted to provide the best means for outside scientists to make maximum contribution to the work of the Foundation. In conjunction with the provisions of subsection 4 (d) for publication of the reports and recommendations of any board or committee this administrative set-up will result in the activities of the Foundation being subjected to the critical and public scrutiny by the Nation's scientists. Your subcommittee believes that this provision will give scientists as a whole greater voice in the affairs of the national science program than would result from any proposed alternative form of administrative organization.

Subsection 4 (e) may seem to provide relatively high per diem compensation, but it is only commensurate with the importance which your subcommittee believes will attach to the contributions of scientists serving the Foundation on a part-time basis.

Subsection 4 (f) specifies that no persons connected with the Foundation, either in advisory or regular positions, shall be chosen with regard to political affiliations. They shall be selected solely on the basis of capacity and fitness to carry out the functions of the Foundation.

Subsection 4 (g) contains provisions deemed necessary if the Foundation is to be able to make use of the advisory services of scientists employed by nongovernmental, educational, and commercial organizations. Scientists who served the Government in advisory capacities during the war were willing to assume the risk of possible prosecution on the ground of technical violations of sections 109 and 113 of the Criminal Code, even though they had no actual conflicts of interest, but it seems unfair to ask scientists to assume such risks indefinitely. Therefore, this subsection protects such advisory personnel against prosecution when they serve as advisers to the Foundation, and the public interest is still protected by the general provisions of the law relative to actual conflicts of interest.

SECTION 5. SUPPORT OF RESEARCH AND DEVELOPMENT

Subsection 5 (a) specifically authorizes the Administrator to enter into contracts or other financial arrangements to finance in whole or part research and development activities to be carried on by universities, colleges, public or private research laboratories, and other Government agencies. From its studies, your subcommittee is convinced that the nature of scientific research requires that the Foundation be free to support research under a variety of financial arrangements and be granted considerable flexibility with respect to the nature of the financial arrangement employed. Thus, the Administrator may enter into contracts for highly specific projects or make relatively nonspecific grants for the support of broad programs of research in a particular field.

In authorizing the Foundation to support research and development in other Government agencies, it should be understood that such support will be supplementary to the regular research budgets of these Government agencies. This provision is regarded as necessary in order to permit scientific groups in Government laboratories to obtain funds to pursue highly promising research in the fields supported by the Foundation.

Subsection 5 (b) guarantees a minimum allocation of funds for medical research and for research in fields essential to national defense. As stated in the beginning of this report your subcommittee feels that the obvious importance of these two fields of applied science to the welfare and security of the Nation justifies this provision. It should be noted that the language of this subsection requires only that 15 percent of the research funds be available for research in national defense and medical sciences. It does not require that it be expended unless suitable projects are submitted.

Subsection 5 (c). The future development of science in America depends in large measure on the strength of the laboratories of the Nation's universities and research institutions. Therefore, section 5 (c) provides that at least 50 percent of all research funds expended by the Foundation shall be used to support research in nonprofit organizations (25 percent to be distributed on a geographical basis and an additional 25 percent irrespective of location of the organization submitting the research proposals). This should result, not only in furthering the development of science but also in general strengthening of our institutions of higher education. The provision that 25 percent of all research funds (excluding national defense) expended by the Foundation shall be apportioned to each State on the basis of an automatic formula is included in order to assure an equitable geographic distribution. Many of our smaller institutions located in the less populous States and Territories are in serious need of support for their scientific work. Many of them are strategically located to carry on unique and greatly needed types of research, for example, research in tropical diseases in Puerto Rico, meteorological studies in Alaska. Your committee feels that it would be a serious mistake for all of this financial aid to be concentrated in a few large institutions, since such maldistribution would result in a serious imbalance in the quality of higher education available in various parts of the country.

It will be noted that the funds allocated on a geographical basis are not automatically distributed to the States but rather are to be

expended to support research projects and programs proposed by tax-supported institutions within each State. The limitation, in this instance, only to tax-supported institutions derives from the logic that Federal funds expended according to automatic formula should be utilized in institutions already supported in whole or in part by other public funds. In expending the remaining 75 percent of its research funds, the Foundation will be able to utilize the facilities of non-tax-supported educational institutions.

Subsection 5 (d) has been included in order to make explicit that the Foundation shall not limit the research activities of existing Government agencies nor interfere with the administration of their research programs. Certain witnesses pointed out that this specific provision is desirable to protect these agencies from an arbitrary reduction in research appropriations. This subsection provides that, in allocation of funds, a Government agency shall be treated in the same manner as other applicants for financial aid, i. e., the funds shall be allocated for research work additional to that normally underway as part of the agency's regular program.

Some witnesses heard by your subcommittee feared that Federal support of science would place restrictions on the traditional freedom of scientific research. Your subcommittee recognizes that such development would be a disaster both to science and the Nation. Subsection 5 (e) directs the Administrator to take steps to eliminate any restraints on scientific freedom. It allows every scientist who uses the Foundation's funds to go about his work in any manner he sees fit with the sure knowledge that the Foundation will stand behind his right to freedom of expression and research. Furthermore, the investigator is permitted to publish his personal views and conclusions, except on projects restricted in the interests of national security. Your subcommittee feels that this subsection will encourage the development of new ideas and scientific methods. It is in keeping with that tradition of freedom which is the very lifeblood of science.

SECTION 6. SCHOLARSHIPS AND FELLOWSHIPS

The success of any program of scientific research is dependent on the availability of adequate numbers of well-trained personnel. Almost every witness urged the provision for a broad program of scholarships and fellowships. Evidence presented in the hearings shows that as a result of drafting science students during the war, the Nation is faced with a serious deficit in scientific personnel, a deficit which must be made up if American science is not to lag.

This section would provide not only for undergraduate scholarships but for graduate and postdoctoral fellowships such as have been so successful in the experience of the National Research Council and the Social Science Research Council. Recipients of these awards are to be chosen solely on the basis of aptitude for scholarly pursuits.

It has not seemed wise to include specific provisions governing the procedure for selecting recipients of scholarships and fellowships nor to specify the mechanics by which this program would be administered. Again, to assure an equitable geographic distribution of funds, provision is made to permit the establishment of State quotas.

Your subcommittee did not consider it wise to indicate the relative proportion of the Foundation funds that should be used to support the

program of scholarships and fellowships. The provisions of this section are designed primarily to develop scientific personnel rather than merely to aid worthy students. It therefore seems wise to write only these general provisions into the bill and thus permit the Foundation to adjust the nature and scope of its program to the personnel needs of American science.

It will be noted that these financial aids to study are to be given to individuals rather than to institutions; it is intended that the individual be permitted to study at a recognized institution of his own choice.

SECTION 7. REGISTER OF SCIENTIFIC PERSONNEL

The experience of war agencies has demonstrated the importance of placement facilities for scientific personnel. The success and usefulness of the National Roster of Scientific and Specialized Personnel and of the Office of Scientific Personnel suggest that the Foundation should maintain an up-to-date register of trained personnel which would be particularly useful—

(1) In meeting the personal needs of its own programs.
(2) In placing the scientific personnel trained through the Foundation's programs of scholarships and fellowhips.
(3) In selecting scientific personnel to meet the Nation's need in time of war or other national emergency.

SECTION 8. USE AND DISSEMINATION OF RESEARCH FINDINGS

Evidence presented at the hearings indicated that the progress of science is largely dependent on the full availability and the prompt dissemination of scientific information. Subsection 8 (a) directs the Administrator to maintain a control file of all federally financed research projects and research findings, to publish all useful materials and authorizes him to cooperate with libraries, other governmental agencies and scientific publications in a broad program designed to further the dissemination and use of scientific information.

In order that the Administrator will be able to carry out his responsibilities with respect to publication of scientific findings, subsection 8 (b) provides that all organizations receiving Federal support for research shall make available to the supporting Government agency all significant data and findings produced in the course of federally financed research, and that such agencies shall in turn make this information available to the Administrator.

Your subcommittee regards it essential that any legislation involving the expenditure of public funds shall include assurance that such expenditures be used for the general welfare and not reserved for the benefit of any special group. There has been no uniform policy with respect to the commercial rights to patents arising out of federally supported research. Your subcommittee is convinced that a uniform policy must be established in the national interest. It has arrived at the conclusion that the best basic policy (sec. 8 (c)) is dedication of all fruits of Federal research to the public which has paid for the development. This policy is in accord with the traditions of free exchange of information among scientists and it seems to be the most logical and business-like solution to the problem.

The first sentence of subsection 8 (c) provides that all patent rights now held by the United States Government shall be made available to the public on a nonexclusive, royalty-free basis to the extent that the Government is entitled to do so under the rights held by it. This provision will have an important immediate effect because it will enable the making available to the public of the benefits of many important inventions made under Government contracts and by Government employees during the war.

For example, under contracts of the Office of Scientific Research and Development, the Government has received title to many patents in the field of microwave radar, rocket propellants, proximity-fuse developments, devices that were important in antisubmarine warfare, and in other important fields. Except for any such inventions that remain classified for security reasons and are, therefore, exempted under section 8 (f) from the requirement of public dedication so long as that classification remains, all such wartime inventions owned by the Government can now be made available for use by the general public.

In addition, all other patents to which the Government has title through the operations of other governmental agencies will be made freely available to the public. Therefore, there will be provided for the first time by statute a policy for the administration of Government-owned patents by all governmental agencies.

Although patents in the field of atomic energy now owned by the Government are covered by the provisions of section 8 (c) and thus would be available to the public, it is assumed that all such inventions will be exempted under section 8 (f) until legislation is enacted covering the field of atomic energy.

Your subcommittee does not intend that the provision of the subsection 8 (c) should deprive research organizations or private industry of their just property rights in inventions developed in the course of Government contracts. Section 8 (d) attempts to provide for an equitable distribution of patent rights resulting from such cooperative projects and allows for contractual exceptions to the basic policy of public dedication in those cases where an invention is the result of a substantial private investment. Your subcommittee believes that this provision will maintain the basic policy of public dedication, while at the same time provide for the utilization of private research facilities, whenever it is in the public interest.

Since the general provisions of this section give preference to nonprofit institutions in the expenditure of research funds, certain additional restrictions have been included with respect to the retention of commercial patent rights by nonprofit institutions. While it is not anticipated that most nonprofit organizations will be interested in the retention of commercial rights to patents resulting from federally supported research, it seems wise to make provision for such exceptional cases as may arise, thus assuring the Foundation of the possibility of utilizing research facilities which might not otherwise be available. In such cases, the basic policy of full utilization is assured by providing that any commercial patent rights retained by nonprofit institutions shall be made generally available through nonexclusive licenses and at a reasonable royalty.

As a means of securing consistent administration of these general provisions by the several Government agencies 8 (d) also provides that the President shall by Executive order prescribe such rules and regulations as he deems necessary.

Subsection 8 (e) provides for publication of a quarterly report by the Administrator listing the essential details of all contracts containing provisions for the retention of commercial patent rights by organizations engaged in federally supported research and development. Evidence presented at the hearings suggests that the failure of certain agencies to protect the public interest in research and development contracts may have resulted largely from the fact that the details of such contracts are not generally known. It is believed that the provisions of this subsection will result in more uniform administration of the provisions of subsection 8 (d) and at the same time provide the President with such information as he needs in prescribing rules and regulations appropriate through the administration of federally supported research and development.

Although recommending the adoption of the basic policy of full publication and free dedication of findings growing out of research and development supported by Federal funds, your subcommittee recognizes that occasionally the demands of national security will demand exemption from the general provisions of this section. Therefore, subsection 8 (f) provides that the President (or any person designated by him) may make such exemption if he determines that it is essential in the interest of national security.

SECTION 9. INTERNATIONAL COOPERATION

Wartime experience revealed not only the desirability but the necessity of international collaboration on certain types of research projects, therefore your subcommittee regards it as essential that this bill include a permissive clause for carrying on such projects in peacetime as were possible by Executive order during wartime.

Subsection 9 (a) authorizes, with the approval of the President, the head of any Government agency including the Administrator of the Foundation to enter into reciprocal agreements with foreign governments regarding the interchange of scientific and technological information and the use and availability of Government-owned patent rights.

Subsection 9 (b) authorizes, with the approval of the President, the Administrator of the Foundation to cooperate in any international research or development activities consistent with the purposes of the act. In both instances, however, it should be noted that such international scientific activities are to be entered into only with the approval of the President and through the Department of State.

Subsection 9 (c) authorizes the Administrator of the Foundation to defray expenses of American scientists to accredited international scientific congresses and meetings. Witnesses appearing at the hearings emphasized the value of personal contacts among scientists of all nations. Experience has shown that American scientists in the past have frequently been inadequately represented at international congresses by the lack of funds for travel expenses. The subsection

would permit the Foundation to defray the expenses of representatives of Government agencies, of scientific societies, and of individual scientists nominated by the Foundation as representatives of American science in international congresses.

SECTION 10. INTERDEPARTMENTAL COORDINATION

Approximately 40 Government agencies are at present engaged in scientific and technical activities. The need for coordination of this work in the many fields vital to the public interest has been hitherto met in many ways: By informal personal contacts among scientists, by impromptu meetings and, in some cases, by standing interdepartmental committees. Witnesses agreed that a more thorough coordination of this work is essential to an efficient Government and that the Foundation should assist in the integration of such programs. They emphasized, however, that this coordination must be by voluntary cooperative effort, not by arbitrary direction from one agency.

This section provides for an Interdepartmental Committee on Science which, we believe, is a distinct improvement over the present ad hoc arrangements without hindering the independence or initiative of the various Federal research organizations. The Interdepartmental Committee will serve as a clearing house through which the various agencies of the Federal Government under the leadership of the Foundation will develop an over-all Federal scientific program.

SECTION 11. MISCELLANEOUS

A. Carry-over of funds.—Your subcommittee is convinced that an effective program for support of research cannot be carried on with the uncertainty of year-to-year appropriations. This section, therefore, provides that the research funds appropriated to the Foundation (and to the other Government agencies) shall remain available for expenditure for 4 years following the fiscal year for which appropriated. Such provision would thus permit the Foundation to enter into long-term research contracts which certain types of investigations require.

Subsection 11 (b) stipulates that while the materials and equipment furnished by Federal funds shall be the property of the United States, the Foundation shall not operate any laboratories or research facilities which it may acquire.

Subsection 11 (c). Miscellaneous authorization: This subsection contains specific authorizations and exemptions from existing statutes which, after careful study, your subcommittee believes necessary in carrying out the program of the Foundation. Provisions of this subsection are based on experience in the administration of federally sponsored research by the Office of Scientific Research and Development and other Government research agencies. Especially important in this group of exemptions is the elimination of the requirements of performance bonds on contracts and of competitive bidding.

Subsection 11 (d): This permits the Foundation structure to be integrated with related programs of scientific research and scientific education in accordance with over-all needs of Federal administration

as determined under the President's reorganization plan as adopted by Congress.

Subsection 11 (e): The Office of Scientific Research and Development and the National Roster of Scientific and Specialized Personnel were created by Executive order and at this time are still functioning organizations. Although the transfer of these agencies to the Foundation could be accomplished by Executive order under the Reorganization Act of 1945 and the War Powers Act, it is believed preferable to include the specific provision in the bill, with the further provision that the transfers shall take effect in such manner at such time as the President shall direct.

SECTION 12. DEFINITIONS

This section defines the terms used in the bill.

Appendix 1

FROM PRESIDENT TRUMAN'S MESSAGE TO CONGRESS SEPTEMBER 6, 1945

SECTION XII. SCIENTIFIC RESEARCH DEVELOPMENT

Progress in scientific research and development is an indispensable condition to the future welfare and security of the Nation. The events of the past few years are both proof and prophecy of what science can do.

Science in this war has worked through thousands of men and women who labored selflessly and, for the most part, anonymously in the laboratories, pilot plants, and proving grounds of the Nation.

Through them, science, always pushing forward the frontiers of knowledge, forged the new weapons that shortened the war.

Progress in science cannot depend alone upon brilliant inspiration or sudden flights of genius. We have recently had a dramatic demonstration of this truth. In peace and in war, progress comes slowly in small new bits, from the unremitting day-by-day labors of thousands of men and women.

No nation can maintain a position of leadership in the world of today unless it develops to the full its scientific and technological resources. No government adequately meets its responsibilities unless it generously and intelligently supports and encourages the work of science in university, industry, and in its own laboratories.

During the war we have learned much about the methods of organizing science, and about the ways of encouraging and supporting its activities.

The development of atomic energy is a clear-cut indication of what can be accomplished by our universities, industry, and Government working together. Vast scientific fields remain to be conquered in the same way.

In order to derive the full profit in the future from what we have learned, I urge upon the Congress the early adoption of legislation for the establishment of a single Federal research agency which would discharge the following functions:

1. Promote and support fundamental research and development projects in all matters pretaining to the defense and security of the Nation.
2. Promote and support research in the basic sciences and in the social sciences.
3. Promote and support research in medicine, public health, and allied fields.
4. Provide financial assistance in the form of scholarships and grants for young men and women of proved scientific ability.
5. Coordinate and control diverse scientific activities now conducted by the several departments and agencies of the Federal Government.
6. Make fully, freely, and publicly available to commerce, industry, agriculture, and academic institutions, the fruits of research financed by Federal funds.

Scientific knowledge and scientific research are a complex and interrelated structure. Technological advances in one field may have great significance for another apparently unrelated. Accordingly, I urge upon the Congress the desirability of centralizing these functions in a single agency.

Although science can be coordinated and encouraged, it cannot be dictated to or regimented. Science cannot progress unless founded on the free intelligence of the scientist. I stress the fact that the Federal research agency here proposed should in no way impair that freedom.

Even if the Congress promptly adopts the legislation I have recommended, some months must elapse before the newly established agency could commence its operations. To fill what I hope will be only a temporary gap, I have asked the Office of Scientific Research and Development and the Research Board for National Security to continue their work.

Our economic and industrial strength, the physical well-being of our people, the achievement of full employment and full production, the future of our security, and the preservation of our principles will be determined by the extent to which we give full and sincere support to the works of science.

It is with these works that we can build the highroads to the future.

Appendix 2

List of Witnesses Testifying at Hearings on Science Legislation

In order of appearance

1. Bowman, Isaiah, president, Johns Hopkins University, October 8, 1945.
2. Langmuir, Irving, associate director of the laboratory, General Electric Co., October 8, 1945.
3. Shapley, Harlow, director, Harvard University Observatory, October 9, 1945.
4. Kettering, C. F., president and general manager, General Motors Research Corp.; president, American Association for the Advancement of Science, October 9, 1945.
5. Moulton, F. R., permanent secretary, American Association for the Advancement of Science, October 9, 1945.
6. Meyerhoff, Howard A., executive secretary, American Association for the Advancement of Science, reporting results of a poll representing 162 members of the council, October 9, 1945.
7. Smith, Harold D., Director of the Bureau of the Budget, October 10, 1945.
8. Hunsaker, J. C., chairman, National Advisory Committee for Aeronautics, October 10, 1945.
9. Hines, Lewis G., legislative representative, American Federation of Labor, October 10, 1945.
10. Smith, Russell, legislative secretary, National Farmers Union, October 10, 1945.
11. Wallace, Henry A., Secretary of Commerce, October 11, 1945.
12. Davis, Watson, director of Science Service; president, American Documentation Institute, October 12, 1945.
13. Dearborn, R. J., chairman of the committee on patents, National Association of Manufacturers, October 12, 1945.
14. Freeman, Orville, American Veterans' Committee, October 12, 1945.
15. Malisoff, Harry, Disabled American Veterans, page 188, October 12, 1945.
16. Bush, Dr. Vannevar, Director, Office of Scientific Research and Development. October 15, 1945.
17. Patterson, Hon. Robert P., et al., War Department, October 15, 1945.
18. Forrestal, Hon. James V., et al., Navy Department, October 16, 1945.
19. Gray, Dr. Horace M., professor of economics and associate dean of the Graduate School, University of Illinois, October 16, 1945.
20. Oppenheimer, Dr. J. R., director, New Mexico Laboratories, Manhattan project, October 17, 1945.
21. Curtis, Dr. H. J. Association of Oak Ridge Scientists, Oak Ridge, Tenn., October 17, 1945.
22. Wilson, Dr. Robert, Association of Los Alamos Scientists, New Mexico Laboratories, Manhattan project, October 17, 1945.
23. Ickes, Hon. Harold L., Secretary of the Interior, October 18, 1945.
24. Arnold, Gen. H. H. et al., Army Air Forces, October 28, 1945.
25. Maverick, Hon. Maury, Chairman and General Manager, Smaller War Plants Corporation, October 18, 1945.
26. Brown, Bruce K., vice president in charge of development, Standard Oil Co., Ind., October 18, 1945.
27. Jewett, Dr. Frank B., president, National Academy of Sciences, October 19, 1945.
28. O'Donnell, Rev. J. C., S. C., president, University of Notre Dame, October 19, 1945.
29. Richards, Dr. A. N., Chairman of the Committee on Medical Research of the Office of Scientific Research and Development, October 22, 1945.
30. Blake, Francis G., dean and Sterling professor of medicine, Yale University School of Medicine, October 22, 1945.
31. Peters, Dr. John P., Yale School of Medicine, October 22, 1945.
32. Rhoads, Dr. Cornelius P., Memorial Hospital, New York City, October 22, 1945.

33. Butler, Dr. Allan, Massachusetts General Hospital, October 22, 1945.
34. Fischelis, Dr. Robert P., secretary, American Pharmaceutical Association, October 22, 1945.
35. MacEwan, Dr. Ewan, Iowa College of Medicine, October 22, 1945.
36. Fishbein, Dr. Morris, et al., editor of the Journal of the American Medical Association, October 22, 1945.
37. Smith, Dr. Homer W., professor of physiology, New York University College of Medicine, October 23, 1945.
38. McIntire, Vice Admiral Ross T, Surgeon General, Navy Department, October 22, 1945.
39. Dyer, R. E., Assistant Surgeon General, Director, National Institute of Health, United States Public Health Service, October 22, 1945.
40. Kirk, Maj. Gen. Norman T., Surgeon General, United States Army, October 22, 1945.
41. Rutstein, Dr. David D., deputy commissioner of health, New York City, October 22, 1945.
42. Richardson, Dr. Henry B., physician's forum, associate professor of clinical medicine, Cornell University Medical College, October 22, 1945.
43. Kubie, Dr. Lawrence S., New York City, October 22, 1945.
44. Dunn, Dr. L. C., chairman, zoology department, Columbia University, October 24, 1945.
45. Bronk, Dr. D. W., director, Johnson Research Foundation, University of Pennsylvania, October 24, 1945.
46. Sinnott, Dr. Edmund W., Sterling professor of botany and director of the Sheffield Scientific School, Yale University, October 24, 1945.
47. Stadler, Dr. L. J., professor of field crops, University of Missouri; agent, United States Department of Agriculture, October 24, 1945.
48. Stanley, Dr. W. M., member of the Rockefeller Institute for Medical Research, Princeton, N. J., October 24, 1945.
49. Steinbach, Dr. H. B., associate professor of zoology, Washington University, October 22, 1945.
50. Waksman, Selman A., microbiologist, New Jersey Agricultural Experiment Station; professor of microbiology, Rutgers University, October 24, 1945.
51. Zirkle, Raymond, professor of botany, University of Chicago; director, Institute of Radiobiology and Biophysics, October 24, 1945.
52. Griggs, Dr. Robert F., National Research Council, October 24, 1945.
53. White, Dr. Philip R., associate, Rockefeller Institute for Medical Research, October 24, 1945.
54. Compton, Dr. Karl T., president, Massachusetts Institute of Technology, October 25, 1945.
55. Smyth, Dr. Henry DeW., chairman, department of physics, Princeton University; author of the War Department report on the atomic bomb, October 25, 1945.
56. Urey, Dr. Harold C., Nobel prize winner in science, professor of physics, University of Chicago.
57. Wolman, Dr. Abel, professor of sanitary engineering, Johns Hopkins University, October 25, 1945.
58. Sargeant, Howland H., Chief, Division of Patent Administration, Alien Property Custodian, October 26, 1945.
59. Ooms, Casper W., Commissioner, United States Patent Office, October 26, 1945.
60. MacQuigg, C. E., et al., Engineering College Research Association, October 26, 1945.
61. Bakhmeteff, Dr. Boris A., et al., Engineers Joint Council, October 26, 1945.
62. Kern, Dr. Frank D., University of Pennsylvania; president Mycological Society of America, October 26, 1945.
63. Mitchell, Dr. Wesley, Social Science Research Council, October 29, 1945.
64. Gaus, Dr. John M., president, American Political Science Association, October 29, 1945.
65. Yerkes, Dr. Robert M., emeritus professor of psychobiology, Yale University, October 29, 1945.
66. Nourse, Dr. E. G., vice president, Brookings Institution, October 29, 1945.
67. Ogburn, Dr. William F., professor of sociology, University of Chicago, October 29, 1945.

68. Cooper, Monsignor John M., professor of anthropology, Catholic University, October 29, 1945.
69. Day, Dr. Edmund E., president, Cornell University, October 29, 1945.
70. Miller, Watson B., Federal Security Administrator, October 29, 1945.
71. Porter, Paul A., Chairman, Federal Communications Commission, October 29, 1945.
72. Dewey, Col. Bradley, president, American Chemical Society, October 29, 1945.
73. Adams, Dr. Roger, chairman, board of directors, American Chemical Society, October 29, 1945.
74. DuBridge, Dr. L. A., director, radiation laboratory, Massachusetts Institute of Technology, October 30, 1945.
75. Berne, Lewis Alan, president, International Federation of Architects, Engineers, Chemists, and Technicians, October 30, 1945.
76. Land, Edwin H., president and director of research, Polaroid Corp., October 30, 1945.
77. Murray, Philip, president, Congress of Industrial Organizations, represented by Dr. Robert K. Lamb, October 31, 1945.
78. Carmichael, Dr. Leonard, president, Tufts College; former director, National Roster of Scientific and Specialized Personnel, October 31, 1945.
79. Rautenstrauch, Dr. Walter, professor of industrial engineering, Columbia University, October 31, 1945.
80. Magruder, Brig. Gen. John, director, Strategic Services Unit (formerly Office of Strategic Services), October 31, 1945.
81. Denslow, Dr. J. S., director of research, Kirksville College of Osteopathy and Surgery, director, research laboratory, Still Memorial Research Trust, Kirksville, Mo., October 31, 1945.
82. Baruch, Bernard M., November 1, 1945.
83. Moe, Dr. Henry Allen, secretary-general Guggenheim Foundation, November 1, 1945.
84. Potter, John Milton, Hobart and William Smith Colleges, Geneva, N. Y., November 1, 1945.
85. Tyler, Dr. Ralph W., professor and chairman, department of education and university examiner, University of Chicago, November 1, 1945.
86. Graves, Dr. Mortimer, American Council of Learned Societies, November 1, 1945.
87. White, Dr. William Charles, committee on medical research, National Tuberculosis Association, November 1, 1945.
88. Conant, Dr. James B., president, Harvard University, November 2, 1945.
89. Rabi, Dr. I. I., Columbia Radiation Laboratory, Columbia University, November 2, 1945.
90. Cooke, Morris L., et al., industrial engineer, representing the Independent Citizens Committee of the Arts, Sciences, and Professions, November 2, 1945.
91. Mather, Dr. Kirtley, professor of geology, Harvard University, et al., representing the American Association of Scientific Workers, November 2, 1945.
92. Weed, Dr. Lewis H., chairman, Division of Medical Sciences, National Research Council.
93. Studebaker, Dr. John, United States Commissioner of Education.
94. Kelly, Dr. Fred J., director, Division of Higher Education, United States Office of Education.
95. Gillmor, R. E., president, Sperry Gyroscope Co., Aircraft Industries Association.
96. Zook, Dr. George F., president, American Council on Education.
97. McIntoch, Frank, consulting radio engineer.
98. McDonald, Ralph, executive secretary, National Education Association.
99. Cockrell, Judge Ewing, United States Federation of Justice.

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(The following report from the subcommittee on science legislation of the Commerce Committee is made a part of this report:)

SUBCOMMITTEE REPORT, COMMITTEE ON COMMERCE,
FEBRUARY 27, 1946

NATIONAL SCIENCE FOUNDATION

Mr. MAGNUSON, from the subcommittee considering science legislation, submitted the following

REPORT

To: The Honorable Josiah W. Bailey, chairman, Senate Committee on Commerce.

From: The Subcommittee Considering S. 1285.

Re: National Science Foundation.

The above subcommittee considering S. 1285 conducted joint hearings on legislation seeking to establish a National Science Foundation with a subcommittee of the Senate Military Affairs Committee, of which Senator Kilgore is chairman. These hearings covered a period from October 8 to November 2, 1945, during which over 100 witnesses were heard and 1,000 pages of testimony taken. The foremost leaders in science, education, and medicine presented their views, together with representatives of government, the military services, the clergy, industry, and labor. The legislation seeking to establish Federal aid to research has been thoroughly examined. S. 1285 was patterned after Dr. Bush's report to the President, Science—The Endless Frontier, and introduced by Senator Magnuson. S. 1297 and S. 1720 were introduced by Senator Kilgore and considered through the Senate Military Affairs Committee. Joint hearings and subsequent conferences have succeeded in joining the issues presented in the above bills.

Your subcommittee attaches herewith the report of the Military Affairs Subcommittee on Science Legislation, in which your subcommittee concurs.

It is proposed that both the Senate Military Affairs Committee and the Senate Commerce Committee accept this report of their subcommittees considering this legislation. Pending this approval, a single bill, S. 1850, has been introduced in the Senate, bearing the names of both groups of Senators immediately identified with these bills.

The President of the United States in two messages to Congress asked for prompt consideration of this subject.

It will be noted from an examination of the testimony that all the eminent witnesses testified as to the immediate need for action on this legislation.

The military services have testified as to the urgency of this country to maintain its scientific leadership. Recent world events make this urgency obvious. The military programs are designed to complement the fundamental research conducted by the proposed foundation.

A further and practical necessity for quick action arises from the dead line imposed by the termination on June 30, 1946, of the predecessor agency, the Office of Scientific Research and Development. Section 11 of the bill transfers the Office of Scientific Research and Development to the Foundation.

The authors of the bill and their respective subcommittees hope both full committees can clear this legislation promptly.

The proposed legislation, in the opinion of your subcommittee, covers all phases of other bills dealing with scientific research now before the committee.

WARREN G. MAGNUSON.

(Report from the War Department follows:)

WAR DEPARTMENT,
Washington, April 5, 1946.

Hon. ELBERT D. THOMAS,
Chairman, Committee on Military Affairs,
United States Senate.

DEAR SENATOR THOMAS: The War Department favors the enactment of S. 1850, Seventy-ninth Congress, "A bill to promote the progress of science and the useful arts, to secure the national defense, to advance the national health and welfare and for other purposes," provided certain amendments hereinafter enumerated are incorporated therein.

S. 1850 establishes a National Science Foundation to foster and encourage research in all fields, including that of the military. It provides for the establishment of eight divisions covering the various fields of research and development, one of which is the Division of National Defense. The Foundation is to be administered by an Administrator who shall be counseled by the advisory board and various divisional scientific committees. The War and Navy Departments are represented on the scientific committee for the Division of National Defense. The bill also establishes a policy concerning patents acquired by federally financed research.

The War Department desires to point out that comments made and amendments hereinafter suggested are restricted to military considerations only.

To insure that no classified military information will have a more or less general dissemination, it is recommended that section 4 (c) be amended by placing a comma after the word "Foundation" on page 8, line 5, and adding to the end thereof—

except that the Division of National Defense is authorized to establish procedures for withholding classified military information.

The present provisions of the bill impose a large administrative burden upon the War Department in that it would be necessary to review substantially all outstanding research and development contracts and to make findings or initiate amendments with respect

thereto to conform the patents rights provisions thereof to this bill. The contractor, in many instances, would undoubtedly be unwilling to grant the additional patents rights required. Hence, section 8 (c) would either have to be construed as having the effect of a condemnation action or those contracts would have to be terminated where the contractors are unwilling to amend them on reasonable terms. The only alternative would be for the Government to pay whatever sums the contractors demand for the amendments. It is also believed necessary that a period of time should be allowed before the new provisions become effective in order to save contracting officers from inadvertently and illegally entering into contracts on the old basis.

In order to eliminate the retroactive application of the patent provisions of the bill to pending contracts entered into prior to enactment of the bill, it is recommended that the words "hereafter in this subsection and" be deleted from section 8 (c), page 16, line 15 and that the words "not contracted for prior to sixty days after enactment of this Act" be inserted after the word "development" on page 16, line 17, and that the last sentence of section 8 (c), page 16, beginning on line 20, be deleted in its entirety.

Undoubtedly a large percentage of research and development contracts of the War Department will be submitted for exemptions under section 8 (d). The bill in its present form provides that—

> The head of any Government agency * * * may * * * provide for the retention by the organization, or by the inventor * * * of such patent rights * * * as the head of such Government agency deems fair and equitable * * *—

and also that the head of such Government agency shall make certain findings in connection therewith. This would impose an impossible burden on the Secretary of War or the head of any other Government agency unless power were given to redelegate this responsibility.

The words "every reasonable effort" which appear in proviso 1, page 17, line 13, are susceptible to severe interpretation. In each case the head of the Government agency involved might have to decide, at his peril, whether he had exhausted every possibility of entering into a contract without granting patent exemptions. It is also believed that under the requirements of this proviso that the contracting agency would be forced to place a contract with a contractor who was willing to grant greater patent rights to the Government than was a competitor, even if his price was much higher and his facilities much less suitable than those of the contractor who declined to grant the greater patent rights. It is, therefore, considered that this proviso should be deleted in its entirety and that there be substituted therefor a general guide as to what is fair and equitable in the national interest.

The limitation in proviso (2), page 17, lines 15 to 20, that the contribution by the contractor must be "financed by the organization" would preclude the application of this proviso to a contractor whose earlier or current research and development activities had been financed by some other party.

If it is desired that there be a policy of dedicating to the public, patent rights in inventions produced in the course of federally financed research and development, then it is considered necessary in the interest of the research and development work of the War Department that there be allowed an exemption from this policy. Experience has

shown that a contract requiring vesting of full ownership of patent rights in the Government would further narrow the Government's available choice of contractors because of competition of industry as well as laboratories and educational institutions for the services of skilled scientists who, in numerous cases, are permitted under the terms of their employment to retain all or part of the commercial rights in inventions made in the performance of their duties. Because of outstanding contracts with such scientists, contractors by whom they are employed are unable to accept Government contracts calling for more than a nonexclusive license. In order to meet these various objections, it will also be necessary to modify proviso (3), page 17, lines 20 to 23, which contains the mandatory requirement that a nonexclusive royalty-free license be obtained in every case.

Proviso (4) (B), page 18, lines 2 to 6, would exclude many nonprofit organizations such as the Massachusetts Institute of Technology, who have a policy of retaining patent rights, from availability for research and development contracts with the War Department.

In view of the foregoing, it is recommended that section 8 (d) in its entirety be amended to provide as follows:

(d) Any Government agency financing by contract, or otherwise administering, federally financed research and development activities, may, by stipulation in the contract or by other advance agreements with any organization, provide, under such rules and regulations as may be prescribed by the head of such Government agency, for the retention by the organization, or by the inventor, or by their assignees of such patent rights based on discoveries, inventions, or findings, produced in the course of such research and development as such Government agency deems fair and equitable and consistent with the national interest: *Provided*, That—

(1) Such retention is in a field specified in the contract and as to which field the Government agency has made a formal finding, prior to entering into such contract or other advance agreement, that such field has been developed substantially as the result of earlier research or development activities of the contractor which were not federally financed; or

(2) A later finding is made, pursuant to such procedures as may be specified in the contract or other advance agreement, that the particular invention, discovery, patent, patent right, process, or finding has been developed substantially as the result of earlier research or development activities of the contractor which were not federally financed; or

(3) The contractor or other recipient of financial assistance from the Government for research and development is currently contributing substantially to the cost of the particular research and development project; or

(4) The contractor is precluded from granting patent rights by bona fide contractual obligations entered into prior to the negotiations culminating in the contract, in which case the contractor shall be required by the terms of the contract to report all such prior contractual obligations which limit the patent rights to be acquired by the Government under the terms of the contract and to furnish the contracting agency, upon request, copies of such prior contracts; and

(5) In the case of any nonprofit organization, it is further determined by the Government agency that the research and development is essential in the field of national defense or in such other fields as the President may specify for such purpose.

In making any stipulation in a contract or other advance agreement pursuant to this subsection, the Government agency shall, in determining what is deemed fair and equitable and in the national interest, be guided by the following principles: (1) That the Government's interest is served best by making fully available to all users at the lowest possible charge any invention, discovery, or finding which may result from such federally financed research or development; (2) That whenever there are two or more facilities of comparable suitability available to meet the Government's needs, the facility which requires no retention or least retention of commercial rights pursuant to this subsection shall be selected.

Any contract or advance agreement made pursuant to this subsection shall in every case provide for at least an irrevocable, nonexclusive, royalty-free license for governmental purposes to the United States under all inventions, discoveries, patents, or findings produced in the course of the research and development contracted for except as prevented by contractual obligations of the nature specified in subparagraph (4) hereof.

It is the conviction of the War Department, based upon difficulties previously encountered in obtaining from research and development contractors nonexclusive licenses of the scope desired, and refusals of such contractors to grant more than a nonexclusive license, that exemptions provided for in subsection (d) will not be sufficient in many instances to enable the War Department to place research and development contracts with qualified contractors because of the inability to obtain from such contractors the patent rights required by this bill. It is extremely important that the War Department should be free to contract with any qualified contractor in order to most effectively provide for the national security. Any restriction on the availability to the War Department of contractors will seriously impair the national security. For these reasons, it is recommended that a new subsection be inserted in section 8 between subsections (d) and (e) of the present bill as follows:

The provisions of subsections (c) and (d) of this section, relating to the patent rights which the UnitedStates shall obtain in any contract for research and development shall not apply to the War or Navy Department or any established defense agency: *Provided:* That the War or Navy Department or such established defense agency shall obtain in any federally financed research and development contract at least an irrevocable, nonexclusive, royalty-free license for governmental purposes for the United States to the extent that the contractor is able to grant the same.

In order to insure that military security with reference to contracts vital to national defense is maintained, it is recommended that section 8 (f) be amended by inserting after the word "rights" and before the word "if," page 19, line 16, the words "or the making of reports of contracts entered into under the provisions of this Act", and that there be added following the word "security," page 19, line 18, the words "or in the public interest".

It is impossible to estimate the fiscal effects of this bill.

If the above recommended amendments are incorporated in S. 1850, the War Department would have no objection to the enactment of this legislation.

The War Department has not been advised by the Bureau of the Budget of the relationship of this report to the program of the President.

Sincerely yours,

ROBERT P. PATTERSON,
Secretary of War.

(Report from the Navy Department follows:)

NAVY DEPARTMENT,
Washington, April 8, 1946.

Hon. ELBERT D. THOMAS,
Chairman of the Committee on Military Affairs,
United States Senate.

MY DEAR MR. CHAIRMAN: The bill (S. 1850) to promote the progress of science and the useful arts, to secure the national defense,

to advance the national health and welfare, and for other purposes, was referred by your committee to the Navy Department with request for a report thereon.

The purposes of the bill are to provide support for scientific research and development, to enable young men and women of ability to receive scientific training, to promote the conservation and use of the natural resources of the nation, to correlate the scientific research and development programs of the several Government agencies, to achieve a full dissemination of scientific and technical information to the public, and to foster the interchange of scientific and technical information in this country and abroad.

To effect these purposes S. 1850 provides that a National Science Foundation would be established. The Foundation would originally contain eight divisions. Three additional divisions would later be set up in the Foundation if need for research in other fields were to develop. Each division would be concerned with a particular type of research. In each division, to advise the division's full-time administrator, would be a scientific advisory committee composed of part-time members. The advisory function for the over-all correlating activities of the Foundation would rest with a National Science Board of nine members appointed by the President and of the chairman of the scientific committees of the several divisions. Continuous over-all supervision would be delegated to a full-time administrator appointed by the President after consultation with the National Science Board.

The proposed bill provides for the appointment to membership on the Foundation's advisory board of persons irrespective of their political affiliation and solely on the basis of their demonstrated capacity to carry out the Foundation's purposes and their fitness to perform the duties of their office. Members of the divisional scientific committees would be reasonably representative of the major scientific interests and functions of the division to which assigned.

It is proposed to develop and apply the Nation's scientific and technical resources in several ways. The administrator may make grants-in-aid to finance or support in whole or in part research and development activities that may be carried on by other Government agencies or by other organizations. He is authorized to award scholarships and fellowships for scientific study or scientific work. It is proposed to maintain a register of scientific and technical personnel; to establish and maintain a central register of inventions, discoveries, patents, patent rights, and findings in which the United States has an interest; and to give wide circulation to all such inventions, discoveries, and patents. It is proposed that all discoveries, patents, and patent rights arising from federally financed research and experiment become public property available thereafter for use by the public without payment of royalties except as to certain discoveries. To provide cooperation at the international level a method for the exchange of scientific and technological information on a reciprocal basis is included in the proposed bill. Since the proposed bill contemplates continued research and experiment by other Government agencies, and Interdepartmental Committee on Science would be set up to gather and correlate data relating to the research and development activities of other departments of the Government.

The proposed bill appears to strike a nice balance in the large field of sponsored scientific research. It tends to promote research and experiment, by those qualified and anxious to pursue this work, in an atmosphere devoid of restraint. Research would be conducted on a cooperative basis under a partnership arrangement developing talent and disseminating the results of talent's efforts. It is assumed that many of the results of the research to be sponsored will be vital to national security. To assure that this security shall be inviolate, the proposed bill provides that certain information and data would not be published so long as the President or a person designated by him determined that such nonpublication was essential in the interest of national security.

The Navy Department strongly endorses those provisions of the proposed bill by which the activities of the Foundation would not supersede, curtail, or limit the research and development activities of other Federal agencies and which would allow the Foundation to finance research and experiment by other agencies in their research activities in addition to funds regularly appropriated to such agencies. The proviso that 15 percent of the funds appropriated for Foundation use be expended for research and development in the field of national defense seems particularly desirable when considered in conjunction with the proposed Division of National Defense. The composition of the five-man executive committee and of the Division's advisory board recognizes the need for active participation by the military in research in matters where the military has primary responsibility. Such recognition permits effective military cooperation and participation within the large arena of research that it is contemplated the Foundation will foster and encourage. Such recognition strikes a neat adjustment wherein the efforts, abilities, and talents of the civilian may be correlated with the needs and requirements of the military.

The patent provisions of S. 1850 are set forth in section 8 of the proposed bill. Section 8 (a) would provide for a register of all inventions, discoveries, patents, patent rights, and findings in which the United States or an agency of the Government has any rights or which pursuant to the bill would be dedicated to the public and would authorize publication, at the expense of the Government, of data on inventions, discoveries, and findings produced in the course of federally financed research. By section 8 (b) all contracts for federally financed research shall contain a proviso by which the contractor will make available to the Government agency sponsoring the research full data on all inventions, discoveries, patents, patent rights, and findings produced in the course of the research. Section 8 (c) would establish a Government-wide uniform policy as to inventions, discoveries, findings, patents, and patent rights that result from, or are produced during, federally financed research. Under it, all inventions, discoveries, and findings in which a Government agency now or hereafter has any rights shall be made available to the public to the extent of the Government's rights on a nonexclusive royalty-free basis. All inventions, discoveries, and findings produced after the enactment of the bill in the course of federally financed research would be freely dedicated to the public and all research contracts containing provisions incompatible with the policy of public dedication would be modified to comply with this policy within 120 days after enactment of the bill.

Section 8 (d) enumerates the conditions that an agency head must find to exist if a research contract or an arrangement will not result in public dedication but in the retention of commercial rights in the research agency on a fair and equitable basis. Such a contract must, however, grant a royalty-free license to the United States. Section 8 (e) provides for reports of contracts made in pursuance to section 8 (d). Section 8 (f) provides for the classification and nondisclosure of information and the nondedication to the public in the interest of national security.

Section 9 would give statutory authority to the heads of departments, with the approval of the President, to exchange technical information under reciprocal agreements with other nations. Statutory authority to cooperate with other nations in research activities, particularly in the field of classified scientific matter, is most desirable. The proposed bill would establish it on a reciprocal agreement basis. It would seem to presuppose a quid pro quo. Section 8 of the bill, however, would dedicate all the results of Government-sponsored research to the public. The Navy Department believes that once an invention, discovery, or finding becomes public property, there will be no opportunity to make effective reciprocal international agreements.

Weakening the Nation's position in effecting reciprocal international agreements is not the only unsatisfactory result of adopting the policy established by section 8. The wartime experience of Government agencies indicates that the opportunity to benefit commercially from an invention, discovery, finding, patent, or patent right was a real incentive to employees engaged in research and persons who conducted research under individual contracts. Supplying funds to permit research in time of peace may not be adequate incentive for effective research activity. The experience of the Navy Department resulted in a policy by which an invention, discovery, or patent produced in its own research laboratories or in the course of a research contract might be patented by the Navy; would be available to all Government agencies on a royalty-free basis; and the employee or research agency would be able to use the discovery or patent commercially. S. 1850 recognizes the necessity of offering expert scientists greater remuneration than the Classification Act of 1923 permits. To remove what has proved to be a real incentive in the form of commercial opportunity may require a substantial raise in pay if scientists are to be engaged as employees on any permanent basis. To require that all research contracts be modified to incorporate a policy of dedication to the public may result in cancellations. Cancellations now may well mean losses, both immediate and long term, that will be detrimental to all Government research. Over and above the probable losses to research is the additional factor of the present difficulty of assigning enough personnel to the task of renegotiating and modifying all Navy research contracts.

The Navy Department is opposed to the patent provisions as set forth in S. 1850. It is suggested that a Government-wide patent policy in the light of its international implications may well be a matter for separate legislation. If it be determined that in spite of those implications, a patent policy be included in S. 1850, it is suggested that there be eliminated those features which would result

in the renegotiation of research contracts that have been entered into before passage of this act.

Subject to the foregoing remarks, the Navy Department recommends enactment of the bill S. 1850.

The Navy Department has been advised by the Bureau of the Budget that there is no objection to submitting this proposed report to the Congress provided that it is made plain that the Navy Department has not been advised as to the relationship of the proposed measure to the program of the President.

Sincerely yours,

W. JOHN KENNEY,
Acting Secretary of the Navy.

(Report from the Interior Department follows:)

DEPARTMENT OF THE INTERIOR,
Washington, March 27, 1946.

Hon. ELBERT D. THOMAS,
Chairman, Committee on Military Affairs,
United States Senate.

MY DEAR SENATOR THOMAS: Reference is made to your request of February 25 for a report on S. 1850, a bill to promote the progress of science and the useful arts, to secure the national defense, to advance the national health and welfare, and for other purposes.

This Department has previously expressed its approval of the general objectives of this proposed legislation in the course of the hearings had on the several bills heretofore prepared on this subject, and has presented recommendations concerning the specific provisions that might be included. I believe that the enactment of S. 1850 would represent a material advance in the development of a sound program of Federal aid to research. I consider, however, that certain modifications of the bill are desirable in order to insure a better coordination of the activities of existing Federal scientific agencies in this and other departments with those of the proposed Foundation.

The two major modifications that I suggest are—

In section 4 (a), at the end of the first paragraph on page 5, line 9, add a new sentence as follows:

At least one member of the scientific committee for each division, except the Division of National Defense, shall be appointed by the Administrator from a panel submitted by the Interdepartmental Committee on Science established by section 10 of this Act.

In section 4 (c), insert, after the word "findings", on page 8, line 3, of the bill a new sentence as follows:

In order to avoid duplication of effort, implementation of these recommendations shall be, insofar as possible, through existing Federal agencies already authorized to undertake such activity.

That the bill contemplates the utilization of the services of existing Federal agencies whenever possible in carrying out the program of the Foundation is implicit in sections 5 (a) and 5 (d), but amendment of the bill as suggested would serve to strengthen that concept.

Moreover, I believe that section 10, establishing the Interdepartmental Committee on Science, should be made a part of either section

3 or section 4, thereby grouping together in one part of the bill the Foundation, the Board, and the various committees therein established. If this suggestion is adopted the present sections 5 to 12 should be renumbered appropriately.

It might also be desirable to insert, after the word "acquire", on page 22, line 12, in section 11 (b), the words:

but, in his discretion, may transfer such facilities or other property to Government agencies or other organizations undertaking research and development activities for the Foundation.

While subsection (c) (5) of section 11 may be construed as sufficiently broad to encompass the authorization proposed by the suggested amendment, specific legislative authorization seems desirable.

Finally, it would be advantageous to insert, after the word "Territories", on page 14, line 3, in section 6 the words "and possessions". This would serve to eliminate any doubt that citizens residing in such offshore possessions as Puerto Rico and the Virgin Islands, which do not bear the technical title of "Territories", would be eligible to receive scholarships and fellowships under the bill.

In view of the possibility that early action may be taken on S. 1850, it has not been possible to submit this report to the Bureau of the Budget and, therefore, no commitment can be made concerning the relationship of the views expressed herein to the program of the President.

Sincerely yours,

OSCAR L. CHAPMAN,
Acting Secretary of the Interior.

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79TH CONGRESS, 2d Session | SENATE | REPT. 1136 Part 2

NATIONAL SCIENCE FOUNDATION

MAY 24 (legislative day, MARCH 5), 1946.—Ordered to be printed

Mr. BRIDGES, from the Committee on Military Affairs, submitted the following

MINORITY VIEWS

[To accompany S. 1850]

The Committee on Military Affairs, on April 9 last, reported favorably upon S. 1850, bearing the title, "A Bill to promote the progress of science and the useful arts, to secure the national defense, to advance the national health and welfare, and for other purposes."

We do not concur in the recommendation that this particular bill be favorably considered. We do not oppose Federal financial aid to those engaged in scientific research but we do oppose Government control and direction of research in the fields of science. Such control will, we believe, stultify progress in research rather than aid it.

The bill itself was an attempt to compromise the divergent provisions of several other bills for the support and promotion of science, referred to the committee, namely, H. R. 3440, S. 1285, S. 1297, and S. 1720, in which the divergence centered about the question of whether future scientific research and development in this country shall be under strict regulation and control of the Federal Government or whether we shall give encouragement to independent research and private enterprise. While S. 1850 represents a modification of the strict Government control provided for in S. 1297 and S. 1720, it is, nevertheless, a clear exposition of the philosophy of centralization and control of science with its attendant bureaucratic autocracy.

The bill is divided into 12 sections as follows:

Section 1 states the purpose of the bill.

Section 2 is entitled "Declaration of Policy," which is stated to be, among other things, to provide support for scientific research and development, to enable young men and women of ability to receive scientific training, to promote the conservation and use of the natural resources of the Nation, to correlate the scientific research and development programs of the several Government agencies, to achieve a full dissemination of scientific and technical information to the public, and to foster the interchange of scientific and technical information in this country and abroad.

Section 3 establishes an independent agency of the Government to be known as the National Science Foundation, with an Administrator appointed by the President, by and with the advice and consent of the Senate, at a salary of $15,000 per year. The Administrator shall appoint a Deputy Administrator at $12,000 per year.

This section also provides for eight divisions within the foundation and such additional divisions, not to exceed three in number, as the Administrator may, from time to time, establish after receiving the advice of the National Science Board (sec. 4). Each division shall have a director at a salary of $12,000 per year.

In addition, the Administrator shall appoint and fix the compensation of such personnel as he may deem necessary to carry out the provisions of the act in accordance with civil-service laws and regulations, except that the Administrator may employ expert, scientific, technical, and professional personnel, including part-time personnel, without regard to civil-service laws.

Section 4 establishes and defines the duties of the National Science Board and various advisory committees.

Section 5 authorizes the Administrator to enter into contracts, pursuant to financing research and development activities, to be carried on by other Government agencies or by other organizations.

Of the funds appropriated to the foundation, not less than 15 percent shall be available for expenditure for research in the fields: (1) National defense and (2) health and the medical sciences.

Twenty-five percent shall be apportioned among the States for research at tax-supported colleges and universities, including the land-grant colleges, with power in the Administrator to veto particular research projects.

Section 6 provides for the awarding of scholarships and fellowships by the Administrator to qualified persons for scientific study in the United States or foreign countries, including the study in the social sciences.

Section 7 authorizes the Administrator to set up and maintain a register of scientific and technical personnel.

Section 8 deals with the use and dissemination of research findings. The Administrator shall establish a central register of all inventions, discoveries, patents, patent rights, and findings, including references to related data, in which the United States or any agency thereof has any right, title, or interest, which have been freely dedicated to the public.

In addition, all inventions, discoveries, or findings in which the United States or any Government agency now or hereafter holds any rights, including patent rights, shall be made available to the public free, to the extent that the United States or such agency is entitled to do so under its rights. Except as provided, any invention, discovery, or finding produced in the course of federally financed research, shall be made freely available to the public.

Section 9 gives authority to the head of any Government agency, with the approval of the President and through the Department of State, to conclude reciprocal agreements with foreign governments or agencies thereof, relating to the interchange of scientific and technological information. The Administrator is authorized to cooperate in international research or development activities and to

expend such sums of money, within appropriations, as he deems desirable for that purpose.

(Note: How far would the Administrator act under this section for international research on the atomic bomb, on which special legislation is contemplated by the Congress?)

Section 10 provides for interdepartmental coordination of scientific activity.

Section 11 deals with miscellaneous matters and specifically enlarges and prescribes the powers and duties of the Administrator.

Section 12 consists of definitions as used in the act.

Our comments are confined to the following provisions of the bill:

(1) Powers of the Administrator and the consequent foreseeable effect of those powers upon future scientific and technological development.

(2) The cost of the program and its effect upon the national economy.

(3) Elimination of the private patent system.

(4) Impairment of existing contracts.

(5) National security.

Obviously, the Administrator, under the provisions of the bill, will become one of the most powerful men in the Government and in the country. The bill proposes to add another large agency to the Government structure. Another large sector of our national economy would come under the centralization, control, and supervision of Washington. Another field of State responsibility—education and learning—would be brought under the domination of the Federal Government. Another huge expenditure of two hundred to three hundred million dollars per year would be added to our already dangerously unbalanced budget.

EDUCATION

The bill is a link in the chain to bind us into the totalitarian society of the planned state.

Section 5 (c) reads, in part:

> * * * the Administrator shall give each individual institution the widest latitude in its selection of individual research and development projects, but the Administrator shall not be required to expend funds in any institution unless it submits proposals for the expenditure of such funds which the Administrator finds to be consistent with such general program and standards, as he may, after receiving the advice of the Board, establish * * *.

The Administrator, therefore, will plan and direct a science program with the full force of two hundred to three hundred million dollars per year. He can ignore the Board's advice in any field he chooses, regardless of his competence in that field; he can ignore their advice in all fields and dictate his own ideas.

Today our educational institutions are proud of their independence and freedom. If in a few years they become dependent upon funds from the Federal Government (funds over which they will have no control) they will not be able to resist the authority for dictation of this czar of science—the Administrator. Only those schools capable of satisfying one man will receive the Federal money.

The events of the war have given a warped perspective to our scientific vision. Many people have been led to think that the mere

creation of the Office of Scientific Research and Development produced many wonders of science, but the testimony of the scientists in the hearings on the Senate bills show that the war years were years of great exploitation and very little exploration. During the war, immediate technological and military fruits of scientific development were apparent and spectacular, particularly with reference to the atom bomb, but what happened during the war was not, in any proper sense, scientific work; it was the exploitation of skills, techniques, fundamental knowledge and, to some extent, human relations between scientists, all of which had been cultivated in the days of peace. (See testimony of J. R. Oppenheimer in charge of atomic-bomb experiments.)

Many colleges and universities may feel that they are protected under the complicated features of section 4 of the bill, though the provisions are so complicated that a clear view of their intent is impossible. There is confusion as to where and when the 15 percent of appropriated funds which goes for military research and the 15 percent for health research can be included, and where and when it must be excluded from other quotas.

There is no protection for States small in population, for such States can be sure of only two-fifths of 25 percent of the funds appropriated. The additional 25 percent earmarked for nonprofit institutions may be expended without regard to the limitations relating to State quotas or the tax-supported character of the organization. Besides, private institutions in small States have no guaranty of any Federal aid. Within the vague language of the law, the Administrator may give it all to the tax-supported institutions.

The extreme lack of flexibility in the provisions of the bill is indicated by the fact that over 65 percent of the funds appropriated are allocated in mutually exclusive classifications, each intended to buy the support of some section of our economy.

There are obvious dangers in the financial power granted to the Administrator, which conceivably could soon force the very dependence which the universities of this country have been careful to avoid. We ought not to shackle freedom of academic thought. We ought not to create a situation in which a university could not allow its professors to criticize Government administration; nor create a situation in which an institution which was in the bad graces of the administration would not receive funds from the Foundation. The fear of such action alone would preclude free exercise of opinion, speech, and writing.

Any Federal aid in money to colleges and universities should be upon a fixed basis and not through selection of an administrator or individual official. Only in this way may research in the schools be free and independent of Government domination. Shackled scientific research is not inducive to discovery and development. This may be the beginning of university scramble for research "pork."

POWERS OF THE ADMINISTRATOR

The Administrator can specifically do the following:

1. Appoint a Deputy Administrator—at $12,000—without consultation with or approval of anyone.

2. Create three additional divisions of the Foundation in addition of eight created by bill, after receiving advice of the Board.

3. Prescribe the functions of each division after receiving the advice of the Board.

4. Appoint 8 to 11 directors, one to each division, at $12,000, without consultation with or approval of anyone.

5. Appoint and fix compensation of such personnel as he may deem necessary subject to civil service and classification.

6. Exempt from Civil Service and Classification Act such personnel as he may decide are expert scientific, technical, and professional "when deemed necessary."

7. Appoint, with advice and approval of the National Science Board, the up to 180 members of the divisional scientific committees for 3-year terms.

8. Pay compensation of executive secretary of Board and provide Board with such other personnel as it selects plus facilities, services, and supplies needed.

9. Request recommendations and reports from Board.

10. Render an annual report to the President and Congress on activities and recommendations.

11. Publish and disseminate widely any recommendation prepared by the Board or a committee whenever requested by Board or a divisional committee.

12. Create such special advisory committees as he may deem necessary.

13. Determine the compensation, up to $50 a day of members of such committees.

14. Enter into contracts or other arrangements to finance or support research and development action.

15. Give widest latitude in each institution to selection of individual research.

16. Not be required to expend funds in any institution unless it submits proposals which he finds consistent with his program.

17. Establish such general program and standards as he may decide after receiving advice of the Board.

18. Allocate all funds within provisions of the act.

19. Allocate funds to other Government agencies for use.

20. Approve all projects using such funds.

21. Make every effort to eliminate restraints upon the free expression of views.

22. Award scholarships and fellowships, without advice.

23. Determine the periods of such grants.

24. Establish quotas for States.

25. Establish "basis of aptitude" for recipients.

26. Maintain a register of scientific and technical personnel.

27. Provide a clearinghouse for information on scientific and technical personnel in United States and possessions.

28. Make and maintain an inventory of all current federally financed research and development projects.

29. Establish, in cooperation, with Commissioner of Patents, a central register of all inventions, discoveries, patents, patent rights, and findings, in which the United States has any right, title, or interest.

30. Collect, record, index, and publish significant data on all inventions and other findings produced in the course of federally financed research or development activities.

31. Take such steps as he deems necessary to make such information fully available. Preparation and distribution of reports, periodic catalogs, inventories, abstracts, translations, bibliographies, etc.

32. May utilize other Government facilities to extent he deems advisable.

33. May contract for expenditure of funds for such purposes.

34. Order any Government agency to make available such data and such reports on research as may be necessary.

35. As head of Government agency: By stipulation in contract allow any organization to retain patent rights to extent he deems fair and equitable and consistent with the national interest.

36. As head of Government agency: Determine agency has made every reasonable effort to get project without patent provision.

37. As head of Government agency: Determine organization has contributed substantially to development of particular project previously.

38. As head of Government agency: Require an irrevocable, nonexclusive, royalty-free license for governmental purposes to United States.

39. As head of Government agency: Determine whether project is essential to national defense in case of nonprofit organization.

40. As head of Government agency: Determine that rights retained by nonprofit organization will not be used for special benefit of any one organization.

41. Make a quarterly report to President and Congress concerning contracts with patent-retention clause.

(*a*) A list of all contracts containing such a provision.

(*b*) The reasons supporting approval of such a provision.

(*c*) Amount of funds expended or to be expended under a contract.

(*d*) Name of the organization with which contract or agreement was made.

(*e*) General nature of the rights retained.

(*f*) List of all inventions, etc., in which patent rights were permitted to be retained first reported in preceding quarters. (*d*) and (*e*) above as to these inventions.)

42. Recommend quarterly new legislation or executive action as he deems necessary.

43. As head of Government agency: Conclude reciprocal agreements with foreign governments for interchange of scientific and technological information.

44. As head of Government agency: Conclude reciprocal agreements with foreign governments for exchange of patents and patent-rights owned or controlled by the respective governments.

45. Cooperate in any international research and development activities.

46. Expend such sums within the limits of appropriated funds as he may deem desirable, for such research.

47. May defray the expenses of representatives of governmental agencies to accredited international scientific congresses and meetings whenever he deems it necessary.

48. May defray expenses of representatives of other organizations to like gatherings whenever he deems it necessary.

49. May defray expenses of individuals to such gatherings whenever he deems it necessary.

50. Serve as Chairman of Interdepartmental Committee on Science.

51. Make a recommendation to President, in consultation with the Interdepartmental Committee, for achievement of maximum effectiveness in all Federal research.

52. Shall not operate any laboratories, pilot plants, or other facilities which he may acquire.

53. Prescribe such rules and regulations as he may deem necessary to govern operations of foundation.

54. Make such expenditures as may be necessary.

55. Enter into contracts, agreements, or modifications of contracts without performance boards.

56. Make advance, progress, and other payments which relate to scientific research.

57. Acquire by purchase, or otherwise, real and personal property of all kinds necessary or resulting from scientific research or development.

58. Hold and dispose of by sale, lease, loan, or otherwise real and personal property of all kinds necessary for, or resulting from, scientific research or development.

59. Prescribe, with approval of Comptroller General of the United States, the extent to which vouchers for expended funds must be itemized and substantiated prior to payment, without regard to the limitations of other laws.

60. Determine expenses to be covered by scholarships.

By comparison with the sweeping powers of the Administrator, the powers granted the National Science Board and the Division Scientific Committees of the National Science Foundation are puny indeed. Briefly, the Board has power to elect its own Chairman, devise its own rules of procedure, meet at the call of the Chairman once each quarter and at least six times a year, select its own Executive Secretary and prescribe his duties, select such additional personnel as may be necessary, and continuously survey the activities of the Foundation and the field it encompasses. All other duties of the Board and of the division committees are purely advisory. These boards and committees presumably will be comprised of the leading scientists of the country.

PATENTS

Article 1, section 8, clause 8 of the Constitution provides:

> The Congress shall have power * * * to promote the progress of science and useful arts, by securing for limited times to authors and inventors the exclusive right to their respective writings and discoveries.

In *Martinetti* v. *Maguire* (1, Deady, 216 (1867)), it was held that this power is not given generally but only as a means to this particular end; hence, it expressly appears that Congress is not empowered by the Constitution to pass laws for the protection or benefit of authors

and inventors, except as a means to "promote the progress of science and useful arts."

The purpose of promoting the progress of science and useful arts is, therefore, a fundamental policy of our Government. Otherwise, it would not be found in the Constitution.

Under the guise of protection for Federal money, the bill contains basic reforms in the patent laws which are in conflict with the purpose of the Constitution and that tend to eliminate the private patent system.

Research and development are defined by section 12 (a) to cover not only basic and theoretical exploration in science but to extend to the "experimental production and testing of models and processes." Thus, the foundation may finance development to the ultimate production.

The patent provisions of the bill require the Administrator, or the head of any Government agency to insure that all patent rights which result from federally financed research shall be in the possession of the Federal Government and discoveries given to the public. The theory that the inventor's exclusive right to his discovery shall be protected by patent and he be thus given an incentive to promote the progress of science and useful arts would be destroyed. The public gets the benefit of the discovery and the inventor suffers the injustice of having his work enrich those who had no part in its production and wholly without profit to him.

There is no limitation in the bill determining where Federal money ceases to control the direct, or indirect, results of federally financed research, except the Administrator's findings.

Assuming that a university should accept Federal money for equipment with which to train students in science, or that an industrial research laboratory should accept a grant for a special project, it is legally possible that Federal claims could be made against subsequent patents obtanied by such persons trained with that equipment, or that the model and process produced from the laboratory would be subject to Federal claim, limited only by an interpretation of reasonableness by the courts.

Assuming that scholarships and fellowships should be awarded by the Administrator to qualified persons, under section 6, the acceptance of the scholarship under the Foundation would impose on such student, even 5 years later, the liability of having a discovery which is patentable, made by him, and dedicated to the public, without reward to the discoverer.

This bill legislates with respect to all patents resulting from research and development conducted directly by the Government, as well as that conducted by outside agencies, financed in whole, or in part, by the Government.

Section 8 (c) provides:

> All inventions, discoveries, or findings in which the United States (or any Government agency), now or hereafter, hold any rights, including patent rights, shall be made available to the public on a nonexclusive and on a royalty-free basis, to the extent the United States or such agency is entitled to do so under the rights held by it.

This ignores exceptional cases in which exclusive licenses are desirable in the public interest. It tends to exclude exploitation of new enterprises which involve risk and uncertainty.

Again, section 8 (c) provides that—

> any invention, discovery, or finding hereafter produced in the course of federally financed research and development shall, whether or not patented * * * be freely dedicated to the public—

with certain exceptions as to "organizations," which exceptions will later be specified.

By section 11 (c) (5), the bill invests the Foundation with the broadest possible power over private patents. Thus, the Administrator is authorized:

> (5) to acquire by purchase, or otherwise, hold and dispose of by sale, lease, loan, or otherwise, real and personal property *of all kinds* necessary for, or resulting from, scientific research or development. [Italics ours.]

In *James* v. *Campbell* (104 U. S. 358 (1882)), it was held that letters patent for a new invention or discovery in the arts confer upon the patentee an exclusive property in the patented invention, which cannot be appropriated or used by the Government itself, without just compensation, any more than it can appropriate or use, without compensation, land which has been patented to a private purchaser.

In *Crozier* v. *Krupp Aktiengesellschaft* (224 U. S. 290 (1912)), it was held that prior to the act of 1910, authorizing suit in the Court of Claims, the right of a patentee against the Government was based on an implied contract; by the act of 1910 (36 Stat. 851), a remedy was afforded in cases where such implication did not arise, but the use of the patent rights was ratified and adopted by the Government.

The revolutionary character of this absolute power is pointed up by specifically applying it to patents, thus: The Administrator may acquire patents necessary for scientific research or development, or patents resulting from scientific research or development, without limitation of any kind and in any manner whatsoever.

The scope of the subject matter is so great as to stultify the professed purpose of basic research and development because it includes by section 12 (b)—

> all other research and development financed, in whole or in part, directly by the Federal Government from funds designated * * *.

By reversing the constitutional theory of promoting the progress of science and useful arts by securing to inventors the exclusive right to their discoveries, the bill also draws in any invention hereafter made by an employee of the Government. This, too, is intended to be freely dedicated to the public.

The existing law (act of April 30, 1928, 45 Stat. 467, amending act of March 3, 1883, 22 Stat. 625) reads, as follows:

> The Commissioner of Patents is authorized to grant, subject to existing law, to any officer, enlisted man, or employee of the Government, except officers and employees of the Patent Office, a patent for any invention of the classes mentioned in section 4886 of the Revised Statutes (U. S. C., title 35, sec. 31), without the payment of any fee when the head of the department or independent bureau certifies such invention is used or liable to be used in the public interest: *Provided*, That the applicant in his application shall state that the invention described therein, if patented, may be manufactured and used by or for the Government for governmental purposes without the payment to him of any royalty thereon, which stipulation shall be included in the patent.

If the pending bill should become the law, would not the existing protection for employees of the Government be in jeopardy?

Now, considering federally financed research and development by organizations: Under the bill, "organizations" include State and local government agencies, corporations, partnerships, nonprofit institutions and individuals (sec. 12). Certain exceptions are made in the rule that patents shall be freely dedicated to the public, if federally financed, in whole or in part, thus exception in section 8 (c):

The above requirements as to dedication, to the extent that they require modification of arrangements already entered into, shall not go into effect until 120 days after the enactment of the act. Does not this imply arbitrary cancellation of contracts between the Government and outside agencies?

Subsection (d) of section 8 sets forth another exception, as follows:

The head of any Government agency financing by contract, or otherwise administering, federally financed research and development activities, may, by stipulation in the contract or by other advance agreements with any organization, provide for the retention by the organization, or by the inventor, or by their assignees of such patent rights based on discoveries, inventions, or findings produced in the course of such research and development as the head of such Government agency deems fair and equitable, and consistent with the national interest.

This exception is further subject to three provisos applicable to any "organization," and still a further fourth proviso applicable only to any "nonprofit organization."

Proviso (1) is:

That (1) the head of such Government agency shall, before entering into any such contract or agreement, make a finding that the agency has made every reasonable effort to arrange for the conduct of the necessary research and development without entering into a contract containing such provision.

This would undoubtedly bar organizations best equipped and qualified for the undertaking, if some less qualified or poorly qualified organization makes a bid therefor.

Proviso (2) is that:

(2) The organization shall contribute or shall have contributed substantially to the development of the particular inventions, discoveries, or findings for which patent rights are retained through earlier or current research and development activities financed by the organization.

Would salaries paid to research scientists be considered as "activities financed by the organization"?

Proviso (3) is that:

(3) In every case, the contract or agreement shall provide for at least an irrevocable, nonexclusive, royalty-free license for governmental purposes to the United States.

If the invention is one which is solely of use to the Government, this third proviso would make the undertaking less attractive to such organization. It should at least for a certain limited period of time have the exclusive right to manufacture the invention for the Government.

Proviso (4), applicable only to nonprofit organizations, is:

In the case of any nonprofit organization, the head of such Government agency further determines (A) that the research and development is essential in the field of national defense or in such other fields as the President may specify for such purpose, and (B) that the patent rights retained will not be used to serve the special benefit of any organization conducted for profit or of any individual, and will be made available or licensed to applicants on a nonexclusive, uniform, and reasonable royalty basis.

This proviso, which provides for compulsory licensing, would discriminate unduly against nonprofit organizations; and, added to the three other objectionable provisos, might well discourage nonprofit organizations from undertaking federally financed research and development, especially in the case of partly financed undertakings.

The above referred to subsections of section 8 are rendered even more uncertain by subsection (f), which reads:

> Notwithstanding any other provision of this Act, the President, or any person designated for that purpose by him, may exempt from the requirements of this Act relating to dedication to the public * * *, patents, inventions, or discoveries, relating to or produced in the course of federally financed research or development or in which the United States holds any rights, if and so long as the President or such designated person determines that such exemption is essential in the interest of national security.

Does the committee propose to alter the constitutional basis of exclusive rights to discoveries?

Under the Constitution, it is not necessary that the President determine that such exemption is essential in the interests of national security. A protection of a private patent for an inventor is founded upon the purpose to "promote the progress of science and useful arts."

Is it the intention by this section to indicate that Congress is not repealing the act of 1883, as amended in 1928, providing that—

> the employee of Government who has a patent for his invention shall state in his application that the invention may be manufactured and used by, and for, the Government for governmental purposes, without payment to him of any royalty thereon?

The revolutionary purpose of the bill is indicated by the use of the words "in whole, or in part" in the definition of "federally financed research and development" in section 12 (b), line 7, page 25, of S. 1850.

Federal agencies may be obliged to make unjust demands for the public dedication of all inventions arising out of a cooperative research project financed only in part by the Federal Government. Such a result is not altogether clear in view of the provisions of section 8 (d), but it is reasonably clear that the use of the present definition of "federally financed research and development" would force Federal agencies to demand broader licenses than those to which it is entitled in a cooperative research program.

For example, suppose that university A, a State university, plans a research program requiring some basic and some applied research work, and costing an estimated $500,000. University A approaches an interested Federal agency and obtains a promise of a contract under which $100,000 is made available for the project. University A then receives $100,000 from State funds to help finance the project and manages to convince a manufacturing firm to finance the remaining $300,000 balance.

In such a case, it would be equitable to use patent provisions in the contract between university A and the Government agency under which the Government would receive patent rights on inventions made in the course of the research work, supported by the Government's $100,000. It would not seem fair for the Government to demand the use of contract provisions to cover all inventions arising out of the entire $500,000 project.

In such a case, however, unless the words "in whole or in part" are eliminated from the definition of "federally financed research and development," the provisions of section 8 (c) and 8 (d) are subject to an interpretation that the Government must not enter into such a contract to furnish one-fifth of the necessary funds for a research project unless it receives patent rights covering all inventions made on the project, even though the major part is financed—not by the Government—but by a private commercial organization.

The provisions relating to patents further in this bill depart from the recommendations of Dr. Bush in his report for a national science foundation, entitled "Science, the Endless Frontier," wherein he says:

> The success of the National Research Foundation in promoting scientific research in this country will depend to a very large degree upon the cooperation of organizations outside the Government. In making contract with or grants to such organizations, the Foundation should protect the public interest adequately and at the same time leave the cooperating organization with adequate freedom and incentive to conduct scientific research. The public interest will normally be adequately protected if the Government receives a royalty-free license for governmental purposes under any patents resulting from work financed by the Foundation. There should be no obligation on the research institution to patent discoveries made as a result of support from the Foundation. There should certainly not be any absolute requirement that all rights in such discoveries be assigned to the Government, but it should be left to the discretion of the director and the interested division whether in special cases the public interest requires such an assignment. Legislation on this point should leave to the members of the Foundation discretion as to its patent policy in order that patent arrangements may be adjusted as circumstances and the public interest require.

COST OF THE PROGRAM

While it is felt that the cost of the national science program should not be of controlling importance in a matter affecting the future welfare and safety of the Nation, the expenditures proposed under this bill ought nevertheless to be viewed in the light of present commitments and the national economy. The following is an analysis of contemplated costs:

Staff and personnel:		
Administrator		$15,000
Deputy Administrator		12,000
Potentially 11 division directors		132,000
Executive Secretary of Board		12,000
Total staff		171,000
National science boards and divisional scientific committees:		
Board members	9	
Divisional committee members	35–150	
Civilian members, Committee of Division of National Defense	20	
Total Board and division committee members	64–179	
Maximum membership of all committees, 179. Cost for 179 members $8,950 per day for each day in session plus expenses and travel.		
Minimum cost per year at required 6 sessions (plus travel and expenses) (1 day session assumed)		53,700
Statutory staff and personnel costs		224,700

Definition of expenses is left to Administrator.

All funds appropriated for research and development must be allocated as follows:

	Percent
Each year not less than—	
National defense	15
Health and medical sciences	15
Total	30
To the States:	
Equally, two-fifths of 25 percent	10
In proportion to population, three-fifths of 25 percent	15
Total	25
To nonprofit organizations	25
Specifically allocated	80

(A doubtful interpretation of the percentage for health and medical sciences might reduce this figure to 65 percent but that is rock bottom.)

With the additional 20 to 35 percent the Administrator must pay a minimum executive pay roll of $224,700.

Award scholarships and fellowships, unless these are to be provided for separately.

Cooperate in international research "within limits of funds appropriated."

These rigid requirements allocate so much of the money that large-scale research projects would continually disrupt the Foundation budget. They would require special authorizations exempting them from the provisions of the act.

Anticipated costs (these figures are based on subcommittee report):
1946 Budget recommendation for first fiscal year: $40,000,000.
Within 3 years, $150,000,000 to $200,000,000 per year.

No further break-down or estimates are available although the subcommittee recommends the appropriation of between $100,000,000 and $200,000,000 the first year to be sure of sufficient funds for long-range projects.

These funds, if unexpended, are carried over for 4 years. The Foundation might have nearly $800,000,000 in current research projects after 4 or 5 years.

This would exceed in peacetime our total Federal research at the height of war as indicated below.

Total Federal research:	
1940	$70, 000, 000
1944	700, 000, 000

The significance of these figures is in the shifting of emphasis in research from private to Government laboratories—the planned regulation of state socialism. A generation ago the genius of the people alone produced wonders of mechanical invention through the efforts of such men as Edison, Marconi, the Wright brothers. The rewards of private enterprise provided inducements for the exercise of initiative and special talents. We need pause before scrapping a system that made America the greatest industrial nation on earth.

There is also the question of the national debt and the mounting necessity for economy in Government expenditures, if our people are to emerge from their already crushing burden of taxation. This bill does not in any sense mitigate the claims of other Government agencies

to their own research funds. Section 5 (d) expressly provides that the activities of the Foundation shall be construed as supplementing and not superseding the functions and activities of other Government agencies.

The summary of the cost of the program indicates the size of the expenditure contemplated and the extreme controls on the use of the appropriated funds. It also illustrates the thinking of those who have operated this Government for many years on an unbalanced budget and placed the citizens of the country under the largest financial debt in history.

VALIDITY OF CONTRACTS IMPAIRED

Section 8 (c) of the bill provides:

> All inventions, discoveries, or findings in which the United States (or any Government agency), now or hereafter, hold any rights, including patent rights, shall be made available to the public on a nonexclusive and on a royalty-free basis to the extent the United States or such agency is entitled to do so under the rights held by it.

In practice, free dedication to the public will not mean its "introduction and fullest use." The experience of existing Government agencies shows that private corporations hesitate to invest capital in research with all the expenses of development, when their competitors can have all the information and be free to begin manufacturing without development cost when the demand is proved.

Section 7 (c) would release to the public hundreds of patents for which the Government holds rights in the form of licenses, assignments, etc. At the time these rights were granted, no one contemplated any such action by Congress and the passage of this bill would amount to an outright breach of contract with the present contractors for the patents.

Contracts now in force are subject to the same provisions of law for 120 days after the passage of the act, during which modifications may be made. This provision will serve as an economic blackjack over the contractor who is deeply involved financially and who must get the department head to see his side or go out of business.

Again section 8 (c) contains the following language:

> * * * any invention, discovery, or finding hereafter produced in the course of federally financed research and development shall, whether or not patented, be made freely available to the public and shall, if patented, be freely dedicated to the public.

It is quite true that the provisions of section 8 (f) empower the Secretary of War and of Navy to withhold from publication, matter which in their judgment is vital to national security. However, that will not be effective because any secret which is known to 200 people will not be a secret for long.

This section, in effect, abrogates all existing patent laws, not by abolishing patents but by rendering the patent worthless. If any invention, discovery or finding shall be made freely available to the public, whether or not patented, a patent has no value to anyone. It means, in effect, that any person doing research of any kind will have to work for the Federal Government.

NATIONAL SECURITY

Section 4 deals with the appointment of various committees of persons especially qualified to promote the broad objectives of the act and provides particularly for a scientific committee of 40 persons for the Division of National Defense. Altogether 200 persons are to be appointed as advisors to the Foundation for 3-year terms. All these persons are entitled under the bill to "all information in the possession of the Foundation" whether secret or not.

The Foundation is intended to correlate all Federal research and to maintain central inventories, and so forth. This information includes Army and Navy files which must be made available to members of each such committee and opens an avenue to unwise and premature disclosure of secret information.

Again, section 5 (e) provides, "Any person engaged in such research and development activities shall not be precluded from independently discussing, writing, or publishing his own views and conclusions relating to such research and development." There is no exemption for the Division of National Defense and the provision will protect any person from prosecution for violation of security precautions, regardless of his intent. We ought not to pass a law removing all security protection from any research which the Foundation in any way supports.

It has been urged that section 8 (f) provides the necessary security protection, but there is a serious question whether subsection (f) of section 8 would provide any exception to section 5 (e). Certainly, under this section there is nothing to prevent a person from "independently discussing" or "writing" his own views and conclusions. It is doubtful whether the term "dissemination" could be so broadly interpreted since section 8 (f) refers to "the provisions of this Act relating to * * * dissemination." Since section 8 contains "the provisions of this Act relating to * * * dissemination" of information, subsection (f) would appear to apply only to section 8. Such an interpretation would leave section 5 (e) unrestricted and leave a dangerous opening in our own security laws.

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