(ii) if a sufficient fraction of postponed births never occurred (the "later means fewer" theme) because of changes in desire for children or the onset of sterility. Our observation that the rate of planned births has remained fairly constant during the decade suggests that one or both of these conditions have operated. It appears from the sharp decline in national fertility since 1970 that planned fertility has probably declined and unplanned fertility has undoubtedly declined much more. We are coming closer and closer to the perfect contraceptive population.

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Dr. Bush Writes a Report: "Science—The Endless Frontier"

In reply to F.D.R.'s request, Bush recommended a postwar National Research Foundation.

J. Merton England

In a letter written on Pearl Harbor Day 1944, Palmer Putnam, who as a wartime scientist had turned his talents as engineer and yachtsman to developing amphibious vehicles, asked his friend Carroll Wilson a series of questions (*1*): "Please tell me what I may know about the background of the President's letter to Bush. Did Bush write it? Did Bush ask for it? . . . Is it welcome to Bush? Will he carry out the requested studies? Are they under way? By whom?"

Wilson sent a prompt reply: "As to the President's letter to Bush, Bush did not write it nor did he ask for it, but he had the opportunity to see it before it was sent and made some suggestions which were incorporated. . . . Bush welcomes the letter and is now organizing studies to enable him to reply on the four numbered items." Wilson expected all four studies to be completed within two months (*2*).

The letter they referred to was one from President Roosevelt to Vannevar Bush, director of the Office of Scientific Research and Development (OSRD). After expressing his belief that OSRD's wartime experience might "be used in the days of peace ahead for the improvement of the national health, the creation of new enterprises bringing new jobs, and the betterment of the national standard of living," President Roosevelt asked for Bush's recommendations on four questions (*3*): (i) How can scientific knowledge developed during the war be released to the world quickly? (ii) How can a program of medical research be organized to continue the attack on disease? (iii) How can the government assist research by public and private organizations? (iv) Can a program be suggested to develop the scientific talent of American youth to ensure high-quality research in the future? As Wilson, who was Bush's executive assistant, indicated in his reply to Putnam, Bush quickly organized groups to help make recommendations on these four matters.

Wilson's letter contradicts the general assumption that Bush himself originated the President's request. Worries about a possible return of the bread lines of the Great Depression probably had more to do with the letter's genesis than did concern for postwar support of science. The idea for the letter very likely came from Oscar Cox, general counsel of the Foreign Economic Administration, rather than from inside OSRD. Cox, who had worked closely with Bush in establishing the National Defense Research Committee (NDRC) and OSRD, reached an agreement with Harry Hopkins several weeks before the November election that the President should call on Bush for a report. Cox's rough draft of the proposed letter, dated 18 October, shows a concern simply "to utilize our war-time discoveries, research and development to create fuller peace-time employment." Bush was to "prepare and submit . . . a list of those discoveries which to your knowledge and judgment are likely to have ready peace-time application." This "inventory of ideas" would "stimulate thinking by enterprising business" and suggest the creation of new industries (*4*, *5*).

Yet if Bush did not originate the President's letter, he characteristically seized the opportunity to see that it asked the "right questions" (*6*). The full-employment emphasis of Cox's draft was soon substantially broadened. After a meeting on 24 October of Bush, Cox, and Oscar M. Ruebhausen, OSRD's general counsel, Ruebhausen drafted another presidential request that reflected ideas gleaned from talks he had had with other OSRD officials—James B. Conant, president of Harvard University and chairman of NDRC, Irvin Stewart, a political scientist who was OSRD's executive secretary and contracting officer, and Wilson. Several people helped to shape and cut this version, and Hopkins adopted Bush's and Conant's suggestion of a post-election release. The letter signed by F.D.R. on 17 November contained the substance of Ruebhausen's

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draft, including the four points that furnished the agenda for Bush's study (*4, 7*).

One reason for Bush's readiness to undertake the report was his worry about the legislation sponsored by Senator Harley M. Kilgore, Democrat of West Virginia. Since 1942 Kilgore had introduced and held hearings on bills to mobilize science and technology for more effective prosecution of the war and for application of science to national problems when peace came (*8*). Bush strongly opposed these bills, but he also tried to guide Kilgore toward more acceptable measures (*9*).

Besides wanting to avoid antagonizing Kilgore to the point of not being asked for advice, Bush thought that the Senator was "honestly trying to get at the root of matters." Although "some of the people about him steer him into strange paths," Bush said, ". . . he himself may yet grasp the subject in a way that will be helpful rather than the reverse. He has certainly made some progress in the last two years, and I hope he makes a great deal more" (*10*).

By the late spring of 1944 Kilgore had indeed made a good deal of progress in the eyes of several of Bush's associates. A new draft of his bill showed "a metamorphosis," according to Lyman Chalkley, an assistant to Bush. Karl T. Compton, president of the Massachusetts Institute of Technology and chief of OSRD's Office of Field Services, found the bill "enormously better" and said he had a "decidedly favorable" reaction. Wilson, who said that Compton's letter "would make the Senator's heart glow," saw several objectionable features in the bill but also "enough alluring parts" to give it a chance of passage. The pressures after D-Day and the introduction of new German weapons kept Bush too busy to study the bill closely, but he did ask Chalkley to relay to the Senator some preliminary observations. One of these dealt with the bill's patent clauses, a constant point of contention since Bush objected vigorously to Kilgore's argument that all rights resulting from federally supported research discoveries should be public property; another expressed Bush's view that OSRD should not be perpetuated in peacetime (*11*).

Although he thought that OSRD should not be perpetuated, Bush had come to favor some kind of postwar federal aid for university science. When he and Cox met on 24 October, they agreed that an alternative to Kilgore's bill should be developed and that the proposed letter from the President offered an opportunity (*4*). The fact that Kilgore and his staff continued to modify his legislation, which by this time provided for the creation of a "National Science Foundation" to fund basic research as well as applied research and development, must have given a sense of urgency to the generation of an alternative proposal, especially since Kilgore was actively seeking support from the science and engineering communities. A prompt, well-considered response to the President's letter would enable Bush to capture the initiative and shape a postwar organization more acceptable to scientists than the liberal Senator was likely to devise (*12*).

The Committees

Bush believed that the first and fourth of the President's questions—those relating to the release of new scientific knowledge and the education of future scientists—could be answered quickly. He realized that it would be difficult to reach agreement on the problems of organizing a postwar program for biomedical sciences and still more difficult to resolve the question of government aid of research conducted by public and private agencies (*13*). If he shared Wilson's view that the four studies could be done in a couple of months, he was too optimistic. The problem of getting people who were deeply committed to the tradition of independent scientific research to concede that some measure of public control must accompany public subsidy proved to be complicated and time-consuming. Much of this resistance was still unresolved when Bush submitted his completed report to President Truman in June 1945. The aversion to public control that was shown by some scientists and medical men foreshadowed the dispute that held up the establishment of the National Science Foundation until five years after the submission of the report.

One of Bush's problems was his relation to the internal work of the committees. The report to the President was to be a personal one, yet its persuasiveness would depend largely on its general harmony with the backup studies. After clearing the committees' membership with Judge Samuel I. Rosenman of the White House staff and getting acknowledgment from the Bureau of the Budget that the final report did not require the Bureau's approval, Bush expected to stay out of the study groups' deliberations. He knew that if he attended committee sessions, he would not be able to keep quiet; and he also knew that, since he wanted to "remain in the detached position of possible umpire," he should not be one of the players. He did believe, however, that he should call the attention of the chairmen to important topics that their groups should address, and he did not hesitate to use this prerogative (*14*).

The first question caused no difficulty. The committee, headed by Irvin Stewart, consisted entirely of OSRD officials. Early in January they submitted a report that recommended what Bush had already proposed, that a board should be established in the National Academy of Sciences "to control the release and promote publication of certain scientific information" (*3*, p. 182). The board, to be made up of Army, Navy, and civilian members, was to permit release of information as soon as it could not be used against the United States in the war. Scientists were to be encouraged to publish promptly when the Academy board cleared the release of their research results, and government agencies were to facilitate publication. The President's letter had emphasized the need to publish war-generated knowledge in order to encourage new enterprises and create jobs for returning veterans. Stewart's committee pointed out that some servicemen would want to resume interrupted college training in science or engineering. That training should reflect the scientific and technological knowledge of 1945, not 1940 (*3*, pp. 178–184).

The Stewart group's brief suggestions about education were amplified in the report of the Committee on Discovery and Development of Scientific Talent (*3*, pp. 128–177). Headed by Henry Allen Moe, secretary general of the John Simon Guggenheim Memorial Foundation, the committee that dealt with F.D.R.'s fourth question reached its decisions without much trouble, although after a good deal of correspondence and consultation. To assure an adequate supply of scientists and engineers in the long-term future without robbing society of talent required for other needs, the committee proposed the annual award of 6000 four-year undergraduate scholarships and 300 three-year graduate fellowships. The scholars were to be chosen by state committees while the fellows were to be selected through national competition. In both instances selection was to be based solely on merit. After completing their education, scholars and fellows would be enrolled in a National Science Reserve, subject to call into federal service during a national emergency (*3*, pp. 130–134, 142–145).

Moe's committee estimated that it would take a decade to fill the seriously depleted ranks of scientists and engineers. The problem had largely been caused by Selective Service policies, but it was too late to remedy the actions of local draft boards. However, highly talented young men who had ended up in the armed services instead of college might be identified and ordered to enter scientific or engineer-

ing education in the United States while still in uniform. Since their number would probably be fewer than 100,000, their loss to the services after V-E Day would not matter greatly. For many other servicemen, the plans of the U.S. Armed Forces Institute to establish overseas "universities" offered an opportunity for up-to-date technical training of a different sort (*3*, pp. 130–154).

The Committee on Science and the Public Welfare, formed to study government aid of research, was headed by Isaiah Bowman, president of Johns Hopkins University. Since Bowman was confined to his home with the grippe for several weeks and missed some of the committee's early sessions, much of the work of directing and coordinating its work fell on the vice chairman, John T. Tate, research professor of physics at the University of Minnesota, and the secretary, W. Rupert Maclaurin, an MIT economics professor. Bowman's illness may have led to more direct intervention by Bush in this panel's business than in that of the other committees, but Bush's intense interest in the subject matter would undoubtedly have caused lapses from his umpire role in any event.

Bush's particular concern was that the research panel open the way for applications of science by new industries. He wrote to Bowman that he would forward any constructive ideas he had on patent policy and that he hoped the committee would adopt a broad view of research that would encompass its crude beginnings in "pioneering effort of a technical sort," like that of the Wright brothers, which might bring "the advent of new, vigorous, small industrial units of all sorts" (*15*). Bush's temper flared when the committee ignored this suggestion. Since they did not think a "couple of bicycle mechanics working on a flying machine would ... be doing research," maybe, he suggested, the panel should be enlarged to include members representing "the rugged type of thing that the Wright brothers exemplified" (*16*).

Bush's worries about the research panel were soon eased when it settled down to work and parceled out assignments to subcommittees. However, patent policies continued to occupy his thoughts. He believed that there should be a thorough legislative modernization of the patent system, one which would especially stimulate "the young struggling concern." Bush decided that he would assist Bowman's committee by attempting "to focus for them the relationship of the patent system to research" (*17*). Soon he decided to make patent recommendations on his own, separate from the committee report; but then President Truman directed Secretary of Commerce Henry A. Wallace to study the patent laws. Bush wrote to a friend, "... this quite effectively stops me from sending a separate patent report directly to the President ..." (*18*).

While studying the patent question, Bush also had to deal with rumblings from Senator Kilgore on the one hand and from the National Academy of Sciences on the other concerning the activities of the research committee. Kilgore was preparing to introduce the latest version of his bill and proposed to meet with representatives of OSRD and other government agencies for joint consideration of desirable revisions, though he first wanted an informal meeting with Bush. They met at a luncheon, and later members of Kilgore's staff talked with Bowman. All seemed harmonious, and the Senator's men agreed that his bill should not be introduced for several weeks at least, by which time Bowman expected his committee members to reach agreement on their statement of purpose and social philosophy. Bush concluded that Kilgore was in a cooperative mood and would probably withhold his bill until after the report to the President had been released (*19*).

If news of these friendly dealings reached the science establishment, they surely added to anxieties about the Bowman group's activities. National Academy of Sciences President F. B. Jewett wrote that several members of the Academy had asked whether there would be reports at the April meeting on the work of Bush's committees. Jewett complained, "I am so completely uninformed as to who the Committees are or what you have in mind that I do not know whether anything can or should be said." Bush replied that it would be inappropriate to discuss the report before its release by the White House, but he sought to reassure the Academy president. "I shall, of course," Bush wrote, "wish to have your own comments and reactions to the final document as it begins to take shape ..." (*20*).

From Robert A. Millikan of the California Institute of Technology came a complaint about a "very unfortunate letter" from Maclaurin which raised the issue of federal subsidies to institutions of higher education. Millikan asked Bush whether the Policies Committee of the Academy should discuss this matter. "Knowing the position that you have taken on the Kilgore bill," Millikan said, "and on other movements toward collectivism, I could not understand how the Maclaurin letter could have been formulated by yourself or any of the other outstanding scientists to whom the President's inquiry was directed as to the need of federal subsidies for our most outstanding institutions, whether heretofore financed by private sources or from state funds" (*21*).

In reply, Bush explained that the committees would resolve questions for themselves without his interference, but that he would not submit to the President a report with which he disagreed on a fundamental issue. He did not expect a dilemma of that sort to occur. In reaction to Millikan's reference to his stand on Kilgore's bill Bush said, "I have at no time opposed his main thesis," and claimed credit for revisions that made the bill "much less objectionable." If research was to be subsidized by government after the war, it must not be subjected to any "stifling controls." Bush said that he had "not gone on record either for or against federal subsidy," but that the government was already giving some support to higher education, and this seemed likely to increase. He was "not inclined to attempt to reverse the trend," he said. "However, if the strong committee which I have set up should take some other point of view, I am ... still open-minded on the entire matter." Finally, Bush saw no objection to discussion of this issue by the Academy's Policies Committee, although the committee's agenda was already rather full (*22*).

Bowman thought Bush's reply was "admirable." He did not intend to write to the Caltech physicist himself but thought Millikan would calm down if he saw the research panel's statement of social philosophy (*23*).

This statement was very carefully drafted. It contains the best judgment of the committee. It is a deliberate judgment following wide differences of opinion at the beginning. It is a unanimous judgment. Without these few pages on social philosophy about half of the committee would be unwilling to sign our report. I would be among that half. We must express our fears regarding Federal control and we must state explicitly how we would avoid such control. Having done so, we are ready to present our recommendations regarding the scale of support and the method of distribution.

The statement of "social philosophy" is the introductory chapter in the committee's report to Bush. It argues that since the nation's defense and welfare depend on the continued advance of science, the federal government must encourage scientific progress, not simply in its own laboratories but also in universities and other nonprofit institutions. It states that America's remarkable achievements in applied science in the past depended on fundamental knowledge imported from Europe, but that now Europe's "intellectual banks" have been ruined by war. In addition, the statement describes a new, direct relation that had developed between pure science and

technological progress. "In the next generation, technological advance and basic scientific discovery will be inseparable; a nation which borrows its basic knowledge will be hopelessly handicapped in the race for innovation." Despite dangers of centralized control, safeguards can be devised to keep science free—"free from the influence of pressure groups, free from the necessity of producing immediate practical results, free from dictation by any central board" (*3*, pp. 71–74).

The committee's main recommendation was that Congress establish an independent federal agency, a National Research Foundation, to promote scientific research and its applications. A board of part-time trustees, appointed by the President from nominees submitted by the National Academy of Sciences, was to control the foundation and appoint its executive director (*3*, pp. 69, 109, 110).

A board chosen from an Academy panel of names could be relied on to foster pure science—the committee's special concern—and guard against the kinds of social uses and federal direction that conservatives feared would result from Kilgore's proposals. Bowman's group hoped that the transit of knowledge from the laboratory to products and services could be speeded up, but not through central planning and guidance of science.

The fear of government control was even greater among the members of Walter W. Palmer's Medical Advisory Committee. Palmer was a professor of medicine at Columbia University, and all his committee's members except Linus Pauling were medical school professors. Perhaps the normal desire of medical school faculties for free-standing autonomy within their university structures helps to explain another of the committee's fixations—the need for a National Foundation for Medical Research that would be independent of the National Research Foundation recommended by Bowman's committee. The medical panel's persistent adherence to this notion caused headaches for Bush and his OSRD staff.

When the chairmen and secretaries of the four committees met in Bush's office early in March, it was revealed that Palmer's group wanted an independent foundation and that they had not even discussed their ideas with officials of the Public Health Service and the Surgeon Generals' offices of the Army and Navy (*24*). The medical men wanted to avoid entanglement in science legislation that involved revision of patent and tax laws or "aid to small industry or alleviation of depressions," as Homer W. Smith, the panel's secretary, wrote Carroll Wilson. "Medicine can not cure all the ills," he added. Smith asked for advice on nominating procedures. (The committee wanted to create an essentially self-perpetuating organization.) "Should we deprive the President of choice, by-pass the Academy entirely, or place the Academy simply in a screening position?" he asked (*25*).

Wilson reminded Smith that other government agencies had important roles in medical research, and that the committee's plan should be related to the existing structure. Wilson thought it was "unrealistic to expect the creation of another independent agency." With regard to appointments, the committee seemed to be attempting to contrive "a rubber stamp role" for the President and the Academy. "Certainly the President . . . cannot discharge his responsibility if he has no choice or selection in naming those to whom he delegates his authority, nor the power of removal," Wilson continued. In a note to Bush transmitting a copy of his letter, Wilson wrote, "This is my fatherly lecture. I trust I've not been too paternal." "Right on the button!" Bush responded (*26*).

The "fatherly lecture" did not persuade the Medical Advisory Committee to abandon their hope for an independent agency. Palmer admitted, however, that the idea might "be too idealistic and impracticable" and professed a willingness to have his committee consider an alternative plan which would protect "the independence so cherished by the Committee and the profession in general" (*27*). The secretary of another committee told Wilson that a foundation executive concerned with medical research "urges that Dr. Bush tell Palmer et al that their proposal for a separate agency is not acceptable and do so with considerable firmness" (*28*). Bush seems to have followed this advice, and he wrote to Jewett that he had heard from Palmer "that the mechanism I propose is preferable to the one proposed by his committee" (*29*). A week later, after Bush had discussed his completed (but still in manuscript form) report with President Truman, Wilson wrote to Palmer about the possibility of adding in page proof to the medical committee report a footnote indicating that the committee accepted Bush's recommendation of a unitary research foundation rather than a separate agency for medicine. "Dr. Bush hopes that your committee will see fit to express such a view," Wilson said, "because I think it is important that the opposition which will undoubtedly arise in certain quarters is not given the opportunity of driving a wedge between your committee and Dr. Bush on this matter of mechanism" (*30*).

Prompted by this eleventh-hour plea, Palmer's group agreed to the insertion of a footnote in their recommendations. The footnote said that in proposing an independent medical foundation they had been unaware of the recommendations of the Bowman and Moe committees; they now recognized "the practical desirability of a single agency" and proposed a medical division as one of its components, "provided the Division is left free to carry out its program" (*31*). The footnote does not appear in the published report. Perhaps the proviso made it seem useless to Bush. In any event, in his own report Bush repeatedly said that all committees concurred in the recommendation of a single new agency (*3*, pp. vi, 7, 26).

Whatever the degree of concurrence in proposing a single agency for the natural and medical sciences, the published recommendation in the Palmer committee report shows the panel's desire for an autonomous and self-perpetuating medical research foundation. The foundation was to consist of a policy-making board of trustees, a technical board, and an executive secretary and administrative staff. The five trustees were to be "eminent scientists" appointed by the President; vacancies were to be filled by presidential appointment from lists of candidates submitted by the chairman of the board after consultation with the president of the National Academy of Sciences. The trustees were then to appoint the 12 scientists of the technical board, who were to recommend the awarding of general research funds (block grants whose use could be determined by the recipient institutions), research fellowships, and special grants-in-aid to important research projects. The proposed foundation was to have no direct links to the specialized medical services of other government agencies, which in turn were to exercise no control over the foundation. Although it was not to engage in research itself, the foundation "would initiate and coordinate research in existing institutions" (*3*, pp. 45, 53, 54, 59–63).

The Report to the President

Roosevelt's letter had asked Bush to give his answers to the four questions "as soon as convenient—reporting on each when you are ready, rather than waiting for completion of your studies in all" (*3*, p. viii). Nevertheless, Bush decided to present a single report, with the four committee reports appended to it.

The job of overseeing the preparation of the general report and relating it to the recommendations of the committees fell mainly on Wilson and Ruebhausen. A New York lawyer, Bethuel M. Webster, worked with the committee chairmen and secretaries to guide their work toward a common goal, and with Wilson and

Ruebhausen in writing drafts of the overall report. Richardson Wood, who had been recommended to Bush by Eric Hodgins of Time, Inc., helped to apply polish and emphasis in the final stages. Another contributor to the final version was a Coast Guard lieutenant on loan from the Bureau of the Budget, Don K. Price, a political scientist, who collaborated with Wilson and Ruebhausen (*32*). Finally, of course, it was Bush himself who made the hard choices, and it was his own report that went to President Truman. Much more aware of political realities and more flexible than most of the members of his committees, Bush seems to have agreed, late in the drafting stage of the report, to a critical change that provided for presidential appointment of the foundation's director. He then backed down in order to avoid a conflict with committee recommendations.

The critical point was public control. The Bowman committee proposals would ensure a board dominated by scientists and a foundation director dominated by the board. Moreover, the committee, looking to the example of the British University Grants Committee, proposed that the foundation be given a half-billion dollar capitalization for a long-term expenditure without detailed Budget Bureau or congressional oversight (*3*, p. 109). Similarly, the medical committee wanted an agency that was immunized from presidential authority and political pressures.

Bush and his associates knew that the Administration would balk at accepting these recommendations. Wilson, after reading a 20 May draft report, suggested five fundamental principles that should characterize the proposed federal research agency. Although the final report contains a "Five Fundamentals" section (*3*, pp. 26, 27), the degree of public control that it calls for is much less than in Wilson's statement, which emphasized that the agency "should adequately represent public interest"; its board "should be truly representative . . . and not composed primarily . . . from those groups which will be the recipients of support"; and, while "stability of support is essential, . . . this should come about through the sympathetic understanding and support of Congress and not through devices to lessen the full responsibility to Congress for the use of public funds" (*33*).

Bush endorsed most of Wilson's views and suggested adding that the agency "should be responsible to will of Congress." Apparently in response to the Bowman group's desire for freedom from budgetary and expenditure controls, he wrote: "No use to avoid the review of the Budget. In fact Budget [Bureau] & Congress must balance needs of this agency against those of Depts for their own research programs," with the assistance of an independent science advisory board. But Bush thought the draft showed that "we are getting pretty close to a finished job" (*34*).

A week later a near-final version of the overall report was sent to the committee members for their criticisms. Bush's covering letter said that a single agency was required, and in devising this "mechanism" he had drawn on the best suggestions made by the four committees. Bush repeated verbatim the five principles that Wilson had said should characterize the agency. He asked that criticisms and comments be returned by 6 June, the day before copy was due at the printer's (*35*).

Most comments lauded the report. The three New York members of the medical committee, for example, agreed on its excellence. Maclaurin liked Bush's suggestions for the foundation better than those made by Bowman's committee, of which he had been secretary. The Harvard astronomer Harlow Shapley, a member of the education panel, thought it was a "remarkably fine report"; as for the medical group's proposal of an independent agency for medical science, "we all knew all along that a unit mechanism would be inevitable and highly to be recommended . . . we do not want to indicate dissension." But Shapley did not like the "abject kowtowing" to Congress and the Budget Bureau that appeared in the "Five Fundamentals" section. This was "undignifiedly subordinating scientists to politicians. The *will* of Congress sounds to me like the *whim* of Congress. You know, this sounds to me as if it were 'writ sarcastic' a bit. Some Congressmen could spot bootlicking, perhaps" (*36*). Bush and his colleagues accepted many of the suggestions for changes in a quick scissors-and-clip revision of the report (*37*).

Bush also asked Jewett for a quick comment on the next-to-final draft. The Academy president wrote back that he had thought all along that Roosevelt's letter would start a "violent controversy," and after his hasty reading he still thought so. He was troubled in part by the report's format and style. Not only did Bush "hand down conclusions as those of final authority," but he did so with too much emphasis. "I think you weaken your case by italicized over-statement," Jewett wrote, "rather than by adopting the powerful English method, viz., that of the sweet reasonableness of understatement." Basically, though, Jewett objected to the report's assertion that federal funding of science was necessary. He favored an attempt to revive the "fruitful stream" of private patronage "before plunging into the uncertain waters of the Federal tax pool" (*38*).

Bush replied that he was essentially summarizing the recommendations of his capable committees, and that he concurred with their conclusions. The fact that the Bowman panel had deliberated earnestly over the danger of federal control of university research and had finally come to a unanimous conclusion had resolved his own doubts. Since sending out his report, Bush wrote, "I have had no dissension on this particular point from anyone. . . . I have come to the conclusion that we are bound to go down this path" (*29*).

The document sent out for comment and suggestions specified that "The chief administrative officer of the Foundation should be a Director chosen by the Members and responsible to them." After the report had been mailed to committee members, however, an important change was entered on the "Master Copy" on which those modifications made as a result of the mailing were incorporated. The words "chosen by the Members and responsible to them" were stricken and "appointed by the President" was inserted in their stead (*37*). Bush approved this change (*39*), but it was fundamentally at odds with the recommendations of Bowman's and Palmer's committees. Since Bush wished to stress that he was summarizing the recommendations of his study groups and that he endorsed them, he must have decided to abandon the principle of presidential appointment of the director, after agreeing to it, because of its incompatibility with the committees' stand (*40*).

On 14 June Bush met with President Truman for about 15 minutes. The President had read and liked the report, Bush recorded, and gave his permission for its release. Judge Rosenman, with whom Bush talked about arrangements for releasing the report, said that the President would probably send a message to Congress with a recommendation after there had been some public reaction to the report (*41*).

The expected release of the report before the end of June was delayed at the Government Printing Office in which appropriations printing took priority over everything else. It was not until 19 July that the White House made a public release of *Science—The Endless Frontier* (*42*).

In a letter transmitting the report to the President, Bush asserted that he had interpreted F.D.R.'s questions as applying only to the natural sciences and medicine. He said that his recommendation of a "single mechanism" was his only departure from the committees' proposals, but that this now met with their full approval (*3*, pp. v, vi).

The report was carefully designed to build a case for a new federal agency which

Table 1. Estimated budget from the first to the fifth year for the proposed National Research Foundation, by division.

Activity	Millions of dollars	
	First year	Fifth year
Division of Medical Research	5.0	20.0
Division of Natural Sciences	10.0	50.0
Division of National Defense	10.0	20.0
Division of Scientific Personnel and Education	7.0	29.0
Division of Publications and Scientific Collaboration	.5	1.0
Administration	1.0	2.5
Total	33.5	122.5

was to supplement the basic research resources of colleges, universities, and research institutes, support long-range research for the armed services, and administer a national program of science scholarships and fellowships. In addition, the proposed National Research Foundation "should develop and promote a national policy for scientific research and scientific education" (*3*, p. 28). The foundation (*3*, p. 4)

> should be composed of persons of broad interest and experience, having an understanding of the peculiarities of scientific research and scientific education. It should have stability of funds so that long-range programs may be undertaken. It should recognize that freedom of inquiry must be preserved and should leave internal control of policy, personnel, and the method and scope of research to the institutions in which it is carried on. It should be fully responsible to the President and through him to the Congress for its program.

The policy-making body of the foundation—essentially a board, although not so called in the report—was to consist of a group of perhaps nine members, appointed by the President. They should not occupy any other government positions, receive compensation other than expenses for their part-time services, or be eligible for immediate reappointment on the expiration of their four-year terms. They were to elect their own chairman and choose the foundation's director, who would administer the agency's business under their supervision (*3*, pp. 28, 29).

The members were to establish professional divisions and appoint their part-time members, with the aid of recommendations from the National Academy of Sciences. Five divisions—medical research, natural sciences, national defense, scientific personnel and education, and publications and scientific collaboration—were to be established at the outset. Each division was to have at least five members; on the division of national defense, in addition to the civilian members, there were to be two representatives designated by the Secretaries of War and the Navy. Responsible to the members of the foundation, the divisions were to formulate their particular policies and programs, present budgets, assess the quality of the research that they sponsored, and make recommendations on the allocation of research programs and other pertinent matters (*3*, pp. 29, 31).

Although Bush's effort to make an independent recommendation on patent policy had been frustrated, he did include a paragraph giving his views on patents. Obviously with the intention of countering Kilgore's aims, Bush said that the foundation should be allowed "discretion as to its patent policy in order that patent arrangements may be adjusted as circumstances and the public interest require" (*3*, pp. 31, 32).

Not only were the members of the foundation and its divisions to be free to have private employment, but legislation was also to provide for special authority for the agency in other respects. Its research contracts or grants should not require competitive bidding, and the recipients of research contracts should not have to submit the detailed itemized vouchers normally required by the General Accounting Office (*3*, pp. 32, 33).

Rough budget estimates submitted by the committees furnished the basis for a table that shows growth "in a healthy manner from modest beginnings" (Table 1). Bush expected that after five years the foundation's operations should reach "a fairly stable level" (*3*, p. 33).

Finally, *Science—The Endless Frontier* urged congressional action (*3*, p. 34):

> 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.

Bush had, in fact, already arranged for the drafting of legislation, and it was introduced in the House and Senate the very day his report was released. An angry Senator Kilgore, who thought he had been "doublecrossed," introduced his bill four days later (*43*). Nearly five years later Congress enacted a compromise National Science Foundation bill that was acceptable to President Truman.

Conclusion

Science—The Endless Frontier seems to have suffered the fate of many other influential reports: often cited but seldom read. Since we should at least know what our classics say and how they came to be written, I have concentrated on the drafting and recommendations of Bush's report and those of his committees. Unfortunately, this limited range has meant the sacrifice of attention to the social and political environment from which the report emerged and which affected its reception. The tags "liberal" and "conservative" fail to show the intensity of feelings of those heirs of the New Deal who wanted to use science as an instrument of progress toward a more democratic and egalitarian society and, on the other hand, those still-rugged individualists who, though generally converted to the view that federal support of science should continue after the war, were dead set against any more bureaucratic interference with free enterprise in business or research. The conflicting ideas of the relation of government to science and of the proper function of science in American society became partisan polical issues in the years after 1945. The issues were resolved, in a sense, with the creation of the National Science Foundation in 1950, but they seem to be hardy perennials.

References and Notes

1. P. C. Putnam to C. L. Wilson, unpublished letter, 7 December 1944. Concise biographical notes on Putnam, Wilson, and several other persons mentioned in this article may be found in V. Bush, *Pieces of the Action* (Morrow, New York, 1970), pp. 318, 330, 331, and passim.
2. C. L. Wilson to P. C. Putnam, unpublished letter, 12 December 1944.
3. V. Bush, *Science—The Endless Frontier: A Report to the President* (Government Printing Office, Washington, D.C., 1945), pp. vii, viii.
4. D. J. Kevles [*Science* **183**, 798 (1974)] described the origins of President Roosevelt's request in a letter to the editor.
5. Cox's draft is attached to O. S. Cox to I. Stewart, unpublished letter, 18 October 1944; for other accounts of the President's letter, see D. S. Greenberg, *The Politics of Pure Science* (New American Library, New York, 1967), p. 104; S. P. Strickland, *Politics, Science, and Dread Disease: A Short History of United States Medical Research Policy* (Harvard Univ. Press, Cambridge, Mass., 1972), p. 214*n*; *Mosaic* **1**, 9 (1970).
6. M. Lomask, *Science* **182**, 116 (1973).
7. O. M. Ruebhausen to O. S. Cox, unpublished letter, 26 October 1944; _____ to V. Bush, unpublished letter with attached draft, 26 October 1944.
8. R. F. Maddox, thesis, University of Kentucky (1974), chaps. 3, 7.
9. V. Bush to F. B. Jewett, unpublished letter, 21 August 1943.
10. _____ to T. Barbour, unpublished letter, 17 January 1944.
11. L. Chalkley, mimeographed memorandum, 5 June 1944; K. T. Compton to L. Chalkley, unpublished letter, 9 June 1944; C. L. Wilson to L. Chalkley, unpublished note, 21 June 1944; V. Bush to H. M.

Kilgore, unpublished letter, 20 June 1944; 22 June 1944; L. Chalkley, statement of comments phoned to C. T. Larson of Kilgore's staff, 9 June 1944.

12. Though Kilgore's bill had been much improved, it was still faulty, Bush thought. In an undated note to Chalkley, Bush commented on Kilgore's proposed revision of S702 in a Senate Subcommittee Print dated 10 November 1944:
"Except for the pat[ent] section this is not bad—on the other hand I don't believe such a setup will do much good, & it certainly will do strange things.
"I ought to accumulate some criticisms—for use when called to testify."
13. V. Bush to J. A. Furer, unpublished letter, 12 December 1944.
14. _____, memorandum to files, 19 December 1944; _____ to R. E. Wilson, unpublished letter, 1 January 1945.
15. _____ to I. Bowman, unpublished letter, 10 January 1945.
16. _____ to C. L. Wilson, memorandum, 15 January 1945.
17. _____ to I. Bowman, unpublished letter, 29 January 1945; 19 February 1945; _____ to C. P. Coe, unpublished letter, 26 December 1944; _____ to D. G. Haynes, unpublished letter, 21 February 1945.
18. C. L. Wilson to W. R. Maclaurin, unpublished letter, 5 April 1945; 14 April 1945; H. A. Wallace to V. Bush, unpublished letter, 24 April 1945; V. Bush to B. Brown, unpublished letter, 26 April 1945; _____ to B. Dewey, unpublished letter, 26 April 1945.
19. H. M. Kilgore to V. Bush, unpublished letter, 5 February 1945; 15 February 1945; V. Bush to H. M. Kilgore, unpublished letter, 10 February 1945; _____ to I. Bowman, unpublished letter, 10 February 1945; 17 February 1945; L. Chalkley to V. Bush, memorandum, 24 February 1945; I. Bowman to V. Bush, unpublished letter, 28 February 1945; V. Bush to S. E. Thompson, unpublished letter, 24 March 1945.
20. F. B. Jewett to V. Bush, unpublished letter, 20 March 1945; V. Bush to F. B. Jewett, unpublished letter, 22 March 1945.
21. R. A. Millikan to V. Bush, copy, unpublished letter, 2 April 1945.
22. V. Bush to R. A. Millikan, unpublished letter, 5 April 1945.
23. I. Bowman to V. Bush, unpublished letter, 11 April 1945.
24. Notes on Meeting of the Chairmen and Secretaries of the Four Committees . . . 8 March 1945.
25. H. W. Smith to C. L. Wilson, unpublished letter, 11 March 1945.
26. C. L. Wilson to H. W. Smith, unpublished letter, 14 March 1945, and attached note.
27. W. W. Palmer to V. Bush, unpublished letter, 25 April 1945.
28. L. K. Frank to C. L. Wilson, not dated (about 10 May 1945), note attached to typed comments on draft report of Palmer committee dated 25 April 1945.
29. V. Bush to F. B. Jewett, unpublished letter, 7 June 1945.
30. C. L. Wilson to W. W. Palmer, unpublished letter, 15 June 1945.
31. H. W. Smith to C. L. Wilson, unpublished letter, 21 June 1945.
32. Correspondence in OSRD Records, especially C. L. Wilson to R. Wood, unpublished letter, 21 May 1945; interview of D. K. Price by J.M.E., 18 April 1975.
33. C. L. Wilson, Notes in Connection with Bush Report to President, 22 May 1945.
34. V. Bush, penciled notes on draft report, 23 May 1945.
35. V. Bush to W. W. Palmer *et al.*, unpublished letter, 31 May 1945.
36. H. W. Smith to V. Bush, unpublished letter, 5 June 1945; W. R. Maclaurin to V. Bush, unpublished letter, 4 June 1945; H. Shapley to V. Bush, unpublished letter, 4 June 1945.
37. "Master Copy" attached to V. Bush's mimeographed letter of 31 May 1945 to W. W. Palmer *et al.*
38. V. Bush to F. B. Jewett, unpublished letter, 2 June 1945; F. B. Jewett to V. Bush, unpublished letter, 5 June 1945.
39. Carbon copy (with intermixed mimeographed sheets), dated June 1945, of the overall report; the carbons are pages retyped to incorporate the changes resulting from comments elicited from committee members and others after the 31 May mailing. This copy contains marginal comments and changes in Bush's hand; thus he obviously approved the change.
40. Bush or his assistants may have sounded out some committee members on this change—perhaps by telephone since I have found no evidence on this matter in the OSRD files. But since there were bound to be violent objections, he may have decided on his own to return to the earlier wording.
41. V. Bush, memorandum of conference with the President, 14 June 1945.
42. On the arrangements for printing and releasing the report, see O. M. Ruebhausen's memorandum to files, 16 June 1945; C. L. Wilson to B. U. Webster, unpublished letter, 14 July 1945; and V. Bush to C. Norcross, unpublished letter, 14 July 1945.
43. D. K. Price to A. Miles, memorandum, 20 July 1945, in Bureau of the Budget Records, Record Group 51, Series 39-32, National Archives.
44. I thank L. Chalkley, R. F. Maddox, D. K. Price, O. M. Ruebhausen, and C. L. Wilson, who read an earlier version of this paper and gave me helpful comments. Unless otherwise indicated, all unpublished documents cited above are in the OSRD Records, Record Group 227, National Archives.

NEWS AND COMMENT

The Nuclear Debate: Clashes in Congress and California

Federal and state governments may be headed toward a collision over a key aspect in the development of nuclear power. Antinuclear groups in California are pressing for a law that would ban nuclear power plants unless Congress removes the present legal limitations on the damages payable in the event of a nuclear accident. But Congress, far from repealing the limitation (mandated by the Price-Anderson nuclear insurance law), recently voted to extend it. The skirmish on Capitol Hill over the Price-Anderson law is analyzed in the first of the following articles; the events that have made the California proposition possible are discussed in the second.

I. Pronuclear Forces Trounce Antis in Insurance Liability Fight

Proponents of nuclear power won a major victory over nuclear critics at the close of the 1975 congressional session.

Both the House and the Senate passed legislation extending the Price-Anderson nuclear insurance law that limits the nuclear industry's liability in the event of a catastrophic accident. Both houses voted down proposed amendments that would have allowed injured parties to sue for damages above the specified liability limits.

The struggle over liability limits had been the most hotly contested political battle involving nuclear power in the recent session. It was widely viewed as a pivotal fight that might affect the future growth rate of the nuclear industry. Its outcome is sure to be interpreted as a measure of the relative strengths of the pro- and antinuclear lobbies.

The forces in favor of retaining a limit on liability included, among others, the Ford Administration, the congressional Joint Committee on Atomic Energy, the nuclear industry, the electric utility industry, the private insurance industry, and the AFL-CIO. Those pushing for an end to the limit included, among others, various environmental groups, Ralph Nader's Congress Watch, Common Cause, the National Taxpayers Union, the United Mine Workers, the United Auto Workers, the oil fuel dealers, the California Bar Association, and the American Trial Lawyers Association.

The Price-Anderson Act was originally enacted in 1957 with two purposes: to protect the infant nuclear industry from potentially bankrupting damage claims in the event of a catastrophic accident (and thus encourage more companies to enter the new industry) and to provide monetary reimbursement to injured parties in the event of a nuclear catastrophe.

As originally passed, the act limited the liability of the industry for any one accident to $560 million. It required nuclear utilities to obtain the maximum coverage available from private insurance companies (currently $125 million), and provided that the federal government would indemnify the utilities for the remaining liability (currently $435 million) in return for a token premium payment. The manufacturers of nuclear equipment—as distinct from the utilities that purchase the equipment—were made exempt from liability.

The coverage was of the "no fault" variety—injured parties could get reimbursed by establishing that they were injured in a nuclear accident without having to establish who was at fault in the accident. However, they could only recover a maximum total of $560 million—even if the total damage far exceeded that figure. Anything