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The National Science Foundation: Origins, Hopes, and Aspirations

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The origins of the National Science Foundation were in the visions of many scientists and federal statesmen during a decade of profound changes in the institutions of American science. But the concepts that initiated the Foundation and molded its structure had roots that reach back into the beginnings of our scientific endeavor in Colonial America; Franklin and Jefferson, scientists and statesmen, paved the way for a close association between government and science. The immediate genesis of the National Science Foundation was in the remarkable contributions of science and technology to the war of 1941 to 1945, and the effects of that war on the role and conduct of science in universities and industry.

Anniversaries are appropriate and pleasant occasions for recalling people and the celebration of their achievements. We are thus reminded that institutions are aggregates of individuals. The history of an institution is the tale of what people did; its future depends in part on the foundation they created. And so I have chosen to tell this fragment of the history of the National Science Foundation mostly as recollections of those in whose dreams the origins of our Foundation are rooted, what were their hopes and aspirations. The composition of my brief record has been pleasant for it has been a recollection of the thoughts, hopes, frustrations, and achievements of many whom I was privileged to know as friends.

It is appropriate to begin with the hopes of that one who did more than any other to bring the Foundation into being. A year before it was created by act of Congress and presidential signature, Vannevar Bush, our patron saint, wrote (*1*):

> When the wheels of Congress finally revolve, we will have a National Science Foundation. As it proceeds, if it is wisely supported, it can ensure federal support of university research; it can provide fellowships for the brilliant; it can go a long way toward providing that equality of higher educational opportunity which we need to superimpose upon our educational system as a whole, in order to adapt it for our true purposes in this world of threats. It can formulate and support a sound governmental attitude toward science, and scientific education, in these days in which the burden of both has increased to the point where it can be carried only at federal expense. It can guard against the heavy hand of bureaucracy and furnish a bulwark against political pressure on this vital aspect of our interests. It can further science, free science pursuing its independent way to unravel the mysteries of existence, carried on by free men whose guide is truth and whose faith is that it is good to know. As it does so, it can aid much to protect us all from the vicissitudes of nature and of selfish man.

The Legislative Process

The first person I heard use the term "National Science Foundation" in federal legislation was Herbert Schimmel, a young physicist from the University of Pennsylvania. The role that he and his friend Senator Harley Kilgore played in our early history is now largely forgotten. But their persistent efforts to create an agency of government to finance science and technology stimulated much discussion and legislative action that had considerable influence in the origins of our Foundation.

Like many others who received their doctorate but no university appointment during the years of depression, Schimmel turned to government for employment of his knowledge of science and its social uses. Like many others, his experiences in depression-affected universities encouraged his hopes for government-supported science.

During an investigation of war production for the Senate Small Business Committee, Schimmel learned that no other aspect of the war so directly affected most families as did the threatened lack of automobile tires. When people began to think about what the United States would be like if there were no rubber tires, they became acutely aware of our nation's dependence on a strong technology. Congressional committees began to be active in the investigation of possible shortages. Their probes soon made it evident that the U.S. government had not been foresighted enough to stock a large amount of natural rubber. Many blamed the government, others saw a failure of private enterprise. The widespread concern was relieved by appointment of a special presidential committee consisting of Bernard Baruch, James Conant, and Karl Compton. Frank Howard, president of Standard Oil Development Corporation and the Sloan-Kettering Institute, described the appointment of the committee as the most widely acclaimed action on the domestic front in the history of the war program. It was a subtle but important assist in preparing government sentiment favorable to a science foundation.

During his study of the Senate investigations of the rubber program, Schimmel decided that the government should equip itself with means to provide for its technological needs and should not rely completely on industries that had not been designed to care for a major war emergency. Consequently,

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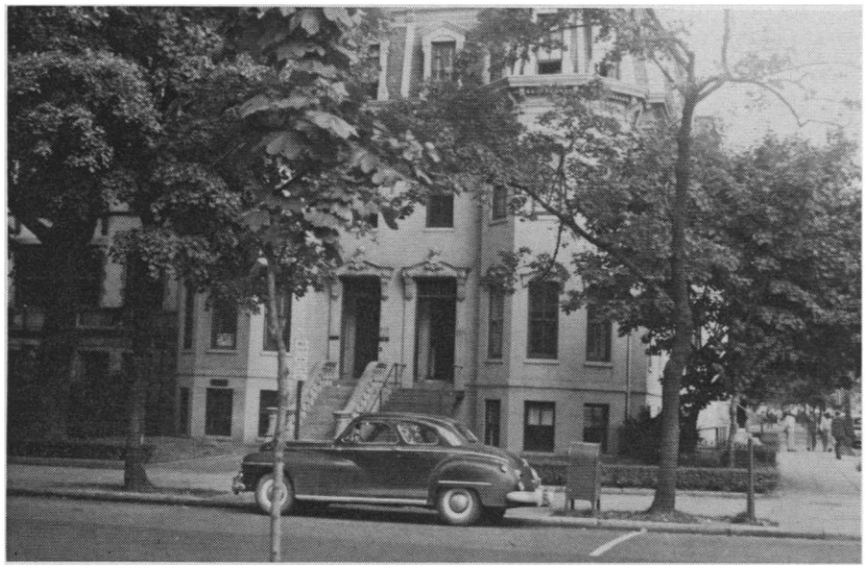


First headquarters of the National Science Foundation during the period April through September 1951. [Lee Anne Embrey Blick, Washington, D.C.]

he began to formulate plans for an office of technological mobilization that would secure world leadership in the practical application of scientific discoveries, stimulate new discoveries and inventions, mobilize all technical facilities, and compel the licensing of all patents at reasonable compensation in order to foster their wide utilization.

He suggested those plans to Senator Kilgore whom he had met while the senator was investigating the rubber program as a member of the National Defense Investigating Committee, better known as the Truman Committee. Kilgore was favorable to Schimmel's suggestion and with the approval of Senators Truman and Pepper sponsored the first Technological Mobilization Bill, S. 2721, in August 1942. The bill evoked little public interest and was opposed by leading members of the National Academy of Sciences and the National Advisory Committee for Aeronautics. It expired with the 77th Congress.

In the 78th Congress of 1943, Senator Kilgore, with the assistance of Schimmel, introduced the Scientific and Technological Bill, S. 702. It was somewhat less antagonistic to the role of industry than was its predecessor, and its broader objectives provided support of scientific and technological education and international scientific cooperation. Many working scientists favored the bill, but scientific leaders and those with administrative experience were opposed to what they considered dictatorial powers of the proposed office.

As hearings proceeded, it became obvious to its sponsors that, if the bill were to succeed, it would be an expression of what scientists desired from government rather than an effort to use science for the solution of social problems. And so, by the time hearings were concluded in September 1944, the objective was changed to a bill so as to establish a National Science Foundation. That was the title of S. 1297 introduced by Kilgore the following spring.

Science—The Endless Frontier

Bush liked to tell of an evening with his friend President Truman. During dinner, Truman said to his neighbor: "Van, you should be a politician, you have some of the instincts." To which Bush replied: "Mr. President, what the hell do you think I have been doing around this town for five or six years?" That conversation between the two is relevant background for many events that led to the final enactment of the National Science Foundation Act of 1950 after much legislative maneuvering.

As the clouds of war began to lighten after the Normandy invasion, Bush began to think about the future of the Office of Scientific Research and Development (OSRD) and what had therein been learned that would be helpful in planning the future role of government in the furtherance of science. His colleagues drafted a letter for Roosevelt in which he asked Bush four major questions. Shortened, they were these: What can be done to organize a program for continuing the war of science against disease? What can the government do now and in the future to aid research activities by public and private organizations? Can an effective program be proposed for discovering and developing scientific talent in American youth so that the future of scientific research in this country may be assured on a level comparable to what has been done during the war? What can be done, consistent with military security, to make known to the world as soon as possible the contributions to scientific knowledge which have been made during our war effort? The letter ended: "New frontiers of the mind are before us, and, if they are pioneered with the same vision, boldness, and drive with which we have waged this war, we can create a fuller and more fruitful employment and a fuller and more fruitful life."

With characteristic respect for the wisdom of others, Bush promptly appointed four committees to consider the four questions and then counsel him on his advisory replies. Walter Palmer, professor of medicine in Columbia University; Isaiah Bowman, president of Johns Hopkins University; Henry Allen Moe, secretary general of the Guggenheim Foundation; and Irvin Stewart, executive secretary of the OSRD, respectively, dealt with the several questions. They were aided by two score eminent scientists who worked steadily on the four committees throughout the early months of 1945.

From their reports evolved "Science—The Endless Frontier" (report requested by President Roosevelt). By the time that was completed in July, Roosevelt, the friend who had given Bush unwavering support during five years, was dead. And so the historic report went to Harry Truman. Said Bush,

> Although this report, which I submit herewith, is my own, the facts, conclusions, and recommendations are based on the findings of the committees which have studied the questions [asked me by President Roosevelt].
>
> A single mechanism for implementing the recommendations of the several committees is essential. In proposing such a mechanism, I have departed somewhat from the specific recommendations of the committees, but I have since been assured that the plan I am proposing is fully acceptable to the committee members.

The plan Bush proposed was the creation of a National Research Foundation. In his judgment the national interest and scientific research and scientific education could thus be best promoted. Its purposes should be to "develop and promote a national policy for scientific research and scientific education, . . .

support basic research in nonprofit organizations, . . . develop scientific talent in American youth by means of scholarships and fellowships, and . . . by contract and otherwise support long range research on military matters."

Even in those days that were still colored by New Deal liberal philosophies, it was bold to propose that the government provide millions of dollars for adventurous research and the education of a select few. Still bolder was the unprecedented plan to entrust the expenditure of those millions to a board of private citizens.

Bush himself predicted that "it will be a minor miracle to persuade the Congress of these pragmatically inclined United States to establish a strong organization to support fundamental research." And he was well aware that his close friend Frank Jewett "was sure we were inviting federal control of the colleges and universities and of industry itself . . . that the independence that has made this country vigorous was endangered." The National Association of Manufacturers had published a pamphlet entitled, "Shall research be socialized?" But it was a time of high hopes, faith in new institutions with which to rebuild a war-torn world, and confidence that science could help create a better society of men.

And so the proposals formulated by Bush were embodied in a bill that was, with skillful timing, introduced in the Senate by Senator Magnuson on the very day that "Science—The Endless Frontier" was released by the White House. It authorized the creation of a National Research Foundation. The structure of the Foundation resembled in many ways the organization of private agencies such as the Rockefeller Foundation and the Carnegie Corporation. It was strongly supported by the presidents of many leading universities, eminent scientists, and prominent industrialists.

Kilgore had hoped to collaborate in the preparation of the bill, but his proposals for management of a foundation and his policies regarding patent rights were unacceptable to Bush. And so Kilgore, with the assistance of Schimmel, in the following week introduced a bill that authorized the creation of a National Science Foundation. Patent rights to all inventions resulting from research supported by federal funds were to become the property of the United States. This bill was favored by President Truman and had the support of the director of the Bureau of the Budget, the Secretary of Commerce, and the Commissioner of Patents. It was endorsed by the Social Science Research Council and, significantly, by the American Federation of Labor and the National Farmers Union.

Truman's Veto

There was potential danger for both bills during two years of lobbying and acrimonious debate despite the fact that most favored some form of federal support for scientific research and education. But ultimately a compromise bill was drafted, endorsed by the Committee Supporting the Bush Report and passed by both Houses in the summer of 1947. Within two weeks it was vetoed by the President.

The pocket veto did not require that the President state his reasons, but his respect for science was clear in his published statement that began:

> I take this action with deep regret. I have urged the Congress to enact legislation to establish a National Science Foundation. Our national security and welfare require that we give direct support to basic scientific research and take steps to increase the number of trained scientists.
>
> However, this bill contains provisions . . . that imply a distinct lack of faith in democratic processes.
>
> The powers of the proposed Foundation would be vested in 24 members appointed by the President . . . .
>
> The Foundation would have a chief executive officer, known as the Director. He would be appointed by the 9-member Executive Committee of the Board unless the 24-member body chose itself to appoint him. The powers and duties of the Director would be prescribed by the Executive Committee and exercised under its supervision.
>
> The President would be deprived of effective means for discharging his constitutional responsibility because full authority and responsibility would be placed in 24 part-time officers whom the President could not effectively hold responsible for proper administration. Neither could the Director be held responsible by the President, for he would be the appointee of the Foundation.

Here it is appropriate to speak of the relations between Truman and Bush as I knew them. They had deep respect for each other and were alike in many respects—forthright, sincere, courageous, and sometimes obstinate in defense of their beliefs. Truman made tough decisions that enhanced Bush's "faith that our sometimes absurd political processes can and do produce leaders of stature." Finally, there was compromise between these two strong-willed but reasonable men. They agreed on a bill which provided for a board of 24 appointed by the President, a director appointed by the President after consultation with the board; the director was to be responsible to the board. Five years after the publication of *Science—The Endless Frontier,* Truman signed the bill on 10 May 1950.

It was generally assumed that Bush would be chairman of the board of the Foundation whose creation he had fostered. He has told why he was not. At an Armed Services Day dinner at the Mayflower Hotel, Bush sat next to Truman (*2*).

> The subject of the science board came up, and I said, "Mr. President, I wish you would leave me off that board. I know my name is on the list, but I wish you would leave me off." He said, "Why?" and I said, "Well, I have been running about everything scientific during the war, and somewhat since, and I think people are getting tired of seeing this guy Bush run things around here. I think this outfit would do better if it had some new leadership. If you put me on the board, they will elect me chairman, and I do not think that the body of scientists are going to like this continuation of one man in the top post. So I think you would do better to let somebody else do it." Well, after a bit more talk, he agreed to leave me off the board. Then he said, "Well, Van, you are not looking for a job, are you?" And I said, "No, Mr. President. I am not looking for a job." He said, "You cannot say I went looking for this job that I am in." And I said, "No, Mr. President, not the first time!" which tickled him quite a bit.

Such was the relationship between those two who guided the creation and shaped the structure of the Foundation: "very pleasant, very informal and on a basis we both greatly enjoyed."

The role of Bush in the Foundation was thus ended; his historic mission had been accomplished. But he lived to see 94 members serve during 24 years on the board to which the director was responsible as he had urged. He often said, "It works because members that have distinct responsibility take their duties very seriously."

Truman continued in office long enough to appoint the first director as he had insisted should be the prerogative of the President. Six years later when I last saw him at a Brandeis commencement, he spoke of Waterman's remarkable achievements as the first director of a Foundation many thought could not succeed. Then with a grin he boasted, "I appointed him as I knew damn well I should."

The Board and Waterman Appointed

Because of their unprecedented power, John R. Steelman, assistant to the President, spent much time selecting the 24 members of the first board so as to have diversity of political, geographical, religious, and racial representation. He often asked me as president of the Academy to determine the scientific competence of an individual who was being considered. Those the President finally nominated included three presidents of large corporations, two presidents of private foundations, seven presidents of universities, and four deans. Some of the more vocal members of the AAAS Inter-Society Committee who had opposed the Bush bill "because the qualifications set for members of the Board were necessarily big-name men from big-name institutions," protested that their fears had been justified. But most were satisfied because 16 states and both private and public universities were represented; all the university presidents had been scientists and professors. Six weeks were required for Senate confirmation, but that was not surprising in the days of Joseph McCarthy.

The first meeting of the board was finally held on 12 December 1950 in the Cabinet Room of the White House; the presidents of Harvard, Wisconsin, and Johns Hopkins—Conant, Fred, and Bronk—were elected chairman, vice chairman, and chairman of the executive committee, respectively. In the course of the meeting the President greeted each member of the board, then asked, "What have you fellows and Sophie Aberle been talking about?" Conant replied that we had been discussing possible directors of the Foundation whom we would then recommend to him. With a smile, Truman said, "That should be easy, someone who can get along with me." He then went on for 10 or 15 minutes discussing his hopes for the Foundation, what it could, should, and should not do. He ended, "You may have trouble getting money out of those fellows in Congress. I will help." He was indeed a loyal supporter during the remainder of his term, as were his successors during my tenure on the board, Presidents Eisenhower and Kennedy. Waterman was soon appointed director, on the recommendation of the board.

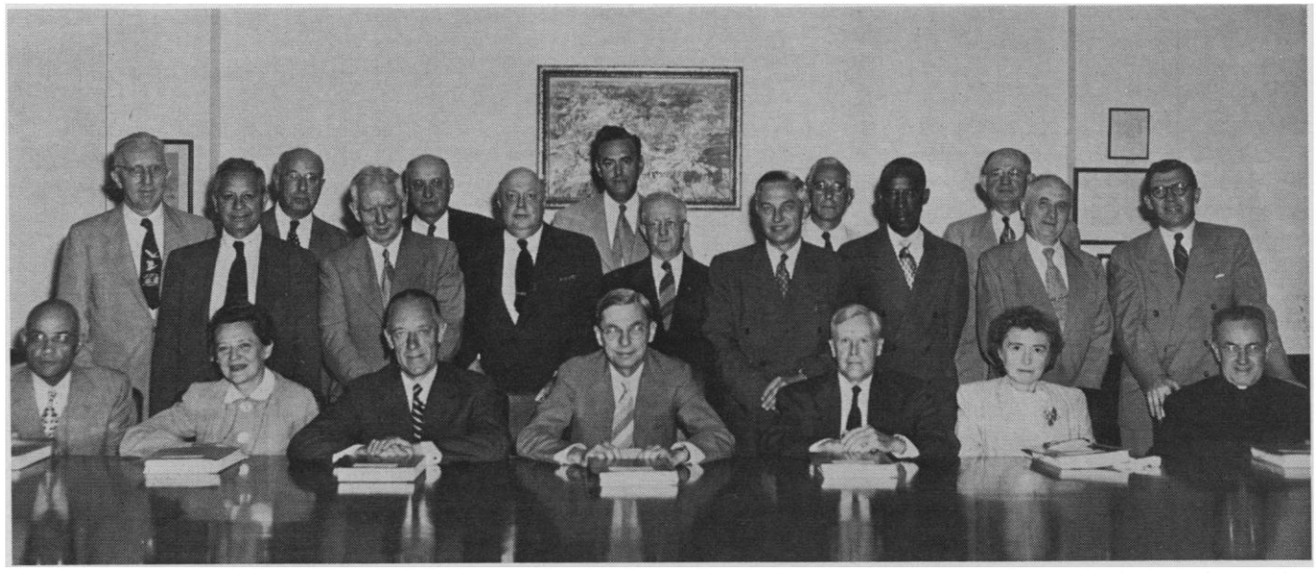
During that time William Golden, a special consultant to the director of the Bureau of the Budget, was reviewing the organization of the government for promoting scientific activities generally. Soon after the first meeting of our board, he sent to the President a memorandum: "Mobilizing science for war; A scientific adviser to the President." Although the Golden proposal had been approved by many leading scientists, it aroused much opposition among members of the Science Foundation Board at their next monthly meeting. In reporting this to the Bureau of the Budget, Conant told of the board's concern that the appointment of a science adviser to the President would lower the status of the Foundation and reduce its appeal for congressional appropriations. There was further fear that their duty "to secure the national defense" would be impaired by the new Office of Science Adviser.

Golden promptly sent the following statement to all members of the board:

> It may be worth repeating that in accordance with the spirit of the Act, as well as the judgment of substantially all scientists with whom I have discussed the question, the National Science Foundation should confine its activities to furthering basic scientific studies and that it should not dilute its effectiveness by supporting studies of directly military or other applied character. To do so would seriously impair the long-term mission of the National Science Foundation without materially contributing to the war effort, since work can better be done by other agencies. In the long run, of course, additions to basic scientific knowledge will contribute, as previously indicated, to both the wartime and peacetime strength of the country; but short-term results are not to be looked for.

The Foundation's Mission

Thus advised and after much debate, the board withdrew its opposition to what became the Science Advisory Committee of the Office of Defense Mobilization and later the President's Science Advisory Committee. There was no further effort by the Foundation during its early years to assume a major role in military defense activities. The temptation to deviate from its primary respon-



Members of the National Science Board at their eighth meeting on 7 September 1951. Bottom row (left to right): John W. Davis, Sophie D. Aberle, Detlev W. Bronk, James B. Conant (chairman), Alan T. Waterman (director, National Science Foundation), Gerty T. Cori, and Patrick H. Yancey, S. J. Back row: Marston Morse, Elvin C. Stakman, Chester I. Barnard, Paul M. Gross, Frederick A. Middlebush, Joseph C. Morris, James A. Reyniers, O. W. Hyman, Lee A. DuBridge, Robert F. Loeb, Robert P. Barnes, George D. Humphrey, Andrey A. Potter, and Charles Dollard. The following were not present: Edwin B. Fred (vice chairman), Donald H. McLaughlin, Charles E. Wilson, and Edward L. Moreland (deceased). [Harris & Ewing]

sibility for free, fundamental, uncommitted scientific research and science education had been resisted.

In his foreword to the First Annual Report of the Foundation, Conant wrote:

> The relations of science to war are so well known as to require no elaboration. But what is often little realized is the relation of highly trained scientific talent to the progress of the technological armament race to which a divided world is now committed. Until such time as disarmament becomes a reality, the free nations must be deeply concerned with finding and developing scientific pioneers. For on their efforts we must rely as much for increasing national security in a war-torn decade as for industrial progress in periods of peace. . . . This means assisting promising young men and women who have completed their college education, but require postgraduate training in order to become leaders in science and engineering. To this end a fellowship program has been placed high on the list of priorities by the National Science Board.

There was long precedent for national fellowships in the natural sciences and medicine. Funds provided by the Rockefeller Foundation were granted by the National Research Council (NRC) to more than one thousand young men and women for postdoctoral study between 1920 to 1940. In 1945, the NRC started a program of fellowships for study leading to the doctorate; it was supported at first by the Rockefeller Foundation and then by the Atomic Energy Commission. Several thousand students were thus aided by private and then by federal funds. And so there was tradition and available experience when the National Science Foundation awarded its first 569 predoctoral and 55 postdoctoral fellowships in 1952. In order to utilize the past experience of the NRC, the Foundation requested the Academy to administer the selection of fellows from among more than 3000 who applied. That cooperation continued.

Cooperation such as this with other institutions has enabled the Foundation to accomplish much without becoming a mammoth operating agency. Unencumbered freedom to initiate and support bold ventures without assuming the burdens of administration has been an important concept in shaping Foundation policies. The National Research Centers that are operated for the Foundation by associations of universities and the programs in marine science that are directed by institutes of oceanography are notable examples of such collaboration. Throughout the International Geophysical Year, the Foundation and the Academy collaborated closely in many far-flung undertakings, each aiding the other, and both utilizing the resources and faculties of many universities.

Social Sciences and Applied Research

The long campaign to secure congressional approval of a Science Foundation bill awakened the sponsors of the bill to a widespread need for public understanding of science. The Foundation was reminded of this need each year during the hearings on our appropriation bill. And so, from the early days one of our objectives has been to meet the challenge President Kennedy gave scientists at the Academy centennial some years later:

> If basic research is to be properly regarded, it must be better understood. I ask you to reflect on this problem and on the means by which, in the years to come, our society can assure continued backing to fundamental research in the life sciences, the physical sciences, the social sciences, our natural resources. Together the scientific community, the government, industry, and education must work out the way to nourish American science in all its power and vitality. Of course what it needs is a wider understanding by the country as a whole of the value of this work which has been so sustained by so many of you.

As Alan Waterman and I often discussed this need for public understanding of science, we recalled the years that he and I had enjoyed the friendship of those in the Senate and House who heard our requests for funds: Senators Magnuson, Saltonstall, Gordon Allott; Congressmen Albert Thomas, Yates, Daddario, and George Miller, to name a few; and Elmer Staats and William Carey in the Bureau of the Budget. They never gave us all we asked, but each successive year they better understood the significance and value of our proposals even though Alan and I had to consume a good deal of bourbon during "educational sessions" with our friends. And we learned from them much about the need for science and what was its proper role in government. In those congressional meetings our friends advised us to extend our programs gradually to include more research that dealt directly with social problems and research that was obviously related to national needs. The advice became more forceful as our budget requests grew larger.

During the congressional hearings on Science Foundation bills, there had indeed been much discussion regarding inclusion of the social as well as the physical and biological sciences. I recall that, as a representative of the Committee Supporting the Bush Report, I testified that

> I cannot think of any field of research in physical science which does not ultimately lead, and usually very promptly, to new social problems. The same is true in biology and medicine. It is important, therefore, that competent social scientists should work hand in hand with the natural scientists so that problems may be solved as they arise and so that many of them may not arise in the first instance.

Donald Young, chairman of the Social Science Research Council, wisely advised us not to press for inclusion of the social sciences lest we lose support of many legislators who doubted the value of sociologists, social psychologists, and political scientists and were suspicious of their social objectives. In fact, Young, who was a sociologist, refrained from testifying in person.

Congress accepted a "permissive, but not mandatory position." And so the Foundation was not barred from supporting research in the social sciences, but on the other hand would not be forced to do so until it had carefully considered what fields could appropriately be handled under federal auspices. Today it seems incredible that courage was required to insist on the "permissive policy." That it was wise to do so is obvious now that the natural sciences, medicine, engineering, and the social sciences are closely interrelated. It enabled the Foundation in 1971 to award $17 million in 484 grants, which was one-fifth of the total federal support of research in the social sciences.

During 30 years between the introduction of the Kilgore Technological Mobilization Bill and the program of support for Research Applied to National Needs, there has been much controversy regarding the relations and relative status of basic and applied research in the Foundation. Kilgore stressed applied research because it had obvious societal values and satisfied immediate practical needs. On the other hand, Bush urged that "it is pure research which deserves and requires special protection and specially assured support." The successive bills he initiated stressed "basic research which leads to new knowledge, provides scientific capital and creates a fund from which the practical applications of knowledge must

be drawn." He added, "Under the pressure for immediate results, and unless deliberate policies are set up to guard against this, applied research invariably drives out *pure*."

I feel confident Bush would agree that a 25-year tradition of primary devotion to uncommitted research is an adequate guarantee that Research Applied to National Needs will not drive out "pure" research from the Foundation. I am sure that Bush, an engineer, would approve what James Fisk said in his memorable address at the centennial of the National Academy of Sciences (*3*):

> Far from interfering with "science for its own sake," the applications of science seem steadily to be leading us into realms of greater and greater intellectual and even spiritual challenge. . . . Applied science and technology show directions in which pure scholars may couple to any degree they choose with the human issues and problems of their time. This, too, is not a bad thing for the motivation of men, or for smoothing the path between the ivory tower and public plaza.

No account of the origins and aspirations of the National Science Foundation, no matter how brief, would deserve reading if it did not allude to the unique role, extraordinary competence, and ceaseless devotion of Alan Waterman. President Truman voiced his esteem and gratitude; it was shared by all who knew Alan. I, who was with him for 14 years while chairman of the board and the executive committee, have especial reason for admiration and affection. Under his leadership the staff and the board of the Foundation became each and together bands of friends working for mutual objectives. "What, after all, is an organization?" asked Vannevar Bush. "It is merely the formalization of a set of human relations among men with a common objective. The form of organization is important. Far more important are the men themselves, and their insistence on working together effectively for a common end." The National Science Foundation is such an organization.

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A Foundation for Research

The return on investment in scientific research during the first 25 years of support by NSF is discussed.

William A. Fowler

Twenty-five years ago the challenge was direct and explicit. The National Science Foundation Act of 1950 authorized and directed the Foundation "To initiate and support basic scientific research. . . ." There were additional mandates; but there it was, the American people, through their elected representatives, created *A Foundation for Research,* and that is the title of this piece. It is not *the* foundation; there are many other agencies and institutions in and out of government which support research. The word "foundation" is not used solely in terms of funding but more in its literal sense, the underlying structure on which all else rests. The word "research" is not qualified by the adjective "basic" because in response to the pressures of our time, the Foundation was authorized to support applied research in 1968 by amendment of the enabling act of 1950.

One hundred and one years ago in *Life on the Mississippi* Mark Twain wrote: "There is something fascinating about science. One gets such wholesale returns of conjecture out of such a trifling investment of fact." Those in experimental work may relish Twain's jibe, those in theory may resent it. Be that as it may, the answer to Twain is clear: Research is the investment of fact, the investment which may lead, at first to healthy conjecture and speculation, but which ultimately leads to understanding and to wisdom.

The NSF has supported, encouraged, initiated, and counseled a fair share of the research investment in this country over the last 25 years in its many functions as *A Foundation for Research.* The NSF has other functions, but here it seems appropriate to inquire into what return, not of conjecture but of knowledge, has this investment brought. This will be the burden of this tale. The choice of research returns to be discussed will be arbitrary but, it is hoped, not capricious. The main subjects will be earth science, molecular science, environmental science, astronomical science, and social and applied science. The word *science* is used here because each of these subjects has involved a number of scientific disciplines. For example, molecular science includes molecular biology, molecular chemistry, and molecular physics. Astronomical science includes astronomy, astrophysics, and astrochemistry. The mathematician will wonder why *The Discovery of New Sporadic Sample Groups* or *The Logic of Computers* was not discussed, as well they might have been. The physicist will wonder why *Parity Violation in the Weak Interaction* or *The Laser Renaissance in Optics* was not included; the chemist, why *Macromolecules in Plastics and Polymers* was omitted. Nonetheless the mathematician, the physicist, and the chemist will find his branch of science thoroughly involved. This piece is about the woods, not about the trees. It adheres to these prescient words and I quote:

> The complete solution of many research problems today requires the correlation of many individual viewpoints approaching the problem from several directions. The Foundation is acutely aware of its obligation to support integrated attacks upon borderline and interdisciplinary problems.

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